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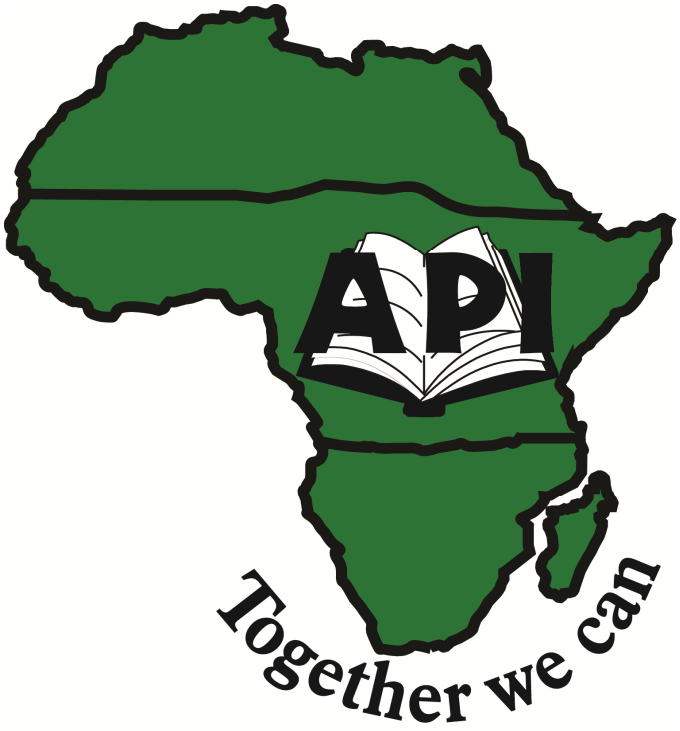

PUBLIC HEALTH
TERM THREE STUDENT'S MODULES
(PHC)
Contents

APDPH 301	Psychological, Sociological Issues in Public Health
APDPH 302	Demography
APDPH 303	Research Methods and data management
APDPH 304	Sanitation and Environmental Health Science
APDPH 305	Information Technology

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Course Name: Psychological, Sociological Issues in Public Health

Course Description

The Course details the most vital objectives of health psychology, application of health psychology, health service delivery and quality, as well as human resources for health. In addition it provides the changing conceptions of health & illness, social psychology and health, health related behaviors, relationship between stress &health, relationship between sociology, health & illness, and sociology in public health.

Course Objectives

- To help students to interact with new and complex management of psychological issues, needs and problems in public health.
- To help students get enriched with knowledge about the daily changing conceptions of health & illness.
- To ensure that students grasp skills in handling maladaptive behaviors that is not socially acceptable in the community.
- To facilitate students in learning defensive mechanisms to reduce personal/potential stressors that may affect their own health.
- To encourage students to appreciate the relevance of integrating sociology as a field of study in understanding the interactions of systems to support public health.

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Psychological, Behavioral, and Social Issues Module

Introduction

Illness and poor health bring a unique set of psychological issues. Daily stress, work, family and financial problems can cause illness and poor health. Is there an answer? That is what a public health psychologist strives to answer as they work with medical personnel or in private practice. Hospitals, medical centers, nursing homes and public health centers employ experts in the field of public health psychology. Government programs can use public psychologists to help design and implement programs that are aimed at prevention and intervention in areas of health that affect the general population. Not only is the area of public health psychology personally rewarding but the job outlook is excellent. The Bureau of Labor Statistics, 'www.bls.gov *reports that 50% of psychologists earn between $45,000 and $77,000 annually*

Public Health Psychology - Making a Difference:

Health psychology is concerned with understanding how biology, behavior, and social context influence health and illness. Health psychologists work alongside other medical professionals in clinical settings, work on behaviour change in public health promotion, teach at universities, and conduct research. Although its early beginnings can be traced to the kindred field of clinical psychology, four different divisions within health psychology and one allied field have developed over time: clinical health psychology, occupational health psychology (an allied field), public health psychology, community health psychology, and critical health psychology. Organizations closely associated with the field of health psychology include Division 38 of the American Psychological Association and the Division of Health Psychology of the British Psychological Association.

Recent advances in psychological, medical, and physiological research have led to a new way of thinking about health and illness. This conceptualization, which has been labeled the biopsychosocial model, views health and illness as the product of a combination of factors including biological characteristics (e.g., genetic predisposition), behavioral factors (e.g., lifestyle, stress, health beliefs), and social conditions (e.g., cultural influences, family relationships, social support).

Psychologists who strive to understand how biological, behavioral, and social factors influence health and illness are called health psychologists. The term "health psychology" is often used synonymously with the terms "behavioral medicine" and "medical psychology". Health psychologists work with many different health care professionals (e.g., physicians, dentists, nurses, physician's assistants, dietitians, social workers, pharmacists, physical and occupational therapists, and chaplains) to conduct research and provide clinical assessments and treatment services. Many health psychologists focus on prevention research and interventions designed to promote health and reduce the risk of disease.

While more than half of health psychologists provide clinical services as part of their duties, many health psychologists function in non-clinical roles, primarily involving teaching and research.

- **Clinical health psychology** (**ClHP**) is a term for a division of health psychology that reflects the fact that the field was originally a branch of clinical

psychology. ClHP is also a major contributor to the field of behavioral medicine within psychiatry. Clinical practice includes education, the techniques of behavior change, and psychotherapy. In some countries, a clinical health psychologist, with additional training, can become a medical psychologist and, thereby, obtain prescription privileges.

- **Occupational health psychology** (**OHP**) is a relatively new discipline allied with health psychology. The ancestry of OHP includes health psychology, industrial/organizational psychology, and occupational health. OHP has own doctoral programs, journals, and professional organizations. The field is concerned with identifying psychosocial characteristics of workplaces that give rise to health-related problems in people who work.

These problems can involve physical health (e.g., cardiovascular disease) or mental health (e.g., depression). Examples of psychosocial characteristics of workplaces that OHP has investigated include amount of decision latitude a worker can exercise and the supportiveness of supervisors. OHP is also concerned with the development and implementation of interventions that can prevent or ameliorate work-related health problems. In addition, OHP research has important implications for the economic success of organizations.

Other research areas of concern to OHP include workplace incivility and violence, work-home carryover, unemployment and downsizing, and workplace safety and accident prevention.

- **Public health psychology** (**PHP**) is population oriented. A major aim of PHP is to investigate potential causal links between psychosocial factors and health at the population level. PH psychologists present research results to educators, policy makers, and health care providers in order to promote better public health. PHP is allied to other public health disciplines including epidemiology, nutrition, genetics and biostatistics. Some PHP interventions are targeted toward at-risk population groups (e.g., undereducated, single pregnant women who smoke) and not the population as a whole (e.g., all pregnant women).
- **Community health psychology** (**CoHP**) investigates community factors that contribute to the health and well-being of individuals who live in communities. CoHP also develops community-level interventions that are designed to combat disease and promote physical and mental health. The community often serves as the level of analysis, and is frequently sought as a partner in health-related interventions.
- **Critical health psychology** (**CrHP**) is concerned with the distribution of power and the impact of power differentials on health experience and behavior, health care systems, and health policy. CrHP prioritizes social justice and the universal right to health for people of all races, genders, ages, and socioeconomic positions. A major concern is health inequalities. The CrH psychologist is an agent of change, not simply an analyst or cataloger.

Health psychology is both a theoretical and applied field. Health psychologists employ diverse research methods. These methods include controlled randomized experiments, quasi-experiments, longitudinal studies, time-series designs, cross-sectional studies, and case-control studies as well as action research. Health psychologists study a broad range of variables including genotype, cardiovascular disease, smoking habits, religious beliefs, alcohol use, social support, living

conditions, emotional state, social class, and much more. Some health psychologists treat individuals with sleep problems, headaches, alcohol problems, etc. Other health psychologists work to empower community members by helping community members gain control over their health and improve quality of life of entire communities.

Objectives of health psychology

Understanding behavioral and contextual factors, Health psychologists conduct research to identify behaviors and experiences that promote health, give rise to illness, and influence the effectiveness of health care. They also recommend ways to improve health care and health-care policy. Health psychologists have worked on developing ways to reduce smoking and improve daily nutrition in order to promote health and prevent illness. They have also studied the association between illness and individual characteristics. For example, health psychology has found a relation between the personality characteristics thrill seeking, impulsiveness, hostility/anger, emotional instability, and depression, on one hand, and high-risk driving, on the other.

Health psychology is also concerned with contextual factors, including economic, cultural, community, social, and lifestyle factors that influence health. The biopsychosocial model can help in understanding the relation between contextual factors and biology in affecting health. Physical addiction plays an important role in smoking cessation. However, seductive advertising also contributes to psychological dependency on tobacco. Research in occupational health psychology indicates that people in jobs that combine little decision latitude with a high psychological workload are at increased risk for cardiovascular disease. Other OHP research reveals a relation between unemployment and elevations in blood pressure. OHP research also documents a relation between social class and cardiovascular disease.
Health psychologists also aim to change health behaviors for the dual purpose of helping people stay healthy and helping patients adhere to disease treatment regimens. Health psychologists employ cognitive behavior therapy and applied behavior analysis for that purpose.

Preventing illness

Health psychologists work towards promoting health through behavioral change, as mentioned above; however, they attempt to prevent illness in other ways as well. Campaigns informed by health psychology have targeted tobacco use. Those least able to afford tobacco products consume them most. Tobacco provides individuals with a way controlling aversive emotional states accompanying daily experiences of stress that characterize the lives of deprived and vulnerable individuals. Practitioners emphasize education and effective communication as a part of illness prevention because many people do not recognize, or minimize, the risk of illness present in their lives. Moreover, many individuals are often unable to apply their knowledge of health practices owing to everyday pressures and stresses. A common example of population-based attempts to motivate the smoking public to reduce its dependence on cigarettes is anti-smoking campaigns.

Health psychologists also aim at educating health professionals, including physicians and nurses, in communicating effectively with patients in ways that

overcome barriers to understanding, remembering, and implementing effective strategies for reducing exposures to risk factors and making health-enhancing behavior changes. There is also evidence from occupational health psychology that stress-reduction interventions at the workplace can be effective. For example, Kompier and his colleagues have shown that a number of interventions aimed at reducing stress in bus drivers has had beneficial effects for employees and bus companies.

The effects of disease

Health psychologists investigate how disease affects individuals' psychological well-being. An individual who becomes seriously ill or injured faces many different practical stressors. The stresssors include problems meeting medical and other bills; problems obtaining proper care when home from the hospital; obstacles to caring for dependents; having one's sense of self-reliance compromised; gaining a new, unwanted identity as a sick person; and so on. These stressors can lead to depression, reduced self-esteem,etc Health psychology also concerns itself with bettering the lives of individuals with terminal illness. When there is little hope of recovery, health psychologist therapists can improve the quality of life of the patient by helping the patient recover at least some his or her psychological well-being. Health psychologists are also concerned with identifying the best ways for providing therapeutic services for the bereaved.

Critical analysis of health policy

Critical health psychologists explore how health policy can influence inequities, inequalities, and social injustice. These avenues of research expand the scope of health psychology beyond the level of individual health to an examination of the social and economic determinants of health both within and between regions and nations. The individualism of mainstream health psychology has been critiqued and deconstructed by critical health psychologists using newer qualitative methods and frameworks for investigating health experience and behavior.

Applications of Health Psychology

Improving doctor-patient communication, Health psychologists attempt to aid the process of communication between physicians and patients during medical consultations. There are many problems in this process, with patients showing a considerable lack of understanding of many medical terms, particularly anatomical terms (e.g., intestines). One main area of research on this topic involves 'doctor-centered' or 'patient-centered' consultations. Doctor-centered consultations are generally directive, with the patient answering questions and playing less of a role in decision-making. Although this style is preferred by elderly people and others, many people dislike the sense of hierarchy or ignorance that it inspires. They prefer patient-centered consultations, which focus on the patient's needs, involve the doctor listening to the patient completely before making a decision, and involving the patient in the process of choosing treatment and finding a diagnosis.

Improving adherence to medical advice

Getting people to follow medical advice and adhere to their treatment regimens is a difficult task for health psychologists. People often forget to take their pills or are inhibited by the side effects of their medicines. Failing to take prescribed medication

is costly and wastes millions of usable medicines that could otherwise help other people. Estimated adherence rates are difficult to measure (see below); there is, however, evidence that adherence could be improved by tailoring treatment programs to individuals' daily lives.

Ways of measuring adherence

Health psychologists have identified a number of ways of measuring patients' adherence to medical regimens.

- Counting the number of pills in the medicine bottle - although this has problems with privacy and/or could be deemed patronizing or showing lack of trust in patients
- Using self-reports - although patients may fail to return the self-report or lie about their adherence
- Asking a doctor or health worker - although this presents problems on doctor-patient confidentiality
- Using 'Trackcap' bottles, which track the number of times the bottle is opened; however, this either raises problems of informed consent or, if informed consent is obtained, influence through demand characteristics.

Managing pain

Health psychology attempts to find treatments to reduce and eliminate pain, as well as understand pain anomalies such as episodic analgesia, causalgia, neuralgia, and phantom limb pain. Although the task of measuring and describing pain has been problematic, the development of the McGill Pain Questionnaire[36] has helped make progress in this area. Treatments for pain involve patient-administered analgesia, acupuncture (found by Berman to be effective in reducing pain for osteoarthritis of the knee), biofeedback, and cognitive behavior therapy.

Mind/Body Health: Stress

We've probably all felt stress. Sometimes it's brief and highly situational, like being in heavy traffic. Other times, it's more persistent and complex—relationship problems, an ailing family member, a spouse's death. And sometimes, stress can motivate us to accomplish certain tasks.

Dangerous Stress

Stress becomes dangerous when it interferes with your ability to live a normal life for an extended period of time. You may feel "out of control" and have no idea of what to do, even if the cause is relatively minor. This in turn, may cause you to feel continually fatigued, unable to concentrate, or irritable in otherwise relaxed situations. Prolonged stress may also compound any emotional problems stemming from sudden events such traumatic experiences in your past, and increase thoughts of suicide.

Natural reactions

Stress can also affect your physical health because of the human body's built-in response mechanisms. You may have found yourself sweating at the thought of an important date, or felt your heartbeat pick up while watching a scary movie. These reactions are caused by hormones that scientists believe helped our ancestors cope with the threats and uncertainties of their world. If the cause of your stress is

temporary, the physical effects are usually short-term as well. In one study, the pressure of taking exams led to increased severity of acne among college students, regardless of how they ate or slept. The condition diminished after exams were over. Abdominal pain and irregularity have also been linked to situational stress. The longer your mind feels stressed, however, the longer your physical reaction systems remain activated. This can lead to more serious health issues.

Physical wear and tear

The old saying that stress "ages" a person faster than normal was recently verified in a study of women who had spent many years caring for severely ill and disabled children. Because their bodies were no longer able to fully regenerate blood cells, these women were found to be physically a decade older than their chronological age. Extended reactions to stress can alter the body's immune system in ways that are associated with other "aging" conditions such as frailty, functional decline, cardiovascular disease, osteoporosis, inflammatory arthritis, type 2 diabetes, and certain cancers. Research also suggests that stress impairs the brain's ability to block certain toxins and other large, potentially harmful molecules. This condition is also common to patients suffering from Alzheimer's Disease.

Pressure points

Although sudden emotional stress has been linked to severe heart dysfunction in otherwise healthy people, scientists are uncertain whether chronic stress alone causes cardiovascular disease. What is clear is that excessive stress can worsen existing risk factors such as hypertension and high cholesterol levels. Studies also show that people who are quick to anger or who display frequent hostility—a behavior common to those under stress—have an increased risk of heart disease and crying fits. Feelings of despair that accompany stress can easily worsen into chronic depression, a condition that can lead you to neglect good diet and activity habits. This, in turn, can put you at a greater risk for heart disease, obesity, and kidney dysfunction. Stress can also complicate your ability to recover from a serious illness. A Swedish study found that women who have suffered heart attacks tend to have poorer chances of recovery if they are also experiencing marital stressors such as infidelity, alcohol abuse, and a spouse's physical or psychiatric illness. On the other hand, stress management training is a proven method for helping speed recovery follow a heart attack.

What you can do

Learning to deal with stress effectively is a worthwhile effort, even if you already consider yourself capable of handling anything life sends your way. Many of the most common long-term stressors—family illness, recovery after injury, career pressures—often arise without warning and simultaneously. Stress management is particularly valuable if your family has a history of hypertension and other forms of heart disease.

Identify the cause. You may find that your stress arises from something that's easy to correct. A psychologist can help you define and analyze these stressors, and develop action plans for dealing with them.

Monitor your moods. If you feel stressed during the day, write down what caused it along your thoughts and moods. Again, you may find the cause to be less serious than you first thought.

Make time for yourself at least two or three times a week. Even ten minutes a day of "personal time" can help refresh your mental outlook and slow down your body's stress response systems. Turn off the phone, spend time alone in your room, exercise, or meditate to your favorite music.

Walk away when you're angry. Before you react, take time to mentally regroup by counting to 10. Then look at the situation again. Walking or other physical activities will also help you work off steam.

Analyze your schedule. Assess your priorities and delegate whatever tasks you can (e.g., order out dinner after a busy day, share household responsibilities). Eliminate tasks that are "shoulds" but not "musts."

Health Service Delivery and Quality

Poor people - in both developed and developing countries - experience more ill health and shorter life spans than their richer fellow citizens. Although people's health is influenced by a wide range of socio-economic and lifestyle factors, access to high quality and affordable health care and public health services makes a critical contribution to health status. Health services are failing poor people - with lower rates of child immunisation, skilled attendance at child birth, and TB and malaria treatment. It's also true that richer groups tend to benefit more from public sector subsidies to health care - hospitals in urban centres often receive disproportionate funds compared with primary care in poor rural areas. And in most poor countries which lack formal taxation and insurance systems, out-of-pocket payments are paid to both private and public providers, consume household income and assets, and contribute to impoverishment.

Improving service delivery to the poor involves all the major stakeholders in the health system - the policymakers in ministries of health, finance, and public administration, health service managers and workers, public and private providers and clients and communities themselves. Better access depends on a wide range of factors - on health policies, strategy and plans that prioritise health needs and set out revenue sources and resource requirements (including mechanisms to address inequalities), on motivated and properly trained and remunerated health workers, on infrastructure, drugs and equipment, on good referral links and communication, and – last but not least - on well-informed clients and their representative bodies.

Human resources for health

This**human resources for health dossier** offers practical up to date information about how to address human resource problems and issues, drawing upon evidence about what works, and identifying innovations in approaches, policy and practice. Developing countries have committed to achieving the Millennium Development Goals (MDGs). They will need to make the most effective use of all available resources to achieve the MDGs - this includes human resources. Many countries are improving their short and medium term financial planning and budgetary processes but in the past, few, if any, have given human resource management a similar focus. Now however human resources are being seen to be as crucial as money in improving services for poor people.

Planning for human resources

Planning the supply of and demand for human resources in healthcare is a neglected topic with little consensus on how it should be done. This section covers institutional and system considerations, gender, labour markets, civil service reform and more.

Human resources contribute to keep a healthy and productive population

Poverty Reduction Strategy Papers (PRSPs) are the major aid instrument in tackling poverty. They provide a mechanism for countries to have a clear focus on this central objective. The link to debt relief for heavily indebted poor countries (HIPC countries) provides real incentives for those very poor countries to make progress. In a World Bank publication, **Review of the Poverty Reduction Strategy Paper (PRSP) approach: main findings**, the authors recognise that there has been widespread acceptance of the PRSP approach and that PRSPs are leading to better informed decision-making. But they also recognise that strategies alone are not sufficient—they must be followed up by actions. The implementation of PRSPs cannot realistically be achieved without clear human resource plans.

An analysis of PRSP and HIPC documentation illustrates the problem. Most of the country based documentation, interim PRSPs, PRSPs and progress reports refer to human resource problems but few indicate how these problems are to be addressed. HIPC documentation is even weaker in this respect. Of course it can be argued that PRSP documents and HIPC documents are not designed to address these issues. But the fact remains that without complementary human resources strategies and plans; few PRSPs will achieve the improvements they envisage.

A Bank review of the HIPC/PRSP process in 18 African countries, **Enhancing human development in the HIPC/PRSP context: progress in the Africa region during 2000**, observes that it is important to take advantage of the specific opportunities presented by the HIPC initiative to strengthen the link between debt relief and improvements in social services and eventually, progress in poverty reduction. As well as the human resource issues of increasing coverage of services to poor people, there is an emphasis on improving efficiency of human resource utilisation. Often civil service reform has focused on reducing staffing numbers but the sustained improvements have been elusive. Civil Service Reform: a review of World Bank assistance provides recommendations on how the implementation of World Bank supported civil service reforms can be improved.

CHANGING CONCEPTIONS OF HEALTH AND ILLNESS

Good health and a long life are important aims of most persons, but surely no more than a moment's reflection is necessary to convince anyone that they are not the only aim. The economic approach implies that there is an 'optimal' expected length of life, where the value in utility of an additional year is less than the utility foregone by using time and other resources to obtain that year. Therefore, a person may be a heavy smoker or so committed to work as to omit all exercise, not necessarily because he is ignorant of the consequences or 'incapable' of using the information he possesses, but because the lifespan forfeited is not worth the cost to him of quitting smoking or working less intensively . . . According to the economic approach

therefore, most (if not all!) deaths are to some extent 'suicides' in the sense that they could have been postponed if more resources had been invested in prolonging life.

THE MODERN INCREASE IN LIFE EXPECTANCY

Progress in medical science has been impressive. Knowledge of the body and understanding of disease processes have advanced continuously from the seventeenth century onwards, slowly at first but very rapidly since the turn of the century. This increase in medical knowledge appears to have resulted in a substantial increase in life expectancy. Today the life expectancy at birth in the USA is 76 years as compared to 48 years in 1900 (Matarazzo 1984; Fielding 1999). This increase in longevity has been due mainly to the virtual elimination of those infectious diseases as causes of death that were common at the turn of the twentieth century (e.g. pneumonia and influenza, tuberculosis, diphtheria, scarlet fever, measles, typhoid, poliomyelitis). Thus, whereas approximately 40 per cent of all deaths were accounted for by 11 major infections in 1900, only 6 per cent of all deaths were due to these infectious diseases in 1973 (McKinlay and McKinlay 1981). Between 1981 and 1995 the death rate due to infections has somewhat increased, mainly due to the appearance of a new infectious disease (AIDS). However, in 1996 the trend changed and infectious

This category excludes motor vehicle accidents in the years 1900 and 1940, but includes them in 1980 and 1992. This category encompasses cancer and other malignant tumours in the years 1900 and 1940 and changes to malignant neoplasms of all types in 1980 and 1992. *Source*: Matarazzo (1984); Gardner *et al*. (1996). disease deaths began to decrease again (Armstrong *et al*. 1999). illustrates the significant shift in causes of death during this century. Because this decline in mortality from infectious diseases happened during a time when medical understanding of the causes of these diseases had vastly improved and when vaccines and other chemotherapeutic medical interventions became widely available, it was only plausible toattribute these changes to the efficacy of the new medical measures.However, this may be yet another example of a premature causal inference from purely correlational evidence. After all, during the same period conditions of life also improved considerably in most industrialized societies.

For large populations in Western societies the problem of malnutrition has been solved and some of the most serious threats to health associated with water and food have been removed by improvements in water supply and sewage disposal.

from their analysis that 'medical measures (both chemotherapeutic and prophylactic) appear to have contributed little to the overall decline in mortality in the United States since about 1900 . . .' Similar conclusions were reached by McKeown (1979) on the basis of an even more extensive analysis of data from England and Wales.
Today, the major killers are cardiovascular diseases (i.e. heart disease and stroke) and cancers, with cardiovascular diseases accounting for approximately 40 per cent of deaths in the USA and other industrialized countries.
Although deaths from cardiovascular diseases increased during the first half of this century, this pattern has recently begun to reverse. During the last four decades there has been a small but steady decline in deaths due to heart disease and stroke in the United States and several other industrialized countries.

Improvements in medical treatment undoubtedly contributed to this decline, but the significant changes in lifestyle that occurred in the USA during that period were also responsible. Goldman and Cook (1984) even estimated that more than half of the decline in heart disease mortality observed in the United States between 1968 and 1976 was related to changes in lifestyle, specifically the reduction in serum cholesterol levels and cigarette smoking.

Unfortunately, despite advances in medical treatment and significant lifestyle changes, deaths due to cancer have increased since 1950 in most industrialized countries. This increase in cancer deaths has been almost entirely due to an increase in lung cancer which is responsible for more than one fourth of all cancer deaths (Breslow 1990). However, from 1990 to 1995, there occurred for the first time a continuous and sustainable decline in cancer mortality in the USA of 0.6 per cent per year (Cole and Rodu 1996). Nearly 40 per cent of this decline in cancer mortality resulted from a reduction in lung carcinoma mortality and is thus likely to be due to the reduction of smoking in the USA.

To summarize, the significant increases in life expectancy at birth that occurred during this century in most industrialized countries seem to have been only partially attributable to improvements in medical treatment.

There is substantial evidence that a purely medical explanation of these changes would be too narrow. Changes in sanitation, nutrition and lifestyles contributed importantly to the increase in life expectancy.

FROM DISEASE CONTROL TO HEALTH PROMOTION

The marked decline in mortality due to infectious disease during the twentieth century, the vast improvement in average living conditions in Western industrialized nations, and the substantial increase in life expectancy have stimulated considerable rethinking of the meaning of health and of the role of public health institutions in helping to achieve and maintain it (Breslow 1990). Whereas health had long been considered merely the absence of disease and infirmity, people were beginning to emphasize the positive aspects of health. This change in perspective was reflected in the influential definition of health offered by the World Health

Organization (WHO) in its constitution in 1948. The WHO defined health as ‘a complete state of physical, mental, and social well-being and not merely the absence of disease or infirmity’ (WHO 1948).

There are two important aspects of this definition of health which set it apart from previous definitions (Kaplan *et al*. 1993). First, by emphasizing well-being as the criterion for health, the WHO definition abandoned the traditional perspective of defining health in negative terms, namely as the absence of disease. Second, by recognizing that health status can vary in terms of a number of different dimensions, namely physical, mental and social well-being, the definition abandons the exclusive emphasis on physical health which had been typical of previous definitions (Kaplan *et al*. 1993).

The growing interest in interventions designed to prevent diseases and promote health has led to a change in focus of public health strategies towards a greater emphasis on health promotion. *Health promotion* can be defined as ‘any planned combination of educational, political, regulatory, and organizational supports for

action and conditions of living conducive to the health of individuals, groups, or communities' (Green and Kreuter
1991: 432). Countries adopting health promotion as policy have directed it mainly at primary prevention through modification of lifestyle factors that account for the largest numbers of deaths (e.g. smoking, drinking too much alcohol, eating a fatty diet, leading a sedentary life). Health promotion influences lifestyles through two strategies, namely health education and fiscal and legislative measures. Education involves the transfer of knowledge or skills. Thus, health education provides individuals, groups or communities with the knowledge about the health consequences of certain lifestyles and with the skills to enable them to change their behaviour.
Fiscal or legislative measures such as increasing the tax on tobacco or introducing seat belt legislation are used to change the incentive structure that influences behaviour. Health promotion also uses strategies not directed at lifestyles such as environmental changes aimed at the protection of health (e.g. car safety measures).

THE IMPACT OF BEHAVIOUR ON HEALTH

No single set of data can better illustrate the fact that our health is influenced by the way we live than the findings of a prospective study on the health impact of some rather innocuous health behaviours, conducted by
Belloc, Breslow and their colleagues (Belloc and Breslow 1972; Belloc 1973;
Breslow and Enstrom 1980). In 1965, these researchers asked a representative probability sample of 6928 residents of Alamedacounty, California, whether they engaged in the following seven health practices:
1 Sleeping seven to eight hours daily.
2 Eating breakfast almost every day.
3 Never or rarely eating between meals.
4 Currently being at or near prescribed height-adjusted weight.
5 Never smoking cigarettes.

At the time, it was found that good practices were associated with positive health status, those who followed all the good practices being in better health than those who failed to do so, and that this association was independent of age, sex, and economic status (Belloc and Breslow 1972).
Most striking, however, were the findings of two follow-up studies in which the relationship between these health habits and longevity was explored by using death records. At the first follow-up, conducted five and a half years later, 371 deaths had occurred (Belloc 1973). When the initial health practices in 1965 were then related to subsequent mortality, it was found that the more of these 'good' health practices a person engaged in, the greater was the probability that he or she would survive the next five and a half years (Figure 1.2).
These findings were confirmed at a second follow-up investigation conducted nine and a half years after the initial inquiry, when again an inverse relationship between health practices and age-adjusted mortality rates was observed (Breslow and Enstrom 1980). Men who followed all seven health practices had a mortality rate which was only 28 per cent of that of men who followed zero to three practices; the comparable rate for women who followed all practices was 43 per cent of those who followed zero to three practices. The authors also observed a great stability in the health practices of each individual over the nine and a half year period.

The importance of lifestyle factors for the maintenance of health and the prevention of disease has also been underlined by the outcome of analyses of the contribution of lifestyle factors and other modifiable causes to mortality in the United States. These analyses were conducted by the Centers for Disease Control and Prevention in 1977 and 1990 (McGinnis and Foege 1993). Since both analyses reached very similar conclusions I will focus here on the more recent report. McGinnis and Foege (1993) estimated that of the approximately 2,148,000 deaths that occurred in the USA in the year 1990, nearly 50 per cent were due to modifiable factors.
More than 40 per cent of these premature deaths were due to lifestyle factors (e.g. smoking, eating the wrong diet, leading a sedentary lifestyle, consuming too much alcohol, sexual risk behaviour, illicit drug use, firearms, motor vehicle accidents). In addition, the list of modifiable causes includes preventable infectious diseases (excluding HIV) and death caused by toxic agents which may pose a threat to human health as occupational hazards, environmental pollutants, contaminants of food and water supplies, and components of commercial products. All these deaths were premature in the sense that they could have been postponed if individuals or communities had taken appropriate measures.

Findings such as these tend to support Becker's (1976) argument that most deaths are to some extent self-inflicted, at least in the sense that they could have been postponed, if people had engaged in 'good' health practices, like the ones listed by Belloc and Breslow (1972). The important implication of this research at the individual level is that the responsibility for health does not rest with the medical profession alone. Each of us can have a major impact on the state of our own health. At the institutional level, it emphasizes the potential effectiveness of preventive measures (i.e. primary prevention) that focus on persuading people to adopt good health habits and to change bad ones.

It is important to note, however, that life extension (i.e. mere quantity) is only one of the goals of health promotion, and perhaps not even the most important one. We may have to accept that there is a natural limit to our life expectancy and that we are unlikely to reach the age of 140, even with the healthiest of lifestyles (Fries *et al*. 1989). People are persuaded to engage in a healthy lifestyle not merely to lengthen their lives but to help them to stay fit longer and lead an active life right into old age without being plagued by pain, infirmity and chronic disease. Thus, the second major goal of health promotion is to increase the quality of life and to contribute to healthy and successful aging by delaying the onset of chronic disease and extending the active lifespan (Fries *et al*. 1989). Low probability of disease and disease-related disability and high cognitive and physical functional capacity in old age are two of the main components of successful aging (Rowe and Kahn 1987).

THE IMPACT OF STRESS ON HEALTH

The concept of stress has become so much part of common culture that it does not seem to need definition. Reports about health consequences of everyday stress pervade the advice columns of popular magazines and even teenagers complain to their teachers that they are under undue stress due to an overload of homework. It has become public knowledge that stress, like smoking or drinking too much alcohol, can have adverse effects on physical as well as mental health.

As we will see later, there is now ample evidence that psychosocial stress results in health impairment. To some extent these health consequences of stressful life events are mediated by the same changes in endocrine, immune and autonomic nervous systems which have been described in the classic work of Selye on the health impact of physical stressors. However, the experience of psychosocial stress also causes negative changes in health behaviour that contribute to the stress–illness relationship (e.g. irregular eating habits, increases in smoking, alcohol consumption and drug intake). Furthermore, stress is often also a result of people's lifestyles. Thus, research on stress and illness is closely related to our interest in the impact of behaviour on health.

FROM THE BIOMEDICAL TO THE BIOPSYCHOSOCIAL MODEL OF DISEASE

That lifestyle factors and psychosocial stress are important determinants of health and illness is difficult to accept within the framework of the biomedical model which has been the dominant model of disease for several centuries (Engel 1977). This model assumes that for every disease, there exists a primary biological cause that is objectively identifiable. Let us exemplify this approach with statements from a typical medical textbook,
Introduction to Human Disease by Kent and Hart (1987). According to these authors, diseases are caused 'by injury which may be either external or internal in origin . . . External causes of disease are divided into physical, chemical and microbiologic . . . Internal causes of disease fall into three large categories' (vascular, immunologic, metabolic) (1987: 8/9). Because behavioural factors are not considered to be potential causes of disease, they are also not assessed as part of the process of diagnosis.
By focusing only on biological causes of illness, the biomedical model disregards the fact that most illnesses are the result of an interaction of social, psychological and biological events. The logical inference of such a biological conception of disease is that physicians need not be concerned with psychosocial issues because they lie outside their responsibility and authority. Thus, the model has little to offer in guiding the kind of preventive efforts that are needed to reduce the incidence of chronic diseases by changing health beliefs, attitudes and behaviour.

In recognition of these problems, Engel (1977) proposed an expansion of the biomedical model which incorporates psychosocial factors into the scientific equation. The biopsychosocial model maintains that biological, psychological and social factors are all important determinants of health and illness. According to this approach, medical diagnosis should always consider the interaction of biological, psychological and social factors to assess health and make recommendations for treatment.

SOCIAL PSYCHOLOGY AND HEALTH

The growing recognition that lifestyle factors and psychosocial stress contribute substantially to morbidity and mortality from cardiovascular disease, cancer, injuries and other leading causes of death in industrialized countries was one of the factors which in the late 1970s led to the development of health psychology as a field which integrates psychological knowledge relevant to the maintenance of health, the prevention of illness, and the adjustment to illness. Social psychology had, and still

has, an important contribution to make to this endeavour, because lifestyles are likely to be determined by health attitudes and health beliefs.
Effective prevention has to achieve large-scale changes in lifestyles and such attempts will have to rely on mass communication and thus on an application of social psychological techniques of attitude and behaviour change.

The interest of social psychologists in the study of stress developed more recently, because many of the most stressful life events (e.g. divorce, bereavement) involve a break-up of social relationships. Furthermore, the health impact of stressful events not only depends on the nature of these events but also on the individuals' ability to cope with the crisis and on the extent to which they receive social support from relatives, friends and other members of their social network. Finally, the impact of stress on health, although to some extent due to the brain's influence on physiological processes such as the body's immune response, is also mediated by the adoption of health-impairing habits as coping strategies (e.g. smoking, alcohol abuse). Thus, social factors are not only important in determining the stressful nature of many life events but also as moderators of the stress–health relationship.
Social psychologists have also made important contributions to another major area of health psychology, namely the analysis and improvement of health care systems. This involved issues such as physician–patient relationships, compliance with medical procedures, anxiety as related to medical procedures, and burnout in the helping profession. Although a review of social psychological research on these topics would have been highly relevant in the context of this book, these issues will not be discussed.
Due to space limitations any attempt at completely reviewing social psychological contributions to health psychology would have had to remain at a superficial level. Instead I decided to present an in-depth analysis of a number of selected areas. The reader interested in social psychological contributions to research into the health care system should consult the excellent overviews provided by Sarafino (1998) or Taylor (1995).

Illness

Illness (sometimes referred to as **ill-health** or **ailment**) is a state of poor health. Illness is sometimes considered a synonym for disease. Others maintain that fine distinctions exist. Some have described illness as the subjective perception by a patient of an objectively defined disease

Introduction

The mode of being healthy includes, as defined by the World Health Organization, " [...] a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". [4] When these conditions are not fulfilled, then one can be considered to have an illness or be ill. Medication and the science of pharmacologyis used to cure or reduce symptoms of an illness or medical conditions. Developmental disability is a term used to describe severe, life-long disabilities attributable to mental and/or physical impairments.

Physical

Conditions of the body or mind that cause pain, dysfunction, or distress to the person afflicted or those in contact with the person can be deemed an illness. Sometimes the term is used broadly to include injuries, disabilities, syndromes, infections, symptoms, deviant behaviors, and atypical variations of structure and function, while in other contexts these may be considered distinguishable categories. A pathogen or infectious agent is a biological agent that causes disease or illness to its host. A passenger virus is a virus that simply hitchhikes in the body of a person or infects the body without causing symptoms, illness or disease. Foodborne illness or food poisoning is any illness resulting from the consumption of food contaminated with pathogenic bacteria, toxins, viruses, prions or parasites.

Adaptive response

According to evolutionary medicine, much illness is not directly caused by an infection or body dysfunction but is instead a response created by the body. Fever, for example, is not caused directly by bacteria or viruses but the body (after having immunologically identified their presence) seeking to clear itself of them through raised body temperature. Evolutionary medicine identifies a set of responses that aids fever in doing this called sickness behavior.[5][6][7] These include such illness defining health changes as lethargy, depression, anorexia, sleepiness, hyperalgesia, and the inability to concentrate. These together with fever are caused by the brain through its top down control upon the body. They are, therefore, not necessary, and often do not accompany an infection (such as the lack of fever during malnutrition or late pregnancy) when they have a cost that outweighs their benefit. In humans, an important factor are beliefs that influence whether the health management system in the brain that evaluates costs and benefits deploys them or not. The health management system, when it factors in false information, has been suggested to underlie the placebo reduction of illness.[8]

Mental

Mental illness (or *Emotional disability*, *Cognitive dysfunction*) is a broad generic label for a category of illnesses that may include affective or emotional instability, behavioral dysregulation, and/or cognitive dysfunction or impairment. Specific illnesses known as mental illnesses include major depression, generalized anxiety disorder, schizophrenia, and attention deficit hyperactivity disorder, to name a few. Mental illness can be of biological (e.g., anatomical, chemical, or genetic) or psychological (e.g., trauma or conflict) origin. It can impact one's ability to work or go to school and contribute to problems in relationships. Other generic names for mental illness include "mental disorder", "psychiatric disorder", "psychological disorder","abnormal psychology", "emotional disability", "emotional problems", or "behavior problem". The term insanity is used technically as a legal term. Brain damage may result in impairment of mental function.

Social

Social determinants of health are the social conditions in which people live which determine their health. Illnesses are generally related to social, economic, political, and environmental circumstances. Social determinants of health have been recognized by several health organizations such as the Public Health Agency of Canada and the World Health Organization to greatly influence collective and personal well-being.

Treatment

Health care is the prevention, treatment, and management of illness and the preservation of mental and physical well-being through the services offered by the medical, nursing, and allied health professions. The organised provision of such services may constitute a health care system. Before the term "healthcare" became popular, English-speakers referred to medicine or to the health sector and spoke of the treatment and prevention of illness and disease. A patient is any person who receives medical attention, care, or treatment. The person is most often ill or injured and is being treated by, or in need of treatment by, a physician or other medical professional. Health consumer or health care consumer is another name for patient, usually used by some governmental agencies, insurance companies, and/or patient groups.

Medical emergencies are injuries or illnesses that pose an immediate threat to a person's health or life which require help from a doctor or hospital. The doctor's specialization of emergency medicine includes techniques for effective handling of medical emergencies and resuscitation of patients. Emergency departments provides initial treatment to patients with a broad spectrum of illnesses and injuries, some of which may be life-threatening and requiring immediate attention.

A drug is any chemical substance other than a food or device that affects the function of living things. Drugs can be used to treat illness, or they can be used recreationally to alter behavior and perception. Medications are typically produced by pharmaceutical companies and are often patented. Those that are not patented are called generic drugs. Some drugs, if misused, can overwhelm the homeostasis of a living organism, causing severe illness or death. Essentially it is a type of poisoning. In the context of biology, poisons are substances that can cause illness.

Bedrest as a medical treatment refers to staying in bed day and night. Even though most patients in hospitals spend most of their time in the hospital beds, bedrest more often refers to an extended period of recumbence at home.

Human enhancement technologies (HET) are technologies that can be used not simply for treating illness and disability, but also for enhancing human capacities and characteristics. Medication is a licenced drug taken to cure or reduce symptoms of an illness or medical condition. A wheelchair is mobility device that takes the form of a chair on wheels, used by people for whom walking is difficult or impossible due to illness or disability.

Shock therapy is the deliberate and controlled induction of some form of physiological state of shock in an individual for the purpose of psychiatric treatment. Electrotherapy is the use of electrical energy in the treatment of impairments of health and a conditions of abnormal functioning.

Study of illness

Epidemiology is the scientific study of factors affecting the health and illness of individuals and populations, and serves as the foundation and logic of interventions made in the interest of public health and preventive medicine.

Behavioral medicine is an interdisciplinary field of medicine concerned with the development and integration of psychosocial, behavioral and biomedical knowledge relevant to health and illness. Clinical Global Impression scale to assess treatment response in patients with mental disorders. It's " Improvement scale" requires the clinician to rate how much the patient's illness has improved or worsened relative to a baseline state. Mental confusion and decreased alertness may indicate that a chronic illness has gotten worse.

Religion and illness

Jewish, Islamic law and Baha'i grant exceptions to people of ill health. For example, one whose life would be endangered by doing so is exempt from (and indeed forbidden to participate in) fasting on Yom Kippur or during Ramadan.

In the New TestamentJesus is described as performing miracles of healing.

Illness was one of the four scenes, referred to as the four sights, encountered by Gautama Buddha.

Folk medicine is collectively procedures traditionally used for treatment of illness and injury, aid to childbirth, and maintenance of wellness. It is a body of knowledge distinct from "scientific medicine" and may coexist in the same culture.

HEALTH BEHAVIOUR

Behaviours such as stopping smoking, moderation of alcohol intake, healthy eating and physical activity can reduce the risks of developing serious illnesses such as cancer, heart disease and type 2 diabetes. However, promoting the uptake of healthier behaviour presents challenges, both at the individual and population levels.

This POSTnote will describe the importance of health behaviour change and the challenges to such change.

In the past, health policy has centred on services to meet the needs of those who are ill. More recently there has been growing interest in preventing illness and promoting good health. The Wanless reports1,2 identified the need to engage people in their health and to shift the emphasis of the NHS from cure to prevention of illness. Two papers published in 2004 contributed to the growing interest in behaviour change. First, the Cabinet Office produced a discussion paper on *Personal Responsibility and*

*Changing Behaviour*outlining evidence for the effectiveness of behavioural interventions and the role of the individual in adopting behaviours that aid efficient delivery of public services. Second, the White Paper
Choosing Health prioritised key areas for improved health behaviour and the provision of resources to enable greater individual responsibility for health. Those applying to physical health are shown in Table 1.

Changing health behaviour

While people may aspire towards a healthier lifestyle, the initiation and maintenance of health behaviours result from an interaction of social, psychological, biological, and environmental factors. In recent years the emerging discipline of Health Psychology has tried to explain why people engage in unhealthy behaviours and to inform the development of health behaviour interventions. Research suggests that intentions to change a behaviour, while often a prerequisite of change, can be insufficient to produce sustained change. Starting and maintaining behavioural change can be aided by psychological characteristics and processes. These include the belief that one has the psychological resources to undertake the desired behaviour (self-efficacy) and the individual's ability to use self-regulatory strategies (see Box 1). Box 2 shows how these can be translated into practice for quitting smoking and healthier eating.

Psychological factors contributing to successful behaviour change

Self-efficacy

Self-efficacy is the belief that one has the capability to undertake the actions to bring about particular outcomes.
Self-efficacy can be enhanced, for example, by:

• Experience of succeeding at the behaviour. To promote safer sex practices, teenagers might be encouraged to role play asking a partner to use a condom.
• Modelling or observing another successfully undertaking the target behaviour. To promote the self-efficacy of children to eat healthily, they might be encouraged to observe other children eating fruit and vegetables

Self-regulation

Self regulation includes a number of processes which aid implementation of the behaviour.

• Setting and reviewing realistic goals to implement a behaviour. The goal of walking to work to increase physical activity may be more achievable than going to the gym which requires effort and financial outlay.
• Formation of implementation intentions specifying the context in which the person is going to engage in the behaviour. If swimming is the target behaviour then the person might identify the day of the week, the time and the place where they will swim.
• Identifying barriers and ways to overcome them.

Someone quitting smoking might identify that they always smoke with a social drink. The smoking cessation charity QUIT advise smokers to overcome this by having a different drink from their usual, and holding it in the hand in which they usually hold their cigarette, along with other practical suggestion.

• Monitoring performance. Tools such as diaries in which to record attempts at the behaviour can be helpful in identifying both successes and failures to reach the goal which can then be used to develop further strategies.
• Feedback on performance from others can contribute to strategies to implement a behaviour.
Research indicates that the impact of psychological interventions is enhanced when supported by legislation that makes healthy choices easier. Findings from one area (smoking research) can be applied to other health behaviour areas (such as obesity management)3.

Issues

Barriers to Health Behaviour Change

Social Deprivation

The government has made tackling health inequalities a major target. More socially deprived groups have poorer health and more difficulty in changing health behaviours.
The proportion of the UK population who smoke has dropped from 45% 30 years ago to 24% today. However, in managerial and professional work 18% of men and 16% of women smoke, whereas in routine and manual positions 32% of men and 29% of women
smoke4. To reduce inequalities and increase population health, improving the health of more socially deprived groups needs to be prioritised. However, there are challenges to implementing such behavioural programmes in these groups. Among these is the belief among health professionals that these groups are “hard to reach”. This belief may reflect the use of inappropriate strategies to try and reach them. For instance, an emphasis on written communication may be less appropriate for reaching socially deprived groups, who tend to have lower literacy levels.

Health promotion tools

Smoking

Population level interventions

• Media information campaigns about the harm of smoking can motivate and support behaviour change.
The “get unhooked” campaign tries to raise smokers’ self-efficacy by communicating that they can stop as well as providing information about support to give an immediate way to turn motivation into behaviour.
• Incentives. Smokers are encouraged to quit by tax on cigarettes, while GPs are offered incentives to promote smoking cessation among their patients.

Individual level interventions

• Medical treatments include nicotine replacement therapy to reduce withdrawal symptoms and medicines such as buproprion to reduce cravings.
• Psychological support such as the telephone counseling service provided by QUIT. This aims to: help smokers understand their smoking behaviour and increase consciousness of their smoking; minimise their reasons to continue smoking and maximise reasons to stop; and plan their quit attempt using psychological support from friends and family and medical treatments.

Healthy Eating

Population level interventions

• Food labelling. The Food Standards Agency (FSA) labelling scheme gives fat, saturates, sugars, and salt a traffic light colour coded label indicating its level in the product. Red labels indicate high levels, amber labels medium levels and green labels low levels. Some retailers also colour code calories. Since Sainsbury's introduced traffic light labels they have identified sales increases of mainly green labelled products and decreases of mainly red labelled products across ranges including sandwiches, ready meals and dairy desserts.
• Advertising bans. Ofcom has announced a ban on adverts for foods high in fat, salt and sugars around children's programmes. Such advertising affects children's food preferences and consumption.
• Signalling. Health researchers and pressure groups suggest public institutions should signal what a healthy diet is by providing it for their clients. Fast food outlets in hospitals and machines vending sweets, crisps and fizzy drinks in schools have the opposite effect.

Individual level interventions
"The Food Dudes" intervention is based on modelling of, and rewards for, healthy eating. Children aged 5-7 years see healthy eating modelled in a video in which a group ofslightly older children are shown eating and enjoyingvegetables while encouraging the viewers to do the same.Rewards include "Food Dudes" lunch boxes and stickers.Developing programmes specific to the needs of thosewho are more socially deprived requires their inclusion inresearch. However researchers suggest that there arebarriers to this aim. For instance, Research EthicsCommittees may be reluctant to consider alternatives tomailed letters in study recruitment. This may excludethose with lower literacy from participating in research,as such people may prefer a direct personal approachand be less likely to respond to written letters.

Some groups in the population are more likely toexperience behaviour-related illness, and those whoexperience one such illness, frequently experience others.At least part of the cause of such clustering is that thesocial environments that maintain one unhealthybehaviour will maintain others. This is an issue for thosewho are more socially deprived and have smaller rangesof healthy options. For instance, more deprived areas areoften unsafe and less pleasant environments, reducingthe motivation to increase physical activity by walking. Such areas may also lack shops selling healthy foods atcompetitive prices, reducing healthy dietary choices.

Implementation of health behaviour change
Responsibility for changing health behaviours is dividedbetween different parts of government. Large scale publichealth media campaigns are the responsibility of theDepartment of Health (DH). Responsibility for identifyingand assessing individual and population levelinterventions with a good evidence base lies with theNational Institute for Health & Clinical Excellence (NICE).

Co-ordination of health behaviour change
Because several government departments haveresponsibility for health behaviour change, the benefitsaccruing from investments made by one department maybe reaped by another. One reason for implementingpublic service agreements (PSAs) was to address suchco-ordination issues. Thus three government departments
- DH; Education and Skills; and Culture, Media and Sport

- share responsibility for meeting the 2004 PSA target toreduce childhood obesity by 2010. In 2006, the
National Audit Office, the Healthcare Commission andthe Audit Commission published a report examining thecapacity of arrangements in place to meet this PSAtarget6. It noted that the three lead departments wouldneed to work closely with each other and other national
(NICE), regional (strategic health authorities) and local(primary care trusts) agencies.
It further noted that while the target was set in 2004,two key ingredients for effective local plans - local dataon the prevalence of childhood obesity and NICEguidance on the prevention and management of obesity -were not available until 2006.This means that most ofthe progress towards meeting the targets will have tooccur in the last three years of the PSA period. Exampleslike this have led to calls for greater co-ordination ofhealth promotion activities. Bodies like the NationalHeart Forum suggest that there is a need for a trustedand independent agency to co-ordinate health promotion.
The Health Education Authority (HEA) played such a roleuntil it was disbanded in 2000.

Targeting behaviour change programmes.
Social marketing uses techniques from commercialmarketing to promote behaviour change. The National
Centre for Social Marketing facilitates the use of thesetechniques. At the population level, social marketing canbe used to target campaigns by identifying segments ofthe population that share traits in relation to the targetbehaviour. As regards campaigns to stop smoking, thosewho smoke and want to stop will require differentinterventions to those who smoke but do not currentlywant to stop. Programmes also need to take account ofindividual differences in the ability to change behaviour.
'Stepped' intervention programmes, currently beingdeveloped by the US National Institutes of Health (NIH)could be used to target more costly intensiveinterventions appropriately. Primary care doctors use acomputer programme to assess the behaviour changeneeds of each patient who attends an appointment and,based on this assessment, recommend a simplebehavioural change programme tailored to the patient. Intensive interventions can then be targeted to those whoare not able to change their behaviour following a lowintensity intervention.

Research into health behaviour change
Implementation of effective behaviour change strategiesrequires the support of an ongoing research programme.However, there are challenges to conducting anddisseminating health behaviour change research.

Communicating research findings
Communicating research evidence to policymakers isproblematic. Academic researchers are not rewarded fordoing so as the Research Assessment Exercise focuses onrewarding publication of work in academic journals. Incontrast, US researchers are encouraged to communicatetheir research to health policymakers; grants includefunds specifically for dissemination and funders organize meetings between policymakers and researchers.

Funding for behavioural medicine research
Most medical research funding is directed at medicalinterventions for disease. In the UK 0.5% of such fundingis spent on developing behavioural interventions topromote health.7 In the US the NIH funding for suchresearch is about 4% of the total budget.

Research in socially deprived groups
Behaviour change interventions tend to concentrate onone behaviour at a time rather than addressing theclusters of behaviour to which those who are moresocially deprived are vulnerable. For example, eating ahealthy diet may have a limited impact on a person'soverall well-being, if additional problems of smoking andlack of physical activity are not also addressed. However,research into changing clusters of behaviours is complexand expensive and, to be fully successful, requires thatthe environmental issues that reduce choices in moredeprived areas are also addressed.

Role of industry in health behaviour change
Industry has an important role to play in promoting health behaviours. It would prefer to do this via voluntary agreements with the public sector. Reformulation of processed foods to reduce their fat, salt and sugar content and schemes to provide consumers with more information about the levels of nutrients in products are examples of such agreements. However, as outlines, the voluntary nature of food labelling means that opinions differ over how to present such information.
NGOs and consumer groups such as Which? Suggest that there is a limit to what voluntary agreements can achieve, and argue for greater regulation of industry. The ban on advertising of certain food products on children's television is a recent example of the sort of stricter regulation that such groups advocate. While the Food and Drink Federation (FDF) agree that there is a need for restrictions on advertising to young children they argue that the ban considers foods in isolation rather than as part of a balanced diet.

Food labelling and healthy eating
Food labelling is currently regulated by the European Union so any UK scheme has to be voluntary. The Food Standard Agency (FSA) worked to propose a voluntary scheme that was acceptable to consumers and industry. Ten different signpost labelling formats were tested. These included those indicating the percentage of the guideline daily amount (GDA) of salt, fat, saturated fat and sugars in the product and those colour coding levels of these nutrients. Testing indicated that consumers found colour coding helpful and straightforward to use, while some found GDAs confusing.
The FSA consulted with all stakeholders including the food industry, consumers and public health groups to produce four core principles to guide signpost labelling while allowing product identity to be maintained:
• Provision of separate information on fat, saturated fat, sugars and salt;
• Use of red, amber and green colour coding to indicate whether levels of a nutrient are high, medium or low;
• Use of nutritional criteria developed by the FSA to determine the colour code
• Information on the levels of a nutrient per portion.
Additional information on GDAs on the label is optional.
While some supermarkets and food manufacturers have introduced traffic light labelling, the largest UK supermarket (Tesco) and many food manufacturers have

introduced labelling which presents percentage GDAs without colour coding. The Food and Drink Federation (FDF) suggest that

GDAs make people think about how each food contributes to their overall diet and allows them to compare levels of key nutrients across different products. Which? compared understanding of the FSA's traffic light labels with GDA labels without colour coding. Traffic lightlabels were most effective at promoting understanding of thenutrient levels in a product, in allowing comparison betweenproducts and were also more likely to be considered quickand easy to use. The traffic light labels were more successfulin enabling those from more socially deprived groups toidentify healthier products. An independent study is beingset up to evaluate the impact of front of pack labelling onconsumer behaviour and understanding. The FSA has madea commitment to stand by the outcome of the independentstudy. The FDF state that it fully supports the independentevaluation and will take on board what is learnt from it.The tobacco industry has learned to live with stricterregulation of its products. The Tobacco ManufacturersAssociation argues that the industry has become moresocially responsibility and should be included indiscussions on future tobacco policy.

Individual responsibility and state intervention

Historically there has been fierce opposition to public health measures. In 1848 the first British Public Health Act which brought water and sewage systems under the control of the government was opposed as 'paternalistic' and 'despotic'. Today many, including industry groups, argue that decisions about engaging in health behaviours should be left to individual choice with regulation against unhealthy choices being condemned as "nanny stateism".

Others, including health researchers and policy organisations, argue for further regulation. They suggest that people live in an environment that is shaped by forces outside their control, including the state and industry and that these forces influence their choices. For instance an Academy of Medical Sciences report suggests that falls in the relative price of alcohol in the UK have driven increases in consumption and that this could be reversed by increases in the price of alcohol9. Such groups argue that it is appropriate to implement legislation, such as increases in the price of alcohol, that contribute to providing an environment in which people can, more readily, act upon their preferences in regards to healthy choices.

Stress and Health

Stress can be defined as any type of change that causes physical, emotional or psychological strain. However, not all types of stress are harmful or even negative. There are a few different types of stress that we encounter:

- **Eustress**, a type of stress that is fun and exciting, and keeps us vital (e.g. skiing down a slope or racing to meet a deadline)
- **Acute Stress**, a very short-term type of stress that can either be positive (eustress) or more distressing (what we normally think of when we think of

'stress') ; this is the type of stress we most often encounter in day-to-day life (e.g. skiing down said slope or dealing with road rage)
- **Episodic Acute Stress**, where acute stress seems to run rampant and be a way of life, creating a life of relative chaos (e.g. the type of stress that coined the terms 'drama queen' and 'absent-minded professor')
- **Chronic Stress**, the type of stress that seems never-ending and inescapable, like the stress of a bad marriage or an extremely taxing job (this type of stress can lead to burnout)

The Fight or Flight Response

Stress can trigger the body's response to perceived threat or danger, the Fight-or-Flight response. During this reaction, certain hormones like adrenalin and cortisol are released, speeding the heart rate, slowing digestion, shunting blood flow to major muscle groups, and changing various other autonomic nervous functions, giving the body a burst of energy and strength. Originally named for its ability to enable us to physically fight or run away when faced with danger, it's now activated in situations where neither response is appropriate, like in traffic or during a stressful day at work. When the perceived threat is gone, systems are designed to return to normal function via the relaxation response, but in our times of chronic stress, this often doesn't happen enough, causing damage to the body.

Stress and Health: Implications of Chronic Stress

When faced with chronic stress and an overactivatedautonomic nervous system, people begin to see physical symptoms. The first symptoms are relatively mild, like chronic headaches and increased susceptibility to colds. With more exposure to chronic stress, however, more serious health problems may develop. These stress-influenced conditions include, but are not limited to:

- depression
- diabetes
- hair loss
- heart disease
- hyperthyroidism
- obesity
- obsessive-compulsive or anxiety disorder
- sexual dysfunction
- tooth and gum disease
- ulcers
- cancer (possibly)

In fact, most it's been estimated that as many as 90% of doctor's visits are for symptoms that are at least partially stress-related!

Social psychology

Social psychology is the study of the relations between people and groups. Scholars in this interdisciplinary area are typically either psychologists or sociologists, though all social psychologists employ both the individual and the group as their units of analysis.

Despite their similarity, psychological and sociological researchers tend to differ in their goals, approaches, methods, and terminology. They also favor separate academic journals and professional societies. The greatest period of collaboration between sociologists and psychologists was during the years immediately following World War II. Although there has been increasing isolation and specialization in recent years, some degree of overlap and influence remains between the two disciplines.

Psychology

Most psychologists are trained within psychology. Their approach to the field focuses on the individual and attempts to explain how the thoughts, feelings, and behaviors of individuals are influenced by other people. Psychologically oriented researchers emphasize the immediate social situation and the interactionbetween person and situation variables. Their research tends to be empirical and quantitative, and it is often centered around laboratory experiments, but there are some computational modeling efforts in the field.

In its early days, with the exception of sociologists of the day, social psychology struggled for recognition as a social science. One of the earliest psychologists to deal directly with this was William McDougall. Contemporary social psychology is "characterised by a fundamental commitment to the experimental method". While publications on social psychology tend to be dominated by American texts, efforts have been made to balance this by publication of a European perspective.

Psychologists who study social psychology are interested in such topics as attitudes, social cognition, cognitive dissonance, social influence, and interpersonal behaviors such as altruism and aggression. Three influential journals for the publication of research in this area are the *Journal of Personality and Social Psychology*, the *Journal of Experimental Social Psychology*, and the *Personality and Social Psychology Bulletin*. There are also many other general and specialized social psychology journals.

Sociology

Sociologists' work has a greater focus on the behavior of the group, and thus examines such phenomena as interactions and exchanges at the micro-level, group dynamics and group development, and crowds at the macro-level. Sociologists are interested in the individual and group, but generally within the context of larger social structures and processes, such as social roles, race, class, gender, ethnicity, and socialization. They use a combination of qualitative research designs and quantitative methods, such as procedures for sampling and surveys.

Sociologists in this area are interested in a variety of demographic, social, and cultural phenomena. Some of their major research areas are social inequality, group dynamics, social change, socialization, social identity, and symbolic interactionism. The key sociological journal is *Social Psychology Quarterly*.

Health promotion

Health promotion has been defined by the World Health Organization's 2005 Bangkok Charter for Health Promotion in a Globalized World as "the process of enabling people to increase control over their health and its determinants, and thereby improve their health"[1]. The primary means of health promotion occur through developing healthy public policy that addresses the prerequisities of health such as income, housing, food security, employment, and quality working conditions. There is a tendency among public health officials and governments—and this is especially the case in liberal nations such as Canada and the USA—to reduce health promotion to health education and social marketing focused on changing behavioral risk factors.

Recent work in the UK (Delphi consultation exercise due to be published late 2009 by Royal Society of Public Health and the National Social Marketing Centre) on relationship between health promotion and social marketing has highlighted and reinforce the potential integrative nature of the approaches. While an independent review (NCC 'It's Our Health!' 2006) identified that some social marketing has in past adopted a narrow or limited approach, the UK has increasingly taken a lead in the discussion and developed of much more integrative and strategic approach (see Strategic Social Marketing in 'Social Marketing and Public Health' 2009 Oxford Press) which adopts a whole-system and holistic approach, integrating the learning from effective health promotion approaches with relevant learning from social marketing and other disciplines. A key finding from the Delphi consultation was the need to avoid unnecessary and arbitrary 'methods wars' and instead focus on the issue of 'utility' and harnessing the potential of learning from multiple disciplines and sources. Such an approach is arguably how health promotion has developed over the years pulling in learning from different sectors and disciplines to enhance and develop.

History

The "first and best known" definition of health promotion, promulgated by the *American Journal of Health Promotion* since at least 1986, is "the science and art of helping people change their lifestyle to move toward a state of optimal health". This definition was derived from the 1974 Lalonde report from the Government of Canada[3], which contained a health promotion strategy "aimed at informing, influencing and assisting both individuals and organizations so that they will accept more responsibility and be more active in matters affecting mental and physical health"[5]. Another predecessor of the definition was the 1979 *Healthy People* report of the Surgeon General of the United States, which noted that health promotion "seeks the development of community and individual measures which can help... [people] to develop lifestyles that can maintain and enhance the state of well-being".

At least two publications led to a "broad empowerment/environmental" definition of health promotion in the mid-1980s:

- In 1984 the World Health Organization (WHO) Regional Office for Europe defined health promotion as "the process of enabling people to increase control over, and to improve, their health". In addition to methods to change lifestyles, the WHO Regional Office advocated "legislation, fiscal measures, organisational change, community development and spontaneous local activities against health hazards" as health promotion methods.
- In 1986, Jake Epp, Canadian Minister of National Health and Welfare, released *Achieving health for all: a framework for health promotion* which also came to be known as the "Epp report". This report defined the three "mechanisms" of health promotion as "self-care"; "mutual aid, or the actions people take to help each other cope"; and "healthy environments".

The WHO, in collaboration with other organizations, has subsequently co-sponsored international conferences on health promotion as follows:

- 1st International Conference on Health Promotion, Ottawa, 1986, which resulted in the "Ottawa Charter for Health Promotion". According to the Ottawa Charter, health promotion:
    - "is not just the responsibility of the health sector, but goes beyond healthy life-styles to well-being"
    - "aims at making... [political, economic, social, cultural, environmental, behavioural and biological factors] favourable through advocacy for health"
    - "focuses on achieving equity in health"
    - "demands coordinated action by all concerned: by governments, by health and other social and economic sectors, by nongovernmental and voluntary organization, by local authorities, by industry and by the media"
    - "should be adapted to the local needs and possibilities of individual countries and regions to take into account differing social, cultural and economic systems"

  In addition, the Ottawa Charter conceptualized "health promotion action" as "Build Healthy Public Policy," "Create Supportive Environments," "Strengthen Community Actions," "Develop Personal Skills," "Reorient Health Services" (i.e., "beyond its responsibility for providing clinical and curative services"), and "Moving into the Future."

- 2nd International Conference on Health Promotion, Adelaide, 1988, which resulted in the "Adelaide Recommendations on Healthy Public Policy".
- 3rd International Conference on Health Promotion, Sundsvall, 1991, which resulted in the "Sundsvall Statement on Supportive Environments for Health".
- 4th International Conference on Health Promotion, Jakarta, 1997, which resulted in the "Jakarta Declaration on Leading Health Promotion into the 21st Century".

- 5th Global Conference on Health Promotion, Mexico City, 2000, which resulted in the "Mexico Ministerial Statement for the Promotion of Health"[13].
- 6th Global Conference on Health Promotion, Bangkok, 2005, which resulted in the "Bangkok Charter for Health Promotion in a Globalized World".

Altogether, the documents produced by conference attendees emphasized "investing in health promotion beyond an individual, disease-oriented, behaviour-change model".

Worksite health promotion

Health promotion can be performed in various locations. Among the settings that have received special attention are the community, health care facilities, schools, and worksites. Worksite health promotion, also known by terms such as "workplace health promotion," has been defined as "the combined efforts of employers, employees and society to improve the health and well-being of people at work". WHO states that the workplace "has been established as one of the priority settings for health promotion into the 21st century" because it influences "physical, mental, economic and social well-being" and "offers an ideal setting and infrastructure to support the promotion of health of a large audience".

Worksite health promotion programs (also called "workplace health promotion programs," "worksite wellness programs," or "workplace wellness programs") include exercise, nutrition, smoking cessation and stress management. Reviews and meta-analyses published between 2005 and 2008 that examined the scientific literature on worksite health promotion programs include the following:

- A review of 13 studies published through January 2004 showed "strong evidence... for an effect on dietary intake, inconclusive evidence for an effect on physical activity, and no evidence for an effect on health risk indicators".
- In the most recent of a series of updates to a review of "comprehensive health promotion and disease management programs at the worksite," Pelletier (2005) noted "positive clinical and cost outcomes" but also found declines in the number of relevant studies and their quality.
- A "meta-evaluation" of 56 studies published 1982-2005 found that worksite health promotion produced on average a decrease of 26.8% in sick leave absenteeism, a decrease of 26.1% in health costs, a decrease of 32% in workers' compensation costs and disability management claims costs, and a cost-benefit ratio of 5.81[22].
- A meta-analysis of 46 studies published 1970-2005 found moderate, statistically significant effects of work health promotion, especially exercise, on "work ability" and "overall well-being"; furthermore, "sickness absences seem to be reduced by activities promoting healthy lifestyle".
- A meta-analysis of 22 studies published 1997-2007 determined that workplace health promotion interventions led to "small" reductions in depression and anxiety.
- A review of 119 studies suggested that successful work site health-promotion programs have attributes such as: assessing employees' health needs and tailoring programs to meet those needs; attaining high participation rates;

promoting self-care; targeting several health issues simultaneously; and offering different types of activities (e.g., group sessions as well as print materials

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Course Name	: Demography

Course Description

The Course details the history of demography, demography transition, the science of population, meaning of bio-demography, demographic analysis, population composition, understanding political demography, population genetics, demarcation of
population geography, concept of ageing in demography, analysis of biological theories, what death means and prevention of premature deaths among populations, methods of birth rates, measuring total fertility rates, leadership developments amongst
different populations. The Course also is entitled to discuss the holistic meaning of Social Welfare Services/Programs, history of Social Welfare Services, different systems
through which social welfare programs are channeled to reach the appropriate population, exploring social assistance programs, social service organizations & welfare
reforms, what service providers know about welfare reforms, corporate welfare, social market economy, case studies of child welfare services.

Course Objectives

· To help students acquire skills in handling issues related to population needs and problems.
· To introduce students them to demographic knowledge which is composed of understanding the trends in birth rates, fertility rates and death rates of several populations in different countries.
· To help students get exposed to various biological theories that is relevant in understanding the growth and development of human beings.
· To increase student's capacities in recognizing challenges in computing demographic statistics.
· To demonstrate critical issues in management of welfare services by responsible sub units of governments.
· To help students acquire skills in differentiating between welfare services and non- welfare services.
· To increase the students' power of analysis in criticizing the government where appropriate to deliver services to its citizens.
· To definitely equip students with knowledge of designing relevant policies in regard to transparent and accountable provision of welfare services to the needy and marginalized groups of people in most developing countries.

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· Meaning of Political demography
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Population geography

· Meaning of Population geography
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Mode of delivery, Face to face lectures
Assessment
Coursework 40%
Exams 60%
Total Mark 100%

API DEMOGRAPHY MODULE

Demography is the statistical study of all populations. It can be a very general science that can be applied to any kind of dynamic population, that is, one that changes over time or space (see population dynamics). It encompasses the study of the size, structure and distribution of populations, and spatial and/or temporal changes in them in response to birth, migration, aging and death.

Demographic analysis can be applied to whole societies or to groups defined by criteria such as education, nationality, religion and ethnicity. In academia,demography is often regarded as a branch of either anthropology, economics, or sociology. Formal demography limits its object of study to the measurement of populations processes, while the more broad field of social demography population studies also analyze the relationships between economic, social, cultural and biological processes influencing a population.

The term demographics is often used erroneously for demography, but refers rather to selected population characteristics as used in government, marketing or opinion research, or the demographic profiles used in such research.

Data and methods

There are two methods of data collection: direct and indirect. Direct data come from vital statistics registries that track all births and deaths as well as certain changes in legal status such as marriage, divorce, and migration (registration of place of residence). In developed countries with good registration systems (such as the United States and much of Europe), registry statistics are the best method for estimating the number of births and deaths.

The census is the other common direct method of collecting demographic data. A census is usually conducted by a national government and attempts to enumerate every person in a country. However, in contrast to vital statistics data, which are typically collected continuously and summarized on an annual basis, censuses typically occur only every 10 years or so, and thus are not usually the best source of data on births and deaths. Analyses are conducted after a census to estimate how much over or undercounting took place.

Censuses do more than just count people. They typically collect information about families or households, as well as about such individual characteristics as age, sex, marital status, literacy/education, employment status and occupation, and geographical location. They may also collect data on migration (or place of birth or of previous residence), language, religion, nationality (or ethnicity or race), and citizenship. In countries in which the vital registration system may be incomplete, the censuses are also used as a direct source of information about fertility and mortality; for example the censuses of the People's Republic of China gather information on births and deaths that occurred in the 18 months immediately preceding the census.

Indirect methods of collecting data are required in countries where full data are not available, such as is the case in much of the developing world. One of these techniques is the sister method, where survey researchers ask women how many of their sisters have died or had children and at what age. With these surveys, researchers can then indirectly estimate birth or death rates for the entire population. Other indirect methods include asking people about siblings, parents, and children.

There are a variety of demographic methods for modeling population processes. They include models of mortality (including the life table, Gompertz models, hazards models, Cox proportional hazards models, multiple decrement life tables, Brass relational logits), fertility (Hernes model, Coale-Trussell models, parity progression ratios), marriage (Singulate Mean at Marriage, Page model), disability (Sullivan's method, multistate life tables), population projections (Lee Carter, the Leslie Matrix), and population momentum (Keyfitz).

Important concepts

A population pyramid is an age/sex distribution diagram.
Important concepts in demography include:
The crude birth rate, the annual number of live births per 1000 people.
The general fertility rate, the annual number of live births per 1000 women of childbearing age (often taken to be from 15 to 49 years old, but sometimes from 15 to 44).
age-specific fertility rates, the annual number of live births per 1000 women in particular age groups (usually age 15-19, 20-24 etc.)
The crude death rate, the annual number of deaths per 1000 people.
The infant mortality rate, the annual number of deaths of children less than 1 year old per 1000 live births.
The expectation of life (or life expectancy), the number of years which an individual at a given age could expect to live at present mortality levels.
The total fertility rate, the number of live births per woman completing her reproductive life, if her childbearing at each age reflected current age-specific fertility rates.
The replacement level fertility, the average number of children a woman must have in order to replace herself with a daughter in the next generation. For example the replacement level fertility in the US is 2.11. This means that 100 women will bear 211 children, 103 of which will be females. About 3% of the alive female infants are expected to decease before they bear children, thus producing 100 women in the next generation.
The gross reproduction rate, the number of daughters who would be born to a woman completing her reproductive life at current age-specific fertility rates.
The net reproduction ratio is the expected number of daughters, per newborn prospective mother, who may or may not survive to and through the ages of childbearing.
A stable population, one that has had constant crude birth and death rates for such long time that the percentage of people in every age class remains constant, or equivalently, the population pyramid has an unchanging structure.[3]

A stationary population, one that is both stable and unchanging in size (the difference between crude birth rate and crude death rate is zero).
A stable population does not necessarily remain fixed in size, it can be expanding or shrinking.[5]
Note that the crude death rate as defined above and applied to a whole population can give a misleading impression. For example, the number of deaths per 1000 people can be higher for developed nations than in less-developed countries, despite standards of health being better in developed countries. This is because developed countries have proportionally more older people, who are more likely to die in a given year, so that the overall mortality rate can be higher even if the mortality rate at any given age is lower. A more complete picture of mortality is given by a life table which summarises mortality separately at each age. A life table is necessary to give a good estimate of life expectancy.
The fertility rates can also give a misleading impression that a population is growing faster than it in fact is, because measurement of fertility rates only involves the reproductive rate of women, and does not adjust for the sex ratio. For example, if a population has a total fertility rate of 4.0 but the sex ratio is 66/34 (twice as many men as women), this population is actually growing at a slower natural increase rate than would a population having a fertility rate of 3.0 and a sex ratio of 50/50. This distortion is greatest in India and Myanmar, and is present in China as well.
Basic equation
Suppose that a country (or other entity) contains Population_t persons at time t. What is the size of the population at time t + 1 ?
$\text{Population}_{t+1} = \text{Population}_t + \text{Naturalincrease}_t + \text{Netmigration}_t$
Natural increase from time t to t + 1:
$\text{Naturalincrease}_t = \text{Birth}_{st} - \text{Death}_{st}$
Net migration from time t to t + 1:
$\text{Netmigration}_t = \text{Immigration}_t - \text{Emigration}_t$
This basic equation can also be applied to subpopulations. For example, the population size of ethnic groups or nationalities within a given society or country is subject to the same sources of change. However, when dealing with ethnic groups, "net migration" might have to be subdivided into physical migration and ethnic reidentification (assimilation). Individuals who change their ethnic self-labels or whose ethnic classification in government statistics changes over time may be thought of as migrating or moving from one population subcategory to another.
More generally, while the basic demographic equation holds true by definition, in practice the recording and counting of events (births, deaths, immigration, emigration) and the enumeration of the total population size are subject to error. So allowance needs to be made for error in the underlying statistics when any accounting of population size or change is made.

History
Ibn Khaldun (1332-1406) is regarded as the "father of demography" for his economic analysis of social organization which produced the first scientific and theoretical work on population, development, and group dynamics. His findings have inspired a recent wave of mathematical modeling of sociodemographic dynamics. His Muqaddimah also laid the groundwork for his observation of the role of state, communication and propaganda in history.

The Natural and Political Observations ... upon the Bills of Mortality (1662) of John Graunt contains a primitive form of life table. Mathematicians, such as Edmond Halley, developed the life table as the basis for life insurance mathematics. Richard Price was credited with the first textbook on life contingencies published in 1771, followed later by Augustus de Morgan, 'On the Application of Probabilities to Life Contingencies', (1838).

At the end of the 18th century, Thomas Malthus concluded that, if unchecked, populations would be subject to exponential growth. He feared that population growth would tend to outstrip growth in food production, leading to ever increasing famine and poverty (see Malthusian catastrophe); he is seen as the intellectual father of ideas of overpopulation and the limits to growth. Later more sophisticated and realistic models were presented by e.g. Benjamin Gompertz and Verhulst.

The period 1860-1910 can be characterized as a period of transition wherein demography emerged from statistics as a separate field of interest. This period included a panoply of international 'great demographers' like Adolphe Quételet (1796-1874), William Farr (1807-1883), Louis-Adolphe Bertillon (1821-1883) and his son Jacques (1851-1922), Joseph Körösi (1844-1906), Anders Nicolas Kaier (1838-1919), Richard Böckh (1824-1907), Wilhelm Lexis (1837-1914) and Luigi Bodio (1840-1920) contributed to the development of demography and to the toolkit of methods and techniques of demographic analysis.
World population from 500CE to 2150, based on UN 2004 projections (red, orange, green) and US Census Bureau historical estimates (black). Only the section in blue is from reliable counts, not estimates or projections.

Demographic transition
Contrary to Malthus' predictions and in line with his thoughts on moral restraint, natural population growth in most developed countries has diminished to close to zero, without being held in check by famine or lack of resources, as people in developed nations have shown a tendency to have fewer children. The fall in population growth has occurred despite large rises in life expectancy in these countries. This pattern of population growth, with slow (or no) growth in pre-industrial societies, followed by fast growth as the society develops and industrializes, followed by slow growth again as it becomes more affluent, is known as the demographic transition.
Similar trends are now becoming visible in ever more developing countries, so that far from spiraling out of control, world population growth is expected to slow markedly in this century, coming to an eventual standstill or even declining. The change is likely to be accompanied by major shifts in the proportion of world population in particular regions. The United Nations Population Division expects the absolute number of infants and toddlers in the world to begin to fall by 2015, and the number of children under 15 by 2025.

The UN "medium" projection shows world population reaching an approximate equilibrium at 9 billion by 2075. Working independently, demographers at the International Institute for Applied Systems Analysis in Austria expect world population to peak at 9 billion by 2070. Throughout the 21st century, the average age of the population is likely to continue to rise.

Science of population

Populations can change through three processes: fertility, mortality, and migration. Fertility involves the number of children that women have and is to be contrasted with fecundity (a woman's childbearing potential). Mortality is the study of the causes, consequences, and measurement of processes affecting death to members of the population. Demographers most commonly study mortality using the Life Table, a statistical device which provides information about the mortality conditions (most notably the life expectancy) in the population. Migration refers to the movement of persons from an origin place to a destination place across some pre-defined, political boundary. Migration researchers do not designate movements 'migrations' unless they are somewhat permanent. Thus demographers do not consider tourists and travelers to be migrating. While demographers who study migration typically do so through census data on place of residence, indirect sources of data including tax forms and labor force surveys are also important. Demography is today widely taught in many universities across the world, attracting students with initial training in social sciences, statistics or health studies. Being at the crossroads of several disciplines such as geography, economics, sociology or epidemiology, demography offers tools to approach a large range of population issues by combining a more technical quantitative approach that represents the core of the discipline with many other methods borrowed from social or other sciences. Demographic research is conducted in universities, in research institutes as well as in statistical departments and in several international agencies. Population institutions are part of the Cicred (International Committee for Coordination of Demographic Research) network while most individual scientists engaged in demographic research are members of the International Union for the Scientific Study of Population or, in the United States, the Birth

A woman giving birth on a birth chair, circa 1515

Birth (calving in livestock and some other animals, whelping in carnivorousmammals) is the act or process of bearing or bringing forth offspring. The offspring is brought forth from the mother. Different forms of birth are oviparity, vivipary or ovovivipary.

Childbirth is the process at the end of a human pregnancy that results in a baby being born.

Natural childbirth is the technique of minimizing medical intervention, particularly anaesthetics, during childbirth.

Unassisted childbirth (UC) is birth without the aid of medical or professional birth attendants. Also known as Freebirth

Multiple birth is the birth of two (twins), three (triplets), four (quadruplets), etc., babies resulting from a single pregnancy.

Birth canal is the term used for the vagina during birth, as it is the route through which the infant passes during a vaginal birth.

Caesarean section or C-Section is surgical birth through the wall of the abdomen.

Birth pangs are the pains felt by the mother during labour, resulting from contractions of the uterus and pressure on nerves and organs.

Lotus Birth is the practice of leaving the umbilical cord uncut after birth so that the baby is left attached to its placenta until the cord naturally separates

Afterbirth is the birth of the placenta following the birth of the infant.

Birth control methods are devices, medications or behavior patterns to reduce the probability of pregnancy.
Placenta is the organ in most mammals, formed in her lining of the uterus by the union of the uterine mucous membrane with the membranes of the fetus, that provides for the nourishment of the fetus and the elimination of its waste products.
Midwife is the term for a health care provider that provides at home health care for expecting mothers, delivers baby during birth, and provides postpartum care.
Birth doula is the term for a labor assistant that provides emotional support, physical comfort measures, and other assistance to expecting mothers, partners, families, and baby before, during, and after childbirth. A postpartum doula provides support after birth, and specializes in postpartum care for mother and infant, infant attachment, and other newborn care. The term "doula" stems from the Greek "doulos," or "one who serves."
Newborn after typical hospital birth
Infertility treatments are devices, medications, or behavior patterns to increase the probability of pregnancy.
Premature birth is the birth of an infant before the full term of pregnancy.
Birth defect is a physical or mental abnormality present at the time of birth.
Stillbirth is the birth of a dead fetus or infant.
Birth trauma is a theory in Pre & Perinatal psychology and natural medicine that the baby experiences extreme pain during the birthing process and that this pain influences the child later in life.
VBAC is a Vaginal Birth after a Caesarean Birth.
Complications may cause a miscarriage or spontaneous abortion to occur.
Musculoskeletal Disorders. Pregnancy related Pelvic Girdle Pain is a significant musculoskeletal disorder that begins in pregnancy and for some women last for years.

Legal meanings
Birthday is a day to celebrate that the person has lived a certain number of years. It is an annual event based either on the anniversary of a person's date of birth, or on astrological birthtime calculations.
Birth certificate is a legal document describing details of a person's birth.
A nuclear family comprising the father, mother, brother or sister, is an institution where the members are related by birth.
In some countries a person is considered of illegitimate birth if the child is born of parents not legally married to each other.
Spiritual meanings
Mother and child reunion, immediately after birth
Astrology is based upon the belief that an individual's life is influenced by the geocentric positions of the Sun, Moon, and planets in the sky or below the horizon at the moment of birth; a natal chart is calculated using the exact time, date, and place of birth in order to try and interpret these cyclical influences on a person's life.
Virgin Birth of Jesus is the Christian doctrine that asserts that Jesus Christ was born to a virgin, and thus that his conception was carried out without an earthly father.
Born again, a term used primarily in ProtestantChristianity, is associated with salvation, conversion, and spiritual rebirth.

Rebirth is a belief that a person is born again after their death based on the karma of their previous births.
Metaphorical meanings
The term birth is used metaphorically to refer to a beginning, especially of a natural phenomenon, one that is impressive in its scope or complexity, or one that is viewed favorably.
Stellar evolution is the field of study that deals with the birth of stars and their life cycles.

Human migration
Net migration rates for 2008: positive (blue), negative (orange), stable (green), and no data (gray).
Human migration is movement (physical or psychological) by humans from one district to another, sometimes over long distances or in large groups. The movement of populations in modern times has continued under the form of both voluntary migration within one's region, country, or beyond, and involuntary migration (which includes the slave trade, trafficking in human beings and ethnic cleansing). People who migrate are called migrants, or, more specifically, emigrants, immigrants, or settlers, depending on historical setting, circumstances and perspective.
The pressures of human migrations, whether as outright conquest or by slow cultural infiltration and resettlement, have affected the grand epochs in history (e.g. the Decline of the Roman Empire); under the form of colonization, migration has transformed the world (e.g. the prehistoric and historic settlements of Australia and the Americas). Population genetics studied in traditionally settled modern populations have opened a window into the historical patterns of migrations, a technique pioneered by Luigi Luca Cavalli-Sforza. mt DNA-based chart of large human migrations. (Numbers are millennia before present) Forced migration (see population transfer) has been a means of social control under authoritarian regimes, yet free initiative migration is a powerful factor in social adjustment (e.g. the growth of urban populations).

In December 2003 The Global Commission on International Migration (GCIM) was launched with the support of Kofi Annan and several countries, with an independent 19-member Commission, threefold mandate and a finite life-span, ending December 2005. Its report, based on regional consultation meetings with stakeholders and scientific reports from leading international migration experts, was published and presented to UN Secretary-General Kofi Annan on 5 October 2005.
Different types of migration include:
Daily human commuting.[citation needed]
Seasonal human migration is mainly related to agriculture.
Permanent migration, for the purposes of permanent or long-term stays.

RUM
Rural to Urban, more common in developing countries as industrialization takes effect (urbanization)
Urban to Rural, more common in developed countries due to a higher cost of urban living (suburbanization)

International migration

Pre-modern migrations

Historical migration of human populations begins with the movement of Homo erectus out of Africa across Eurasia about a million years ago. Homo sapiens appear to have occupied all of Africa about 150,000 years ago, moved out of Africa 70,000 years ago, and had spread across Australia, Asia and Europe by 40,000 years. Migration to the Americas took place 20 to 15,000 years ago, and by 2,000 years ago, most of the Pacific Islands were colonized. Later population movements notably include the Neolithic Revolution, Indo-European expansion, and the Early Medieval Great Migrations including Turkic expansion.

This evidence indicates that the ancestors of the Austronesians' spread from the South Chinese mainland to Taiwan at some time around 8,000 years ago. Evidence from historical linguistics suggests that it is from this island that seafaring peoples migrated, perhaps in distinct waves separated by millennia, to the entire region encompassed by the Austronesian languages. It is believed that this migration began around 6,000 years ago. Indo-Aryan migration to and within Northern India is consequently presumed to have taken place in the Middle to Late Bronze Age, contemporary to the Late Harappan phase in India (ca. 1700 to 1300 BC). From 180 BC, a series of invasions from Central Asia followed, including those led by the Indo-Greeks, Indo-Scythians, Indo-Parthians and Kushans in the north-western Indian subcontinent.

From about 750 BC the Greeks began 250 years of expansion, settling colonies in all directions. In Europe two waves of migrations dominate demographic distributions, that of the Celtic people, and the later Migration Period from the east. Other examples are small movements like ancient Scots moving from Hibernia to Caledonia and Magyars into Pannonia (modern-day Hungary). Turkic peoples spread across most of Central Asia into Europe and the Middle East between the 6th and 11th centuries. Recent research suggests that the Madagascar was uninhabited until Austronesian seafarers from Indonesia arrived during the 5th and 6th centuries A.D. Subsequent migrations from both the Pacific and Africa further consolidated this original mixture, and Malagasy people emerged.
One common hypothesis of the Bantu expansion.

Before the expansion of the Bantu languages and their speakers, the southern half of Africa is believed to have been populated by Pygmies and Khoisan speaking people, today occupying the arid regions around the Kalahari Desert and the forest of Central Africa. By about 1000 AD Bantu migration had reached modern day Zimbabwe and South Africa. The Banu Hilal and Banu Ma'qil were a collection of ArabBedouin tribes from the Arabian Peninsula who migrated westwards via Egypt between the 11th and 13th centuries. Their migration strongly contributed to the arabization and islamization of the western Maghreb, which was until then dominated by Berber tribes. Ostsiedlung was the medieval eastward migration and settlement of Germans. The 13th century was the time of the great Mongol and Turkic migrations across Eurasia.

Between the 11th and 18th centuries, the Vietnamese expanded southward in a process known as nam tiến (southward expansion). Manchuria was separated from China proper by the Inner Willow Palisade, which restricted the movement of the

Han Chinese into Manchuria during the Qing Dynasty, as the area was off-limits to the Han until the Qing started colonizing the area with them later on in the dynasty's rule.
The Age of Exploration and European Colonialism led to an accelerated pace of migration since Early Modern times. In the 16th century perhaps 240,000 Europeans entered American ports. In the 19th century over 50 million people left Europe for the Americas. The local populations or tribes, such as the Aboriginal people in Canada, Brazil, Argentina, Australia, Japan and the United States, were usually far overwhelmed numerically by the settlers. More recent examples are the movement of ethnic Chinese into Tibet and Xinjiang, ethnic Javanese into Western New Guinea and Kalimantan (Transmigration program), Brazilians into Amazonia, Israelis into the West Bank and Gaza, ethnic Arabs into Iraqi Kurdistan, and ethnic Russians into Siberia and Central Asia.

Modern migrations and Industrialization
While the pace of migration had accelerated since the 18th century already (including the involuntary slave trade), it would increase further in the 19th century. Manning distinguishes three major types of migration: labor migration, refugee migrations, and, lastly, urbanization. Millions of agricultural workers left the countryside and moved to the cities causing unprecedented levels of urbanization. This phenomenon began in Britain in the late 18th century and spread around the world and continues to this day in many areas.

Industrialization encouraged migration wherever it appeared. The increasingly global economy globalized the labor market. Atlantic slave trade diminished sharply after 1820, which gave rise to self-bound contract labor migration from Europe and Asia to plantations. Also overpopulation[citation needed], open agricultural frontiers and rising industrial centers attracted voluntary, encouraged and sometimes coerced migration. Moreover, migration was significantly eased by improved transportation techniques.
Transnational labor migration reached a peak of three million migrants per year in the early twentieth century. Italy, Norway, Ireland and the Quongdong region of China were regions with especially high emigration rates during these years. These large migration flows influenced the process of nation state formation in many ways. Immigration restrictions have been developed, as well as diaspora cultures and myths that reflect the importance of migration to the foundation of certain nations, like the American melting pot. The transnational labor migration fell to a lower level from 1930s to the 1960s and then rebounded.

The United States experienced considerable internal migration related to industrialization, including its African American population. From 1910–1970, approximately 7 million African Americans migrated from the rural Southern United States, where blacks faced both poor economic opportunities and considerable political and social prejudice, to the industrial cities of the Northeast, Midwest and West where relatively well paid jobs were available. This phenomenon came to be known in the United States as its own Great Migration.

The twentieth century experienced also an increase in migratory flows caused by war and politics. Muslims moved from the Balkan to Turkey, while Christians moved the

other way, during the collapse of the Ottoman Empire. 400,000 Jews moved to Palestine in the early twentieth century. The Russian Civil War caused some 3 million Russians, Poles and Germans to migrate out of the Soviet Union. World War II and decolonization also caused migrations, see below.
World War II

The Jewish across Europe, the Mediterranean and the Middle East formed from voluntary migrations, enslavement, threats of enslavement and pogroms. After the Nazis brought the Holocaust upon Jewish people in the 1940s, there was increased migration to the British Mandate of Palestine, which became the modern day state of Israel as a result of the United Nations Partition Plan for Palestine.
Provisions of the Potsdam Agreement from 1945 signed by victorious Western Allies and the Soviet Union led to one of the largest European migrations, and definitely the largest in the 20th century. It involved the migration and resettlement of close to or over 20 million people. The largest affected group were 16.5 million Germans expelled from Eastern Europe westwards. The second largest group were Poles, millions of whom were expelled westwards from eastern Kresy region and resettled in the so-called Recovered Territories (see Allies decide Polish border in the article on the Oder-Neisse line). Hundreds of thousands of Poles, Ukrainians (Operation Wisła), Lithuanians, Latvians, Estonians and some Belarusians, were in the meantime expelled eastwards from Europe to the Soviet Union. Finally, many of the several hundred thousand Jews remaining in the Eastern Europe after the Holocaustmigrated outside Europe to Israel.

Contemporary migration
Further information: immigration, emigration, forced migration, and refugees
Target regions with currently high immigration rates are North America, Australia, Europe (except eastern Europe), and the Russian Federation.
Small countries like island states can have extremely high migration rates that fluctuate over short times due to their low overall population: Micronesia -2% per year, Grenada -1.6%, Samoa -1.2%, Dominica -0.93%, Suriname and Virgin Islands -0.87%, Greenland -0.83%, Guyana and Saint Vincent and the Grenadines -0.75%; Liberia 2.7%, Kuwait 1.6%, Turks and Caicos Islands 1.1%, San Marino 1.1%.
Migrations and climate cycles
The modern field of climate history suggests that the successive waves of Eurasian nomadic movement throughout history have had their origins in climatic cycles, which have expanded or contracted pastureland in Central Asia, especially Mongolia and the Altai. People were displaced from their home ground by other tribes trying to find land that could be grazed by essential flocks, each group pushing the next further to the south and west, into the highlands of Anatolia, the plains of Hungary, into Mesopotamia or southwards, into the rich pastures of China.
Toward an understanding of migration

Types of migrations
The cyclic movement which involves commuting,and a seasonal movement, and nomadism.
The periodic movement which consists of migrant labor, military service, and pastoral farming Transhumance.

The migratory movement that moves from the eastern part of the US to the western part. It also moves from China to southeast Asia, from Europe to North America, and from South America to the middle part of the Americas.
Rural exodus, migration from rural areas to the cities
Ravenstein's 'laws of migration'
Certain laws of social science have been proposed to describe human migration. The following was a standard list after Ravenstein's proposals during the time frame of 1834 to 1913. The laws are as follows:
every migration flow generates a return or countermigration.
the majority of migrants move a short distance.
migrants who move longer distances tend to choose big-city destinations
urban residents are less migratory than inhabitants of rural areas.
families are less likely to make international moves than young adults.
Other migration models
Migration occurs because individuals search for food, sex and security outside their usual habitation.(Idyorough, 2008)
Zipf's Inverse distance law (1956)
Gravity model of migration and the Friction of distance
Buffer Theory
Stouffer's Theory of intervening opportunities (1940)
Lee's Push-pull theory (1967)
Zelinsky's Mobility Transition Model (1971)
Bauder's Regulation of labor markets (2006) "suggests that the international migration of workers is necessary for the survival of industrialized economies...[It] turns the conventional view of international migration on its head: it investigates how migration regulates labor markets, rather than labor markets shaping migration flows." (from the book description)
Causes of migrations
Causes of migrations have modified over hundreds of years. Some cases are constant, some of them do not carry the same importance as years ago (for example: in 18th and 19th centuries labor migration did not have the same character like today).
In general we can divide factors causing migrations into two groups of factors: Push and pull factors. In general:
Push Factors are economic, political, cultural, and environmentally based.
Pull Factors are economic, political, cultural, and environmentally based.
Barriers/Obstacles of which Nigeria in the 1970s and 1980s is an example.
On the macro level, the causes of migration can be distilled into two main categories: security dimension of migration (natural disasters, conflicts, threats to individual safety, poor political prospects) and economic dimension of migration (poor economic situation, poor situation of national market). [AIV document]

Push and Pull Factors

Push and pull factors are those factors which either forcefully push people into migration or attract them. A push factor is forceful, and a factor which relates to the country from which a person migrates. It is generally some problem which results in people wanting to migrate. Different types of push factors can be seen further below. A push factor is a flaw or distress that drives a person away from a certain place. A pull factor is something concerning the country to which a person migrates. It is

generally a benefit that attracts people to a certain place. Push and pull factors are usually considered as north and south poles on a magnet.

Push Factors
Not enough jobs
Few opportunities
"Primitive" conditions
Desertification
Famine/drought
Political fear/persecution
Poor medical care
Loss of wealth
Natural Disasters
Death threats
Slavery
Pollution
Poor housing
Landlords
Bullying
Discrimination
Poor chances of finding courtship
Pull Factors
Job opportunities
Better living conditions
Political and/or religious freedom
Enjoyment
Education
Better medical care
Security
Family links
Industry
Better chances of finding courtship
Effects of migration: Migration like any other process shapes many fields of life, having both advantages and disadvantages. Effects of migrations are:
changes in population distribution
demographic consequences: since migration is selective of particular age groups, migrants are mostly young and in productive age. It can cause a demographic crisis – population ageing, what in turn can be followed by economic problems (shrinking group of economically active population has to finance extending group of inactive population).
[[Economic results of migration, which are of the greatest importance for the development of the countries.
decreases in global poverty Crisis and the Diaspora Nation, Lauren Falcao, "International Economics Bulletin, June 18, 2009."</ref>
Migration has had a significant effect on world geography.
It has contributed to the evolution and development of separate cultures.
It has contributed to the diffusion of cultures by interchange and communication.
It has contributed to the complex mix of people and cultures found in different regions of the world today

European Union

The wages in Western Europe are generally higher than the rest of Europe – thus explaining why a large number of Eastern Europeans choose to migrate to Western Europe.

Migration patterns in India

Estimates based on industry sectors mainly employing migrants suggest that there are around 100 million circular migrants in India. Caste, social networks and historical precedents play a powerful role in shaping patterns of migration. Migration for the poor is mainly circular, as despite moving temporarily to urban areas, they lack the social security which might keep them there more permanently. They are also keen to maintain a foothold in home areas during the agricultural season. Research by the Overseas Development Institute identifies a rapid movement of labour from slower to faster growing parts of the economy. Migrants can often find themselves excluded by urban housing policies and migrant support initiatives are needed to give workers improved access to market information, certification of identity, housing and education. Jewish Diaspora

Ageing

Ageing (British and Australian English) or aging (American and Canadian English) is the accumulation of changes in an organism or object over time.[1] Ageing in humans refers to a multidimensional process of physical, psychological, and social change. Some dimensions of ageing grow and expand over time, while others decline. Reaction time, for example, may slow with age, while knowledge of world events and wisdom may expand. Research shows that even late in life potential exists for physical, mental, and social growth and development. Ageing is an important part of all human societies reflecting the biological changes that occur, but also reflecting cultural and societal conventions. Age is usually measured in full years — and months for young children. A person's birthday is often an important event. Roughly 100,000 people worldwide die each day of age-related causes.

The term "ageing" is somewhat ambiguous. Distinctions may be made between "universal ageing" (age changes that all people share) and "probabilistic ageing" (age changes that may happen to some, but not all people as they grow older, such as the onset of type two diabetes). Chronological ageing, referring to how old a person is, is arguably the most straightforward definition of ageing and may be distinguished from "social ageing" (society's expectations of how people should act as they grow older) and "biological ageing" (an organism's physical state as it ages). There is also a distinction between "proximal ageing" (age-based effects that come about because of factors in the recent past) and "distal ageing" (age-based differences that can be traced back to a cause early in person's life, such as childhood poliomyelitis).[3] Differences are sometimes made between populations of elderly people. Divisions are sometimes made between the young old (65–74), the middle old (75–84) and the oldest old (85+). However, problematic in this is that chronological age does not correlate perfectly with functional age, i.e. two people may be of the same age, but differ in their mental and physical capacities. Each nation, government and non-government organization has different ways of classifying age.

Population ageing is the increase in the number and proportion of older people in society. Population ageing has three possible causes: migration, longer life expectancy (decreased death rate), and decreased birth rate. Ageing has a significant impact on society. Young people tend to commit most crimes, they are more likely to push for political and social change, to develop and adopt new technologies, and to need education. Older people have different requirements from society and government as opposed to young people, and frequently differing values as well. Older people are also far more likely to vote, and in many countries the young are forbidden from voting. Thus, the aged have comparatively more political influence.

In biology, senescence is the state or process of ageing. Cellular senescence is a phenomenon where isolated cells demonstrate a limited ability to divide in culture (the Hayflick Limit, discovered by Leonard Hayflick in 1961), while organismal senescence is the ageing of organisms. After a period of near perfect renewal (in humans, between 20 and 35 years of age), organismal senescence is characterized by the declining ability to respond to stress, increasing homeostatic imbalance and increased risk of disease. This currently irreversible series of changes inevitably ends in death. Some researchers (specifically biogerontologists) are treating ageing as a disease. As genes that have an effect on ageing are discovered, ageing is increasingly being regarded in a similar fashion to other geneticly influenced "conditions", potentially "treatable."

Indeed, ageing is not an unavoidable property of life. Instead, it is the result of a genetic program. Numerous species show very low signs of ageing ("negligible senescence'), the best known being trees like the bristlecone pine (however Dr. Hayflick states that the bristlecone pine has no cells older than 30 years), fish like the sturgeon and the rockfish, invertebrates like the quahog or sea anemone.[4]
In humans and other animals, cellular senescence has been attributed to the shortening of telomeres with each cell cycle; when telomeres become too short, the cells die. The length of telomeres is therefore the "molecular clock," predicted by Hayflick.

Telomere length is maintained in immortal cells (e.g. germ cells and keratinocyte stem cells, but not other skin cell types) by the telomerase enzyme. In the laboratory, mortal cell lines can be immortalized by the activation of their telomerase gene, present in all cells but active in few cell types. Cancerous cells must become immortal to multiply without limit. This important step towards carcinogenesis implies, in 85% of cancers, the reactivation of their telomerase gene by mutation. Since this mutation is rare, the telomere "clock" can be seen as a protective mechanism against cancer.[5] Research has shown that the clock must be located in the nucleus of each cell and there have been reports that the longevity clock might be located in genes on either the first or fourth chromosome of the twenty-three pairs of human chromosomes.
Other genes are known to affect the ageing process, the sirtuin family of genes have been shown to have a significant effect on the lifespan of yeast and nematodes. Over-expression of the RAS2 gene increases lifespan in yeast substantially.

In addition to genetic ties to lifespan, diet has been shown to substantially affect lifespan in many animals. Specifically, caloric restriction (that is, restricting calories

to 30-50% less than an ad libitum animal would consume, while still maintaining proper nutrient intake), has been shown to increase lifespan in mice up to 50%. Caloric restriction works on many other species beyond mice (including species as diverse as yeast and Drosophila), and appears (though the data is not conclusive) to increase lifespan in primates according to a study done on Rhesus monkeys at the National Institute of Health (US), although the increase in lifespan is only notable if the caloric restriction is started early in life. Since, at the molecular level, age is counted not as time but as the number of cell doublings, this effect of calorie reduction could be mediated by the slowing of cellular growth and, therefore, the lengthening of the time between cell divisions.
Drug companies are currently searching for ways to mimic the lifespan-extending effects of caloric restriction without having to severely reduce food consumption.

In his book, 'How and Why We Age', Dr. Hayflick notes a contradiction to the caloric restriction longevity increase theory for humans, noting that data from the Baltimore Longitudinal Study of Ageing show that being thin does not favour longevity.

Dividing the lifespan
An animal's life is often divided into various ages. Historically, the lifespan of humans is divided into Eight ages; because biological changes are slow moving and vary from person to person, arbitrary dates are usually set to mark periods of life. In some cultures the divisions given below are quite varied.
In the USA, adulthood legally begins at the age of eighteen, while old age is considered to begin at the age of legal retirement (approximately 65).
Pre-conception: ovum, spermatozoon
Conception: fertilization
Pre-birth: conception to birth (pregnancy)
Infancy: Birth to 1
Childhood: 1 to 12
Adolescence: 13 to 19
Early adulthood: 20 to 39
Middle adulthood: 40 to 64
Late adulthood: 65+
Death

People from 13 to 19 years of age are also known as teens or teenagers. The casual terms "twentysomething", "thirtysomething", etc. are also in use to describe people by decade or age.
Cultural variations

In some cultures (for example Serbian) there are four ways to express age: by counting years with or without including current year. For example, it could be said about the same person that he is twenty years old or that he is in the twenty-first year of his life. In Russian the former expression is generally used, the latter one has restricted usage: it is used for age of a deceased person in obituaries and for the age of an adult when it is desired to show him/her older than he/she is. (Psychologically, a woman in her 20th year seems older than one who is 19 years old.)

Considerable numbers of cultures have less of a problem with age compared with what has been described above, and it is seen as an important status to reach stages in life, rather than defined numerical ages. Advanced age is given more respect and status.

East Asian age reckoning is different from that found in Western culture. Traditional Chinese culture uses a different ageing method, called Xusui (虛歲) with respect to common ageing which is called Zhousui (周歲). In the Xusui method, people are born at age 1, not age 0, because conception is already considered to be the start of the life span

Society

Legal

There are variations in many countries as to what age a person legally becomes an adult.

Most legal systems define a specific age for when an individual is allowed or obliged to do something. These ages include voting age, drinking age, age of consent, age of majority, age of criminal responsibility, marriageable age, age of candidacy, and mandatory retirement age. Admission to a movie for instance, may depend on age according to a motion picture rating system. A bus fare might be discounted for the young or old.

Similarly in many countries in jurisprudence, the defence of infancy is a form of defence by which a defendant argues that, at the time a law was broken, they were not liable for their actions, and thus should not be held liable for a crime. Many courts recognise that defendants who are considered to be juveniles may avoid criminal prosecution on account of their age, and in borderline cases the age of the offender is often held to be a mitigating circumstance.

Economics and marketing

The economics of ageing are also of great importance. Children and teenagers have little money of their own, but most of it is available for buying consumer goods. They also have considerable impact on how their parents spend money.

Young adults are an even more valuable cohort. They often have jobs with few responsibilities such as a mortgage or children. They do not yet have set buying habits and are more open to new products.

The young are thus the central target of marketers. Television is programmed to attract the range of 15 to 35 year olds. Mainstreammovies are also built around appealing to the young.

Health care demand

Many societies in the rich world, e.g. Western Europe and Japan, have ageing populations. While the effects on society are complex, there is a concern about the impact on health care demand. The large number of suggestions in the literature for specific interventions to cope with the expected increase in demand for long-term care in ageing societies can be organized under four headings: improve system performance; redesign service delivery; support informal caregivers; and shift demographic parameters.

However, the annual growth in national health spending is not mainly due to increasing demand from ageing populations, but rather has been driven by rising incomes, costly new medical technology, a shortage of health care workers and informational asymmetries between providers and patients.
Even so, it has been estimated that population ageing only explains 0.2 percentage points of the annual growth rate in medical spending of 4.3 percent since 1970. In addition, certain reforms to Medicare decreased elderly spending on home health care by 12.5 percent per year between 1996 and 2000. This would suggest that the impact of ageing populations on health care costs is not inevitable.

Impact on prisons
As of July 2007, medical costs for a typical inmate in the United States might run an agency around $33 per day, while costs for an ageing inmate could run upwards of $100. Most State DOCs report spending more than 10 percent of the annual budget on elderly care. That is expected to rise over the next 10–20 years. Some states have talked about releasing ageing inmates early.

Cognitive effects
Steady decline in many cognitive processes is seen across the lifespan, starting in one's thirties. Research has focused in particular on memory and ageing, and has found decline in many types of memory with ageing, but not in semantic memory or general knowledge such as vocabulary definitions, which typically increases or remains steady. Early studies on changes in cognition with age generally found declines in intelligence in the elderly, but studies were cross-sectional rather than longitudinal and thus results may be an artefact of cohort rather than a true example of decline. Intelligence may decline with age, though the rate may vary depending on the type, and may in fact remain steady throughout most of the lifespan, dropping suddenly only as people near the end of their lives. Individual variations in rate of cognitive decline may therefore be explained in terms of people having different lengths of life.[3] There are changes to the brain: though neuron loss is minor after 20 years of age there is a 10% reduction each decade in the total length of the brain's myelinatedaxons.

Coping and well-being
Psychologists have examined coping skills in the elderly. Various factors, such as social support, religion and spirituality, active engagement with life and having an internal locus of control have been proposed as being beneficial in helping people to cope with stressful life events in later life. Social support and personal control are possibly the two most important factors that predict well-being, morbidity and mortality in adults. Other factors that may link to well-being and quality of life in the elderly include social relationships (possibly relationships with pets as well as humans), and health.
Individuals in different wings in the same retirement home have demonstrated a lower risk of mortality and higher alertness and self-rated health in the wing where residents had greater control over their environment, though personal control may have less impact on specific measures of health. Social control, perceptions of how much influence one has over one's social relationships, shows support as a moderator variable for the relationship between social support and perceived health in the elderly, and may positively influence coping in the elderly.

Religion
Religion has been an important factor used by the elderly in coping with the demands of later life, and appears more often than other forms of coping later in life.[20] Religious commitment may also be associated with reduced mortality,[citation needed] though religiosity is a multidimensional variable; while participation in religious activities in the sense of participation in formal and organized rituals may decline, it may become a more informal, but still important aspect of life such as through personal or private prayer.

Self-rated health
Self-ratings of health, the beliefs in one's own health as excellent, fair or poor, has been correlated with well-being and mortality in the elderly; positive ratings are linked to high well-being and reduced mortality. Various reasons have been proposed for this association; people who are objectively healthy may naturally rate their health better than that of their ill counterparts, though this link has been observed even in studies which have controlled for socioeconomic status, psychological functioning and health status. This finding is generally stronger for men than women, though the pattern between genders is not universal across all studies, and some results suggest sex-based differences only appear in certain age groups, for certain causes of mortality and within a specific sub-set of self-ratings of health.

Retirement
Retirement, a common transition faced by the elderly, may have both positive and negative consequences.
[Societal impact
Of the roughly 150,000 people who die each day across the globe, about two thirds — 100,000 per day — die of age-related causes. In industrialized nations, the proportion is much higher, reaching 90%.
Societal ageing refers to the demographic ageing of populations and societies.
Cultural differences in attitudes to ageing have been studied.
Emotional improvement
Given the physical and cognitive declines seen in ageing, a surprising finding is that emotional experience improves with age. Older adults are better at regulating their emotions and experience negative affect less frequently than younger adults and show a positivity effect in their attention and memory. The emotional improvements show up in longitudinal studies[specify] as well as in cross-sectional studies[specify] and so cannot be entirely due to only the happier individuals surviving.
Successful ageing

The concept of successful ageing can be traced back to the 1950s, and popularised in the 1980s. Previous research into ageing exaggerated the extent to which health disabilities, such as diabetes or osteoporosis, could be attributed exclusively to age, and research in gerontology exaggerated the homogeneity of samples of elderly people. Successful ageing consists of three components:[29]
Low probability of disease or disability;
High cognitive and physical function capacity;

Active engagement with life.

A greater number of people self-report successful ageing than those that strictly meet these criteria.
Successful ageing may be viewed an interdisciplinary concept, spanning both psychology and sociology, where it is seen as the transaction between society and individuals across the life span with specific focus on the later years of life. The terms "healthy ageing "optimal ageing" have been proposed as alternatives to successful ageing.
Six suggested dimensions of successful ageing include:
No physical disability over the age of 75 as rated by a physician;
Good subjective health assessment (i.e. good self-ratings of one's health);
Length of undisabled life;
Good mental health;
Objective social support;
Self-rated life satisfaction in eight domains, namely marriage, income-related work, children, friendship and social contacts, hobbies, community service activities, religion and recreation/sports.

Biological theories
At present, the biological basis of ageing is unknown. Most scientists agree that substantial variability exists in the rates of ageing across different species, and that this to a large extent is genetically based. In model organisms and laboratory settings, researchers have been able to demonstrate that selected alterations in specific genes can extend lifespan (quite substantially in nematodes, less so in fruit flies, and even less in mice). Nevertheless, even in the relatively simple organisms, the mechanism of ageing remain to be elucidated. Because the lifespan of even the simple lab mouse is around 3 years, very few experiments directly test specific ageing theories (most of the evidence for the ones listed below is correlative).

The US National Institute on Aging currently funds an intervention testing program, whereby investigators nominate compounds (based on specific molecular ageing theories) to have evaluated with respect to their effects on lifespan and age-related biomarkers in outbred mice.[31] Previous age-related testing in mammals has proved largely irreproducible, because of small numbers of animals, and lax mouse husbandry conditions. The intervention testing program aims to address this by conducting parallel experiments at three internationally recognized mouse ageing-centres, the Barshop Institute at UTHSCSA, the University of Michigan at Ann Arbor and the Jackson Laboratory. While the hypotheses below reflect some of the current direction in biological ageing research, none of them is accepted as a "theory" in the sense of the "theory of gravity" or "theory of relativity".

Telomere Theory
Telomeres (structures at the ends of chromosomes) have experimentally been shown to shorten with each successive cell division. Shortened telomeres activate a mechanism that prevents further cell multiplication. This may be an important mechanism of ageing in tissues like bone marrow and the arterial lining where active cell division is necessary. Importantly though, mice lacking telomerase enzyme do not show a dramatically reduced lifespan, as the simplest version of this theory would predict.
Reproductive-Cell Cycle Theory

The idea that ageing is regulated by reproductive hormones that act in an antagonistic pleiotropic manner via cell cycle signalling, promoting growth and development early in life in order to achieve reproduction, but later in life, in a futile attempt to maintain reproduction, become dysregulated and drive senescence (dyosis).

Wear-and-Tear Theory
The very general idea that changes associated with ageing are the result of chance damage that accumulates over time.

Somatic Mutation Theory
The biological theory that ageing results from damage to the genetic integrity of the body's cells.

Error Accumulation Theory
The idea that ageing results from chance events that escape proof reading mechanisms, which gradually damages the genetic code.
Evolutionary Theories
See Theories of ageing in Senescence. These are by far the most theoretical; however, their usefulness is somewhat limited as they do not provide readily testable biochemically based interventions.

Accumulative-Waste Theory
The biological theory of ageing that points to a buildup of cells of waste products that presumably interferes with metabolism.

Autoimmune Theory
The idea that ageing results from an increase in autoantibodies that attack the body's tissues. A number of diseases associated with ageing, such as atrophic gastritis and Hashimoto's thyroiditis, are probably autoimmune in this way. While inflammation is very much evident in old mammals, even SCID mice in SPF colonies still senescence.

Ageing-Clock Theory
The theory that ageing results from a preprogrammed sequence, as in a clock, built into the operation of the nervous or endocrine system of the body. In rapidly dividing cells the shortening of the telomeres would provide just such a clock. This idea is in direct contradiction with the evolutionary based theory of ageing.

Cross-Linkage Theory
The idea that ageing results from accumulation of cross-linked compounds that interfere with normal cell function.

Free-Radical Theory
The idea that free radicals (unstable and highly reactive organic molecules, also named reactive oxygen species or oxidative stress) create damage that gives rise to symptoms we recognize as ageing.
Reliability theory of ageing and longevity

A general theory about systems failure. It allows researchers to predict the age-related failure kinetics for a system of given architecture (reliability structure) and given reliability of its components. Reliability theory predicts that even those systems that are entirely composed of non-ageing elements (with a constant failure rate) will nevertheless deteriorate (fail more often) with age, if these systems are redundant in irreplaceable elements. Ageing, therefore, is a direct consequence of systems redundancy. Reliability theory also predicts the late-life mortality deceleration with subsequent levelling-off, as well as the late-life mortality plateaus, as an inevitable consequence of redundancy exhaustion at extreme old ages. The theory explains why mortality rates increase exponentially with age (the Gompertz law) in many species, by taking into account the initial flaws (defects) in newly formed systems. It also explains why organisms "prefer" to die according to the Gompertz law, while technical devices usually fail according to the Weibull (power) law. Reliability theory allows to specify conditions when organisms die according to the Weibull distribution: organisms should be relatively free of initial flaws and defects. The theory makes it possible to find a general failure law applicable to all adult and extreme old ages, where the Gompertz and the Weibull laws are just special cases of this more general failure law. The theory explains why relative differences in mortality rates of compared populations (within a given species) vanish with age (compensation law of mortality), and mortality convergence is observed due to the exhaustion of initial differences in redundancy levels.

Mitohormesis

It has been known since the 1930s that restricting calories while maintaining adequate amounts of other nutrients can extend lifespan in laboratory animals. Recently, Michael Ristow's group has provided evidence for the theory that this effect is due to increased formation of free radicals within the mitochondria causing a secondary induction of increased antioxidant defence capacity.[32]

Misrepair-Accumulation Theory: This very recent novel theory by Wang et al.[33] suggests that ageing is the result of the accumulation of "Misrepair". Important in this theory is to distinguish among "damage" which means a newly emerging defect BEFORE any reparation has taken place, and "Misrepair" which describes the remaining defective structure AFTER (incorrect) repair. The key points in this theory are:

There is no original damage left unrepaired in a living being. If damage was left unrepaired a life threatening condition (such as bleeding, infection, or organ failure) would develop.

Misrepair, the repair with less accuracy, does not happen accidentally. It is a necessary measure of the reparation system to achieve sufficiently quick reparation in situations of serious or repeated damage, to maintain the integrity and basic function of a structure, which is important for the survival of the living being.

Hence the appearance of Misrepair increases the chance for the survival of individual, by which the individual can live at least up to the reproduction age, which is critically important for the survival of species. Therefore the Misrepair mechanism was selected by nature due to its evolutionary advantage.

However, since Misrepair as a defective structure is invisible for the reparation system, it accumulates with time and causes gradually the disorganization of a structure (tissue, cell, or molecule); this is the actual source of ageing.

Ageing hence is the side-effect for survival, but important for species survival. Thus Misrepair might represent the mechanism by which organisms are not programmed to die but to survive (as long as possible), and ageing is just the price to be paid.

Non-biological theories

Disengagement Theory

This is the idea that separation of older people from active roles in society is normal and appropriate, and benefits both society and older individuals. Disengagement theory, first proposed by Cumming and Henry, has received considerable attention in gerontology, but has been much criticised.[3] The original data on which Cumming and Henry based the theory were from a rather small sample of older adults in Kansas City, and from this select sample Cumming and Henry then took disengagement to be a universal theory.[34] There are research data suggesting that the elderly who do become detached from society as those were initially reclusive individuals, and such disengagement is not purely a response to ageing.

Activity Theory

In contrast to disengagement theory, this theory implies that the more active elderly people are, the more likely they are to be satisfied with life. The view that elderly adults should maintain well-being by keeping active has had a considerable history, and since 1972, this has become to be known as activity theory.[34] However, this theory may be just as inappropriate as disengagement for some people as the current paradigm on the psychology of ageing is that both disengagement theory and activity theory may be optimal for certain people in old age, depending on both circumstances and personality traits of the individual concerned.[3] There are also data which query whether, as activity theory implies, greater social activity is linked with well-being in adulthood.

Selectivity Theory

mediates between Activity and Disengagement Theory, which suggests that it may benefit older people to become more active in some aspects of their lives, more disengaged in others.

The view that in ageing people are inclined to maintain, as much as they can, the same habits, personalities, and styles of life that they have developed in earlier years. Continuity theory is Atchley's theory that individuals, in later life, make adaptations to enable them to gain a sense of continuity between the past and the present, and the theory implies that this sense of continuity helps to contribute to well-being in later life. Disengagement theory, activity theory and continuity theory are social theories about ageing, though all may be products of their era rather than a valid, universal theory.

Prevention and reversal

Several drugs and food supplements have been shown to retard or reverse the biological effects of ageing in animal models; none has yet been proved in humans. Resveratrol, a chemical found in red grapes, has been shown to extend the lifespan of yeast by 60%, worms and flies by 30% and one species of fish by almost 60%. Small doses of heavy water increase fruit-fly lifespan by 30%, but large doses are toxic to complex organisms.

In 2002 a team led by Professor Bruce Ames at UC Berkeley discovered that feeding aged rats a combination of acetyl-L-carnitine and alpha-lipoic acid (both substances are already approved for human use and sold in health food stores) produced a rejuvenating effect. Ames said, "With these two supplements together, these old rats got up and did the macarena. The brain looks better, they are full of energy - everything we looked at looks like a young animal." UC Berkeley has patented the use of these supplements in combination and a company, Juvenon, has been established to market the treatment.
In 2007 researchers at the Salk Institute for Biological Studies, identified a critical gene in nematode worms that specifically links eating fewer calories with living longer. Professor Andrew Dillin and colleagues showed that the gene pha-4 regulates the longevity response to calorie restriction. In the same year Dr Howard Chang of the Stanford University School of Medicine was able to rejuvenate the skin of two-year-old mice to resemble that of newborns by blocking the activity of the gene NF-kappa-B.
In 2008, a team at the Spanish National Cancer Research Center genetically engineered mice to produce ten times the normal level of the telomerase enzyme. The mice lived 26% longer than normal. The same year a team led by Professor Michael O Thorner at the University of Virginia discovered that the drug MK-677 restored 20% of muscle mass lost due to ageing in humans aged 60 to 81. The subjects' growth hormone and insulin-like growth factor 1 (IGF-1) levels increased to that typical of healthy young adults.
In 2009 a drug called rapamycin, discovered in the 1970s in the soil of Easter Island in the South Pacific, was found to extend the life expectancy of 20-month-old mice by up to 38%. Rapamycin is generally used to suppress the immune system and prevent the rejection of transplanted organs. Dr Arian Richardson of the Barshop Institute said, "I never thought we would find an anti-ageing pill in my lifetime; however, rapamycin shows a great deal of promise to do just that." Professor Randy Strong of the University of Texas Health Science Center at San Antonio said, "We believe this is the first convincing evidence that the ageing process can be slowed and lifespan can be extended by a drug therapy starting at an advanced age."

Also in 2009 the British Journal of Nutrition reported a study at Tufts University in Boston which showed that brain function and motor skills in aged rats could be improved by adding walnuts to their diet. The human equivalent would be to eat seven to nine walnuts per day.
In September the same year researchers at UC Berkeley discovered they could restore youthful repair capability to muscle tissue taken from men aged 68 to 74 by in vitro treatment with mitogen-activated protein kinase. This protein was found to be essential for the production of the stem cells necessary to repair muscle after exercise and is present at reduced levels in aged individuals.
Measure of age
The age of an adult human is commonly measured in whole years since the day of birth. Fractional years or months or even weeks may be used to describe the age of children and infants for finer resolution. The time of day the birth occurred is not commonly considered.
The measure of age has historically varied from this approach in some cultures. For example, in China, Korea, Japan and Vietnam, children were considered to be one year old at the moment of birth and two years old on the following New Year's Day.

Thus, a child could be considered two years old several days after birth. In parts of Tibet, age is counted from conception i.e. one is 9 months old when one is born. Age in prenatal development is normally measured in gestational age, taking the last menstruation of the woman as a point of beginning. Alternatively, fertilisation age, beginning from fertilisation can be taken.

Death

Death is the termination of the biological functions that define a livingorganism. It refers both to a particular event and to the condition that results thereby. The true nature of the latter has, for millennia, been a central concern of the world's religious traditions and of philosophical enquiry. Belief in some kind of afterlife or rebirth is a central aspect of many religious traditions.

Humans and the vast majority of other animals die in due course from senescence. Remarkable exceptions include the hydra, and the jellyfish turritopsis nutricula, which is thought to possess in effect biological immortality.

Intervening phenomena which commonly bring about death earlier include malnutrition, disease, or accidents resulting in terminal physical injury. Predation is a cause of death for many species. Intentional human activity causing death includes suicide, homicide, and war. Roughly 150,000 people die each day across the globe. Death in the natural world can also occur as an indirect result of human activity: an increasing cause of species depletion in recent times has been destruction of ecosystems as a consequence of the widening spread of industrialtechnology.

Physiological death is now seen as less an event than a process: conditions once considered indicative of death are now reversible. Where in the process a dividing line is drawn between life and death depends on factors beyond the presence or absence of vital signs. In general, clinical death is neither necessary nor sufficient for a determination of legal death. A patient with working heart and lungs determined to be brain dead can be pronounced legally dead without clinical death occurring. Precise medical definition of death, in other words, becomes more problematic, paradoxically, as scientific knowledge and technology advance.

Signs and symptoms

Signs of death, or strong indications that a person is no longer alive are:

Ceasing respiration

The body no longer metabolizes

No pulse

Pallor mortis, paleness which happens in the 15–120 minutes after death

Livor mortis, a settling of the blood in the lower (dependent) portion of the body

Algor mortis, the reduction in body temperature following death. This is generally a steady decline until matching ambient temperature

Rigor mortis, the limbs of the corpse become stiff (Latin rigor) and difficult to move or manipulate

Decomposition, the reduction into simpler forms of matter, accompanied by a strong, unpleasant odor.

Diagnosis

Problems of definition

What is death? A flower, a skull and an hour-glass stand in for Life, Death and Time in this 17th-century painting by Philippe de Champaigne

For those who define death as a state following the state of life, one of the challenges in defining death is in distinguishing it from life. Death would seem to refer to either the moment at which life ends, or when the state that follows life begins. However, determining when death has occurred requires drawing precise conceptual boundaries between life and death. This is problematic because there is little consensus over how to define life. Some[who?] have suggested defining life in terms of consciousness. When consciousness ceases, a living organism can be said to have died. One of the notable flaws in this approach is that there are many organisms which are alive but probably not conscious (for example, single-celled organisms). Another problem with this approach is in defining consciousness, which has many different definitions given by modern scientists, psychologists and philosophers. This general problem of defining death applies to the particular challenge of defining death in the context of medicine.

Other definitions for death focus on the character of cessation of something.[5] In this context "death" describes merely the state where something has ceased, e.g., life. Thus, the definition of "life" simultaneously defines death.

Historically, attempts to define the exact moment of a human's death have been problematic. Death was once defined as the cessation of heartbeat (cardiac arrest) and of breathing, but the development of CPR and prompt defibrillation have rendered that definition inadequate because breathing and heartbeat can sometimes be restarted[citation needed]. Events which were causally linked to death in the past no longer kill in all circumstances; without a functioning heart or lungs, life can sometimes be sustained with a combination of life support devices, organ transplants and artificial pacemakers.

Today, where a definition of the moment of death is required, doctors and coroners usually turn to "brain death" or "biological death" to define a person as being clinically dead; people are considered dead when the electrical activity in their brain ceases. It is presumed that an end of electrical activity indicates the end of consciousness. However, suspension of consciousness must be permanent, and not transient, as occurs during certain sleep stages, and especially a coma. In the case of sleep, EEGs can easily tell the difference.

However, the category of "brain death" is seen by some scholars to be problematic. For instance, Dr Franklin Miller, senior faculty member at the Department of Bioethics, National Institutes of Health, notes "By the late 1990s, however, the equation of brain death with death of the human being was increasingly challenged by scholars, based on evidence regarding the array of biological functioning displayed by patients correctly diagnosed as having this condition who were maintained on mechanical ventilation for substantial periods of time. These patients maintained the ability to sustain circulation and respiration, control temperature, excrete wastes, heal wounds, fight infections and, most dramatically, to gestate fetuses (in the case of pregnant "brain-dead" women)."

Those people maintaining that only the neo-cortex of the brain is necessary for consciousness sometimes argue that only electrical activity there should be

considered when defining death. Eventually it is possible that the criterion for death will be the permanent and irreversible loss of cognitive function, as evidenced by the death of the cerebral cortex. All hope of recovering human thought and personality is then gone given current and foreseeable medical technology. However, at present, in most places the more conservative definition of death – irreversible cessation of electrical activity in the whole brain, as opposed to just in the neo-cortex – has been adopted (for example the Uniform Determination Of Death Act in the United States). In 2005, the Terri Schiavo case brought the question of brain death and artificial sustenance to the front of American politics.

Even by whole-brain criteria, the determination of brain death can be complicated. EEGs can detect spurious electrical impulses, while certain drugs, hypoglycemia, hypoxia, or hypothermia can suppress or even stop brain activity on a temporary basis. Because of this, hospitals have protocols for determining brain death involving EEGs at widely separated intervals under defined conditions.

Legal death

In the United States, a person is dead by law if a Statement of Death or Death Certificate is approved by a licensed medical practitioner. Various legal consequences follow death, including the removal from the person of what in legal terminology is called personhood.

The possession of brain activities, or ability to resume brain activity, is a necessary condition to legal personhood in the United States. "It appears that once brain death has been determined ... no criminal or civil liability will result from disconnecting the life-support devices." (Dority v. Superior Court of San Bernardino County, 193 Cal.Rptr. 288, 291 (1983))

Misdiagnosed: Premature burial

There are many anecdotal references to people being declared dead by physicians and then "coming back to life", sometimes days later in their own coffin, or when embalming procedures are about to begin. From the mid-18th century onwards, there was an upsurge in the public's fear of being mistakenly buried alive, and much debate about the uncertainty of the signs of death. Various suggestions were made to test for signs of life before burial, ranging from pouring vinegar and pepper into the corpse's mouth to applying red hot pokers to the feet, or even into the rectum. Writing in 1895, the physician J. C. Ouseley claimed that as many as 2,700 people were buried prematurely each year in England and Wales, although others estimated the figure to be closer to 800.

In cases of electric shock, CPR for an hour or longer can allow stunned nerves to recover, allowing an apparently dead person to survive. People found unconscious under icy water may survive if their faces are kept continuously cold until they arrive at an emergency room.[10] This "diving response", in which metabolic activity and oxygen requirements are minimal, is something humans share with cetaceans called the mammalian diving reflex.

As medical technologies advance, ideas about when death occurs may have to be re-evaluated in light of the ability to restore a person to vitality after longer periods of apparent death (as happened when CPR and defibrillation showed that cessation of heartbeat is inadequate as a decisive indicator of death). The lack of electrical brain activity may not be enough to consider someone scientifically dead. Therefore, the

concept of information theoretical death has been suggested as a better means of defining when true death occurs, though the concept has few practical applications outside of the field of cryonics.
There have been some scientific attempts to bring dead organisms back to life, but with limited success. In science fictionscenarios where such technology is readily available, real death is distinguished from reversible death.

Causes
The leading cause of death in developing countries is infectious disease. The leading causes of death in developed countries are atherosclerosis (heart disease and stroke), cancer, and other diseases related to obesity and aging. These conditions cause loss of homeostasis, leading to cardiac arrest, causing loss of oxygen and nutrient supply, causing irreversible deterioration of the brain and other tissues. Of the roughly 150,000 people who die each day across the globe, about two thirds – 100,000 per day – die of age-related causes. In industrialized nations, the proportion is much higher, reaching 90%. With improved medical capability, dying has become a condition to be managed. Home deaths, once commonplace, are now rare in the developed world.
In developing nations, inferior sanitary conditions and lack of access to modern medical technology makes death from infectious diseases more common than in developed countries. One such disease is tuberculosis, a bacterial disease which killed 1.7 million people in 2004. Malaria causes about 400–900 million cases of fever and 1–3 million deaths annually. AIDS death toll in Africa may reach 90–100 million by 2025.
According to Jean Ziegler, who was the United Nations Special reporter on the Right to Food from 2000 to March 2008; mortality due to malnutrition accounted for 58% of the total mortality rate in 2006. Ziegler says worldwide approximately 62 million people died from all causes and of those deaths more than 36 million died of hunger or diseases due to deficiencies in micronutrients."
Tobacco smoking killed 100 million people worldwide in the 20th century and could kill 1 billion people around the world in the 21st century, a WHO Report warned.
Many leading developed world causes of death can be postponed by diet and physical activity, but the accelerating incidence of disease with age still imposes limits on human longevity. The evolutionary cause of aging is, at best, only just beginning to be understood. It has been suggested that direct intervention in the aging process may now be the most effective intervention against major causes of death.[19]
Autopsy
Rembrandt turns an autopsy into a masterpiece: The Anatomy Lesson of Dr. Nicolaes Tulp
An autopsy, also known as a postmortem examination or an obduction, is a medical procedure that consists of a thorough examination of a human corpse to determine the cause and manner of a person's death and to evaluate any disease or injury that may be present. It is usually performed by a specialized medical doctor called a pathologist.
Autopsies are either performed for legal or medical purposes. A forensic autopsy is carried out when the cause of death may be a criminal matter, while a clinical or academic autopsy is performed to find the medical cause of death and is used in cases of unknown or uncertain death, or for research purposes. Autopsies can be further classified into cases where external examination suffices, and those where

the body is dissected and an internal examination is conducted. Permission from next of kin may be required for internal autopsy in some cases. Once an internal autopsy is complete the body is generally reconstituted by sewing it back together. Autopsy is important in a medical environment and may shed light on mistakes and help improve practices.
A "necropsy" is an older term for a postmortem examination, unregulated, and not always a medical procedure. In modern times the term is more often used in the postmortem examination of the corpses of animals.

Prevention
Life extension
Life extension refers to an increase in maximum or average lifespan, especially in humans, by slowing down or reversing the processes of aging. Average lifespan is determined by vulnerability to accidents and age or lifestyle-related afflictions such as cancer, or cardiovascular disease. Extension of average lifespan can be achieved by good diet, exercise and avoidance of hazards such as smoking. Maximum lifespan is determined by the rate of aging for a species inherent in its genes. Currently, the only widely recognized method of extending maximum lifespan is calorie restriction. Theoretically, extension of maximum lifespan can be achieved by reducing the rate of aging damage, by periodic replacement of damaged tissues, or by molecular repair or rejuvenation of deteriorated cells and tissues.

Researchers of life extension are a subclass of biogerontologists known as "biomedical gerontologists". They try to understand the nature of aging and they develop treatments to reverse aging processes or to at least slow them down, for the improvement of health and the maintenance of youthful vigor at every stage of life. Those who take advantage of life extension findings and seek to apply them upon themselves are called "life extensionists" or "longevists". The primary life extension strategy currently is to apply available anti-aging methods in the hope of living long enough to benefit from a complete cure to aging once it is developed, which given the rapidly advancing state of biogenetic and general medical technology, could conceivably occur within the lifetimes of people living today.

Society and culture
Death haunts even the beautiful: an early 20th-century artist says, "All is Vanity"
Death is the center of many traditions and organizations, and is a feature of every culture around the world. Much of this revolves around the care of the dead, as well as the afterlife and the disposal of bodies upon the onset of death. The disposal of human corpses does, in general, begin with the last offices before significant time has passed, and ritualistic ceremonies often occur, most commonly interment or cremation. This is not a unified practice, however, as in Tibet for instance the body is given a sky burial and left on a mountain top. Proper preparation for death and techniques and ceremonies for producing the ability to transfer one's spiritual attainments into another body (reincarnation) are subjects of detailed study in Tibet. Mummification or embalming is also prevalent in some cultures, to retard the rate of decay.
Legal aspects of death are also part of many cultures, particularly the settlement of the deceased estate and the issues of inheritance and in some countries, inheritance taxation.

Capital punishment is also a culturally divisive aspect of death. In most jurisdictions where capital punishment is carried out today, the death penalty is reserved for premeditated murder, espionage, treason, or as part of military justice. In some countries, sexual crimes, such as adultery and sodomy, carry the death penalty, as do religious crimes such as apostasy, the formal renunciation of one's religion. In many retentionist countries, drug trafficking is also a capital offense. In China human trafficking and serious cases of corruption are also punished by the death penalty. In militaries around the world courts-martial have imposed death sentences for offenses such as cowardice, desertion, insubordination, and mutiny.
Death in warfare and in suicide attack also have cultural links, and the ideas of dulce et decorum est pro patria mori, mutiny punishable by death, grieving relatives of dead soldiers and death notification are embedded in many cultures. Recently in the western world, with the supposed increase in terrorism following the September 11 attacks, but also further back in time with suicide bombings, kamikaze missions in World War II and suicide missions in a host of other conflicts in history, death for a cause by way of suicide attack, and martyrdom have had significant cultural impacts.
Suicide in general, and particularly euthanasia, are also points of cultural debate. Both acts are understood very differently in different cultures. In Japan, for example, ending a life with honor by seppuku was considered a desirable death, whereas according to traditional Christian and Islamic cultures, suicide is viewed as a sin.
Death is personified in many cultures, with such symbolic representations as the Grim Reaper, Azrael and Father Time.

In biology

After death the remains of an organism become part of the biogeochemical cycle. Animals may be consumed by a predator or a scavenger. Organic material may then be further decomposed by detritivores, organisms which recycle detritus, returning it to the environment for reuse in the food chain. Examples of detritivores include earthworms, woodlice and dung beetles.
Microorganisms also play a vital role, raising the temperature of the decomposing matter as they break it down into yet simpler molecules. Not all materials need be decomposed fully, however. Coal, a fossil fuel formed over vast tracts of time in swamp ecosystems, is one example.

Natural selection

Competition (biology), natural selection, and extinction
Contemporary evolutionary theory sees death as an important part of the process of natural selection. It is considered that organisms less adapted to their environment are more likely to die having produced fewer offspring, thereby reducing their contribution to the gene pool. Their genes are thus eventually bred out of a population, leading at worst to extinction and, more positively, making possible the process referred to as speciation. Frequency of reproduction plays an equally important role in determining species survival: an organism that dies young but leaves numerous offspring displays, according to Darwinian criteria, much greater fitness than a long-lived organism leaving only one.

Extinction

Dead as a dodo: the bird that became a byword in English for species extinction

Extinction is the cessation of existence of a species or group of taxa, reducing biodiversity. The moment of extinction is generally considered to be the death of the last individual of that species (although the capacity to breed and recover may have been lost before this point). Because a species' potential range may be very large, determining this moment is difficult, and is usually done retrospectively. This difficulty leads to phenomena such as Lazarus taxa, where a species presumed extinct abruptly "reappears" (typically in the fossil record) after a period of apparent absence. New species arise through the process of speciation, an aspect of evolution. New varieties of organisms arise and thrive when they are able to find and exploit an ecological niche – and species become extinct when they are no longer able to survive in changing conditions or against superior competition.

Evolution of ageing

Inquiry into the evolution of aging aims to explain why so many living things and the vast majority of animals weaken and die with age (a notable exception being hydra, which may be biologically immortal). The evolutionary origin of senescence remains one of the fundamental puzzles of biology. Gerontology specializes in the science of human aging processes.

Causes of Death 1916 How the medical profession categorized causes of death a century ago.

George Wald: The Origin of Death A biologist explains life and death in different kinds of organisms in relation to evolution.

Before and After Death Interviews with people dying in hospices, and portraits of them before, and shortly after, death

Birth rate

Crude birth rate is the nativity or childbirths per 1,000 people per year.

According to the United Nations' World Population Prospects: The 2008 Revision Population Database, crude birth rate is the Number of births over a given period divided by the person-years lived by the population over that period. It is expressed as number of births per 1,000 population. CBR = (births in a period / population of person-years over that period).

According to the Dictionary of Geography by Audrey Clark, crude birth rate is also known as natural increase. It ranges from 12 to 50 per 1000 people. Furthermore, Clark describes that there is only a small tendency for birth-rates to fall even with more usage of birth control. During the period of 1960 to 1980, the world population's annual rate of increase fell two percentage points, from 3.7 percent per annum 1.7 per cent per annum in the 1980s. [Is this what the original sentence meant?].

It can be represented by number of childbirths in that year, and p is the current population. This figure is combined with the crude death rate to produce the rate of natural population growth (natural in that it does not take into account net migration).

Another indicator of fertility that is frequently used is the total fertility rate, which is the average number of children born to each woman over the course of her life. In general, the total fertility rate is a better indicator of (current) fertility rates because unlike the crude birth rate it is not affected by the age distribution of the population.

Fertility rates tend to be higher in less economically developed countries and lower in more economically developed countries.

The birth rate is an item of concern and policy for a number of national governments. Some, including those of Italy and Malaysia, seek to increase the national birth rate using measures such as financial incentives or provision of support services to new mothers. Conversely, others aim to reduce the birth rate. For example, China's One child policy; measures such as improved information about and availability of birth control have achieved similar results in countries such as Iran.

There has also been discussion on whether bring women into the forefront of development initiatives will lead to a decline in birth rates. In some places, government policies have been focused on reducing birth rates through improving women's sexual and reproductive health and rights. Typically, high birth rates has been associated with health impairments and low life expectancy, low living standards, low status of women, and low levels of education. There are claims that as countries go through economic development and social change, population growth such as birth rate declines. Family programmes become widely accepted and birth rates decline
In 1974 at the World Population Conference in Bucharest, women's issues gained considerable attention. family programmes were seriously discussed and 137 countries drafted a World Population Plan of Action. In the discussion, many countries accepted modern birth control, such as the pill and the condom, but opposed abortion. In 1994, Another Action plan was drafted in Cairo under the United Nations. They discussed the concern on population and the need to incorporate women into the discourse. They agreed that a need to improve women's status, initiatives in defence of reproductive health and freedom, the environment, and sustainable socio-economic development were needed.

Generally, birth rate is calculated using live birth counts from a universal system of registration of births, deaths, and marriages, and population counts from a census or using estimation through specialized demographic techniques. Birth rate is also commonly used to calculate population growth. It is combined with death rates and migration rates to calculate population growth.

As for 2009, the average birth rate for the whole world is 19.95 per year per 1000 total population. Birth rate from 2003 to 2009 shows that there has been a -.48% decline from 2003's world birth rate of 20.43 per 1000 total population. According to the CIA - The World Factbook, the country with the highest birth rate currently is Niger at 51.6 births per 1000 people. The country with the lowest birth rate is Japan at 7.64 births per 1000 people. (Hong Kong as a Special Administrative Region of China is at 7.42 births per 1000 people.) As compared to the 1950s (birth rate was at 36 births per 1000 in the 1950s[3]), birth rate has declined by 16 births per 1000 people.

Countries with birth rates ranging from 10-20 births per 1000 is considered low and countries ranging from 40-50 births per 1000 is considered high. There are problems associated with both an extremely high birth rate and extremely low birth rate. High

birth rates could cause stress on the government welfare and family programs to support the youthful population. Further problems of a country with a high birth rate include: how to educate growing number of children, creating jobs for these children when they grow up to be working age, and dealing with the environmental effects that a large population can produce. Low birth rates can also put stress on the government to prove adequate senior welfare systems and also the stress on families to support the elders themselves. There will be less children or working age population to support the constantly growing aging population.

Methods of measuring birth rate

General fertility rate (GFR): This measures the number of births per 1,000 women aged 15 to 44 or 15 to 49. Standardised birth rate (SBR): This compares the age-sex structure to a hypothetical standard population.

Total fertility rate (TFR): The mean number of children a woman is expected to bear during her child-bearing years. It is also independent of the age-sex structure of the population.

Child-to-woman ratio: This measures the number of children below five to the number of women of child-bearing years (age 15 to 44). In the past, when there is no universal registration of births, this ratio is a relatively good indicator of fertility since it can be measure using data from the Census. However, high infant mortality rate would cause huge difference between child to woman ratio and general fertility rate (GFR).

Factors affecting birth rate

Pro-natalist policies and Antinatalist policies from government

Existing age-sex structure

Availability of family planning services

Social and religious beliefs - especially in relation to contraception and abortion

Female literacy levels

Economic prosperity (although in theory when the economy is doing well families can afford to have more children, in practice the higher the economic prosperity the lower the birth rate: the Demographic-economic paradox).

Poverty levels – Children can be seen as an economic resource in developing countries as they can earn money.

Infant Mortality Rate – A family may have more children if a country's IMR is high as it is likely some of those children will die.

Urbanization

Typical age of marriage

Pension availability

Conflict

Birth rate and the Demographic Transition Model

The demographic Transition Model describes population mortality and fertility may decline as social and economic development occurs through time. The two major factors in the Demographic Transition Model is Crude Birth Rate (CBR) and Crude Death Rate (CDR). There are 4 stages to the Demographic Model and in the first and second stage, CBR remains high because people are still in agrarian cultures and need more labour to work on farms. In addition, the chances of children dying are high because medicine is not as advance during that phrase. However, in the third

stage, CBR starts to decline due to more women's participation in society and the reduced need of families to have many children. In the fourth stage, CBR is sustained at a really low level with some countries below replacement levels.

Total fertility rate

The total fertility rate (TFR, sometimes also called the fertility rate, period total fertility rate (PTFR) or total period fertility rate (TPFR)) of a population is the average number of children that would be born to a woman over her lifetime if (1) she were to experience the exact current age-specific fertility rates (ASFRs) through her lifetime, and (2) she were to survive from birth through the end of her reproductive life.[1] It is obtained by summing the single-year age-specific rates at a given time.

The TFR is a synthetic rate, not based on the fertility of any real group of women, since this would involve waiting until they had completed childbearing. Nor is it based on counting up the total number of children actually born over their lifetime, but instead is based on the age-specific fertility rates of women in their "child-bearing years," which in conventional international statistical usage is ages 15–44 or 15-49The TFR is therefore a measure of the fertility of an imaginary woman who passes through her reproductive life subject to all the age-specific fertility rates for ages 15–49 that were recorded for a given population in a given year. The TFR represents the average number of children a woman would have were she to fast-forward through all her childbearing years in a single year, under all the age-specific fertility rates for that year. In other words, this rate is the number of children a woman would have if she was subject to prevailing fertility rates at all ages from a single given year, and survives throughout all her childbearing years.

An alternative fertility measure is the net reproduction rate (NRR), which measures the number of daughters a woman would have in her lifetime if she were subject to prevailing age-specific fertility and mortality rates in the given year. When the NRR is exactly one, then each generation of women is exactly reproducing itself. The NRR is less widely used than the TFR, and the United Nations stopped reporting NRR data for member nations after 1998. But the NRR is particularly relevant where the number of male babies born is very high. The gross reproduction rate (GRR), is the same as the NRR, except that - like the TFR - it ignores life expectancy.

The TFR (or TPFR—total period fertility rate) is a better index of fertility than the Crude birth rate (annual number of births per thousand population) because it is independent of the age structure of the population, but it is a poorer estimate of actual completed family size than the total cohort fertility rate, which is obtained by summing the age-specific fertility rates that actually applied to each cohort as they aged through time. In particular, the TFR does not necessarily predict how many children young women now will eventually have, as their fertility rates in years to come may change from those of older women now. However, the TFR is a reasonable summary of current fertility levels.

Replacement rates

Graph of Total Fertility Rates vs. GDP per capita of the corresponding country, 2009. Only countries with over 5 Million population were plotted to reduce outliers. Sources: CIA World Fact Book

Replacement fertility is the total fertility rate at which newborn girls would have an average of exactly 1 daughter over their lifetimes. In more familiar terms, women have just enough babies to replace themselves.

If there were no mortality in the female population until the end of the childbearing years (generally taken as 44 or 49, though some exceptions exist) then the replacement level of TFR would be very close to 2.0 (actually slightly higher because of the excess of boy over girl births in human populations). However, the replacement level is also affected by mortality, especially childhood mortality. The replacement fertility rate is roughly 2.1 births per woman for most industrialized countries (2.075 in the UK for example), but ranges from 2.5 to 3.3 in developing countries because of higher mortality rates.[3] Taken globally, the total fertility rate at replacement is 2.33 children per woman. At this rate, global population growth would trend towards zero.

Developed countries usually have a much lower fertility rate due to greater wealth, education, and urbanization. Mortality rates are low, birth control is understood and easily accessible, and costs are often deemed very high because of education, clothing, feeding, and social amenities. Further, longer periods of time spent getting higher education often mean women have children later in life. The result is the demographic-economic paradox. Female labor participation rate also has substantial negative impact on fertility. However, this effect is neutralized among Nordic or liberalist countries.[4]
In developing countries on the other hand, families desire children for their labour and as caregivers for their parents in old age. Fertility rates are also higher due to the lack of access to contraceptives, generally lower levels of female education, and lower rates of female employment in industry.
The total fertility rate in the United States after World War II peaked at about 3.8 children per woman in the late 1950s and by 1999 was at 2 children. This means that an imaginary woman (defined in the introduction) who fast-forwarded through her life in the late 1950s would have been expected to have about four children, whereas an imaginary woman who fast-forwarded through her life in 1999 would have been expected to have only about two children in her lifetime. The fertility rate of the total U.S. population is at around the replacement level of about 2.1 children per woman. However, the fertility of the population of the United States is below replacement among those native born, and above replacement among immigrantfamilies, most of whom come to the U.S. from countries with higher fertility than that of the U.S.[citation needed] However, the fertility rates of immigrants to the U.S. has been found to decrease sharply in the second generation, correlating with improved education and income.
According to a thesis submitted in 2005 to the Office of Graduate Studies of Texas A&M University, the lowest TFR recorded anywhere in the world in recorded history is for Xiangyang district of Jiamusi city (Heilongjiang, China) which had a TFR of 0.41. Outside China, the lowest TFR ever recorded was 0.80 for Eastern Germany in 1994.

A population that maintains a TFR of 3.8 over a long time without a correspondingly high death or emigration rate would increase rapidly, whereas a population that maintains a TFR of 2.0 over a long time would decline (unless it had a large enough

immigration). However, it may take several generations for a change in the total fertility rate to be reflected in birth rate, because the age distribution must reach equilibrium. For example, a population that has recently dropped below replacement-level fertility will continue to grow, because the recent high fertility produced large numbers of young couples who would now be in their child-bearing years. This phenomenon carries forward for several generations and is called population momentum or population-lag effect. This time-lag effect is of great importance to the growth rates of human populations.

Infant mortality

World infant mortality rates in 2008

Infant mortality is defined as the number of infant deaths (one year of age or younger) per 1000 live births. The most common cause worldwide has traditionally been due to dehydration from diarrhea. However, the spreading information about Oral Rehydration Solution (a mixture of salts, sugar, and water) to mothers around the world has decreased the rate of children dying from dehydration. Currently the most common cause is pneumonia. Other causes of infant mortality include malnutrition, malaria, congenital malformation, infection and SIDS.

Infanticide, child abuse, child abandonment, and neglect may also contribute to infant mortality.[weasel words][vague] Related statistical categories:

Perinatal mortality only includes deaths between the foetal viability (22 weeks gestation) and the end of the 7th day after delivery.

Neonatal mortality only includes deaths in the first 28 days of life.

Postneonatal mortality only includes deaths after 28 days of life but before one year.

Child mortality includes deaths within the first five years after birth.

Infant mortality throughout history

Infant mortality rate (IMR) is the number of newborns dying under a year of age divided by the number of live births during the year times 1000. The infant mortality rate is also called the infant death rate. It is the number of deaths that occur in the first year of life for 1000 live births.

In past times, infant mortality claimed a considerable percentage of children born, but the rates have significantly declined in the West in modern times, mainly due to improvements in basic health care, though high technology medical advances have also helped. Infant mortality rate is commonly included as a part of standard of living evaluations in economics.

The infant mortality rate is reported as number of live newborns dying under a year of age per 1,000 live births, so that IMRs from different countries can be compared.

Comparing infant mortality rates

The infant mortality rate correlates very strongly with and is among the best predictors of state failure.[4] IMR is also a useful indicator of a country's level of health or development, and is a component of the physical quality of life index. But the method of calculating IMR often varies widely between countries based on the way they define a live birth and how many premature infants are born in the country. The World Health Organization (WHO) defines a live birth as any born human being who demonstrates independent signs of life, including breathing, voluntary muscle movement, or heartbeat. Many countries, however, including certain European states and Japan, only count as live births cases where an infant

breathes at birth, which makes their reported IMR numbers somewhat lower and raises their rates of perinatal mortality.

The exclusion of any high-risk infants from the denominator or numerator in reported IMRs can be problematic for comparisons. Many countries, including the United States, Sweden or Germany, count an infant exhibiting any sign of life as alive, no matter the month of gestation or the size, but according to United States Centers for Disease Control researchers,[6] some other countries differ in these practices. All of the countries named adopted the WHO definitions in the late 1980s or early 1990s,[7] which are used throughout the European Union.[8] However, in 2009, the US CDC issued a report which stated that the American rates of infant mortality were affected by the United States' high rates of premature babies compared to European countries and which outlines the differences in reporting requirements between the United States and Europe, noting that France, the Czech Republic, Ireland, the Netherlands, and Poland do not report all live births of babies under 500 g and/or 22 weeks of gestation.[6][9][10] However, the report also concludes that the differences in reporting are unlikely to be the primary explanation for the United States' relatively low international ranking.

Another well-documented example also illustrates this problem. Historically, until the 1990s Russia and the Soviet Union did not count as a live birth or as an infant death extremely premature infants (less than 1,000 g, less than 28 weeks gestational age, or less than 35 cm in length) that were born alive (breathed, had a heartbeat, or exhibited voluntary muscle movement) but failed to survive for at least seven days. Although such extremely premature infants typically accounted for only about 0.005 of all live-born children, their exclusion from both the numerator and the denominator in the reported IMR led to an estimated 22%-25% lower reported IMR.[12] In some cases, too, perhaps because hospitals or regional health departments were held accountable for lowering the IMR in their catchment area, infant deaths that occurred in the 12th month were "transferred" statistically to the 13th month (i.e., the second year of life), and thus no longer classified as an infant death.

UNICEF uses a statistical methodology to account for reporting differences among countries. "UNICEF compiles infant mortality country estimates derived from all sources and methods of estimation obtained either from standard reports, direct estimation from micro data sets, or from UNICEF's yearly exercise. In order to sort out differences between estimates produced from different sources, with different methods, UNICEF developed, in coordination with WHO, the WB and UNSD, an estimation methodology that minimizes the errors embodied in each estimate and harmonize trends along time. Since the estimates are not necessarily the exact values used as input for the model, they are often not recognized as the official IMR estimates used at the country level. However, as mentioned before, these estimates minimize errors and maximize the consistency of trends along time."

Another challenge to comparability is the practice of counting frail or premature infants who die before the normal due date as miscarriages (spontaneous abortions) or those who die during or immediately after childbirth as stillborn. Therefore, the quality of a country's documentation of perinatal mortality can matter greatly to the

accuracy of its infant mortality statistics. This point is reinforced by the demographer Ansley Coale, who finds dubiously high ratios of reported stillbirths to infant deaths in Hong Kong and Japan in the first 24 hours after birth, a pattern that is consistent with the high recorded sex ratios at birth in those countries and suggests not only that many female infants who die in the first 24 hours are misreported as stillbirths rather than infant deaths but also that those countries do not follow WHO recommendations for the reporting of live births and infant deaths.

Another seemingly paradoxical finding is that when countries with poor medical services introduce new medical centers and services, instead of declining the reported IMRs often increase for a time. The main cause of this is that improvement in access to medical care is often accompanied by improvement in the registration of births and deaths. Deaths that might have occurred in a remote or rural area and not been reported to the government might now be reported by the new medical personnel or facilities. Thus, even if the new health services reduce the actual IMR, the reported IMR may increase.
Global infant mortality trends

For the world, and for both Less Developed Countries (LDCs) and More Developed Countries (MDCs), IMR declined significantly between 1960 and 2001. World infant mortality rate declined from 126 in 1960 to 57 in 2001. However, IMR remained higher in LDCs. In 2001, the Infant Mortality Rate for Less Developed Countries (91) was about 10 times as large as it was for More Developed Countries (8). For Least Developed Countries, the Infant Mortality Rate is 17 times as high as it is for More Developed Countries. Also, while both LDCs and MDCs made dramatic reductions in infant mortality rates, reductions among less developed countries are, on average, much less than those among the more developed countries.

Infant mortality rate in countries
In the United States, infant mortality is 630 per 100,000 live births or 6.3 per 1000 live births. Life expectancy is the expected (in the statistical sense) number of years of life remaining at a given age. It is denoted by ex, which means the average number of subsequent years of life for someone now aged x, according to a particular mortality experience. (In technical literature, this symbol means the average number of complete years of life remaining, ie excluding fractions of a year. The corresponding statistic including fractions of a year, ie the normal meaning of life expectancy, has a symbol with a small circle over the \(see for example)

The term is most often used in the human context, but is also used in plant or animal ecology; it is calculated by the analysis of life tables (also known as actuarial tables). The term life expectancy may also be used in the context of manufactured objects[3] although the related term shelf life is used for consumer products and the term mean time to breakdown (MTTB) is used in engineering literature.
Life expectancy is heavily dependent on the criteria used to select the group. For example, in countries with high infant mortality rates, the life expectancy at birth is highly sensitive to the rate of death in the first few years of life. In these cases, another measure such as life expectancy at age 5 (e5) can be used to exclude the effects of infant mortality to provide a simple measure of overall mortality rates other

than in early childhood. Life expectancy is usually calculated separately for males and females.

Humans

Humans live on average 39.5 years in Swaziland and 81 years in Japan (2008 est.), although Japan's recorded life expectancy may have been very slightly increased by counting many infant deaths as stillborn. The oldest confirmed recorded age for any human is 122 years (see Jeanne Calment), though some people are reported to have lived longer. This is referred to as the "maximum life span", which is the upper boundary of life, the maximum number of years any human is known to have lived.

Lifespan variation over time

The following information is derived from Encyclopaedia Britannica, 1961 and other sources, and unless otherwise stated represents estimates of the life expectancies of the population as a whole. In many instances life expectancy varied considerably according to class and gender.

The average life expectancy in Colonial America was under 25 years in the Virginia colony,[22] and in New England about 40% of children failed to reach adulthood.[23] During the Industrial Revolution, the life expectancy of children increased dramatically.[24] The percentage of children born in London who died before the age of five decreased from 74.5% in 1730-1749 to 31.8% in 1810-1829.[25][26]

Public health measures are credited with much of the recent increase in life expectancy. During the 20th century, the average lifespan in the United States increased by more than 30 years, of which 25 years can be attributed to advances in public health.

In order to assess the quality of these additional years of life, 'healthy life expectancies' have been calculated for the last 30 years. Since 2001, the World Health Organization publishes statistics called Healthy life expectancy (HALE), defined as the average number of years that a person can expect to live in "full health", excluding the years lived in less than full health due to disease and/or injury. Since 2004, Eurostat publishes annual statistics called Healthy Life Years (HLY) based on reported activity limitations. The United States of America uses similar indicators in the framework of their nationwide health promotion and disease prevention plan "Healthy People 2010". An increasing number of countries are using health expectancy indicators to monitor the health of their population.

There are great variations in life expectancy worldwide, mostly caused by differences in public health, medical care and diet from country to country. Much of the excess mortality (higher death rates) in poorer nations is due to war, starvation, and diseases (AIDS, Malaria, etc.). Over the past 200 years, countries with Black or African populations have generally not had the same improvements in mortality rates that have been enjoyed by populations of European origin. Even in countries with a majority of White people, such as USA, England, and France, Black people tend to have shorter life expectancies than their White counterparts (although often the statistics are not analysed by race). For example, in the U.S. White Americans are expected to live until age 78, but African Americans only until age 71.[6]. Climate may also have an effect, and the way data is collected may also influence the figures.

According to the U.S. Census Bureau, Andorra has the world's longest life expectancy of 83.5 years.

There are also significant differences in life expectancy between men and women in most countries, with women typically outliving men by around five years. Economic circumstances also affect life expectancy. For example, in the United Kingdom, life expectancy in the wealthiest areas is several years longer than in the poorest areas. This may reflect factors such as diet and lifestyle as well as access to medical care. It may also reflect a selective effect: people with chronic life-threatening illnesses are less likely to become wealthy or to reside in affluent areas.[28] In Glasgow the disparity is among the highest in the world with life expectancy for males in the heavily deprived Calton standing at 54 – 28 years less than in the affluent area of Lenzie, which is only eight kilometres away.

Life expectancy is also likely to be affected by exposure to high levels of highway air pollution or industrial air pollution.[citation needed] Thus occupation may also have a major effect on life expectancy. Well-educated professionals working in offices have a high life expectancy, while coal miners (and in prior generations, asbestos cutters) do not. Other factors affecting an individual's life expectancy are genetic disorders, obesity, access to health care, diet, exercise, tobacco smoking, drug use and excessive alcohol use.

Gender differences

Women tend to have a lower mortality rate at every age. In the womb, male fetuses have a higher mortality rate (babies are conceived at a ratio of about 124 males to 100 females, but the ratio of those surviving to birth is only 105 males to 100 females). Among the smallest premature babies (those under 2 pounds or 900 g) females again have a higher survival rate. At the other extreme, about 90% of individuals aged 110 are female.

In the past, mortality rates for females in child-bearing age groups were higher than for males at the same age. This is no longer the case, and female human life expectancy is considerably higher than those of men. The reasons for this are not entirely certain[31]. Traditional arguments tend to favor socio-environmental factors: historically, men have generally consumed more tobacco, alcohol and drugs than females in most societies, and are more likely to die from many associated diseases such as lung cancer, tuberculosis and cirrhosis of the liver.[32] Men are more likely to die from injuries, whether unintentional (such as car accidents) or intentional (suicide, violence, war).[32] Men are also more likely to die from most of the leading causes of death (some already stated above) than women. Some of these in the United States include: cancer of the respiratory system, motor vehicle accidents, suicide, cirrhosis of the liver, emphysema, and coronary heart disease [6]. These far outweigh the female mortality rate from breast cancer and cervical cancer etc. However, such arguments are not entirely satisfactory and, even if the statistics are corrected for known socio-environmental effects on mortality, females still have longer life expectancy. Interestingly, the age of equalization[clarification needed] (about 13) tends to be close to the age of menarche, suggesting a potential reproductive-equilibrium explanation.

Some argue that shorter male life expectancy is merely another manifestation of the general rule, seen in all mammal species, that larger individuals tend on average to have shorter lives.. This biological difference occurs because women have more resistance to infections and degenerative diseases.

Influence of disabilities

In the western world, people with a serious mental illness die on average 25 years earlier than the rest of the population. In the 1990s the life expectancy of the seriously mentally ill was 10 to 15 years shorter, and now has grown to a 25 year average shorter life span.[citation needed]

There is no objective test for mental illness[citation needed], yet studies show the evidence of the increasingly earlier death of those diagnosed mentally ill.

Mental illnesses include schizophrenia, bipolar disorder and major depression. Three out of five mentally ill die from mostly preventable physical diseases. Diseases such as Heart/Cardiovascular disease, Diabetes, Dyslipidaemia, Respiratory ailments, Pneumonia, Influenza.[citation needed]

Stress also decreases life expectancy. The side effects of stress are: pain of any kind, heart disease, digestive problems, sleep problems, depression, obesity, autoimmune diseases, skin conditions, etc., all of which contribute to mental disorders, faster ageing, and other physical diseases.[citation needed]

Centenarians

The number of centenarians is increasing at 7% per year, which means doubling the centanarian population every decade, pushing it into the millions in the next few years.[citation needed] Japan has the highest ratio of centenarians. In Okinawa, there are 34.7 centenarians for every 100,000 inhabitants [6].

In the United States, the number of centenarians grew from 15,000 in 1980 to 77,000 in 2000.[citation needed]

Evolution and aging rate

It is interesting to consider why the various species of plants and animals, including humans, have different lifespans. There is a well-developed evolutionary theory of aging, and general consensus in the academic community of evolutionary theorists; however the theory doesn't work well in practice, and there are many unexplained exceptions. Evolutionary theory states that organisms that, by virtue of their defenses or lifestyle, live for long periods whilst avoiding accidents, disease, predation, etc., are likely to have genes that code for slow ageing - which often translates to good cellular repair. This is theorized to be true because if predation or accidental deaths prevent most individuals from living to an old age, then there will be less natural selection to increase intrinsic life span. The finding was supported in a classic study of opossums by Austad, however the opposite relationship was found in an equally-prominent study of guppies by Reznick

One prominent and very popular theory attributes aging to a tight budget for food energy. The theory has difficulty with the caloric restriction effect, in which animals live longer the less food they eat.

In theory, reproduction is costly and takes energy away from the repair processes that extend life spans. However, in actuality females of many species invest much more energy in reproduction than do their male counterparts, and live longer

nevertheless. In a broad survey of zoo animals, no relationship was found between the fertility of the animal and its life span .

One area in which theory seems to be well validated: Better-defended animals such as small birds and bats, that can fly away from danger, and naked mole rats that live underground, survive for decades, whereas mice, which cannot, die of old age in a year or two. Tortoises and turtles are very well defended and can live for over 100 years.

Calculating life expectancies

The starting point for calculating life expectancies is the age-specific death rates of the population members. A very simple model of age-specific mortality uses the Gompertz function, although these days more sophisticated methods are used.
In cases where the amount of data is relatively small, the most common methods are to fit the data to a mathematical formula, such as an extension of the Gompertz function, or to look at an established mortality table previously derived for a larger population and make a simple adjustment to it (eg multiply by a constant factor) to fit the data.
With a large amount of data, one looks at the mortality rates actually experienced at each age, and applies smoothing (eg by cubic splines) to iron out any apparently random statistical fluctuations from one year of age to the next.

While the data required is easily identified in the case of humans, the computation of life expectancy of industrial products and wild animals involves more indirect techniques. The life expectancy and demography of wild animals are often estimated by capturing, marking and recapturing them. The life of a product, more often termed shelf life is also computed using similar methods. In the case of long-lived components such as those used in critical applications, such as in aircraft methods such as accelerated aging are used to model the life expectancy of a component.

The age-specific death rates are calculated separately for separate groups of data which are believed to have different mortality rates (eg males and females, and perhaps smokers and non-smokers if data is available separately for those groups) and are then used to calculate a life table, from which one can calculate the probability of surviving to each age. In actuarial notation the probability of surviving from age x to age x+n is denoted and the probability of dying during age x (i.e. between ages x and x+1) is denoted . For example, if 10% of a group of people alive at their 90th birthday die before their 91st birthday, then the age-specific death probability at age 90 would be 10%. The life expectancy at age x, denoted , is then calculated by adding up the probabilities to survive to every age. This is the expected number of complete years lived (one may think of it as the number of birthdays they celebrate).

Because age is rounded down to the last birthday, on average people live half a year beyond their final birthday, so half a year is added to the life expectancy to calculate the full life expectancy. Life expectancy is by definition an arithmetic mean. It can also be calculated by integrating the survival curve from ages 0 to positive infinity (the maximum lifespan, sometimes called 'omega'). For an extinct cohort (all people born in year 1850, for example), of course, it can simply be calculated by averaging

the ages at death. For cohorts with some survivors it is estimated by using mortality experience in recent years.
It is important to note that this statistic is usually based on past mortality experience, and assumes that the same age-specific mortality rates will continue into the future. Thus such life expectancy figures are not generally appropriate for calculating how long any given individual of a particular age is expected to live. But they are a useful statistic to summarize the current health status of a population. However for some purposes, such as pensions calculations, it is usual to adjust the life table used, thus assuming that age-specific death rates will continue to decrease over the years, as they have done in the past. This is often done by simply extrapolating past trends; however some models do exist to account for the evolution of mortality (e.g., the Lee-Carter model.

As discussed above, on an individual basis, there are a number of factors that have been shown to correlate with a longer life. Factors that are associated with variations in life expectancy include family history, marital status, economic status, physique, exercise, diet, drug use including smoking and alcohol consumption, disposition, education, environment, sleep, climate, and health care.[6]
Life Expectancy Index

The Life Expectancy Index is a statistical measure used to determine the average lifespan of the population of a certain nation or area. Life expectancy is one of the factors in measuring the Human Development Index (HDI) of each nation, along with adult literacy, education, and standard of living.[44]
The gross reproduction rate (GRR) is the average number of daughters that would be born to a woman (or a group of women) if she survived at least to the age of 45 and conformed to the age-specific fertility rate of a given year. This rate is similar to the net reproduction rate but it ignores the fact that some women will die before completing their childbearing years.[1] See also total fertility rate and replacement-level fertility.

The GRR is particularly relevant where sex ratios are significantly affected by the use of reproductive technologies. In actuarial science, a life table (also called a mortality table or actuarial table) is a table which shows, for each age, what the probability is that a person of that age will die before their next birthday. From this starting point, a number of statistics can be derived and thus also included in the table: the probability of surviving any particular year of age remaining life expectancy for people at different ages the proportion of the original birth cohort still alive estimates of a cohort's longevity characteristics.
Life tables are usually constructed separately for men and for women because of their substantially different mortality rates. Other characteristics can also be used to distinguish different risks, such as smoking status, occupation, and socio-economic class.

Life tables can be extended to include other information in addition to mortality, for instance health information to calculate health expectancy. Health expectancies, of which disability-free life expectancy (DFLE) and Healthy Life Years (HLY) are the best-known examples, are the remaining number of years a person can expect to live in a specific health state, such as free of disability. Two types of life tables are used

to divide the life expectancy into life spent in various states: 1) multi-state life tables (also known as increment-decrement life tables) based on transition rates in and out of the different states and to death, and 2) prevelence-based life tables (also known as the Sullivan method) based on external information on the proportion in each state. Life tables can also be extended to show life expectancies in different labor force states or marital status states. Life tables are also used extensively in biology and epidemiology. The concept is also of importance in product life cycle management.

Insurance applications

In order to price insurance products, and ensure the solvency of insurance companies through adequate reserves, actuaries must develop projections of future insured events (such as death, sickness, and disability). To do this, actuaries develop mathematical models of the rates and timing of the events. They do this by studying the incidence of these events in the recent past, and sometimes developing expectations of how these past events will change over time (for example, whether the progressive reductions in mortality rates in the past will continue) and deriving expected rates of such events in the future, usually based on the age or other relevant characteristics of the population. These are called mortality tables if they show death rates, and morbidity tables if they show various types of sickness or disability rates.

The availability of computers and the proliferation of data gathering about individuals has made possible calculations that are more voluminous and intensive than those used in the past (i.e. they crunch more numbers) and it is more common to attempt to provide different tables for different uses, and to factor in a range of non-traditional behaviors (e.g. gambling, debt load) into specialized calculations utilized by some institutions for evaluating risk. This is particularly the case in non-life insurance (eg the pricing of motor insurance can allow for a large number of risk factors, which requires a correspondingly complex table of expected claim rates).

The mathematics

The basic algebra used in life tables is as follows.

: the probability that someone aged exactly will die before reaching age .

: the probability that someone aged exactly will survive to age .

: the number of people who survive to age note that this is based on a starting point of lives, typically taken as 100,000

: the number of people who die aged last birthday

: the probability that someone aged exactly will survive for more years, i.e. live up to at least age years

: the probability that someone aged exactly will survive for more years, then die within the following years

μx : the force of mortality, ie the instantaneous mortality rate at age x, ie the number of people dying in a short interval starting at age x, divided by lx and also divided by the length of the interval. Unlike , the instantaneous mortality rate, μx, may exceed 1.

[edit] Biology

When biologists and demographers use life tables, they will normally also include fertility for each age. The extra parameter used is

: expected number of progeny for an individual aged

Epidemiology

In epidemiology and public health, both standard life tables to calculate life expectancy and Sullivan and multistate life tables to calculate health expectancy are commonly used. The latter include information on health in addition to mortality.

History of religious categories

In world cultures, there have traditionally been many different groupings of religious belief. In India and China, different religious philosophies were traditionally respected as academic differences in pursuit of the same truth. In Islam, the Qu'ran mandates three different categories: true Muslims (to be treated as brothers), the People of the Book (to be respected), and idol worshipers (to be converted). To some extent these theories of religiousness are still prevalent today. However, the most common classification today was birthed out of Western Christianity.

Initially, Christians had a simple dichotomy of world beliefs: Christian civility versus foreign heresy or barbarity. In the eighteenth century, "heresy" was clarified to mean Judaism and Islam; along with outright paganism, this created a fourfold classification which spawned such works as John Toland's Nazarenus, or Jewish, Gentile, and Mahometan Christianity, which represented the three Abrahamic traditions as different "nations" or sects within religion itself, the true monotheism. At the turn of the 18th century, in between 1780 and 1810, the language dramatically changed: instead of "religion" being synonymous with spirituality, authors began using the plural, "religions", to refer to both Christianity and other forms of worship. This new definition was described as follows by Daniel Defoe: "Religion is properly the Worship given to God, but 'tis also applied to the Worship of Idols and false Deities."

In 1838, the four-way division of Christianity, Judaism, "Mahommedanism" and Paganism was multiplied considerably by Josiah Conder's Analytical and Comparative View of All Religions Now Extant among Mankind. Conder's work still adheres to the four-way classification, but in his eye for detail he puts together much historical work to create something resembling our modern Western image: he includes Druze, Yezidis, Mandeans, and Elamites under a list of possibly monotheistic groups, and under the final category, of "polytheism and pantheism", he lists Zoroastrianism, "Vedas, Puranas, Tantras, Reformed sects" of India as well as "Brahminical idolatry", Buddhism, Jainism, Sikhism, "Lamaism", "religion of China and Japan", and "illiterate superstitions".[2]

Even through the late nineteenth century, it was common to view these "pagan" sects as dead traditions which preceded Christianity, the final, complete word of God. This in no way reflected the reality of religious experience: Christians supposed these traditions to have maintained themselves in an unchanging state since whenever they were "invented", but actually all traditions survived in the words and deeds of people, some of whom could make radical new inventions without needing to create a new sect. The biggest problem in this approach was the existence of Islam, a religion which had been "founded" after Christianity, and which had been experienced by Christians as intellectual and material prosperity. By the nineteenth century, however, it was possible to dismiss Islam as a revelation of "the letter, which killeth", given to savage desert nomads. In this context, the term "world

religion" referred only to Christianity, which Europeans considered uniquely posed to civilize the world.

The modern meaning of the phrase "world religion" began with the 1893 Parliament of the World's Religions in Chicago, Illinois. This event was sharply criticized by European Orientalists up until the 1960s as "unscientific", because it allowed religious leaders to speak for themselves instead of bowing to the superior knowledge of the Western academic. As a result its approach to "world religion" was not taken seriously in the scholarly world for some time. Nevertheless, the Parliament spurred the creation of a dozen privately funded lectures with the intent of informing people of the diversity of religious experience: these lectures funded researchers such as William James, D.T. Suzuki, and Alan Watts.
In the latter half of the 20th century, the category of "world religion" fell into serious question, especially for drawing parallels between vastly different cultures, and thereby creating an arbitrary separation between the religious and the secular.[5] Even history professors have now taken note of these complications and advise against teaching "world religions" in schools.

Western classification
Further information: Comparative religion and Sociological classifications of religious movements
Religious traditions fall into super-groups in comparative religion, arranged by historical origin and mutual influence. Abrahamic religions originate in the Middle East, Indian religions in India and Far Eastern religions in East Asia. Another group with supra-regional influence are African diasporic religions, which have their origins in Central and West Africa.

Abrahamic religions are by far the largest group, and these consist mainly of Christianity, Islam and Judaism (sometimes the Bahá'í Faith is also included). They are named for the patriarch Abraham, and are unified by the practice of monotheism. Today, around 3.4 billion people are followers of Abrahamic religions and are spread widely around the world apart from the regions around South-East Asia. Several Abrahamic organizations are vigorous proselytizers.

Indian religions originated in Greater India and tend to share a number of key concepts, such as dharma and karma. They are of the most influence across the Indian subcontinent, East Asia, South East Asia, as well as isolated parts of Russia. The main Indian religions are Hinduism, Buddhism, Sikhism, and Jainism. Indian religions mutually influenced each other. Sikhism was also influenced by the Abrahamic tradition of Sufism.

East Asian religions consist of several East Asian religions which make use of the concept of Tao (in Chinese) or Do (in Japanese or Korean), namely Taoism and Confucianism, both of which are asserted by some scholars to be non-religious in nature.

African diasporic religions practiced in the Americas, imported as a result of the Atlantic slave trade of the 16th to 18th centuries, building of traditional religions of Central and West Africa.

Indigenous tribal religions, formerly found on every continent, now marginalized by the major organized faiths, but persisting as undercurrents of folk religion. Includes African traditional religions, Asian Shamanism, Native American religions, Austronesian and Australian Aboriginal traditions, Chinese folk religion, and postwar Shinto. Under more traditional listings, this has been referred to as "Paganism" along with historical polytheism.
Iranic religions (not listed below due to overlaps) originated in Iran and include Zoroastrianism, Yazdanism, Ahl-e Haqq and historical traditions of Gnosticism (Mandaeanism, Manichaeism). It has significant overlaps with Abrahamic traditions, e.g. in Sufism and in recent movements such as Bábísm and the Bahá'í Faith.

New religious movement is the term applied to any religious faith which has emerged since the 19th century, often syncretizing, re-interpreting or reviving aspects of older traditions: Hindu revivalism, Ayyavazhi, Pentecostalism, polytheistic reconstructionism, and so forth.
The generally agreed upon demographic distribution of the major super-groupings mentioned is shown in the table below:

Religious demographics
One way to define a major religion is by the number of current adherents. The population numbers by religion are computed by a combination of census reports and population surveys (in countries where religion data is not collected in census, for example USA or France), but results can vary widely depending on the way questions are phrased, the definitions of religion used and the bias of the agencies or organizations conducting the survey. Informal or unorganized religions are especially difficult to count.
There is no consensus among researchers as to the best methodology for determining the religiosity profile of the world's population. A number of fundamental aspects are unresolved:
Whether to count "historically predominant religious culture[s]"
Whether to count only those who actively "practice" a particular religion
Whether to count based on a concept of "adherence"
Whether to count only those who expressly self-identify with a particular denomination[22]
Whether to count only adults, or to include children as well.
Whether to rely only on official government-provided statistics[23]
Whether to use multiple sources and ranges or single "best source(s)"
Largest religions or belief systems by number of adherents

The population numbers below are computed by a combination of census reports, random surveys (in countries where religion data is not collected in census, for example USA or France), and self-reported attendance numbers, but results can vary widely depending on the way questions are phrased, the definitions of religion used and the bias of the agencies or organizations conducting the survey. Informal or unorganized religions are especially difficult to count. Some organizations may wildly inflate their numbers.

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Course Name	: Research Methods & Data Management

Course Description

This Course explores basic philosophy of research, its types and variables, its defines sampling design, research design, methods/tools of data collection, planning the survey as a tool of data collection, the structure of a research proposal , modes of analysis, interpretation and validation.

Course Objectives

- To provide students with descriptive and exploratory skills required in research.
- To help them develop writing skills in relation to research discoveries from different research studies undertaken.
- To provide students with a better analytical perspective on the findings acquired from the field.
- To expose students to the field experiences in attempts to collecting data.

Course content

Introduction

- Definition of research
- Different forms of research
- Distinguish between qualitative and quantitative variables
- Differences between qualitative and quantitative research
- Concepts that relate broadly to both quantitative and qualitative research

Sample Design

- Definition of sampling
- Different types of both random and non-random sampling

Research Design

- Meaning of a research design
- Types of research design i.e descriptive designs, co relational designs, case study designs
- How to design and conduct a case study

Methods of data collection

- Observation method
- Survey
- Group interviews (Focus Group Discussions)
- Questionnaires
- Advantages and disadvantages of each stated method/tool

Planning the survey as a data collection tool

- Hypotheses
- Determine the respondents
- Questionnaire, interview or telephone survey
- Format issues
- Rules for asking good questions
- Analyzing survey data

The structure of a research proposal

- Title
- Table of contents
- An abstract
- Chapter one: Background to the problem
- Chapter two: Literature review
- Chapter three: Methodology
- Chapter four: Results/findings of the study
- Chapter five: Discussion, conclusion and recommendations
- References
- Appendices

Assessment
Coursework 40%
Exams 60%
Total Mark 100%

Introduction

This module generally focuses on the various health research methods used in public health, with these methods various techniques are applied to identify issues. By the end of this module one should be in position to identify the various research methods and explain them efficiently as well as knowing their relevancies

Course work

a) Through proper explanations and illustrations briefly explain ten medical research methods used in public health.

b) What is the importance's of research to the profession of Public health and the health fraternity as a whole

What Are Health Services Research Methods? Why Are They Important?

In the 1960's, the field of health services research was created by combining several study sections at the National Institutes of Health to create the Health Services Research Study Section. The HSR study section sought to define HSR as a distinct field of scientific inquiry at the intersection of public health and medical care, informed by disciplinary perspectives. Since that time, the field has evolved to encompass multiple disciplinary perspectives, including methods from cognate disciplines such as economics, statistics, political science, sociology, and many other schools of thought. The field has also developed new models and techniques to address research questions in specialized areas of inquiry such as patient safety and access to care.

Due to the breadth of the field, two terms are critical to defining the scope of health services research methods. These are: 1) health services research, and 2) methodology.

The Academy Health definition of health services research, developed in 2000 by Kathleen Lohr and Don Steinwachs, is as follows:

Health services research is the multidisciplinary field of scientific investigation that studies how social factors, financing systems, organizational structures and processes, health technologies, and personal behaviours affect access to health care, the quality and cost of health care, and ultimately our health and well-being. Its research domains are individuals, families, organizations, institutions, communities, and populations.

An additional definition of health services research is provided by *Lexikon*:

Research concerned with the organization, financing, administration, effects, and other aspects of health services. Health services research is often concerned with the relationships among need, demand, supply, use, and outcomes of health services. Structure, process, and outcome of health services may be evaluated. Evaluation of structure is concerned with resources, facilities, and manpower; process, with matters, such as where, by whom, and how health care is provided; and outcome, with the results of the services (such as the degree to which individuals receiving health services actually experience measurable benefits).

Methodology is the collection or study of methods (practices, procedures, and rules) used by those who work in a discipline or engage in an inquiry, as in the methodology of measuring, assessing, and improving performance. Methodology addresses the full range of issues confronted by empirical work in health services research, including conceptualization, modelling, literature review, study design, sampling, data collection, measurement, and research ethics.

By combining the definitions above, it is apparent how wide the scope of methods employed by health services researchers is. HSR methods encompass a variety of study frameworks, designs, and analytic techniques. These include a spectrum of methods, from understanding of various epistemological perspectives on research, to study designs including focus groups and randomised controlled trials, to specific analytic techniques such as longitudinal data analysis.

To help organise the array of HSR methods, core and desired resources have been divided into 18 major topic areas, including:

Economics & Cost Effectiveness
Epidemiology
Ethics
Evaluation
Health Services Research Applied Methods
Information Technology
Management Sciences

Medicine
Outcomes Research
Policy
Psychology
Public Health
Qualitative Research
Quality and Safety
Sociology
Statistics, Biostatistics & Econometrics
Survey Research
Trials

Reviewing the topic areas above, it is apparent that HSR methods are not confined to disciplinary methods, but rather, are unique in their approach to medical and health care delivery questions because the field was developed to facilitate study of applied questions. These include:

- Who has access to health care?
- Do patients in large urban areas receive the same level of services as those in rural areas?
- At different levels of care, which patients have the best outcomes?

Many of these types of questions have policy implications. As a result, funding for health services research has often been linked to political interests. Yet, HSR studies are girded by the same methods as many other disciplines. As discussed above, econometric, epidemiological, survey research, and other widely accepted methods form the backbone of HSR.

A related challenge for health services researchers is that the types of questions of interest to the field rely on the ability to generalise from data to the population at large. In order to collect information that may be generalised to the population, it is often necessary to draw associations from existing sources of data such as claims databases or large population surveys - frequently referred to as observational data. Observational data is collected in situations when it would be unethical or impractical to randomize participants to one condition or another - such as having or not having health insurance. Because the data is not randomised, it is not possible to assume that an intervention causes a particular outcome; rather, researchers rely on statistical analyses to draw associations between factors in a study.

Despite concerns about the shortcomings of using non-randomised data in HSR studies, there are major benefits to studying the implications of care delivery or policy at the population level. The scope of HSR studies often allows for greater understanding of an intervention's effectiveness, or effect in a real-world population, as opposed to randomized controlled trials, which are better at assessing efficacy -- the outcome in an ideal, controlled population. In addition, HSR studies have always been closely linked to policy considerations, and as such, have the potential to enhance understanding of health care systems and impact care delivery for large numbers of individuals.

For librarians it is becoming increasingly important to create a collection of materials that address the types of applied questions that health services research addresses. This is a daunting task because of the breadth and depth of the disciplines and subjects encompassed by HSR. As the list of disciplines and topic areas relevant to HSR demonstrates, a wide array of disciplines are included in the health services research methodological 'toolkit'.

Librarians may wish to utilise the module by choosing specific content areas that will benefit their personal library needs. Likewise, faculty developing new courses may look to this list for suggested current textbooks in the field. The organisation of the list is intended to facilitate understanding of the array of options in different disciplines.

This list of resources is not intended to define the full range of HSR methods texts, rather, to provide a set of resources considered valuable by librarians and academics in the field of health services research.

The field of health services research is continually expanding and developing new methods to apply to health care and health care delivery questions. Due to the fact that the field is growing rapidly, we recommend that users of this list search for updated versions of the resources cited here in order to ensure the most recent information on methodological topics.

They are basically two main types of research methods which is quantitative and qualitative, which all the methods lie under

Research and experimental development (R&D) comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications." Thus research is a careful and systematic investigation in some field of knowledge such as culture of people, religion, etc (Neon 1995)

Variable: Variables are properties or characteristics of some event, object, or person that can take on different values or amounts (as opposed to constants which do not vary). When conducting research, experimenters often manipulate variables. For example, an experimenter might compare the effectiveness of four types of antidepressants. In this case, the variable is the "type of antidepressant" I.e. attributes which take on different values from time to time e.g.

- Height
- Weight
- Age etc

The following are the types of variables

1: Independent variable

When a variable is manipulated by an experimenter

2: Dependent variable

The experiment seeks to determine the effect of the independent variable on relief from depression. In this example, relief from depression is called a dependent variable.

In general the independent variable is manipulated by the experimenter and its effects on the dependent variable are measured.

Or

Dependent variable: a variable in a logical or mathematical expression whose value depends on the independent variable; "if f(x) =y, y is the dependent variable"

Consider age with beauty of an individual: beauty deterioration of an individual is caused by advancement in age .Age is an independent variable and beauty is thedependent variable.

3:Extraneous variable; this is the characteristics whose effects are not needed in the study like noise, for the case if one is studying the causes of lack of concentration in a given computer class or any other class.

4: Active variables characteristics that can be manipulated e.g. study environment or teaching methods etc

5; Assigned variables, certain characteristics assigned by nature and can not be changed or manipulated like height, sex of individual, age etc

Qualitative and Quantitative Variables

Qualitative variables: These are variables that express a qualitative attribute. Some examples of qualitative variables are hair color, eye color, religion, favorite movie, gender, and so on. The values of a qualitative variable do not imply a numerical ordering. Values of the variable "religion" differ qualitatively; no ordering of religions is implied. Qualitative variables are sometimes referred to as categorical variables. Values on qualitative variables do not imply order, they are simply categories

Quantitative variables: These are variables that are measured in terms of numbers, Some examples of quantitative variables are height, weight, and shoe size.

Discrete and Continuous Variables: Variables such as number of children in a household are called discrete variable.

Discrete variables: These are variable with possible scores of discrete points on the scale e.g a household could have three children or six children, but not 4.53 children. Other variables such as "time to respond to a question" are continuous variable

Continuous variable: These are variables where the scale is continuous and not made up of discrete steps e.g. The response time could be 1.64 seconds, or it could be 1.64237123922121 seconds. Of course, the practicalities of measurement preclude most measured variables from being truly continuous.

Random selection: is how you draw the sample of people for your study from a population.

Random assignment is how you assign the sample that you draw to different groups or treatments in your study. It is possible to have both random selection and assignment in a study. Let's say you drew a random sample of 100 clients from a population list of 1000 current clients of your organization. That is random sampling. Now, let's say you randomly assign 50 of these clients to get some new additional treatment and the other 50 to be controls. That's random assignment
.
Concepts that relate broadly to both quantitative and qualitative research
Association:
Sometimes there is a relationship between two variables but the relationship may not be causal i.e., neither variable is dependent upon the other. It may be seen that short men are more assertive than taller men but it does not follow that being short causes men to be assertive and we can not state that being assertive make a man short; there is no causal relationship

Bias:
Distortion of the findings resulting from an undesirable influence.

Causality / Causal relationship:
A relationship in which one action brings about (causes) a particular consequence. More correctly, (since research can only hope to disprove a theory rather than prove it), a relationship in which failure to do 'x' means that 'y' will not follow. E.G., We can be less certain that bathing in the sun for two hours around midday causes skin to burn, than we can know that keeping out of the sun for the two hours around midday is unlikely to cause skin to burn.

Hawthorn Effect:
A psychological response in which subjects alter their behaviour because they are aware of their participation in the study

Piloting:
A small-scale trial of the research method to ensure that the design is feasible, Although only a small number of subjects may be used, a variety of practical questions may be determined. E.g., can the subjects understand the questions they are being asked?
Population:
Literally means "all the people" and in research the term is most commonly used to refer to a specific group of people. However, in a research context, population refers to all the members or objects of any defined group which might be taken or about which information might be given. A research population refers to the entire group to which the research results apply e.g., a relevant age group, or equipment group such as syringes.

Sample:
Refers to the segment of the population that is selected for investigation (the subset of the population)

Sampling frame: it is the listing of all the units in the population from which the sample will be selected

Census: this is a complete enumeration of an entire population

Reliability:
Is concerned with the accuracy (consistency, stability and repeatability) of a measure in representing the true score of the subject being assessed on a particular dimension, the same results must be achieved, as far as possible, regardless of whom is doing the measuring. e.g., several nurses weighing the same patient on the same set of scales, in quick succession, should gain the same results. Reliability of measurement reduces influence or bias on the part of the person(s) doing the measurement, to a minimum.

Representative:
Refers to the extent to which a sample reflects the "truth" for the whole population in the study. The sampling technique should aim to ensure that the views of the population are reflected by the sample.

Validity:
Refers to whether a particular instrument actually measures the construct it is designed to assess. e.g., a cardiac monitor is not a valid tool for measuring the peripheral pulse. A cardiac monitor is a valid tool for measuring the electrical activity of the heart.

Internal validity:
The extent to which the effects detected in a study are a true reflection of what is real, e.g., if the detected effect is that better nutrition leads to greater height gain in infants, internal validity exists if the height gain can not be attributed to another factor. (NB this other factor may be referred to as a confounding or extraneous variable).

External validity:
"The extent to which study findings can be generalised beyond the sample used in the study" (Burns and Grove 1993) e.g., One study may find that better nutrition leads to increased height gain in infants but external validity exists only if this finding is found with other samples.
NB the concept "Variable" appeared on the glossary of the previous session
SAMPLE DESIGN
The way of selecting a sample from a population is known as sample design. It describes various sampling techniques and sample size. It refers to the technique or procedure the researcher would adopt in selecting items for the sample.

Sampling:
Sample; Sampling; method of selecting a certain number of units from a total population
(Macleod Clark J and Hockey L. 1981)
The way a sample is selected should be clearly demonstrated in a research report. The aim of a sample is that it should be as unbiased a cross section of the "parent"

population as possible, i.e., a sample of subjects needs to be as representative as possible of the population under study.
To obtain a cross section we need to devise a sampling frame to define the boundaries (limits) within the context of the study and to reflect the organization within which the sampling is taking place.
The larger the size of the sample, the lower is the likelihood of it failing to represent the population under study. However, the law of diminishing returns tells us that there is, for each study, a desirable sample size under which their may fail to be accuracy yet above which there is no better a reflection of the parent population.
Sampling may be

a) Random and non random sampling.
b) Non random: In a nonrandom sample, members are selected on the basis of a particular set of characteristics, rather than a random chance of being included and certainly it introduces bias.

Random- Random sampling is completely based on chance. For example, one might identify all members of a population, (n=250) write their names on separate pieces of paper, and then draw 25 names out of a hat to determine who is actually to be included in the study and every individual has a chance of being included in the study.
Types of random sampling
Systematic
Is a statistical method involving the selection of every k^{th} element from a sampling frame, where *k*, the sampling interval, is calculated as:
k = population size (*N*) / sample size (*n*)

- Stratified
- cluster sampling

Stratified sample
In a stratified sample the sampling frame is divided into non-overlapping groups or strata, e.g. geographical areas, age-groups, genders. A sample is taken from each stratum, and when this sample is a simple random sample it is referred to as stratified random sampling.
Where there is heterogeneity in the population this can be reflected in the strata, i.e., each stratum can be weighed to reflect the heterogeneity. In this way a proportional representation of the whole population can be gained.
Cluster sample
Best used where there is a wide geographical spread. Clusters may be chosen subjectively to be representative of the whole. The clusters can be further stratified. E.G., if we want to know about all A&E patients in the country we need to take a sample from a variety of A/E's. Each department can bring a number of patients into the sample according to whether they meet the stratification criteria and it is often used in marketing research
Multistage sampling
This is the use of sampling methods that are considerably more complex than these other methods. The most important principle here is that we can combine the simple methods described above in a variety of useful ways that help us address our sampling needs in the most efficient and effective manner possible. When we combine sampling methods, we call this multi-stage sampling.

Concepts strongly associated with quantitative research

Survey:
Involves the study of a large number of subjects drawn from a defined population

Randomisation:
A method for controlling possible extraneous variables involving assigning objects (subjects, treatments etc.,) to a group or condition in such a way that every object has an equal probability of being assigned to any particular condition. Randomisation can also be applied in other settings for research e.g., within a questionnaire there may be a sequence of questions, which, if reordered randomly, may evoke different responses because the previous question does not then influence the current question.

Control:
In order to increase the probability that findings accurately reflect the reality of the situation being studied, the study needs to be designed in such a way as to maximise the amount of control over the research situation and variables. Through control the influence of extraneous variables, variables which are not being studied but which could influence the results of the study by interfering with the action of the ones being studied, is reduced.

Manipulation:
Refers to the fact that we can create artificial divisions and circumstances in order that we can test a particular hypothesis, In experimental research the "causative" variable must be amenable to manipulation by the investigator; i.e., the researcher "does something" to subjects in the experimental condition. Subjects in the control group are not "manipulated" in the way that subjects in the "experimental group" are manipulated.

Treatment Group: The portion of a sample or population that is exposed to a manipulation of the independent variable is known as the treatment group. For example, youth who enroll and participate in recreation programs are the treatment group, and the group to which no recreation services are provided constitutes the control group

Confounding Errors
Errors: are conditions that may confuse the effect of the independent variable with that of some other variable(s).

1. Premeasurement and interaction errors
2. Maturation errors
3. History errors
4. Instrumentation errors
5. Selection bias errors
6. Mortality errors

Measurement (levels)
Nominal: Subjects of research are differentiated by possessing or not possessing a given characteristic, e.g., pass/fail, single/married, and divided into a number of

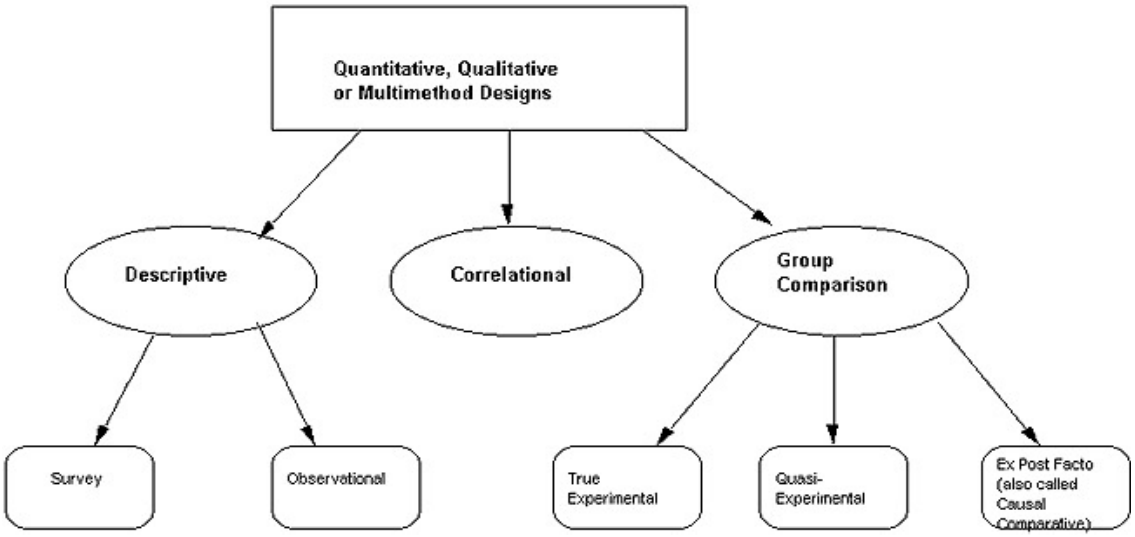
categories but the difference between the categories is not measurable in any real sense. This is the least sophisticated level of measurement.
Ordinal: Subjects are ranked in order from greatest to least or best to worst. Again there is no precisely measurable difference between the ranks.
Interval: Genuinely quantitative measurement such as that of temperature is measured at the interval level of measurement. Here the difference between 10 and 11 degrees centigrade is the same as the difference between 11 and 12degrees centigrade.
Ratio: In a scale of measurement where the difference between points on the scale is precise (as in the measurement of height and weight,) *and the scale starts at zero* the level of measurement is referred to as ratio. Height and weight start at zero. You can not weigh less than 0.00kg and cannot be less than 0.00mm in length/height; these are ratio scales. You can however record temperatures of the weather in terms of minus *x* degrees centigrade and this is why the scale is interval and not ratio.

Research Design
Research design can be thought of as the *structure* of research -- it is the "glue" that holds all of the elements in a research project together or plan for a study that guides the collection and analysis of the data
We often describe a design using a concise notation that enables us to summarize a complex design structure efficiently. What are the "elements" that a design includes?

Types of design:- Experimental design , Quasi-experimental design, Survey design, cross-sectional design, Case studies, comparative study etc

The research design:
(1) Is driven by there search problem
(2) Depends upon how much is known about the problem
Types of Research Design
For example, if you are doing a study where you will be *rating* students (numerically) on their performance of a sensory-motor skill AND also *interviewing* these students (data in words) to determine how they perceive their own skill levels (if one does that !), *then at least one "design methodology label" that would apply is "multimethod*."
Now, some design labels apply only to qualitative studies -- while others could apply to a study that's any of the of designs. We'll look at the qualitative labels in a future follow-up lesson. For now, let's look at the possibility: families of design methodology labels that could apply to any/all of the above 3 possibilities.

Figure 2.



Design Methodology
That Correspond To Quant/ Qual/ Multi method Studies

Most of these, as we'll see, "link" to certain "keywords" in the research question or problem statement!

I. Descriptive Designs

Example: This study is to *identify* the perceived barriers to successful implementation of the Career Ladder Teacher Incentive & Development Program in X School District.

"Identify"/"what is - what are" (the perceived barriers) - > Descriptive problem statement AND also descriptive research design methodology!

Two "sub-types" (add'l. design methodology labels that could apply to "descriptive designs):"

Survey - This label also applies to any study in which data or responses (be they quant/qual/both) are recorded via any form of what we think of as "survey instrumentation."

You've probably seen (more than you care to think about! if you've been 'approached' by a 'needy dissertation stage doctoral student' to participate in his/her study!) such surveys. They can take many forms:

A. Check-off items (e.g., gender, position);
B. Fill-in-the-blank items;
C. Likert-type scales (e.g., on a 5-point scale, say, from "strongly disagree" to "strongly agree," you're asked to circle or check your opinion regarding a statement such as, "The Career Ladder Teacher Incentive and Development Program provides ample opportunity for teacher advancement in my district")
D. Open-ended fill-in items (you're asked to give a response in your own words, using the back of the survey sheet or extra paper if necessary; something like "Please state the three main reasons you chose to apply for the Career Ladder Teacher Incentive and Development Program this year.")

Types of Survey Research

While often these surveys are paper-&-pencil in nature (e.g., you're handed one or receive it in the mail & asked to fill it out and return it to the researcher), they are

sometimes "administered" orally in a face-to-face or telephone interview (e.g., the researcher records your answers him/herself).

Some Guidelines for Interviews

There are other variations on survey-type questions; the above are just examples of the most common forms and scaling of such responses.

If the responses to our earlier example were collected in the form of a survey -- be it, say, Likert-scaled attitudinal items and/or open-ended questions where the teachers are asked to share the perceived barriers in their own words -- then the study would be characterized as a *descriptive survey design methodology*.

E. **Observational** - In these design methodologies, instead of administering a survey instrument, the researcher collects data by observing/tallying/recording the occurrence or incidence of some outcome -- perhaps with the aid of assistants.

He/she might want to identify the most frequently occurring type(s) of disruptive behavior in a particular classroom. With clear prior agreement on what constitutes such "disruptive behavior" (operational definitions of our variables are important, remember?! It becomes an issue of "reliability," or verifiability that "we saw what we saw" vs. "our own bias" of what constitutes this disruptive behavior!), the researcher could develop a listing of such behaviors and observe and record the number of times each one occured in a particular observation session in a classroom. (Again, he/she might wish to 'compare notes' with assistants in order to enhance reliability or verifiability -- e.g., as a cross-check for accuracy).

This type of research would warrant the design methodology label of not only "descriptive" (due to the 'identify/what is - what are [the most frequently occurring ...]?') but also "observational" due to the recording/tallying protocol.

(By the way, qualitative-type observations can also be recorded. They don't have to be strictly numeric tallies. Examples that come to mind include case notes of counselors, where they record their perceptions in words.)

II. Correlational Designs

We've seen these too! Just as in the case of "descriptive" designs, these "link" to the keywords of "association," "relationship," and/or "predictive ability" that we've come to associate with "correlational" research questions or problem statements!

Correlational Research

III. Group Comparisons

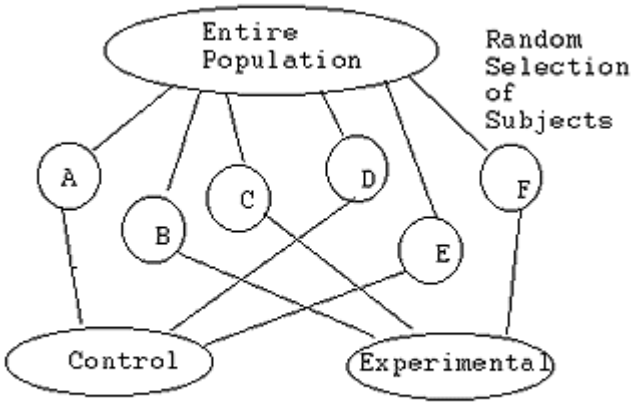
We've briefly talked about "experiments" generally, in terms of "key features" such as the following:

a. **tight control** (the researcher attempts to identify in advance as many possible 'contaminating' and/or confounding variables as possible and to control for them in his/her design -- by, say, building them in and balancing on them -- equal numbers of boys and girls to 'control for gender' -- or 'randomizing them away' by drawing a random sample of subjects and thereby 'getting a good mix' on them -- e.g., all levels of 'socioeconomic status')
b. because of the preceding control, the 'confidence' to **make 'cause/effect statements'**

That is, we begin to get the idea of ***2 or more groups, as balanced and equivalent as possible on all but one "thing:" our "treatment"*** (e.g., type of lesson, type of counseling). ***We measure them before and after this treatment and if we do find a difference in the group that 'got the treatment,' we hope to attribute that difference to the treatment only*** (because of this tight control, randomization, and so forth).

Now ... there are actually two "sub-types" of experimental designs. Plainly put, they have to do with how much 'control' or 'power' you as the researcher have to do the above randomization and grouping!

A. **True experimental** - If you can BOTH randomly draw (select) individuals for your study AND then randomly assign these individuals to 2 or more groups (e.g., 'you have the power to make the groups' yourself!), then you have what is known as a true experiment.'



Random Assignment of Subjects to Experimenter-Formed Groups

In the preceding scenario, the researcher first:

1. Randomly selected subjects A through F from the larger population; AND
2. Then randomly assigned these individuals to (experimenter-formed) groups. In our example, by coin-flipping or some other random procedure, Subjects A, D & E "landed" in the control group (e.g., the class that will get the traditional lecture), while Subjects B, C, & F "landed" in the experimental or treatment group (e.g., the researcher-formed class that will get the hands-on science instruction, say).

The two levels of "randomization" help to ensure good control of those pesky contaminating or confounding variables, don't they?! You're more likely to get a "good mix" on all those other factors when you can randomly draw your subjects and also randomly assign them to groups that you as the researcher have the "power" to form!

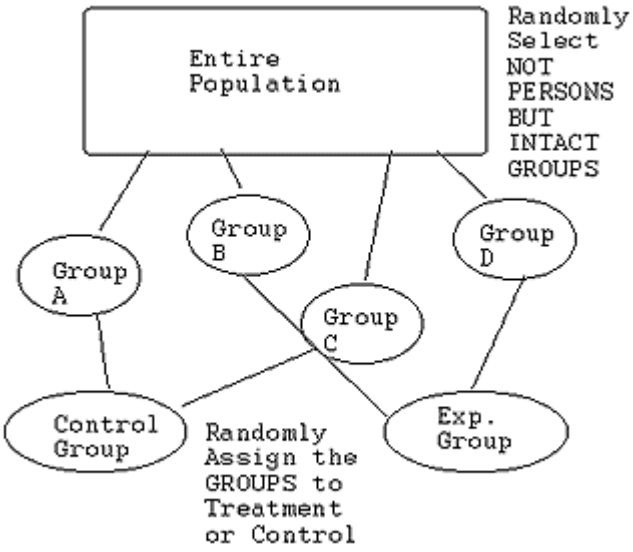
Ah...but ivory-tower research is one thing; real life quite another !

What if you get the OK to do your research within a school district, but the sup't. says, "Oh no! I can't let you be disrupting our bureaucratic organization here and "making your own 4th grade classrooms" for your study! That's way too disruptive! No, no, the best you can do is to randomly select INTACT existing 4th grade classrooms and then go ahead and use all the kids in those randomly drawn GROUPS instead!"

The True Experiment and Quasi-Experiment

Which brings us to the 2nd variant of "experimental designs:"

B. **Quasi-experimental - what you are 'randomly drawing' (selecting) is NOT INDIVIDUALS but INTACT (pre-existing) GROUPS**! These could be existing classrooms, clinics, vocational education centers, etc. In other words, you "lose" the power to "make your own groups" for your study!



Here (for the quasi-experiment), you randomly draw intact groups (e.g., from all the 4th grades in the district, you draw 4 of them at random) and then flip a coin or use some other random procedure to assign the pre-existing 4th grades to either the "treatment" or "control" conditions. (In our example Grades A and C "land" in the traditional lecture method (control), while Grades B and D end up in the hands-on science instruction (e.g., the "treatment" or the "experimental" group).

Do you see how this is different from the "true" experiment? In the "true" experiment, you selected the children themselves (subjects) at random and then "had the power" to in essence "form" your own "4th grades" by assigning the individual kids themselves randomly to either the control or the experimental conditions.

Here, though, the 'best you can do' (again, often for practical reasons such as access to sites, permission, etc.) is draw not individual kids but the GROUPS themselves (pre-existing 4th grade classrooms) at random and then in step # 2 assigning NOT the INDIVIDUAL KIDS but rather the WHOLE GROUPS to either the treatment or control conditions.

Quasi-Experimental Design

See how ***this one-step loss of randomization may mean a bit less control over those pesky contaminants***?! By forming your own groups you have a greater likelihood of "getting a good mix on all other stuff". But here, you've got to "live with the existing groups as is." And suppose that in the above scenario, 4th Grades B & D also happen (quite by accident, but welcome to 'real life!') to have a higher average I.Q. of 15 points than A & B! Now we've got a contaminant! Did the kids do better because of the hands-on science lesson -- or because of their inherently higher aptitude, intelligence or whatever?!

But at least we still have that last step: random assignment to either the experimental or control conditions!

Remember ... again...

1. For true experiments, we're randomly assigning individuals to treatment vs. control; and
2. For quasi-experiments, we're randomly assigning intact/pre-existing groups to treatment vs. control.

Well -- we lose that "random assignment" property in the 3rd "family" of group comparison design methodologies!

Ex post facto (also called "causal comparative") - really no 'random anything!' We identify some sort of outcome and wonder 'what makes it vary like that?' Could it be some pre-existing grouping? For instance, if we 'divided' or 'pile-sorted' the responses by gender, would that account for the difference we see?
Thus, there is no treatment either! Simply an attempt to see if a grouping that we had no prior control over seems to "make a difference" on some outcome(s)!
The keyword "difference" (by grouping) and no treatment would be the tip-off to an ex post facto or causal-comparative study design.
And -- regarding the grouping -- maybe this rather silly example will make the point! And help you to identify if you are in such a situation of "no-control-over-grouping:"
You wish to study whether preschoolers from single-parent homes are different in terms of emotional readiness for kindergarten than those of two-parent homes.
Now ... you couldn't go to prospective subjects' homes and say, "OK, now you've got to get divorced ... and YOU have to stay married ... 'cuz that's how you came up in the random assignment!"
I don't think so...!!! Same thing with "gender:" you took it "as is" (e.g., those subjects in essence 'self-selected into their gender grouping). You had no prior control over 'making' them 'be' one gender or the other but rather took those groups 'as is' and kind of pile-sorted some response(s) by gender to see if it 'made a difference' on some outcome! Indeed ... the ***literal Latin translation of "ex post facto" is "after the fact."*** This shows YOUR role in the 'grouping' process as the researcher! You didn't 'assign' them into any one group, randomly or otherwise. Instead, you came in "after the fact" and wished to see if that self-determined grouping made a difference on some outcome(s) that you are studying!
As you can imagine -- even bigger problems with contaminating variables! There is no randomization or control here!
Thus the name "causal comparative" is sort of a misnomer. You are indeed "comparing" two or more "pre-formed" groups on some outcome(s). But due to that *lack of randomization and control*, you can't really use this design to study "cause/effect" types of research questions or problem statements. There are generally *too many uncontrolled, unrandomized contaminating variables* that may have entered the picture to confidently make 'strong' cause/effect statements!
Nonetheless, given the circumstances, this type of design might be "the best you can do." Group differences on some outcome(s) might indeed be interesting to study even though you had little or no "control" in the situation.

To summarize, for the "group comparison" family of designs:

Kind of Study	**Method of Forming Groups**
Ex Post Facto (Causal Comparative)	Groups Formed
True Experiment	Random Assignment of Individual to "Researchr-Made" Groups
Quazi-Experiment	Random Assignment of Intact Groups

Case study design

It is a useful tool for investigating trends and specific situations in many scientific disciplines, especially social science, psychology, anthropology and ecology

Basically, a case study is an in depth study of a particular situation rather than a sweeping statistical survey. It is a method used to narrow down a very broad field of research into one easily researchable topic

Though it does not answer a question completely, it gives some indications and allows further elaboration and hypothesis creation on a subject.

The case study research design is also useful for testing whether scientific theories and models actually work in the real world. You may come out with a great computer model for describing how the ecosystem of a rock pool works but it is only by trying it out on a real life pool that you can see if it is a realistic simulation.

For psychologists, anthropologists and social scientists they have been regarded as a valid method of research for many years. Scientists are sometimes guilty of becoming bogged down in the general picture and it is sometimes important to understand specific cases and ensure a more holistic approach to research.

Its advantage, (case study research design) is that you can focus on specific and interesting cases. This may be an attempt to test a theory with a typical case or it can be a specific topic that is of interest. Research should be thorough and note taking should be meticulous and systematic. In a case study, you are deliberately trying to isolate a small study group, one individual case or one particular population.

For example, statistical analysis may have shown that birthrates in African countries are increasing. A case study on one or two specific countries becomes a powerful and focused tool for determining the social and economic pressures driving this

How To Design And Conduct A Case Study

It is best if you make yourself a short list of 4 or 5 bullet points that you are going to try and address during the study. If you make sure that all research refers back to these then you will not be far wrong.

With a case study, even more than a questionnaire or survey, it is important to be passive in your research. You are much more of an observer than an experimenter and you must remember that, even in a multi-subject case, each case must be treated individually and then cross case conclusions can be drawn

How To Analyze The Results

Analyzing results for a case study tends to be more opinion based than statistical methods. The usual idea is to try and collate your data into a manageable from and construct a narrative around it.

Use examples in your narrative whilst keeping things concise and interesting. It is useful to show some numerical data but remember that you are only trying to judge trends and not analyze every last piece of data. Constantly refer back to your bullet points so that you do not lose focus.

It is always a good idea to assume that a person reading your research may not possess a lot of knowledge of the subject so try to write accordingly.

In addition, unlike a scientific study which deals **with facts,** a case study is based on **opinion** and is very much designed to provoke reasoned debate. There really is no right or wrong answer in a case study.

Cross-sectional design

A research design where **subjects are assessed at a single time** in their lives, A cross sectional study is fast and can study a large number of patients at little cost or effort. Also, you don't have to worry about patients dropping out during the course of the study. This study is efficient at identifying association, but may have trouble deciding cause and effect. With data at only one time point, you don't know whether the chicken or the egg came first. Here are two examples of cross sectional designs

In Zureik et al (BMJ 2002 Aug 24;325(7361):411), a group of 1132 adults with asthma were given respiratory function tests to assess the severity of their asthma. They were also given skin prick tests to assess their sensitization to mold, pollen, dust mites, and cats. In this study, those patients with reactions to mold were much more likely to have severe asthma.

Types Of Research

Research can also be classified on the basis of its purpose its intended to achieve and examples of such researches include:

Evaluative research:

This is the study that focuses on whether an intervention was properly implemented and whether the intended outcomes of a given programme or project have been realized or not. (Mouton, 2001) Evaluation studies are both quantitative and qualitative in nature and it requires an understanding of the project objectives so that the performance of the project can be measured against the set objectives.

Predictive research

This type of research takes on several variables and tries to predict the likely outcome. It asks ‘what if questions. Thus it is based on predictions which themselves grow out of repeated actions and events which have been studied. It is based on probability and can be used to predict the likelihood of an event occurring (Wisker, 2001)

Historical research

These are studies which attempt to reconstruct the past and chronology of events (mouton 2001) and aim at arriving at an accurate account of the past so as to gain a better understanding of the present and fore cast what the future is likely to be.

Historical research is also referred to as analytical research. Common methodological characteristics include a research topic that addresses past events, review of primary and secondary data, techniques of criticism for historical searches and evaluation of the information, and synthesis and explanation of findings. Historical studies attempt to provide information and understanding of past historical, legal, and policy

Meta-Analysis

Meta-analysis combines the results of studies being reviewed. It utilizes statistical techniques to estimate the strength of a given set of findings across many different studies. This allows the creation of a context from which future research can emerge and determine the reliability of a finding by examining results from many different studies. Researchers analyze the methods used in previous studies, and collectively quantify the findings of the studies. Meta-analysis findings form a basis for establishing new theories, models and concepts.

Thomas and Nelson (1990) detail the steps to meta-analysis:

1. Identification of the research problem.
2. Conduct of a literature review of identified studies to determine inclusion or exclusion.
3. A careful reading and evaluation to identify and code important study characteristics.
4. Calculation of effect size. Effect size is the mean of the experimental group minus the mean of the control group, divided by the standard deviation of the control group. The notion is to calculate the effect size across a number of studies to determine the relevance of the test, treatment, or method.
5. Reporting of the findings and conclusions.

Exploratory research:

These are studies intended to carry out preliminary investigation into relatively unknown areas of research (Terre Blanch and Durrheim). They employ open, flexible and inductive approach to research as they attempt to look for new insights into phenomena. They generate speculative insights, new questions and hypothesis. They ask both 'what and why 'questions (Wiker, 2001, and Mbaaga, 1990) and this type of research is more flexible.

Descriptive research

Descriptive reseach are designed to gain more information about a particular characteristic within a particular field of study. A descriptive study may be used to, develop theory, identify problems with current practice, justify current practice, make judgements or identify what others in similar situations may be doing. There is no manipulation of variables and no attempt to establish causality. They are qualitative in nature and produce descriptive data i.e they use people's own written and spoken words as well as observable behaviour to describe a phenomenon or event so that it can be understood better.

- Descriptive research requires the clear specification of...
  WHO, ***WHAT***, ***WHEN***, ***WHERE***, ***WHY***, and***HOW***

-- Before data collection can begin

- Exploratory research is very flexible; descriptive research is **MUCH** more rigid

Causal research

This is a type of research that tries to find out the cause and effect of phenomenon (Leedy, 1997). The possibility of causal inference derives from the use of randomization techniques, experimental and comparative groups and repeated measures over time. Thus it aims at establishing cause-effect relationships between the research variables.

Other classification of research
It may also be categorized into the following

- Quantitative versus qualitative research
- Basic versus applied research
- Empirical and non empirical research

Qualitative and Quantitative Research
Quantitative research is:
"a formal, objective, systematic process in which numerical data are utilized to obtain information about the world" (Burns and Grove cited by Cormack 1991 p 140). There is massive use of mathematics, statistical tools and the samples are comparatively large.
In general, qualitative research generates rich, detailed and valid (process) data that contribute to in-depth understanding of the context. Quantitative research generates reliable population based and gereralizable data and is well suited to establishing cause-and-effect relationships

Quantitative research is research involving the use of structured questions where the response options have been predetermined and a large number of respondents is involved.
By definition, measurement must be objective, quantitative and statistically valid. Simply put, it's about numbers, objective hard data.

The sample size for a survey is calculated by statisticians using formulas to determine how large a sample size will be needed from a given population in order to achieve findings with an acceptable degree of accuracy. Generally, researchers seek sample sizes which yield findings with at least 95% confidence interval (which means that if you repeat the survey 100 times, 95 times out of a hundred, you would get the same response) and plus/minus 5 percentage points margin error. Many surveys are designed to produce smaller margin of error.

Qualitative Research is collecting, analyzing, and interpreting data by observing what people do and say. Whereas, quantitative research refers to counts and measures of things, qualitative research refers to the meanings, concepts, definitions, characteristics, metaphors, symbols, and descriptions of things.

Qualitative research is much more subjective than quantitative research and uses very different methods of collecting information, mainly individual, in-depth interviews and focus groups. The nature of this type of research is exploratory and open-ended. Small numbers of people are interviewed in-depth and/or a relatively small number of focus groups are conducted.

Participants are asked to respond to general questions and the interviewer or group moderator probes and explores their responses to identify and define people's perceptions, opinions and feelings about the topic or idea being discussed and to determine the degree of agreement that exists in the group. The quality of the finding from qualitative research is directly dependent upon the skills, experience and sensitive of the interviewer or group moderator.

This type of research is often less costly than surveys and is extremely effective in acquiring information about people's communications needs and their responses to and views about specific communications.

Basically, quantitative research is objective; qualitative is subjective. Quantitative research seeks explanatory laws; qualitative research aims at in-depth description. Qualitative research measures what it assumes to be a static reality in hopes of developing universal laws. Qualitative research is an exploration of what is assumed to be a dynamic reality. It does not claim that what is discovered in the process is universal, and thus, replicable. Common differences usually cited between these types of research include.

Characteristics of quantitative and qualitative research

Quantitative	**Qualitative**
Objective	Subjective
Research questions: How many? Strength of association?	Research questions: What? Why?
"Hard" science	"Soft" science
Literature review must be done early in study	Literature review may be done as study progresses or afterwards
Test theory	Develops theory
One reality: focus is concise and narrow	Multiple realities: focus is complex and broad
Facts are value-free and unbiased	Facts are value-laden and biased
Reduction, control, precision	Discovery, description, understanding, shared interpretation
Measurable	Interpretive
Mechanistic: parts equal the whole	Organismic: whole is greater than the parts
Report statistical analysis. Basic element of analysis is numbers	Report rich narrative, individual; interpretation. Basic element of analysis is words/ideas.
Researcher is separate	Researcher is part of process
Subjects	Participants

Context free	Context dependent
Hypothesis	Research questions
Reasoning is logistic and deductive	Reasoning is dialectic and inductive
Establishes relationships, causation	Describes meaning, discovery
Uses instruments	Uses communications and observation
Strives for generalization Generalizations leading to prediction, explanation, and understanding	Strives for uniqueness Patterns and theories developed for understanding
Highly controlled setting: experimental setting (outcome oriented)	Flexible approach: natural setting (process oriented)
Sample size: n	Sample size is not a concern; seeks "informal rich" sample
"Counts the beans"	Provides information as to "which beans are worth counting"

The decision of whether to choose a quantitative or a qualitative design is a philosophical question. Which methods to choose will depend on the nature of the project, the type of information needed the context of the study and the availability of recourses (time, money, and human).
It is important to keep in mind that these are two different philosophers, not necessarily polar opposites. In fact, elements of both designs can be used together in mixed-methods studies. Combining of qualitative and quantitative research is becoming more and more common.

Every method is different line of sight directed toward the same point, observing social and symbolic reality. The use of multiple lines of sight is called triangulation.
It is a combination of two types of research. It is also called pluralistic research.
Advantages of combining both types of research include:

1. research development (one approach is used to inform the other, such as using qualitative research to develop an instrument to be used in quantitative research)
2. Increased validity (confirmation of results by means of different data sources)
3. Complementarity (adding information, i.e. words to numbers and vice versa)
4. Creating new lines of thinking by the emergence of fresh perspectives and contradictions.

Barriers to integration include philosophical differences, cost, inadequate training and publication bias.

Qualitative data analysis

Qualitative analysis involves a continual interplay between theory and analysis. In analyzing qualitative data, we seek to discover patterns such as changes over time or possible causal links between variables.

Examples of approaches to discovery and explanations of such patterns are Grounded Theory Method (GTM), semiotics, and conversation analysis.

Qualitative researchers sometimes attempt to establish theories on a purely inductive basis. This approach begins with observations rather than hypothesis and seeks to discover patterns and develop theories.

Qualitative data Processing

The processing of qualitative data is as much art as science. Three key tools for preparing data for analysis *are coding, memoing*, and *concept mapping.*

Coding is classifying or categorizing individual pieces of data.

If you are testing hypothesis, then the codes could be suggested by the theory, in forms of variables. Open coding – codes are suggested by the researcher‘s examination and questioning of the data.

Example: 2 passages from Book Leviticus (Revised Standard version): religious bases for homophobia.

18:22 You shall not lie with male as with a woman, it is an abomination.

20:13 If a man lies with a male as with a woman, both of them have committed an abomination; they shall be put to death, their blood is upon them.

Homosexuality – key concept

Lying implies having sex

Male homosexuality

Prohibited behavior

Abomination

Put to Death

Male homosexuality is not the only abomination. Most of the abominations have to do with dietary rules and mishandling of ritual artifacts. **Thus, Dietary Rules and Ritual Artifacts are additional codes**.

Death penalty is broadly applied by Leviticus: everything from swearing to murder, including male homosexuality somewhere in between.

An extended analysis of prohibited behavior, short of abomination and death, and also turns up a lengthy list. Among them are slander, cursing the deaf, putting stumbling blocks in front of the blind people, and so forth.

Memoing writing memos or notes to yourself and others involved in the project.It is appropriate at several stages of data processing to capture code meaning, theoretical ideas, preliminary conclusions, and other thoughts that will be useful during analysis.

Concept mapping uses diagrams to explore relationships in the data graphically

Basic Research And Applied

Basic Research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view.

Applied research is also an original investigation undertaken to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective.

Experimentaldevelopment is systematic work, drawing on existing knowledge gained from research and/or practical experience that is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed."

Content In The Proposal
What follows is more information about what is required in the various sections of your evolving research proposal.
I. **The Problem**. You should begin by stating what the problem is that you are going to research. You should give the reader an idea of the project you intend to undertake.

II. **Importance to the Discipline**. Not every topic is worth researching. What should guide your choice of a topic is that it is important and relevant to the field in which you are engaged. You must convince the reader that your topic is important. It is here that you need to integrate some theory that supports the need to investigate your topic.

III. **Literature Review**. Your review should follow the introduction of the problem and should include a logically organized review of the relevant literature. You should give a summary of the theory that guides your work, as well as discuss what others have found who have done the same or similar research. If you are proposing to replicate someone else's work, you should say why. For example, do you wish to extend the generalizability of their findings, or are you hoping to improve on their methodology? Tell why. There is no need for you to rediscover the wheel; therefore, be careful in your search of the literature.

List Questions/Hypotheses. Your review of the literature should lead you to your research questions. In other words, these questions should be a natural outgrowth of your review of others' work. State these questions concisely. Be clear about what you are going to try to prove or disprove. If the reader cannot understand what you are proposing, then you are not making a strong argument
Hypothesis: A statement that specifies how two or more measurable variables are related. e.g
(H1): Women are more likely than men to make impulse purchases of our brand.
(H2): Decreasing price by 10% will increase unit sales by 30%.
(H3): Adoption of our new product will be greater in Northern states than in Southern States.

IV. **Method of Research**. While there are various methods by which one can approach social research, there are certain parameters which must be taken into consideration and addressed in your proposal. If the parameter does not appear to be relevant to your proposed research, you must address why that may be the case. What follows below is a list of parameters which might be considered in the writing

of a research proposal. During the course of the semester, we will address these and other components of a research proposal.

A. **Operationalization of the Variables**: If your question is “Is job security related to job satisfaction?” you must tell what you mean by both job security and job satisfaction, and be very specific. Will these concepts be measures by a response to a question? What is that specific question? If you are asking more than one question to capture a concept, will you form a scale measure? What kind of scale measure? Each variable must have specific operations (hence, operationalization) attached to is so that the reader knows exactly how the variable will be measured in the proposed research.

B. **Design**: Specify what research design your study will take, and why. Is it an experimental design? Will you look at one group once or on several different occasions? Will you look at more than one group? Will you
be comparing different groups? Why? Will you use a case study approach?

C**. Sample**: How will you draw your sample? What is the method(s) you will employ? How many will be in your sample? Why? Will you use probability sampling or non-probability sampling? Why?

D. **Data Gathering Method**: How will you actually gather the data that measures your variables? Will you use a survey? Will you interview people? you use existing data? Which data? If you are using specific instruments,include copies of them in an appendix to the proposal. Will you use focus groups?

E. **Ethical Considerations**: What impact might your study have on your “subjects?” What risk, if any, might you impose on the population you study by conducting the research? What are some different ways in which
the findings of your research might be utilized by others? Are there any possible political uses and what might be some implications of those uses? How your findings might be utilized differently from your research intentions?

F. **Political Considerations** : To what political ends might the findings of your research be used? It is important to be aware that one’s findings,regardless of what was hypothesized, can be put to political use. If the costs of political use outweigh the benefits of the research (which is also true of ethical considerations), one must question whether to conduct the proposed research

G. **Validity and Reliability**: How will you know if you are measuring what you say you are measuring? How will you know if your data is valid? What checks for validity will you provide? Are your measuring tools reliable? How will you know if they are reliable? What will you do that will convince the reader that you have addressed validity and reliability?

H**. Limitations to the Proposed Study**: You should tell the reader some of the limitations you foresee for your study. If you are using a specific sample and this limits generalizability, you should say so. If you are testing a group that might change the effectiveness of your measuring instrument, you need to address it.

Anything that might limit the knowledge gained,in any way, should be mentioned. None of us cond uct the perfect research project; therefore, it is important the we address possible limitations.

V**. Data Analysis**: How do you propose to analyze the data you would collect from this proposed research? If you posit a relationship between some of the variables, how will you determine if there really is a relationship? What statistical techniques might you use? While you are not actually going to do any statistical analysis at this point, you must have an idea of what types of analyses would be appropriate for both your variables and your research questions.

VI. **Reference List**: Any of the studies you cite in the literature review, or any other relevant works that you use in the proposal, must be included in a proper reference list. (See Writing Guidelines) Note that a reference list should include only those items actually referenced in the body of the paper. If you do not use it in the body of the paper, you should not include it inthe reference list.

VII. **Appendices:** You should attach a copy of any relevant supplemental materials, such as questionnaires, interview schedules, scoring keys (code sheets),.

Grading Points for Proposal Papers
Consider the following criteria used in grading to increase your skills in project proposal writing

GRADING: Stage 1 is worth 120 points. Stage 2 is worth 280 points and the next pages detail the grading criteria for each paper.

RESEARCH PROPOSAL –
STAGE 1 – EVALUATION SHEET
MECHANICS (10%) – 12 POINTS
1. Grammatical and spelling errors (possible 8 points): Average number of errors per page: 0 = 8 pts;
1 = 6 pts;
2-3 = 4 pts;
4-5 = 2 pts;
6-7 = 1 pts;
8 or more = 0 pts. _____

2. Follows required writing guidelines, including spacing, margins, and citation of sources. (4 points) _____

ORGANIZATION (30%) – 36 POINTS
1. Presents critical thought on the topic; i.e., does not merely provide Descriptions or lists. (12 points) _____
2. Shows evidence of careful, logical planning and presentation, with use of appropriate headings throughout proposal. (12 points) _____
3. Shows evidence of careful writing, with clear articulate use of language. (12 points) _____

CONTENT (60%) – 72 POINTS

1. Statement of the problem that clearly describes the topic that is being proposed for research. (10 points) _____
2. Demonstrates the importance of the topic for research and for the respective discipline. (10 points) _____
3. Integrates scholarly material and own ideas in the development and discussion of the topic. (25 points) _____
4. Uses scholarly references and shows a clear link to the existing professional literature and relevant theory. (12 points) _____
5. Poses appropriate and clear research questions/hypotheses. (15 pts

The following are the methods of data collection

Observation method

Observational research is used for studying nonverbal behaviors (gestures, activities, social groupings, etc).

Sommer & Sommer (1986) developed the list shown below to assist in observation research.

1. Specify the question(s) of interest (reason for doing the study).
2. Are the observational categories clearly described? What is being observed and why?
3. Design the measurement instruments (checklists, categories, coding systems, etc.).
4. Is the study designed so that it will be 'Valid (i.e., does it measure what it is supposed to measure, and does it have some generalizability)?
5. Train observers in the use of the instruments and how to conduct observational research.
6. Do a pilot test to (a) test the actual observation procedure and (b) check the reliability of the categories of observation using at least two independent observers.
7. Revise the procedure and instruments in light of the pilot test results. If substantial changes are made to the instrument, run another pilot test to make sure changes will work under the field conditions.
8. Collect, compile, and analyze the data and interpret results.

Casual observation is normally done like unstructured interviews. During the early stages of a research project, casual observation allows the researcher(s) to observe subjects prior to designing questionnaires and/or interview formats.

Types of Observation Studies

Ethnographies which are observations of groups

Grounded theory which uses multi-staged data collection Phenomenological studies which studying subjects over a period of time through developing relationships with them and reporting findings based on research “experiences”.

Case studies which use various data to investigate the subject over time and by activity

Each research method has its strengths and weaknesses. When designing a research study it is important to decide what the outcome (data) the study will produce then select the best methodology to produce that desired information.

SURVEY: This is the method used to describe a method of gathering information from a sample of individuals in a population in order to learn something about the larger population from which the sample is drawn.

Types of surveys: descriptive statistics which is largely conducted by the government to obtain major descriptive information about the population and its density, the composition of the labor force, national health statistics etc.

Survey for social research: mainly used by social scientists to gather and a analyze information about the social and economic conditions of the population or segments of the population and leads to the better understanding of human beings in their social settings.

Market research survey: this is carried on by business in consumer market research to determine consumer needs and the effectiveness of marketing programs.

The Steps In A Survey Project

1. Establish the goals of the project or what you want to learn
2. Determine your sample –whom you will interview
3. Choose interviewing methodology-how you will interview
4. Create your questionnaire –what you ask
5. Pretest the questionnaire, if practical test the questions
6. conduct interviews and enter data
7. Analyse the data and produce the report

Interviews; this may be defined as a deliberate conversation between the interviewer and an informant conducted for the purpose of collecting information. It may take the form of face to face interview schedule or telephone survey by Mbaaga (Ibid.). it may be formal or informal interview

Formal interview: this type involves the pre determined list of questions that are asked to all the interviewees in the same order. They may be structured with standardized questions or semi-structured with some degree of flexibility and the more structured the interview, the easier it is to quantify the results.

Group Interview: (Focus Group Discussion) FGD

Richard Krueger (1988), describe the focus group as a special type of group in terms of purpose, size, composition, and procedures. A focus group is typically composed of seven to twelve participants who are unfamiliar with each other and conducted by a trained interviewer. These participants are selected because they have certain characteristics in common that relate to the topic of the focus group.

The researcher creates a permissive environment in the focus group that nurtures different perceptions and points of view, without pressuring participants to vote, plan, or reach consensus. The group discussion is conducted several times with similar types of participants to identify trends and patterns in perceptions. Careful and systematic analyses of the discussions provide clues and insights as to how a product, service, or opportunity is perceived.

A focus group can be defined as a carefully planned discussion designed to obtain perceptions on a defined area of interest in a permissive, non threatening environment. It is conducted with approximately seven to twelve people by a skilled interviewer. The discussion is relaxed, comfortable, and often enjoyable for participants as they share their ideas and perceptions. Group members influence each other by responding to ideas and comments in the discussion.

Characteristics Of Focus Groups

Focus group interviews typically have four characteristics:

1. Identify the target market (people who possess certain characteristics);
2. Provide a short introduction and background on the issue to be discussed;
3. Have focus group members write their responses to the issue(s);
4. Facilitate group discussion;
5. Provide a summary of the focus group issues at the end of the meeting.

Other types of group processes used in human services (delphic, nominal, planning, therapeutic, sensitivity, or advisory) may have one or more of these features, but not in the same combination as those of focus group interviews.

Key Data Collection Techniques
Face to Face or personal interviews
Telephone interviews
Mail / postal interviews
E-mail interviews
Internet/ intranet (WEB PAGE)
How ever the above techniques may have advantages and disadvantages

The above techniques may be applied using a questionnaire,
Questionnaire: Is a predetermined written list of questions, which may be answered, by a subject or respondent.
The type of population, the nature of the research question and resources available determines the type of questionnaire to be used.

Planning the Survey
I. Hypotheses

- Descriptive hypotheses best answered by this method
- If you don't consider your hypotheses before writing your survey, you may be Overwhelmed with data and End up with data that doesn't address your concerns
- Good to go through several different scenarios of outcome from survey to see whether different outcomes would indeed have different implications for: Your

hypotheses and What action you will take (if survey is to address applied issue)

II. After determining precisely what you want to find out, determine who you want to ask

A. Defining your population
B. Determining whether to use the population or to sample
C. Types of samples
1. Convenience samples
2. Quota samples
3. Random samples: Allow you to use inferential statistics to determine how closely your results reflect their population
4. Stratified random samples: The advantage of random samples, but with a smaller sample and/or greater accuracy

III. Questionnaire, Interview, or Telephone Survey?

A. Issues to consider
1. Cost
2. Response rate
3. Honesty of responses
4. Standardization
B. The case for the telephone survey

IV. Format issues:

A. Format of questions
1. Dichotomous versus continuous
2. Fixed versus open-ended

B. Format of survey
1. Structured
2. Semi-structured
3. Unstructured

C. Why a novice might be better off with fixed alternative questions and a structured survey:
1. Data is easily coded
2. Structure may reduce investigator bias: Data on hypothesis-confirming bias (Snyder, 1984, Snyder, 1981, Snyder and Cantor, 1979)

V. Rules for asking good questions

A. Use words a third-grader would understand
B. Use words that won't be misinterpreted
C. Avoid personal questions
D. Make sure your sample has the information you seek
E. Avoid leading questions
F. Avoid questions loaded with social-desirability
G. Avoid double-barreled questions negation
H. Keep questions short and concise
I. Avoid negations barrel
J. Avoid irrelevant questions

K. Pretest the questions

VI. Analyzing survey data
A. Summarizing data
B. Summarizing interval data
C. Summarizing ordinal or nominal data
D. Using inferential statistics
1. Parameter estimation with interval data
2. Hypothesis testing with interval data
a. Relationships among more than two variables
b. More complicated procedures
E. Using inferential statistics with nominal data
1. Estimating overall percentages in population
2. Relationships between variables

A. Literature review
1. To avoid doing a study that has already been done
2. To learn from others' mistakes and successes

B**. Ethical concerns**
1. Assessing potential gain:
- Is it a test of theory?
- Does it address a practical problem?
- Does it open up new lines of inquiry?
- Be sure you're **not** trying to prove the null hypothesis or unwittingly replicating a study that has been done before.
- Peer review

2. Assessing potential harm:
- Are ethical principles compromised?
- Peer review
- Review by professor
- Review by ethics committee
- Practical concerns

Should scientific principles be used to study humans and other animals?
Only if:
A. The potential benefits exceed the potential harm.
B. The potential for harm has been minimized
II. Maximizing benefits
A. Getting a good, useful idea to test.
B. Providing a valid test of that idea. The study should have at least one of the following three types of validity. The type or types needed depend on the research question.

Documentary Analysis

This is also known as the study of documents where documents are the materials which contain the information we wish to study. It is important to note that all

studies begin by a review of related literature and certain documents; this may become a method of data collection if the research based on available documents.

Documents are divided into two broad categories namely primary (eye witness account written by people who experienced the particular event or behavior) and secondary documents (accounts written by those who were not present during the event but received the necessary information for compiling the documents by interviewing the eyewitnesses or reading the primary documents.

Primary documents may include things like letters, agendas, committee minutes, financial accounts and diaries. Secondary documents may include things like books, newspapers, journals articles etc.

Forms of documentary Analysis: Historical, Literature, Meta-Analysis Diaries and Content Analysis

Content Analysis
Content analysis systematically describes the form or content of written and/or spoken material. It is used to quantitatively studying mass media. The technique uses secondary data and is considered unobtrusive research.
The first step is to select the media to be studied and the research topic. Then develop a classification system to record the information. The techniques can use trained judges or a computer program can be used to sort the data to increase the reliability of the process.
Content analysis is a tedious process due to the requirement that each data source be analyzed along a number of dimensions. It may also be inductive (identifies themes and patterns) or deductive (quantifies frequencies of data). The results are descriptive, but will also indicate trends or issues of interest.

Experimental Designs
1. True Designs
2. Quasi Designs
3. Ex Post Facto Designs

True Designs - Five Basic Steps to Experimental Research Design
1. Survey the literature for current research related to your study.
2. Define the problem, formulate a hypothesis, define basic terms and variables, and operationalize variables.
3. Develop a research plan:
    a. Identify confounding/mediating variables that may contaminate the experiment, and develop methods to control or minimize them.
    b. Select a research design as seen already above
    c. Randomly select subjects and randomly assign them to groups.
    d. Validate all instruments used.
    e. Develop data collection procedures, conduct a pilot study, and refine the instrument.
    f. State the null and alternative hypotheses and set the statistical significance level of the study.

4. Conduct the research experiment(s).
5. Analyze all data, conduct appropriate statistical tests and report results.

Quasi Designs

The primary difference between true designs and quasi designs is that quasi designs do not use random assignment into treatment or control groups since this design is used in existing naturally occurring settings.

Groups are given pretests, then one group is given a treatment and then both groups are given a post-test. This creates a continuous question of internal and external validity, since the subjects are self-selected. The steps used in a quasi design are the same as true designs.

Ex Post Facto Designs

An ex post facto design will determine which variables discriminate between subject groups.

Steps in an Ex Post Facto Design

1. Formulate the research problem including identification of factors that may influence dependent variable(s).
2. Identify alternate hypotheses that may explain the relationships.
3. Identify and select subject groups.
4. Collect and analyze data

Ex post facto studies cannot prove causation, but may provide insight into understanding of phenomenon.

Data Analysis

The data collected in a given research can be analyzed either qualitatively or quantitatively depending on the nature of the data collected. In analysing the data,you need to develop skills in finding patterns in the data and to have the ability to isolate critical facts and information from other information that is not so important. Although the analysis depends on the type of data collected, how the data collected depends on the type analysis anticipated.

Qualitative Data Analysis

Its normally analyzed continuously during and after data collection (Mbaaga 1990). The analysis involves a pure description of events, places, people or objects. This will enable the reader to know what happened, what it was like from the participant's activities etc. In most cases qualitative analysis does not go beyond the measure of central tendency and measure of dispersion (mean, mode, median, range, and standard deviation)

Thus the analysis takes place simultaneously during and after the data collection (Merrian et al 1995), this enables the researcher to make adjustments, restructure and if possible examine emerging concepts not originally in the study design.

How ever NVivo 8 is a software package for analysis of qualitative data, such as transcripts of in-depth interviews, focus groups and field notes.

Quantitative Data Analysis

This type of data can be analyzed by use of statistical procedures after the researcher has measured the relevant variables. The first step in quantitative data analysis is to prepare the raw data and transform them into a data set in machine readable format (in a form that can be read by a computer

Raw data is a collection of unprocessed measurements such as pile of completed questionnaires, strings of numerical codes applied to written texts etc these are then transformed into ordered data set before they can be analysed. The data preparation process involves three important tasks namely;

- Coding
- Entering and
- creating

Coding where the data is grouped into certain categories and assigned specific codes and process involves translating verbal responses into numerical codes that facilitates data manipulation. Then after the data is coded it is entered into computer for analysis using the appropriate statistical package. How ever before the analysis, data has to be cleaned i;e the information has to be edited or cross checked for errors if good results are to be expected and Following data entry, some data manipulation is usually needed to manipulate the entered ("raw") data into structures that are suitable for analysis. Typically, data manipulation tasks include

- *Copying data*
- *Selecting subsets of the data*
- *Restructuring the data to make analysis easier*
- *Transforming data*
- *Merging data at different levels*

Copying data
To avoid confusing the entry and the management, we suggest that you copy the raw data to a second sheet. This is easily done in Excel by creating a new worksheet (Insert => Worksheet), using Edit => Copy to copy the original data to the clipboard, and then Edit => Paste Special (rather than Paste) and clicking the Paste Link button. This ensures that the data in the new sheet are linked to the original data, so that any subsequent changes to the original are reflected automatically in the copy.

It is a good idea to get into the habit of naming sheets. In general your analysis will be simpler to follow if you use more sheets, rather than putting all your information together in a few sheets. But you then need to give them meaningful names so you can easily find them and retrieve the information that you want.
Also, you can take advantage of Excel's facility for naming cells or areas of cells (Insert => Name => Define). This makes it much easier to refer to your data, rather than using cell addresses.

Selecting subsets of the data
It is often useful to look at subsets of the cases (rows) in your data, for example to concentrate on female subjects, or on cases that show abnormally large values for a

particular variable. Excel has some excellent filtering facilities for selecting rows of interest, in particular the automatic filter (Data => Filter => Autofilter). This allows you to display only those rows containing particular values of one or more variables. By using the Custom option, you can specify up to two specific criteria for each variable. All rows that do not meet the criteria are hidden from view (but are not deleted). More complex filtering can be achieved using the Advanced Filter facility (Data => Filter => Advanced Filter), but this is more difficult to use.

Restructuring data
It is often necessary to extract some of the data and convert them to a different structure. The most common requirement is to split a data column into several columns, one for each level of a factor (or combination of factors). For example, we may wish to separate data for males and females, so that we can process them separately or compare them.
We call this process "unstacking", since in list format the data for a variable are held in a single column for all levels of a factor (i.e. stacked on top of each other).

Transforming data
You will commonly need to perform some transformations of the original data (for example, taking logarithms or converting from grammes per plot to tonnes per hectare). This is easily achieved by adding a new column to a copy of the data, and using a suitable Excel formula to transform the data contained in an existing column. The need to add new columns to your data is one of the reasons that we recommend taking a copy of your original data.

Merging data at different levels
When you have data at multiple levels, you may wish to incorporate data about one level in the data at a more detailed level. For example, records about individuals may contain an indication of which household they belong to. You may wish to add some details about the households to the individual data.

This can be achieved using the Excel lookup function. For each column of household information that you want to incorporate, you should create a new column in the individual table and use lookup to extract the appropriate information from the household data for each individual.
The analysis can be done at three levels depending on the investigation of the study namely;

At univariate level of Analysis: frequency tables to provide an enumeration of activity of people that have pre-specified characteristic. Percentages can also be presented so as to show the distribution of people that have certain characteristics within the total population of the study.

Suitable aids to visualizing your data fall generally into the following categories:
Graphics, which give a picture of the structure of your data and the relationships within them
Tables, which enable you to compare values, frequency counts, etc between levels of factors. Other univariate descriptive statistics include measures central tendency

(e.g. mean, median, mode),deciles, quartiles and measures of dispersion(e.g. ,range, mean deviation, standard deviation, coefficient of variation).

At The Bivariate this involves making contingency tables between the dependent variable and the independent (explanatory variables). In order to establish relationship between the independent and the dependent variable Pearson -chi square test statistics can be used to measure the degree of association.

At multivariate can be used to carry out further investigation to establish the relative importance of the dependent variable.

NB programs we teach most statistical packages used in analysis like SPSS, STATA

Difference between Research Proposal and Project Proposal

A research proposal	**A project proposal**
Exclusively written by academics and students in institutions of higher learning	Not restricted to academics
Review of related literature is emphasized	Literature review section is absent
Focuses on collecting data on a problem which will be analyzed for drawing conclusion and making recommendation	Makes use of the recommendations of a study to solve the problems of a given community
Bibliography and references are a must	Bibliography and reference may not be necessary
May be written and presented in chapters	Written and presented in sections
Proposals especially written by students may not necessarily be presented to seek financial assistance	The primary aim is to seek financial assistance
May not need a follow up action	Emphasizes a follow up action
Evaluation plan not necessary	Evaluation plan a must

The structure of a research report

- Title
- Table of content
- An abstract
- Chapter one: Background to the problem
- Chapter two: Literature review
- Chapter three: Methodology
- Chapter four : Results /findings of the study
- Chapter five: Discussion, Conclusion and Recommendations
- References
- Appendices
    - Timetable
    - Budget
    - Research instruments
    - Field photograps
    - Introduction letters
    - Any other important document

Appendix
WRITING UP RESEARCH
This is how method fits into your thesis:

	Introduction: introduction of research problem introduction of objectives introduction of how objectives will be achieved (methodology), optional introduction of main findings and conclusions, optional
	Literature review: review of previous work relating to research problem (to define, explain, justify) review of previous work relating to methodology (to define, explain, justify) review of previous work relating to results (particularly reliability, etc.) i.e identify weaknesses and success
	Method (how the results were achieved): explanation of how data was collected/generated · explanation of how data was analyzed explanation of methodological problems and their solutions or effects
	Results and discussion: presentation of results interpretation of results discussion of results (e.g. comparison with results in previous research, effects of methods used on the data obtained)
	Conclusions: has the research problem been "solved"? to what extent have the objectives been achieved? what has been learnt from the results? how can this knowledge be used? what are the shortcomings of the research, or the research methodology? etc.

	analysis: classes of data are collected and studies conducted to discern patterns and formulate principles that might guide future action
	Case study: the background, development, current conditions and environmental interactions of one or more individuals, groups, communities, businesses or institutions is observed, recorded and analyzed for stages of patterns in relation to internal and external influences.
	Comparison: two or more existing situations are studied to determine their similarities and differences.
	Correlation-prediction: statistically significant correlation coefficients between and among a number of factors are sought and interpreted.
	Evaluation: research to determine whether a program or project followed the prescribed procedures and achieved the stated outcomes.
	Design-demonstration: new systems or programs are constructed, tested and evaluated
	Experiment: one or more variables are manipulated and the results analyzed.
	Survey-questionnaire: behaviors, beliefs and observations of specific groups are identified, reported and interpreted.
	Status: a representative or selected sample of one or more phenomena is examined to determine its special characteristics.
	Theoryconstruction: an attempt to find or describe principles that explain how things work the way they do.
	Trendanalysis: predicting or forecasting the future direction of events
	Descriptive narration tells the story from beginning to end in chronological order, utilizing limited generalizations and synthesized facts.
	Interpretive analysis relates one event to another event. The event is studied and described within a broader con- text to add meaning and credibility to the data.

	For example, an examination of the development of a local jurisdiction's ability to dedicate land for parks may be related to the urbanization and loss of open space in our communities.
	Comparative analysis examines similarities and differences in events during different time periods-for example, the budget-cutting priorities and procedures of the Proposition 13 era of the early 1980s in parks and recreation as compared to the budget-cutting priorities and procedures of today
	Theoretical and philosophical analysis utilizes historical parallels, past trends, and sequences of events to suggest the past, present, and future of the topic being researched. Findings would be used to develop a theory . For example, an analysis of public recreation agency goals and objectives of previous eras can be used to describe the future in the context of social, political, economic, technological, and cultural changes in society.

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Course Name	: Sanitation & Environmental Health Science

Course Description

This Course deals with defining the term sanitation, the application of the concept to several variables, analysis of current sanitation, understanding the role of the health sector improving sanitation, strategies to achieve success in sanitation. The course further stipulates relevant aspects to be considered in order to manage good sanitation, determinants of health, water pollution, and chemical and other contaminants as well as noise pollution.

Course Objectives

· To enable students critically learn the various causes of pollution and numerous measures to control it.
· To provide the students with the scope of managing sanitation to promoteindividual and community hygiene as one major focus of public health.
· To help remind students about working hard towards protecting the environment to create its sustainability as one of the millennium development (MDGs) in order to achieve sustainable development.

Course Content

Introduction

· Definition of Sanitation
· Application of Sanitation to specific aspect, concepts, location and strategy
· Sanitation and Public Health
· Health Impacts of Sanitation
· Wider benefits of Sanitation
· Analysis of the Current Situation
· Successful approaches to Sanitation
· The role of the Health Sector in Improving Sanitation
· Constraints to success in Sanitation
· Strategies to achieve success in Sanitation

Relevant aspects to be considered in order to manage good sanitation

· Disinfectants
· Environmental epidemiology
· Environmental Health
· Environmental health concerns

Determinants of Health

· Human Biology
· Environment
· Lifestyles
· Healthcare services

Water Pollution

· Definition of Water pollution
· Point Source pollution

· Non-point source pollution
· Groundwater pollution
· Causes of Water Pollution

Chemical and other contaminants
· Organic water pollution
· Inorganic water pollution
· Thermal pollution
· Transports and chemical reactions of water pollutants
· Measurement of water pollution
· Control of water pollution

Noise Pollution
· Meaning of Noise Pollution
· Human health effects
· Environmental effects

Mode of delivery Face to face lectures
Assessment
Course work 40%
Exams 60%

Total Mark 100%

SANITATION AND ENVIRONMENTAL HEALTH SCIENCE

Contents
Introduction and Definitions
Sanitation and public health
Global access to improved sanitation
Health Impacts of Sanitation
Neglected Tropical Diseases
Acute Respiratory Infections
Wider Benefits of Sanitation
Analysis of the Current Situation
Successful Approaches to Sanitation
Approaches Specific to Urban Sanitation
Constraints to Success in Sanitation
Strategies to Achieve Success in Sanitation
Environmental health science

Introduction
Sanitation perhaps one of the core units of public health, Under sanitation they arenumerous topics we are going to look at with the highest public health importance; explaintheir causation, the complications, containments and their public health strategies toimprove the condition. The chapter is divided into communicable and non communicablediseases, diseases related to lifestyle and injuries.

Course work question

By the sanitation standards of Uganda, Uganda has not yet achieved it's internationalstandard of sanitation. As a public health student what measures would you recommendfor the government to adopt in order to achieve a global standard?

What are the consequences of poor hygiene and sanitations to the communities within andaround?

Definitions

Adequate sanitation, together with good hygiene and safe water, are fundamental to goodhealth and to social and economic development. That is why, in 2008, the Prime Minister ofIndia quoted Mahatma Gandhi who said in 1923, "sanitation is more important thanindependence" . Improvements in one or more of these three components of good health cansubstantially reduce the rates of morbidity and the severity of various diseases and improvethe quality of life of huge numbers of people, particularly children, in developing countries.Although linked, and often mutually supporting, these three components have differentpublic health characteristics. This paper focuses on sanitation. It seeks to present the latestevidence on the provision of adequate sanitation, to analyse why more progress has notbeen made, and to suggest strategies to improve the impact of sanitation, highlighting therole of the health sector. It also seeks to show that sanitation work to improve health, onceconsidered the exclusive domain of engineers, now requires the involvement of socialscientists, behaviour change experts, health professionals, and, vitally, individual people.Throughout this paper, we define sanitation as the safe disposal of human excreta. Thephrase "safe disposal" implies not only that people must excrete hygienically but also thattheir excreta must be contained or treated to avoid adversely affecting their

Sanitation is the hygienic means of promoting health through prevention of human contactwith the hazards of wastes. Hazards can be either physical, microbiological, biological orchemical agents of disease. Wastes that can cause health problems are human and animalfeces, solid wastes, domestic wastewater (sewage, sullage, greywater), industrial wastes andagricultural wastes. Hygienic means of prevention can be by using engineering solutions(e.g. sewerage and wastewater treatment), simple technologies (e.g. latrines, septic tanks),or even by personal hygiene practices (e.g. simple handwashing with soap).

Sanitation generally refers to the provision of facilities and services for the safe disposal ofhuman urine and feces. Inadequate sanitation is a major cause of disease world-wide andimproving sanitation is known to have a significant beneficial impact on health both inhouseholds and across communities. The word 'sanitation' also refers to the maintenance ofhygienic conditions, through services such as garbage collection and wastewater disposal.

The term "sanitation" can be applied to a specific aspect, concept, location or strategy, suchas:

· Basic sanitation - refers to the management of human feaces at the household level.

This terminology is the indicator used to describe the target of the MillenniumDevelopment Goal on sanitation.

· On-site sanitation - the collection and treatment of waste is done where it isdeposited. Examples are the use of pit latrines, septic tanks, and Imhoff tanks.
· Food sanitation - refers to the hygienic measures for ensuring food safety.
· Environmental sanitation - the control of environmental factors that form links indisease transmission. Subsets of this category are solid waste management, waterand wastewater treatment, industrial waste treatment and noise and pollutioncontrol.
· Ecological sanitation - an approach that tries to emulate nature through therecycling of nutrients and water from human and animal wastes in a hygienicallysafe manner.

Sanitation and public health

The importance of the isolation of waste lies in an effort to prevent diseases which can betransmitted through human waste, which afflict both developed countries as well asdeveloping countries to differing degrees. It is estimated that up to 5 million people die eachyear from preventable water-borne disease, as a result of inadequate sanitation and hygienepractices. The effects of sanitation have also had a large impact on society. The results ofstudies published in *Griffins Public Sanitation* show that better sanitation produces anenhanced feeling of wellbeing.

Relevant disease include:

· Waterborne diseases, which can contaminate drinking water
· Diseases transmitted by the fecal-oral route
· Hookworm, where eggs can survive in the soil

Global access to improved sanitation

The Joint Monitoring Program for water and sanitation of WHO and UNICEF has definedimproved sanitation as

· connection to a public sewer
· connection to a septic system
· pour-flushlatrine
· simple pit latrine
· ventilated improved pit latrine

According to that definition, 62% of the world's population has access to improvedsanitation in 2008, up by 8% since 1990 Only slightly more than half of them or 31% of theworld population lived in houses connected to a sewer. Overall, 2.5 billion people lackaccess to improved sanitation and thus must resort to open defecation or other unsanitaryforms of defecation, such as public latrines or open pit latrines. This includes 1.2 billionpeople who have access to no facilities at all This outcome presents substantial publichealth risks as the waste could contaminate drinking water and cause life threateningforms of diarrhea to infants. Improved sanitation, including hand washing and waterpurification, could save the lives of 1.5 million children who die from diarrheal diseaseseach year.In developed countries, where less than 20% of the world population lives, 99% of thepopulation has access to improved sanitation and 81% were connected to sewers.

Health Impacts of Sanitation

Lack of sanitation leads to disease, as was first noted scientifically in 1842 in Chadwick'sseminal “Report on an inquiry into the sanitary condition of the labouring population of
Great Britain”. A less scientifically rigorous but nonetheless professionally significantindicator of the impact on health of poor sanitation was provided in 2007, when readers ofthe BMJ (British Medical Journal) voted sanitation the most important *medical* milestonesince 1840
The diseases associated with poor sanitation are particularly correlated with poverty andinfancy and alone account for about 10% of the global burden of disease. At any given timeclose to half of the urban populations of Africa, Asia, and Latin America have a diseaseassociated with poor sanitation, hygiene, and water

Of human excreta, feaces are the most dangerous to health. One gram of fresh feaces froman infected person can contain around 106 viral pathogens, 106–108 bacterial pathogens,104 protozoan cysts or oocysts, and 10–104helminthes eggs. The major feaco-oral diseasetransmission pathways are demonstrated in the “F Diagram”, which illustrates theimportance of particular interventions, notably the safe disposal of feaces, in preventingdisease transmission.

Diarrheal Diseases

Diarrheal diseases are the most important of the feaco-oral diseases globally, causingaround 1.6–2.5 million deaths annually, many of them among children under 5 years oldliving in developing countries. In 2008, for example, diarrhea was the leading cause of deathamong children under 5 years in sub-Saharan Africa, resulting in 19% of all deaths in thisage group

Systematic reviews suggest that improved sanitation can reduce rates of diarrheal diseasesby 32%–37% .While many of the studies included in those reviews could not rigorouslydisaggregate the specific effects of sanitation from the overall effects of wider water,sanitation, and hygiene interventions, a longitudinal cohort study in Salvador, Brazil, foundthat an increase in sewerage coverage from 26% to 80% of the target population resulted ina 22% reduction of diarrhea prevalence in children under 3 years of age; in those areaswhere the baseline diarrhea prevalence had been highest and safe sanitation coveragelowest, the prevalence rate fell by 43%.
Similarly, a recent meta-analysis that explored theimpact of the provision of sewerage on diarrhea prevalence reported a pooled estimate of a
30% reduction in diarrhea prevalence and up to 60% reduction in areas with especially poorbaseline sanitation conditions. Another longitudinal study in urban Brazil found that themajor risk factors for diarrhea in the first three years of life were low socioeconomic status,poor sanitation conditions, presence of intestinal parasites, and absence of prenatalexamination. The study concluded that diarrheal disease rates could be substantiallydecreased by interventions designed to improve the sanitary and general living conditions ofhouseholds.
Further, it is not just the provision and adult use of sanitation that is important. A metaanalysisof observational studies of infants' faeces disposal practices found that unsafedisposal increased the risk of diarrhea by 23%, highlighting the importance of the safemanagement of both adults' and infants' feaces.

Neglected Tropical Diseases

Neglected tropical diseases, while resulting in little mortality, cause substantial disabilityadjustedlife year (DALY) losses in developing countries . Many of these diseases have afeaco-oral transmission pathway. Thus, improved sanitation could contribute significantlyto a sustained reduction in the prevalence of many of them, including trachoma, soiltransmittedhelminthiases, and schistosomiasis. Unfortunately, the current policy focus inmost parts of the world is on treatment by medication, which, unlike good sanitation, is nota preferred solution because, in part, it is much more expensive.

Trachoma is endemic in many of the world's poorest countries. It is caused by thebacterium *Chlamydia trachomatis* and is the world's leading cause of preventable blindness.

Trachoma control is predominantly antibiotic-based despite the existence of the SAFEcontrol strategy (surgery, antibiotics, face-washing, and environmental measures, namelysanitation promotion). However, a recent cluster-randomised control trial in Ghana foundthat the provision of toilets reduced appreciably the number of *Muscasorbens* flies (thevector for trachoma) caught on children's eyes and by 30% the prevalence of trachoma, thusconfirming the long-suspected role that sanitation could play in the control of trachoma

Soil-transmitted helminths such as the large human roundworm, the human whipworm,and the human hookworms cause many millions of infections every year and manyindividuals are infected with more than one of these geohelminths. Helminthic infectionsnegatively impact the nutritional status of infected individuals, with consequent growthfaltering in young children, and anaemia, particularly in pregnant women. Adult helminthes live in the human gastrointestinal tract where they reproduce sexually. Their eggs aredischarged in the faeces of the infected host and thus, mainly via open defecation, to otherpeople. Ending the practice of open defecation with good sanitation can cut thistransmission path completely, but most current helminth-control programmes focus onmedication, which must be repeated periodically in the absence of sanitation.

Globally, some 190 million people are infected with schistosomiasis, which can result inchronic debilitation, haematuria, impaired growth, bladder and colorectal cancers, andessential organ malfunction. Adult schistosomes live in the portal veins where they passtheir eggs into the environment via the urine (*Schistosomahaematobium*) or faeces (the otherhuman schistosomes). After passing part of their life cycle in aquatic snails where theymultiply asexually, cercariae are discharged into the water where they come into contactwith and infect their human hosts through their skin. Thus, sanitation (and water)interventions are essential to any long-term control and elimination of schistosomiaisis,whereas the current standard intervention is repeated medication .

Acute Respiratory Infections

With 4.2 million deaths each year (1.6 million among children under 5 years), acuterespiratory infections are the leading cause of mortality in developing countries. Althoughsanitation is not directly linked to all acute respiratory infections, a recent study reportedthat 26% of acute lower respiratory infections

among malnourished children in rural Ghanamay have been due to recent episodes of diarrhea. Thus, sanitation could be a powerfulintervention against acute respiratory infections.

Under nutrition

Poor sanitation, hygiene, and water are responsible for about 50% of the consequences ofchildhood and maternal underweight, primarily through the synergy between diarrhealdiseases and under nutrition, whereby exposure to one increases vulnerability to the other.

Wider Benefits of Sanitation

In addition to its impact on health, improved sanitation generates both social and economicbenefits. Householders understand these wider benefits but scientists have only recentlybegun to study individuals' motivations for improving sanitation and changing sanitationbehaviour.

While the main goal of agencies' sanitation programming is to improve health, householdersrarely adopt and use toilets for health-related reasons. Instead, the main motivations forsanitation adoption and use include the desire for privacy and to avoid embarrassment,wanting to be modern, the desire for convenience and to avoid the discomforts or dangers of
the bush (e.g., snakes, pests, rain), and wanting social acceptance or status.

Furthermore,for women, the provision of household sanitation reduces the risk of rape and/or attack experienced when going to public latrines or the bush to defecate, and for girls, theprovision of school sanitation facilities means that they are less likely to miss school bystaying at home during menstruation

The economic benefits of improved sanitation include lower health system costs, fewer dayslost at work or at school through illness or through caring for an ill relative, andconvenience time savings (time not spent queuing at shared sanitation facilities or walkingfor open defecation)

In total, the prevention of sanitation- and water-related diseases could save some $7 billionper year in health system costs; the value of deaths averted, based on discounted futureearnings, adds another $3.6 billion per year . Furthermore, in much of the developing worldat any one time around half the hospital beds are occupied by people with diarrhoealdiseases Expressed at a national scale, poor sanitation and hygiene costs the Lao People's

Democratic Republic 5.6% of its GDP per year and studies in Ghana and Pakistan suggestthat general improvements in environmental conditions could save 8%–9% of GDP annuallyshows the cost–benefit ratios associated with achieving the Millennium Development Goal

(MDG) sanitation target (a reduction of 50% in the proportion of people without improvedsanitation by 2015 from the 1990 baseline figure) and with achieving universal sanitationaccess in the non-OECD (Organisation for Economic Co-operation and Development)countries. Thus, one dollar spent on sanitation could generate about ten dollars' worth ofeconomic benefit, mainly by productive work time gained from not being ill if either of thesegoals were achieved.

Finally, the Disease Control Priorities Project recently found hygiene promotion to preventdiarrhea to be the most cost-effective health intervention in the world at only $3.35 perDALY loss averted, with sanitation promotion following closely behind at just $11.15 perDALY loss averted

Analysis of the Current SituationCoverage

Currently, some 2.6 billion people lack access to improved sanitation, two-thirds of whomlive in Asia and sub-Saharan Africa. 1.2 billion people, of whom more than half live in India,lack even an unimproved sanitation facility and must defecate in the open. Regionaldisparities in sanitation coverage are huge. Whereas 99% of people living in industrialized countries have access to improved sanitation, in developing countries only 53% have suchaccess. Within developing countries, urban sanitation coverage is 71% while rural coverageis 39%. Consequently, at present the majority of people lacking sanitation live in ruralareas; this balance will shift rapidly as urbanisation increases. Worryingly, over the pasttwo decades, provision of improved sanitation has barely kept pace with increasingpopulations while most other social services, including water supply, have outpacedpopulation growth.

Reasons for Slow Progress

For many years, national governments, aid agencies, and charities have subsidized sewerage and toilet construction as a means to improve access. This approach has resultedin slow progress for two main reasons. First, the programmes have tended to benefit the fewrelatively well-off people who can understand the system and capture the subsidies, ratherthan reach the more numerous poor people. Second, such programmes have built toiletsthat remain unused because they are technically or culturally inappropriate or because the
householders have not been taught the benefits of them. In India, for example, many toiletsare used as firewood stores or goat sheds and a recent study showed that about 50% oftoilets built by a large government programme are not used for their intended purpose

Even when appropriate toilets are promoted, their technical specifications frequently makethem prohibitively expensive. Thus, a recent study in Cambodia found that while there is astrong demand for toilets, that demand remains mostly unrealised because people favouran unaffordable $150 design rather than simpler but still hygienic designs costing $5–$10

Another reason for slow progress is that disposal of children's faeces—the group mostvulnerable to faeco-oral disease transmission—is neglected and under-researched. A recentliterature review that analysed a wide range of disposal practices for children's faeces andthe health gains that can result from them noted that this whole topic is significantlyneglected

Finally, sanitation is not an inherently attractive or photogenic subject. Before 2008, theInternational Year of Sanitation, sanitation specialists had failed to persuade politicians,the media, and other influential people of the importance of the subject. During 2008,however, there were many political events related to sanitation—notably regional sanitationconferences across the developing world—that resulted in Regional Sanitation Declarations,which have moved sanitation up the political agenda

Successful Approaches to Sanitation

Recently, there has been a shift away from centrally planned provision of infrastructuretowards demand-led approaches that create and serve people's motivation to improve theirown sanitation. Although sound technological judgment about appropriate solutionsremains essential, appropriate programming approaches are now more important andcontribute most to the success of sanitation work. Some of the most promising approachesthat apply to both rural and urban sanitation are described below. Regarding the costs ofthese demand-led approaches, there are few published comparative studies, but sectorprofessionals estimate that they cost less than traditional infrastructure provision. Forexample, the Water Supply and Sanitation Collaborative Council's Global Sanitation Fundallows average costs of $15 per person for demand-led approaches, whereas governmentalprovision of infrastructure typically costs tens to hundreds of dollars per person.

Sanitation Marketing

Sanitation marketing uses a range of interventions to raise householders' demand forimproved sanitation . The approach involves understanding householders' motivations andconstraints to sanitation adoption and use. These are then used to develop both demandandsupply-side interventions to ensure that appropriate sanitation products and servicesare available to match the demand. A successful example of sanitation marketing isdescribed in

Community-Led Total Sanitation

Community-led total sanitation (CLTS) is a communications-based approach that aims toachieve “open defecation–free” status for whole communities rather than helping individualhouseholds to acquire toilets. CLTS was developed in Bangladesh (see section 2 in Text S1) nand uses external facilitators and community volunteers to raise (“ignite”) communityawareness that open defecation contaminates the environment and the water and foodingested by householders. It encourages a cooperative, participatory approach towardsending open defecation and creating a clean, healthy, and hygienic environment from whicheveryone benefits. CLTS has spread from South Asia to Africa and South America in thepast ten years and appears to be highly successful in certain communities. However, onerecent study estimates that only 39% of ignited villages achieve open defecation–free status. The success or failure of CLTS may relate to its cultural suitability and to the degree towhich it addresses supply-side constraints to sanitation adoption .

Community Health Clubs

Community Health Clubs aim to change sanitation and hygiene attitudes and behavior through communal activities. The approach has proved effective and cost-effective in theMakoni and Tsholotsho Districts of Zimbabwe where villagers were invited to weeklysessions where one health topic was debated and then action plans formulated. In one yearin Makoni District, for example, 1,244 health sessions were held by 14 trainers, costing anaverage of US$0.21 per beneficiary and involving 11,450 club members. Club members'hygiene in both districts was significantly different ($p<0.0001$) from that of a control group,

and the study's authors concluded that if a strong community structure is developed andthe norms of a community are altered, sanitation and hygiene behaviour are likely toimprove.

Sanitation as a Business

Traditionally, sanitation has been regarded as a centrally provided service with little role forthe creativity or energy of business. However, the increased demand created by sanitationmarketing, CLTS, and Community Health Clubs can be met by the development of a vibrantlocal private sector for producing, marketing, and maintaining low-cost toilets. For example,in Lesotho the national government organised and planned workshops for people to reviewtoilet designs and building methods in its “local latrine builders” programme. The localprivate sector can also be encouraged to become involved in pit-emptying, sale of safelycomposted human excreta as fertilizer, generation of methane from biogas toilets, and theoperation of public toilets.

Approaches Emphasizing Low Cost

Many sanitation advocates now place the affordability of the toilets at the centre of theplanning process. A common strategy is to encourage people to start with the simplest type
of improved pit latrine (see section 3 in Text S1) and then to progress over time towardshigher-specification and higher-cost toilets—the “sanitation ladder.” The critical and mostcost-effective step on this ladder, for both health and social reasons, is the first step fromopen defecation to fixed-location defecation; the subsequent steps up the ladder may yieldsmaller incremental benefits.

Approaches Specific to Urban Sanitation

Most successful demand-led approaches have been developed in rural contexts. Urbansanitation is much more complex, mainly because of higher population densities, lesscoherentcommunity structures, and the absence of opportunities for open defecation.

Urban sanitation must extend beyond the household acquisition of a toilet to a systemsbased approach that covers the removal, transport, and safe treatment or disposal ofexcreta (see section 4 in Text S1).

For on-site urban sanitation systems, pit-emptying services are common in middle-incomecountries where householders can afford the cost, but less common in poorer countries.

However, in Maputo, Mozambique, a small community-based association has developed apit emptying/septic tank desludging service using self-propelled machines to provide service
in unplanned areas of the city]. For off-site or centralised systems, simplified or “condominial” sewerage systems, in which sewers are placed inside housing blocks andthen discharged into conventional sewers if there are any nearby or led to a simple localwastewater treatment plant, can provide the same level of service as conventional seweragebut at around one-third to one-half of the cost .

In densely populated low-income urban areas, community-managed sanitation blocks, usedonly by community members who pay a monthly fee for operation and maintenance, are anoption. Public sanitation blocks that can be used by anyone,

normally for a small fee peruse, can be an acceptable alternative provided that they are well operated and maintainedand have 24-hour access. Finally, in less densely populated low-income urban areas, onsitesanitation options of the types described in section 3 in Text S1 for rural areas are oftenapplicable.

The Role of the Health Sector in Improving Sanitation

Sanitation promotion is one of the most important roles the health sector can have inenvironmental health planning, because behaviours must be changed to increasehouseholders' demand for and sustained use of sanitation, especially in rural areas wherethe pressure for change is lower. Thus, two of the most promising large-scale sanitation
programmes in Africa are centred around demand creation and are both led and deliveredby the Ministry of Health and its associated structures
Sanitation can be promoted by the health sector through a stand-alone programme such assanitation marketing or CLTS or included in disease-specific control programmes such asthe 'SAFE' approach to trachoma. Alternatively, it can be incorporated into a widerintegrated community health package such as Ethiopia's HEP (Health Extension

Programme), which was developed in 2004 to prevent the five most prevalent diseases in thecountry; safe sanitation and hygiene became a major focus within HEP because of therecognition that these diseases are all linked with poor environmental health.
Promotion alone by the health sector may be insufficient, however, to ensure sanitationadoption and maintenance. A "carrot and stick" approach may be needed in whichsanitation coverage is increased through a combination of community-based promotion andenforcement of national or local legislation that every house must have a toilet. In manycountries, Environmental Health Officers are responsible for ensuring the sanitarycondition and hygienic emptying of toilets, and have the power to sanction dissentinghouseholds with fines and court action. This enforcement role of the health sector isparticularly important in urban areas where high-density living increases the risks of feacalcontamination of the environment and where one person's lack of sanitation can affect thehealth of many other people.
The health sector also has an important role to play in advocacy and leadership. Politiciansand the general public listen to doctors. That puts an onus on the medical profession tospeak out on all important health issues, including sanitation.

Historically, this has not happened. Thus, in 2008, *The Lancet* wrote, "the shamefully weak presence of the healthsector in advocating for improved access to water and sanitation is incomprehensible andcompletely short-sighted"
Given the huge potential health-cost savings achieved through improved sanitation, thehealth sector should be advocating for stronger institutional leadership, stronger nationalplanning, and the establishment of clear responsibilities and budget lines for sanitation.

Unfortunately, although the international health community puts large human andfinancial resources into many low- to medium-cost health interventions such asimmunization and bed net distribution, it has been slow to act on the evidence

showing thatsanitation promotion and hygiene promotion are among the most cost-effective publichealth interventions available to developing countries.
Finally, the well-honed epidemiology and surveillance skills of health professionals mustalso now be applied to sanitation to establish clear links between national healthinformation systems and sanitation planning and financing, which has historically beenseparate from health in most countries.

Constraints to Success in Sanitation

The lack of national policies is a major constraint to success in sanitation (see section 5 inText S1 for additional information on this and other constraints). Governments in generaland health ministries in particular cannot play their key roles as facilitators and regulators
of sanitation without policies that support the transformation of national institutions intolead institutions for sanitation, that increase focus on household behaviours andcommunity action, that promote demand creation, and that enable health systems toincorporate sanitation and hygiene. Other constraints to success in sanitation arepopulation growth and increasingly high population densities in urban and periurban areasof developing countries. Furthermore, most of the people who lack improved sanitation liveon less than $2 per day, which makes high-cost, high-technology sanitation solutionsinappropriate .

Finally, although macroeconomic analysis shows that sanitation generates economicbenefit, the benefit does not necessarily accrue to the person who invests in the improvedsanitation. So the economics at the household level remain a constraint to success insanitation—many people are simply unable or unwilling to invest, given all the othercompeting demands on their money. This under-researched topic is currently underinvestigation by the WASH Cost Project, which is studying the life-cycle costs of water,sanitation, and hygiene services in rural and periurban areas in four countries.

Strategies to Achieve Success in Sanitation

Sanitation is a complex topic, with links to health and to social and economic development.
It affects many but is championed by few. From our analysis of the situation, we believethat three major strategies could achieve success in sanitation.
The most important of these strategies is political leadership, which is manifested byestablishing clear institutional responsibility and specific budget lines for sanitation, and byensuring that public sector agencies working in health, in water resources, and in utilityservices work together better. The regional sanitation conference declarations releasedduring the International Year of Sanitation, in which many government ministers werepersonally involved, were an important step forward. In addition, the biennial global reportson sanitation and drinking water published by the World Health Organization and UNICEFcontribute towards political leadership and aid effectiveness by publicising the sanitationwork of both developing country governments and support agencies.
The second strategy is the shift from centralised supply-led infrastructure provision todecentralised, people-centred demand creation coupled with support to service providers tomeet that demand. This strategy is transforming sanitation from a minor grant-baseddevelopment sector into a major area of human economic activity and

inherently addressesthe problem of affordability, since people install whatever sanitation systems they can affordand subsequently upgrade them as economic circumstances permit.

The final strategy is the full involvement of the health sector in sanitation. The health sectorhas a powerful motivation for improving sanitation, and much strength to contribute toachieving this goal. The Declaration of Alma Ata in 1978 emphasised the importance ofprimary health care and included “an adequate supply of safe water and basic sanitation”as one of its eight key elements. Many years have passed since this Declaration, and thebody of evidence about sanitation has increased substantially. The health sector now needs
to reassert its commitment and leadership to help achieve a world in which everybody hasaccess to adequate sanitation.

Solid waste disposal

Disposal of solid waste is most commonly conducted in landfills, but incineration, recycling,composting and conversion to bio-fuels are also avenues. In the case of landfills,advanced countries typically have rigid protocols for daily cover with topsoil, whereunderdeveloped countries customarily rely upon less stringent protocols.[9] The importanceof daily cover lies in the reduction of vector contact and spreading of pathogens. Daily coveralso minimises odour emissions and reduces windblown litter. Likewise, developedcountries typically have requirements for perimeter sealing of the landfill with clay-typesoils to minimize migration of leachate that could contaminate groundwater (and hencejeopardize some drinking water supplies).
For incineration options, the release of air pollutants, including certain toxic components is an attendant adverse outcome. Recycling and bio-fuel conversion are the sustainableoptions that generally have superior life cycle costs, particularly when total ecologicalconsequences are considered Composting value will ultimately be limited by the marketdemand for compost product.

Wastewater collection

The standard sanitation technology in urban areas is the collection of wastewater in sewers,
its treatment in wastewater treatment plants for reuse or disposal in rivers, lakes or thesea. Sewers are either combined with storm drains or separated from them as sanitarysewers. Combined sewers are usually found in the central, older parts or urban areas.

Heavy rainfall and inadequate maintenance can lead to combined sewer overflows orsanitary sewer overflows, i.e. more or less diluted raw sewage being discharged into theenvironment. Industries often discharge wastewater into municipal sewers, which cancomplicate wastewater treatment unless industries pre-treat their discharges.

The high investment cost of conventional wastewater collection systems are difficult toafford for many developing countries. Some countries have therefore promoted alternativewastewater collection systems such as condominial sewerage, which uses smaller diameterpipes at lower depth with different network layouts from conventional sewerage.

Wastewater treatment
In developed countries treatment of municipal wastewater is now widespread, but not yetuniversal (for an overview of technologies see wastewater treatment). In developingcountries most wastewater is still discharged untreated into the environment. For example,in Latin America only about 15% of collected sewerage is being treated (see water andsanitation in Latin America)

Reuse of wastewater
The reuse of untreated wastewater in irrigated agriculture is common in developingcountries. The reuse of treated wastewater in landscaping, especially on golf courses,irrigated agriculture and for industrial use is becoming increasingly widespread.
In many suburban and rural areas households are not connected to sewers. They dischargetheir wastewater into septic tanks or other types of on-site sanitation.

RELEVANT ASPECTS TO BE CONSIDERED IN ORDER TO MANAGE GOOD SANITATION

Disinfectants are substances that are applied to non-living objects to destroymicroorganisms that are living on the objects.[1] Disinfection does not necessarily kill allmicroorganisms, especially nonresistant bacterial spores; it is less effective thansterilisation, which is an extreme physical and/or chemical process that kills all types of life. Disinfectants are different from other antimicrobial agents such as antibiotics, which
destroy microorganisms within the body, and antiseptics, which destroy microorganisms onliving tissue. Disinfectants are also different from biocides — the latter are intended todestroy all forms of life, not just microorganisms. Disinfectants work by destroying the cellwall or microbes or interfering with the metabolism. Sanitisers are substances that simultaneously clean and disinfect.[2]
Bacterial endospores are most resistant to disinfectants, but some viruses and bacteria alsopossess some tolerance.
Disinfectants are frequently used in hospitals, dental surgeries, kitchens, and bathrooms tokill infectious organisms.
They are several types of disinfectants which range from air disinfectants, Alcohol, Aldehydes, Oxdising agents, Phelonics. Quarter nary ammonium compounds, Silver andcopper alloy surfaces among others. Phenol is the standard, and the corresponding ratingsystem is called the "Phenol coefficient". The disinfectant to be tested is compared withphenol on a standard microbe. Those that are less effective have a coefficient

Environmental epidemiology
Environmental epidemiology is the branch of epidemiology concerned with discovery ofthe environmental exposures that contribute to or protect against injuries, illnesses,developmental conditions, disabilities, and deaths; and identification of public health andhealth care actions to avoid, prepare for, and effectively manage the risks associated withharmful exposures. Environmental epidemiology studies external factors that affect theincidence, prevalence, and geographic range of health conditions. These factors may benaturally occurring or may be introduced into environments where people live, work, andplay.

Environmental epidemiology seeks to:
1. understand who is most vulnerable and sensitive to an exposure,
2. evaluate mechanisms of action of environmental exposures,
3. identify public health and health care policies and measures to manage risks, and
4. evaluate effectiveness, costs, and benefits of these policies and measures, as well asprovide evidence for accountability.
Environmental epidemiology research can inform risk assessments; development ofstandards and other risk management activities; and estimates of the co-benefits and coharms
of policies designed to reduce global environment change, including policiesimplemented in other sectors (e.g. food and water) that can affect human health.

Environmental health
Environmental health is the branch of public health that is concerned with all aspects ofthe natural and built environment that may affect human health. Other terms that concern
or refer to the discipline of environmental health include **environmental public health** and**environmental health and protection**.
Environmental health is defined by the World Health Organization as:
Those aspects of the human health and disease that are determined by factors in theenvironment. It also refers to the theory and practice of assessing and controllingfactors in the environment that can potentially affect health.
Environmental health as used by the WHO Regional Office for Europe, includes both thedirect pathological effects of chemicals, radiation and some biological agents, and the effects(often indirect) on health and well being of the broad physical, psychological, social andcultural environment, which includes housing, urban development, land use and transport.

Environmental health services are defined by the World Health Organization as:those services which implement environmental health policies through monitoringand control activities. They also carry out that role by promoting the improvement ofenvironmental parameters and by encouraging the use of environmentally friendlyand healthy technologies and behaviours. They also have a leading role in developingand suggesting new policy areas.
Environmental health practitioners may be known as sanitarians, public health inspectors,environmental health specialists, environmental health officers or environmental healthpractitioners. In many European countries physicians and veterinarians are involved inenvironmental health. Many states in the United States require that individuals haveprofessional licenses in order to practice environmental health. California state law definesthe scope of practice of environmental health as follows:

The environmental health profession had its modern-day roots in the sanitary and publichealth movement of the United Kingdom. This was epitomized by Sir Edwin Chadwick, whowas instrumental in the repeal of the poor laws and was the founding president of theAssociation of Public Sanitary Inspectors in 1884, which today is the Chartered Institute ofEnvironmental Health.
Environmental medicine

Environmental medicine may be seen as the medical branch of the broader field ofenvironmental health. Terminology is not fully established, and in many Europeancountries they are used interchangeably.

Environmental health science

Environmental health is the branch of public health that is concerned with all aspects ofthe natural and built environment that may affect human health. Other terms that refer tothe discipline of environmental health include **environmental public health** and
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"Scope of practice in environmental health" means the practice of environmental health byregistered environmental health specialists in the public and private sector within themeaning of this article and includes, but is not limited to, organization, management,education, enforcement, consultation, and emergency response for the purpose ofprevention of environmental health hazards and the promotion and protection of the publichealth and the environment in the following areas: food protection; housing; institutional
environmental health; land use; community noise control; recreational swimming areas andnwaters; electromagnetic radiation control; solid, liquid, and hazardous materials
management; underground storage tank control; on-site septic systems; vector control;drinking water quality; water sanitation; emergency preparedness; and milk and dairy sanitation.

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Chadwick, whowas instrumental in the repeal of the poor laws and was the founding president of theAssociation of Public Sanitary Inspectors in 1884, which today is the Chartered Institute ofEnvironmental Health.

Environmental health concerns

Environmental health addresses all human-health-related aspects of both the naturalenvironment and the built environment. Environmental health concerns include:

· Air quality, including both ambient outdoor air and indoor air quality, which alsocomprises concerns about environmental tobacco smoke.
· Body art safety, including tattooing, body piercing and permanent cosmetics.
· Climate change and its effects on health.
· Disaster preparedness and response.
· Food safety, including in agriculture, transportation, food processing, wholesale andretail distribution and sale.
· Hazardous materials management, including hazardous waste management,contaminated site remediation, the prevention of leaks from underground storagetanks and the prevention of hazardous materials releases to the environment andresponses to emergency situations resulting from such releases.
· Housing, including substandard housing abatement and the inspection of jails andprisons.
· Childhood lead poisoning prevention.
· Land use planning, including smart growth.
· Liquid waste disposal, including city wastewater treatment plants and on-site wastewater disposal systems, such as septic tank systems and chemical toilets.
· Medical waste management and disposal.
· Noise pollution control.
· Occupational health and industrial hygiene.
· Radiological health, including exposure to ionizing radiation from X-rays orradioactive isotopes.
· Recreational water illness prevention, including from swimming pools, spas andocean and freshwater bathing places.
· Safe drinking water.
· Solid waste management, including landfills, recycling facilities, composting andsolid waste transfer stations.
· Toxic chemical exposure whether in consumer products, housing, workplaces, air,water or soil.
· Vector control, including the control of mosquitoes, rodents, flies, cockroaches andother animals that may transmit pathogens.
· Air Pollution
· *Environmental Health Perspectives*
· Globalization and Health
· Noise Pollution
· Water Pollution

Determinants of health

The LaLonde report suggests that there are four general determinants of health including*human biology*, *environment*, *lifestyle*, and *healthcare services* Thus, health is maintainedand improved not only through the advancement and application of

health science, but alsothrough the efforts and intelligent lifestyle choices of the individual and society.
A major environmental factor is water quality, especially for the health of infants andchildren in developing countries.
Studies show that in developed countries, the lack of neighborhood recreational space thatincludes the natural environment leads to lower levels of neighborhood satisfaction andhigher levels of obesity; therefore, lower overall well being. Therefore, the positivepsychological benefits of natural space in urban neighborhoods should be taken intoaccount in public policy and land use.

Maintaining health

Achieving health and remaining healthy is an ongoing process. Effective strategies forstaying healthy and improving one's health include the following elements:

Social Activity

Personal health depends partially on the social structure of one's life. The maintenance ofstrong social relationships is linked to good health conditions, longevity, productivity, and apositive attitude. This is due to the fact that positive social interaction as viewed by theparticipant increases many chemical levels in the brain which are linked to personality andintelligence traits.

Hygiene

Hygiene is the practice of keeping the body clean to prevent infection and illness, and theavoidance of contact with infectious agents. Hygiene practices include bathing, brushingand flossing teeth, washing hands especially before eating, washing food before it is eaten,cleaning food preparation utensils and surfaces before and after preparing meals, and manyothers. This may help prevent infection and illness. By cleaning the body, dead skin cellsare washed away with the germs, reducing their chance of entering the body.

Stress management

Prolonged psychological stress may negatively impact health, and has been cited as a factorin cognitive impairment with aging, depressive illness, and expression of disease. Stress management is the application of methods to either reduce stress or increase tolerance tostress. Relaxation techniques are physical methods used to relieve stress. Psychologicalmethods include cognitive therapy, meditation, and positive thinking which work byreducing response to stress. Improving relevant skills and abilities builds confidence, whichalso reduces the stress reaction to situations where those skills are applicable.
Reducing uncertainty, by increasing knowledge and experience related to stress-causingsituations, has the same effect. Learning to cope with problems better, such as improvingproblem solving and time management skills, may also reduce stressful reaction toproblems. Repeatedly facing an object of one's fears may also desensitize the fight-or-flightresponse with respect to that stimulus—e.g., facing bullies may reduce fear of bullies.

Health care

One's overall well-being is the definiton of health

Health care is the prevention, treatment, and management of illness and the preservation ofmental and physical well being through the services offered by the medical, nursing, andallied health professions.

Workplace wellness programs

Workplace wellness programs are recognized by an increasingly large number of companiesfor their value in improving the health and well-being of their employees, and for increasingmorale, loyalty, and productivity. Workplace wellness programs can include things likeonsite fitness centers, health presentations, wellness newsletters, access to healthcoaching, tobacco cessation programs and training related to nutrition, weight and stressmanagement. Other programs may include health risk assessments, health screenings andbody mass index monitoring.

Role of science in health

Health science is the branch of science focused on health, and it includes many subdisciplines. There are two approaches to health science: the study and research of thehuman body and health-related issues to understand how humans (and animals) function,and the application of that knowledge to improve health and to prevent and cure diseases.

Sources

Health research builds primarily on the basic sciences of biology, chemistry, and physics aswell as a variety of multidisciplinary fields (for example medical sociology). Some of theother primarily research-oriented fields that make exceptionally significant contributions tohealth science are biochemistry, epidemiology, and genetics.

Application

Applied health sciences also endeavor to better understand health, but in addition they tryto directly improve it. Some of these are: biomedical engineering, biotechnology, nursing,nutrition, pharmacology, pharmacy, public health (see above), psychology, physical therapy,and medicine. The provision of services to maintain or improve people's health is referred toas health care (see above)

Water pollution

Water pollution is the contamination of water bodies such as lakes, rivers, oceans, andgroundwater. All water pollution affects organisms and plants that live in these waterbodies and in almost all cases the effect is damaging either to individual species andpopulations but also to the natural biological communities. It occurs when pollutants aredischarged directly or indirectly into water bodies without adequate treatment to removeharmful constituents.

Water pollution categories

Surface water and groundwater have often been studied and managed as separateresources, although they are interrelated. Sources of surface water pollution are generallygrouped into two categories based on their origin.

Point source pollution

Point source pollution refers to contaminants that enter a waterway through a discreteconveyance, such as a pipe or ditch. Examples of sources in this category includedischarges from a sewage treatment plant, a factory, or a city storm drain. The U.S. Clean
Water Act (CWA) defines point source for regulatory enforcement purposes.[8] The CWAdefinition of point source was amended in 1987 to include municipal storm sewer systems,as well as industrial stormwater, such as from construction sites.[9]

Non-point source pollution

Non-point source (NPS) pollution refers to diffuse contamination that does not originate
from a single discrete source. NPS pollution is often accumulative effect of small amounts ofcontaminants gathered from a large area. The leaching out of nitrogen compounds fromagricultural land which has been fertilized is a typical example. Nutrient runoff in
stormwater from "sheet flow" over an agricultural field or a forest are also cited as examplesof NPS pollution.

Contaminated storm water washed off of parking lots, roads and highways, called urbanrunoff, is sometimes included under the category of NPS pollution. However, this runoff istypically channeled into storm drain systems and discharged through pipes to local surfacewaters, and is a point source. However where such water is not channeled and drainsdirectly to ground it is a non point source.

Groundwater pollution

Interactions between groundwater and surface water are complex. Consequently, groundwater pollution, sometimes referred to as **groundwater contamination**, is not as
easily classified as surface water pollution. By its very nature, groundwater aquifers are
susceptible to contamination from sources that may not directly affect surface water bodies,and the distinction of point vs. nonpoint source may be irrelevant. A spill of a chemicalcontaminant on soil, located away from a surface water body, may not necessarily createpoint source or non-point source pollution, but nonetheless may contaminate the aquiferbelow. Analysis of groundwater contamination may focus on soil characteristics andhydrology, as well as the nature of the contaminant itself. *See Hydrogeology.*

Causes of water pollution

The specific contaminants leading to pollution in water include a wide spectrum ofchemicals, pathogens, and physical or sensory changes such as elevated temperature anddiscoloration. While many of the chemicals and substances that are regulated may benaturally occurring (calcium, sodium, iron, manganese, etc.) the concentration is often thekey in determining what is a natural component of water, and what is a contaminant.

Oxygen-depleting substances may be natural materials, such as plant matter (e.g. leavesand grass) as well as man-made chemicals. Other natural and anthropogenic substancesmay cause turbidity (cloudiness) which blocks light and disrupts plant growth, and clogsthe gills of some fish species.

Many of the chemical substances are toxic. Pathogens can produce waterborne diseases ineither human or animal hosts. Alteration of water's physical chemistry include acidity(change in pH), electrical conductivity, temperature, and eutrophication. Eutrophication isan increase in the concentration of chemical nutrients in an ecosystem to an extent thatincreases in the primary productivity of the ecosystem. Depending on the degree of
eutrophication, subsequent negative environmental effects such as anoxia and severereductions in water quality, fish, and other animal populations may occur.

Chemical and other contaminants
Contaminants may include organic and inorganic substances.
Organic water pollutants include:
· Detergents
· Disinfection by-products found in chemically disinfecteddrinking water, such aschloroform
· Food processing waste, which can include oxygen-demanding substances, fats andgrease
· Insecticides and herbicides, a huge range of organohalides and other chemicalcompounds
· Petroleum hydrocarbons, including fuels (gasoline, diesel fuel, jet fuels, and fuel oil)and lubricants (motor oil), and fuel combustion byproducts, from storm water runoff
· Tree and bush debris from logging operations
· Volatile organic compounds (VOCs), such as industrial solvents, from improperstorage. Chlorinated solvents, which are dense non-aqueous phase liquids (DNAPLs),may fall to the bottom of reservoirs, since they don't mix well with water and aredenser.
· Various chemical compounds found in personal hygiene and cosmetic products
Inorganic water pollutants include:
· Acidity caused by industrial discharges (especially sulfur dioxide from power plants)
· Ammonia from food processing waste
· Chemical waste as industrial by-products
· Fertilizers containing nutrients--nitrates and phosphates--which are found in stormwater runoff from agriculture, as well as commercial and residential use[15]
· Heavy metals from motor vehicles (via urban stormwater runoff)[15][16] and acid minedrainage
· Silt (sediment) in runoff from construction sites, logging, slash and burn practices orland clearing sites

Macroscopic pollution—large visible items polluting the water—may be termed "floatables"
in an urban stormwater context, or marine debris when found on the open seas, and caninclude such items as:
· Trash (e.g. paper, plastic, or food waste) discarded by people on the ground, and that
are washed by rainfall into storm drains and eventually discharged into surface waters
· Nurdles, small ubiquitous waterborne plastic pellets
· Shipwrecks, large derelict ships

Thermal pollution

Thermal pollution is the rise or fall in the temperature of a natural body of water caused byhuman influence. A common cause of thermal pollution is the use of water as a coolant bypower plants and industrial manufacturers. Elevated water temperatures decreases oxygenlevels (which can kill fish) and affects ecosystem composition, such as invasion by newthermophilic species. Urban runoff may also elevate temperature in surface waters.Thermal pollution can also be caused by the release of very cold water from the base ofreservoirs into warmer rivers.

Transport and chemical reactions of water pollutants

Most water pollutants are eventually carried by rivers into the oceans. In some areas of theworld the influence can be traced hundred miles from the mouth by studies using hydrologytransport models. Advanced computer models such as SWMM or the DSSAM Model havebeen used in many locations worldwide to examine the fate of pollutants in aquaticsystems. Indicator filter feeding species such as copepods have also been used to studypollutant fates in the New York Bight, for example. The highest toxin loads are not directlyat the mouth of the Hudson River, but 100 kilometers south, since several days arerequired for incorporation into planktonic tissue. The Hudson discharge flows south alongthe coast due to coriolis force. Further south then are areas of oxygen depletion, caused bychemicals using up oxygen and by algae blooms, caused by excess nutrients from algal celldeath and decomposition. Fish and shellfish kills have been reported, because toxins climbthe food chain after small fish consume copepods, then large fish eat smaller fish, etc. Eachsuccessive step up the food chain causes a stepwise concentration of pollutants such asheavy metals (e.g. mercury) and persistent organic pollutants such as DDT. This is knownas biomagnification, which is occasionally used interchangeably with bioaccumulation.

Large gyres (vortexes) in the oceans trap floating plastic debris. The North Pacific Gyre forexample has collected the so-called "Great Pacific Garbage Patch" that is now estimated at100 times the size of Texas. Many of these long-lasting pieces wind up in the stomachs ofmarine birds and animals. This results in obstruction of digestive pathways which leads toreduced appetite or even starvation.

Many chemicals undergo reactive decay or chemically change especially over long periods oftime in groundwater reservoirs. A noteworthy class of such chemicals is the chlorinatedhydrocarbons such as trichloroethylene (used in industrial metal degreasing and electronics
manufacturing) and tetrachloroethylene used in the dry cleaning industry (note latestadvances in liquid carbon dioxide in dry cleaning that avoids all use of chemicals). Both ofthese chemicals, which are carcinogens themselves, undergo partial decompositionreactions, leading to new hazardous chemicals (including dichloroethylene and vinylchloride).

Groundwater pollution is much more difficult to abate than surface pollution becausegroundwater can move great distances through unseen aquifers. Non-porous aquifers suchas clays partially purify water of bacteria by simple filtration (adsorption and absorption),dilution, and, in some cases, chemical reactions and biological activity: however, in somecases, the pollutants merely transform to soil contaminants. Groundwater that movesthrough cracks and caverns is not filtered and can be transported as easily as surfacewater. In fact, this can be aggravated by

the human tendency to use natural sinkholes asdumps in areas of Karst topography.
There are a variety of secondary effects stemming not from the original pollutant, but aderivative condition. An example is silt-bearing surface runoff, which can inhibit thepenetration of sunlight through the water column, hampering photosynthesis in aquaticplants.

Measurement of water pollution

Water pollution may be analyzed through several broad categories of methods: physical,
chemical and biological. Most involve collection of samples, followed by specialized analytical tests. Some methods may be conducted *in situ,* without sampling, such astemperature. Government agencies and research organizations have publishedstandardized, validated analytical test methods to facilitate the comparability of resultsfrom disparate testing event.

Sampling

Sampling of water for physical or chemical testing can be done by several methods,depending on the accuracy needed and the characteristics of the contaminant. Manycontamination events are sharply restricted in time, most commonly in association withrain events. For this reason "grab" samples are often inadequate for fully quantifyingcontaminant levels. Scientists gathering this type of data often employ auto-sampler devicesthat pump increments of water at either time or discharge intervals.
Sampling for biological testing involves collection of plants and/or animals from the surfacewater body. Depending on the type of assessment, the organisms may be identified for
biosurveys (population counts) and returned to the water body, or they may be dissected forbioassays to determine toxicity.

Physical testing

Common physical tests of water include temperature, solids concentration and turbidity.

Chemical testing

Water samples may be examined using the principles of analytical chemistry. Manypublished test methods are available for both organic and inorganic compounds.
Frequently-used methods include pH, biochemical oxygen demand (BOD), chemical oxygendemand (COD), nutrients (nitrate and phosphorus compounds), metals (including copper,zinc, cadmium, lead and mercury), oil and grease, total petroleum hydrocarbons (TPH), andpesticides.

Biological testing

Biological testing involves the use of plant, animal, and/or microbial indicators to monitorthe health of an aquatic ecosystem.
For microbial testing of drinking water, see Bacteriological water analysis.

Control of water pollution

Domestic sewage

Domestic sewage is 99.9% pure water, the other 1% are pollutants. These pollutantsalthough small, pose risk on a large scale. In urban areas, domestic sewage is typicallytreated by centralized sewage treatment plants. In the U.S., most of these plants areoperated by local government agencies. Municipal treatment plants are designed to controlconventional pollutants: BOD and suspended solids. Well-designed and operated systems
(i.e., secondary treatment or better) can remove 90 percent or more of these pollutants.

Some plants have additional sub-systems to treat nutrients and pathogens. Most municipalplants are not designed to treat toxic pollutants found in industrial wastewater.

Cities with sanitary sewer overflows or combined sewer overflows employ one or moreengineering approaches to reduce discharges of untreated sewage, including:

· utilizing a green infrastructure approach to improve stormwater managementcapacity throughout the system

· repair and replacement of leaking and malfunctioning equipment

· increasing overall hydraulic capacity of the sewage collection system (often a veryexpensive option).

A household or business not served by a municipal treatment plant may have an individualseptic tank, which treats the wastewater on site and discharges into the soil. Alternatively,domestic wastewater may be sent to a nearby privately-owned treatment system (e.g. in arural community).

Industrial wastewater

Some industrial facilities generate ordinary domestic sewage that can be treated bymunicipal facilities. Industries that generate wastewater with high concentrations ofconventional pollutants (e.g. oil and grease), toxic pollutants (e.g. heavy metals, volatileorganic compounds) or other nonconventional pollutants such as ammonia, needspecialized treatment systems. Some of these facilities can install a pre-treatment system toremove the toxic components, and then send the partially-treated wastewater to themunicipal system. Industries generating large volumes of wastewater typically operate theirown complete on-site treatment systems.

Some industries have been successful at redesigning their manufacturing processes toreduce or eliminate pollutants, through a process called pollution prevention.

Heated water generated by power plants or manufacturing plants may be controlled with:

· cooling ponds, man-made bodies of water designed for cooling by evaporation,convection, and radiation

· cooling towers, which transfer waste heat to the atmosphere through evaporationand/or heat transfer

· cogeneration, a process where waste heat is recycled for domestic and/or industrialheating purposes.

Agricultural wastewater

Nonpoint source controls

Sediment (loose soil) washed off fields is the largest source of agricultural pollution in theUnited States.[10] Farmers may utilize erosion controls to reduce runoff flows

and retain soilon their fields. Common techniques include contour plowing, crop mulching, crop rotation,planting perennial crops and installing riparian buffers. Nutrients (nitrogen and phosphorus) are typically applied to farmland as commercialfertilizer; animal manure; or spraying of municipal or industrial wastewater (effluent) orsludge. Nutrients may also enter runoff from crop residues, irrigation water, wildlife, andatmospheric deposition.[23]:p. 2-9 Farmers can develop and implement nutrient management,plans to reduce excess application of nutrients.
To minimize pesticide impacts, farmers may use Integrated Pest Management (IPM)techniques (which can include biological pest control) to maintain control over pests, reducereliance on chemical pesticides, and protect water quality.

Point source wastewater treatment
Farms with large livestock and poultry operations, such as factory farms, are called*concentrated animal feeding operations* or *confined animal feeding operations* in the U.S. andare being subject to increasing government regulation. Animal slurries are usually treatedby containment in lagoons before disposal by spray or trickle application to grassland.
Constructed wetlands are sometimes used to facilitate treatment of animal wastes, as areanaerobic lagoons. Some animal slurries are treated by mixing with straw and composted athigh temperature to produce a bacteriologically sterile and friable manure for soilimprovement.

Construction site stormwater
.Sediment from construction sites is managed by installation of:
· erosion controls, such as mulching and hydroseeding, and
· sediment controls, such as sediment basins and silt fences.
Discharge of toxic chemicals such as motor fuels and concrete washout is prevented by use
of:
· spill prevention and control plans, and
· specially-designed containers (e.g. for concrete washout) and structures such as overflow controls and diversion berms.

Urban runoff (stormwater)
Effective control of urban runoff involves reducing the velocity and flow of stormwater, aswell as reducing pollutant discharges. Local governments use a variety of stormwatermanagement techniques to reduce the effects of urban runoff. These techniques, called bestmanagement practices (BMPs) in the U.S., may focus on water quantity control, whileothers focus on improving water quality, and some perform both functions.
Pollution prevention practices include low impact development techniques, installation ofgreen roofs and improved chemical handling (e.g. management of motor fuels & oil,fertilizers and pesticides). Runoff mitigation systems include infiltration basins, bioretentionsystems, constructed wetlands, retention basins and similar devices.
Thermal pollution from runoff can be controlled by stormwater management facilities thatabsorb the runoff or direct it into groundwater, such as bioretention systems andinfiltration basins. Retention basins tend to be less effective at reducing

temperature, as themwater may be heated by the sun before being discharged to a receiving stream.

Noise pollution

Noise pollution (or **environmental noise**) is displeasing human-, animal- or machinecreatedsound that disrupts the activity or balance of human or animal life. The word *noise*comes from the Latin word *nausea* meaning seasickness.

The source of most outdoor noise worldwide is transportation systems, including motorvehicle noise, aircraft noise and rail noise. Poor urban planning may give rise to noisepollution, since side-by-side industrial and residential buildings can result in noisepollution in the residential area.

Other sources of indoor and outdoor noise pollution are car alarms, emergency servicesirens, office equipment, factory machinery, construction work, groundskeeping equipment,
barking dogs, appliances, power tools, lighting hum, audio entertainment systems,loudspeakers, and noisy people.

Human health effects

Noise health effects are both health and behavioural in nature. The unwanted sound iscalled noise. This unwanted sound can damage physiological and psychological health.

Noise pollution can cause annoyance and aggression, hypertension, high stress levels,tinnitus, hearing loss, sleep disturbances, and other harmful effects. Furthermore, stress
and hypertension are the leading causes to health problems, whereas tinnitus can lead toforgetfulness, severe depression and at times panic attacks.

Chronic exposure to noise may cause noise-induced hearing loss. Older males exposed tosignificant occupational noise demonstrate significantly reduced hearing sensitivity than
their non-exposed peers, though differences in hearing sensitivity decrease with time andthe two groups are indistinguishable by age 79. A comparison of Maabantribesmen, who
were insignificantly exposed to transportation or industrial noise, to a typical U.S.population showed that chronic exposure to moderately high levels of environmental noisecontributes to hearing loss.

High noise levels can contribute to cardiovascular effects and exposure to moderately high
levels during a single eight hour period causes a statistical rise in blood pressure of five toten points and an increase in stress[3] and vasoconstriction leading to the increased bloodpressure noted above as well as to increased incidence of coronary artery disease.

Noise pollution is also a cause of annoyance. A 2005 study by Spanish researchers foundthat in urban areas households are willing to pay approximately four Euros per decibel peryear for noise reduction.

Environmental effects

Noise can have a detrimental effect on animals by causing stress, increasing risk of deathby changing the delicate balance in predator/prey detection and avoidance, and byinterfering with their use of sounds in communication especially in relation to

reproductionand in navigation. Acoustic overexposure can lead to temporary or permanent loss ofhearing.
An impact of noise on animal life is the reduction of usable habitat that noisy areas maycause, which in the case of endangered species may be part of the path to extinction. One ofthe best known cases of damage caused by noise pollution is the death of certain species ofbeached whales, brought on by the loud sound of military sonar.
Noise also makes species communicate louder, which is called Lombard vocal response.

Scientists and researchers have conducted experiments that show whales' song length islonger when submarine-detectors are on. If creatures don't "speak" loud enough, their voicewill be masked by anthropogenic sounds. These unheard voices might be warnings, findingof prey, or preparations of net-bubbling. When one species begins speaking louder, it willmask other species' voice, causing the whole ecosystem to eventually speak louder.
European Robins living in urban environments are more likely to sing at night in placeswith high levels of noise pollution during the day, suggesting that they sing at nightbecause it is quieter, and their message can propagate through the environment moreclearly. Interestingly, the same study showed that daytime noise was a stronger predictor ofnocturnal singing than night-time Light pollution, to which the phenomenon is oftenattributed.
Zebra finches become less faithful to their partners when exposed to traffic noise. Thiscould alter a population's evolutionary trajectory by selecting traits, sapping resourcesnormally devoted to other activities and thus lead to profound genetic and evolutionaryconsequences.

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Course Name : Information Technology

Course Description
This Course is built on the previous acquired knowledge of Computer applications through theoretical lecturers and laboratory sessions. The course explores systems development life cycle (SDLC), describing the data processing cycle, data processing, security issues & concerns in systems protection of its information, office automation, data base management system (DBMS)

Course Objectives
· To expose students to practical knowledge of developing information and database system for organizations and business firms.
· To enable understand how information and data is processed through an automated cycle.
· To help them develop skills in data entry and retrieval within differentcomputer systems.

Course Content
Systems Development Life cycle (SDLC)
· Stages involved in the SDLC include; Problem identification, feasibilitystudy, systems investigation, systems analysis, systems implementation,systems implementation, review and maintenance

Data Processing Cycle
· The input function
· The processing function
· The output function
· The storage function

Data processing operations
· Batch processing
· Real-time processing
· Features of a storage and retrieval system

Security issues/ concerns
· Risks to the computer users
· Risks to hardware
· Physical Access control
· Risks to storage media
· Risks to data
· Best password practice(BPP)
· Telecommunications dangers
· Encryption and other safety measures on telecommunication

Data Base Management systems (DBMS)
· Definition of DBMS
· DBMS structures
· Application program

· Elements of a DBMS
· Facilities offered by database management systems
· Benefits of a DBMS
· Designing a database
· Verification and validation checks

Office Automation
· Spread sheet
· Features of spread sheets
· Word processing
· Microsoft Access
· Internet

Mode of delivery Face to face lectures
Assessment
Coursework 40%
Exams 60%
Total Mark 100%

COMPUTER TECHNIQUES

CHAPTER FIVE

SYSTEMS DEVELOPMENT LIFE CYCLE (SDLC)

5:0 INTRODUCTION

Under this Chapter we shall look at the following:
♦Feasibility study
♦Systems investigation
♦Systems analysis
♦Systems design
♦Systems implementation
♦Review and maintenance

A company or an organisation of any sort will normally have a strategic plan.
This strategic plan could be probably increasing sales by say 30% in the next 5 years.

When such a plan is in place, departments in the organisation will also set their strategies, to ensure that they contribute as required to the overall strategic plan. These departments may include; Production, Marketing, Sales, IT, Human Resource, etc.

Definition
A strategy is a general statement of a business's long-term objectives and goals and the ways by which these will be achieved.

5:1 THE IT STRATEGY

This will always deal with the organisational needs from IT, the organisation's current use of IT and the potential opportunities that IT can bring.
During the evaluation of current use of IT in the organisation, Gaps (differences) can be identified. E.g. does the system meet the desired requirements, are users happy, is the system reliable, etc.

5:2 STAGES IN THE SYSTEMS DEVELOPMENT LIFE CYCLE

This is the cycle that any system, which can be used in an organisation, can be developed through. It is called a cycle because the stages involved in the development will always be continuous and repeat themselves in the same way.

The stages involved in the systems development life cycle include the following in their order

- ♦Problem identification
- ♦Feasibility study
- ♦Systems investigation
- ♦Systems analysis
- ♦Systems design
- ♦Systems implementation
- ♦Review and maintenance

Definition
A system is a collection of activities and elements organised to accomplish a goal.

A computer information system (CIS) is a collection of hardware, software, people procedures and data that work together to provide information essential to running an organisation.
Life cycle -This implies t hat the system changes continually, in other words that, development of computer information system within an organisation is an ongoing activity.

PROBLEM IDENTIFICATION

The SDLC typically begins by identifying a problem or need. It involves a preliminary investigation of a proposed project to determine the need for a new information system.

An end user usually requests this or manger who wants something done that is not presently being done.

The exact problem or flow in the system should be known e.g. slowness resulting in the incompetence of the system, too heavy work than is manageable effectively by the system and areas of poor performance being identified by management which increase the level of indirect expenses.

Possible plans or suggestions with alternative arrangements to the present ones are then forwarded to management in a report - to decide whether to pursue the project further.

If so then management hands the terms of reference to the system analyst. Once the analyst get a go ahead, he conducts a feasibility study within the limits of the terms of reference.

FEASIBILITY STUDY
This is a forma study to decide what type of system can be developed which meets the needs of the organisation.

It involves a brief review of the existing system and the identification of a range of possible alternative solutions.

The systems analyst here will estimate the costs and benefits of the systems with greater accuracy.
The alternative that promises a significant return on the investment will be accepted.

Feasibility study comprises the following:
- Technical feasibility
- Operational feasibility
- Financial feasibility
- Economic feasibility
- Social feasibility or organisational feasibility

1. Technical feasibility
The requirements, as defined in the feasibility study, must be technically achievable. This means that any proposed solution must be capable of being implemented using available hard ware, soft ware and other equipment.

2. Financial feasibility
The certified public accountant will have an in depth role to play at this stage in proceedings. The economic contribution of the whole system must be assessed.

At this level, the cost-benefit analysis will be carried out on all the possible alternatives, to identify the one with best returns.

There are three principal methods of evaluating a capital project

i) **Payback Period**
This method of investment appraisal calculates the length of time a project will take to recoup the initial investment - that is, how long a project will take to pay for itself. The method is based on cash flows.

ii) **Accounting Rate of Return**
This method, also called return on investment, calculates the profits that will be earned by a project and expresses this as a percentage of the capital invested in the project. The higher the rate of return, the higher a project is ranked. This method is based on
accounting results rather than cash flows.

iii) **Discounted Cash Flow (DCF)**
This method can be sub divided into two

♦**Net Present Value (NPV)**
This considers all relevant cash flows associated with a project over the whole of its life and adjusts those occurring in future years to 'present value' by discounting at a rate called the 'cost of capital'.

♦ **Internal rate of return (IRR)**
This involves comparing the rate of return expected from the project calculated On a discounted cash flow basis with the rate used as the cost of capital. Projects with an IRR higher than the cost of capital are worth undertaking.

3. Organisational feasibility
The culture of the organisation, its structure, working practices, behavioural patterns and social systems need to be considered.

After the outlined project specifications are prepared these are presented to users who, with the assistance of technical staff will evaluate each option and make a final choice.

The results of this are included in a feasibility report.

SYSTEMS INVESTIGATION
The systems investigation is a detailed fact finding exercise about the area under consideration.

The following will be considered here by the project team;
♦Determine the inputs, outputs, processing methods and volumes of the current system
♦Examining controls, staffing and costs and also reviews the organisational structure.
♦Also considers the expected growth of the organisation and its future requirements.

The stages involved in this phase of systems development are as follows:

a) Fact finding by means of questionnaires, interviews, observation, reading handbooks, manuals, organisational charts.
b) Fact recording using flow charts, decision tables, narrative descriptions, etc.
c) Evaluation, assessing the strengths and weaknesses of the existing system.

Methods used in obtaining facts about the existing system:

♦**Interviews**
If interviews are conducted effectively, they allow the interviewer to provide information as well as obtain it. This method is the most appropriate for senior management, as other approaches may not be appropriate at executive levels.

♦**Questionnaires**
The use of questionnaires may be useful whenever a limited amount of information is required from a large number of individuals, or where the organisation is decentralised with many 'separate entity' locations. Questions are normally set in such a way that each one is equal to another and the evaluation is done by simply adding the number of 'yes' and 'no'.

♦**Observation**
Here the investigator simply observes/watches the procedures as they occur. The problem here is that people normally tend to behave abnormally especially if they know that they are being watched.

♦**Document Review**
The systems analyst must investigate the document that are used in the system., e.g. organisational charts, procedures mammals and standard operational forms.

The overriding risk is that staff do not follow documented policies and procedure or that these documents have not been properly updated, so this method is best used within other techniques.

SYSTEM ANALYSIS
At this phase, a full documentation of the current system, oftenly using data flow diagrams is done. The ways in which the system can be changed to improve it are then considered, and diagrams are redrawn to reflect the required system.
Definition
A data flow diagram is a recording of the ways in which data is processed, without bothering with the equipment used.

SYSTEMS DESIGN

This involves the detailed systems specification draw up.
The selection of the suitable hardware, software and any required human - computer interface is done at this level.

Hard ware
In general terms, the choice of computer hardware will depend on the following factors:

♦User requirements - will the hardware suite in with the user's requirements.
♦Power - the computer power should be sufficient for the current and future requirements.
♦Reliability - there should be a low expected 'break down' rate. Back-up facilities should be available.
♦Simplicity - simple systems are probably best for small organisations.
♦Ease of communication - the system (hard ware and soft ware) should be able to communicate well with the user.

♦Flexibility - the hardware should be able to meet new requirements as they emerge, especially more powerful CPUs.
♦Cost - it must be affordable.

Soft ware
There are several points to consider while choosing a suitable package. They include the following:
♦**User requirements**
Does the package fit the user's particular requirements? E.g. report production, anticipated volume of data, etc.
♦Processing times
Is the processing times fast enough?
♦Documentation
The documentation should be full and clear to the user e.g. the manuals should easily be understood.
♦Controls - what controls are included in the package e.g. pass words, data validation checks, spell checks, etc.
♦Compatibility - will the package run on the user's computer?
♦Support and maintenance - what support and maintenance services will the software supplier provide?
♦User friendliness
Is the package easy to use? E.g. with means and clear on-screen prompts for the Key board operator.
♦Cost
Comparative costs of different packages should be a low priority. The company Should obtain what it needs for efficient operation. Off-the-shelf packages are a little cheaper that tailor made packages (bespoke).

A key question regarding software is whether to develop a system specially or buy what is already available (off-the-shelf)

Bespoke Packages
These are designed and written either 'in-house' by the IS department or externally by a software house. They are normally developed according to the customer specifications.

Off-the shelf packages
These are packages that are developed and sold to lots of users and intended to handle the most common user requirements.

Advantages of bespoke packages include:
i) The company owns the software and may be able to sell it to other potential users.
ii) The company can be able to do things with its software that competitors cannot do with theirs.
iii) It is likely that the package will be able to do all that is required it to do both now and in the future.

Disadvantages

a) The soft ware may not work at all.
b) There may be long delay before the soft ware is ready.
c) The cost is relatively high compared to off-the-shelf packages.

Advantages of using off-the shelf packages
a) It is available now and ready for use.
b) It is almost certainly cheaper than a specially commissioned product.
c) Expected high quality because software specialist writes them.
d) The software manufacturer will continually update a successful package, and so the version that a customer buys should be up-to-date.
e) Other users will have used the package already, and a well established package should be error-free.
f) These packages (good) are usually well-documented with easy to follow user manuals.

Disadvantages
a) A computer user gets a standardised solution to a data processing task. This may not well suite in the individual user's particular needs.
b) The user is dependent on the supplier for maintenance of the package.

c) There is always no competitive advantage as the competitors can use the same package.

Systems prototypes are likely to be developed here.

Definition
A prototype is a diagrammatic representation of the actual proposed system. It includes the number of hardware required, its configuration, information flow, staff, etc.

SYSTEMS INSTALLATION AND IMPLEMENTATION

Under this phase, the following stages are normally followed;

a) Installation of hardware and software
b) Testing
c) Staff training and production of documentation
d) Conversion of files and database creation
e) Change over

The items/stages in the list above do not necessarily happen in a set chronological order, and some can be done at the same time - for example staff training and system testing can be part of the same operation.

Installation of equipment
Installing a mainframe computer or a large network is a major operation that is carried out by the manufacturer/supplier.

Installation of a PC and other peripheral equipment will need a little bit of planning.

♦They should not be put in small, hot rooms since they generate some heat.
♦Large desks may be advisable, to accommodate a screen and keyboard and leave some free desk space for the officer worker to use.
♦There should be plenty of power sockets-enough to meet future needs as t he system grows, not just immediate needs.
♦If noisy printers are being purchased, it may be advisable to locate these in a separate printer room to cut down the noise for office workers.
♦There should be a telephone near the computer, for communicating with the dealer that provides systems support and advice if there is a problem.
♦The cabling for network connections should consider possible future changes in office key out or in system requirements.

After the installation of hardware, then software can be installed too. The can be done very fast there days since software is available on CD-ROMs and DVDs.

Back up copies of the software may also be got.

Testing
Programs must be thoroughly tested as they are being written and the whole system should also be thoroughly checked before implementation, otherwise there is a danger that the new system will go live with faults that might prove costly.
'Test data' is normally used here.
Test data is fed into the computer/new system and the results from the new system are compared with the already existing/pre-determined results from the old system.
Any deviations can be used to make decisions as to whether the system has passed or failed the test.

Training and documentation
Staff training in the use of information technology is as important as the technology itself. There is no use in having it if people don't know hoe to use it. This can be done through, lectures, discussion meetings, handbooks, trials/tests, internal company magazines, courses, manuals, etc.

Conversion of files
This means converting existing files into a format suitable for the new system.
Large organisations may use conversion software to change over:

Once the new system has been fully and satisfactorily tested, the change over can be made. This may be according to one of four approaches.
♦ Direct change over
♦Parallel running
♦Pilot tests
♦ 'Phased' or 'Stayed' implementation

Direct change over

This is the method of changeover in which the old system is completely replaced by the new system in one move.

This may be unavoidable where the two systems are substantially different, or where extra staff to over seed parallel running are unobtainable.

It is very cheap, but very risky as well and it is best used in business slack periods e.g. Christmas, holidays, etc.

Parallel running
This is a form of changeover where by the old and new systems are run in parallel for a period of time, both processing current data and enabling cross checking to be done.

It is a bit safe (less risky), but if the two systems are different, then cross-checking may be hard or impossible. Also, there is a delay in the cultural implementation of the new system and also a need for more staff to run the two system - an indication of high expenses.

Pilot Operation
This may involve a complete logical part of the whole system being chosen and run as a unit on the new system. If that is shown to be working well, the remaining parts are then transferred.

Gradually the whole system can be transferred in this piece meal fashion.
This method is cheaper and easier to control than parallel running, and provides a greater degree of safety than does a direct change over.

Phased Implementation
This involves a parallel running or direct change over done to a system of a particular section, say a branch of a company.

This method is suitable for very large projects and/or those where distinct parts of the system are geographically dispersed.

At this phase/stage (systems installation) of the SDLC, the internal auditors role is usually very important, especially during the testing of the new system.

This is because the facts he obtains at the testing stage can be used in future evaluation of the system and any audits that may be carried out.

A reference can always be made to the facts generated by the auditor at the testing stage to ensure there are no illegal amendments to the system.

SYSTEMS MAINTENANCE AND REVIEW

Maintenance
This is geared towards keeping the system running smoothly and achieving the intended goals.

There are three types of maintenance activities,

- ♦Corrective maintenance
- ♦ Perfective maintenance
- ♦Adaptive maintenance

Corrective maintenance
Is carried out when there is a systems failure of some kind, for example in processing or in an implementation procedure. Its objective is to ensure that systems remain operational.

Perfective maintenance
Is carried out in order to perfect the software, or to improve software so that the processing inefficiencies are eliminated and performance is enhanced.

Adaptive maintenance
Is carried out to take account of anticipated changes in the processing environment. E.g. the new taxation legislation might require change to be made to payroll software.

Post Implementation Review
This is devoted to uncovering problems in the system so as they can be fine tuned. Also it reviews t he activities involving methods used in developing the system. It is of two steps:

- ♦**Development review**

Here the problems that arose during the development phases of the life cycle are analysed. Major discussions focus on expenditure and the period taken to complete the new system. Positive or negative variances in the expenditures are analysed. Mistakes resulting to negative variances are noted and are unlikely to be repeated in the future like wise positive variances.

Also mistakes that led to the delay are noted and avoided in the future.

- ♦**Implementation Review**

This step investigates the specific successes and problems of system operations. These activities take some time after systems implementation say 1½ years. It is intended to ensure that the system meets the desired goals it was implemented for.

In summary still, the systems development life cycle follows these stages and it is very examinable.

1. Problem identification
2. Feasibility study
3. Systems investigation - detailed
4. Systems analysis
5. Systems design
6. Systems implementation

7. Systems maintenance and review

Question:

a) In the SDLC, which stage go you think directly involves a certified public accountant like you, and what would you be required for?
b) Describe for methods of system change over.
c) Distinguish between off-the shelf and bespoke software.
d) What is feasibility study?

CHAPTER SIX

THE DATA PROCESSING CYCLE

6:0 INTRODUCTION

Under this Chapter we shall look at the following:

- ♦Processing cycle
- ♦ Processing operations
- ♦Storage and retrieval systems
- ♦Classification of files

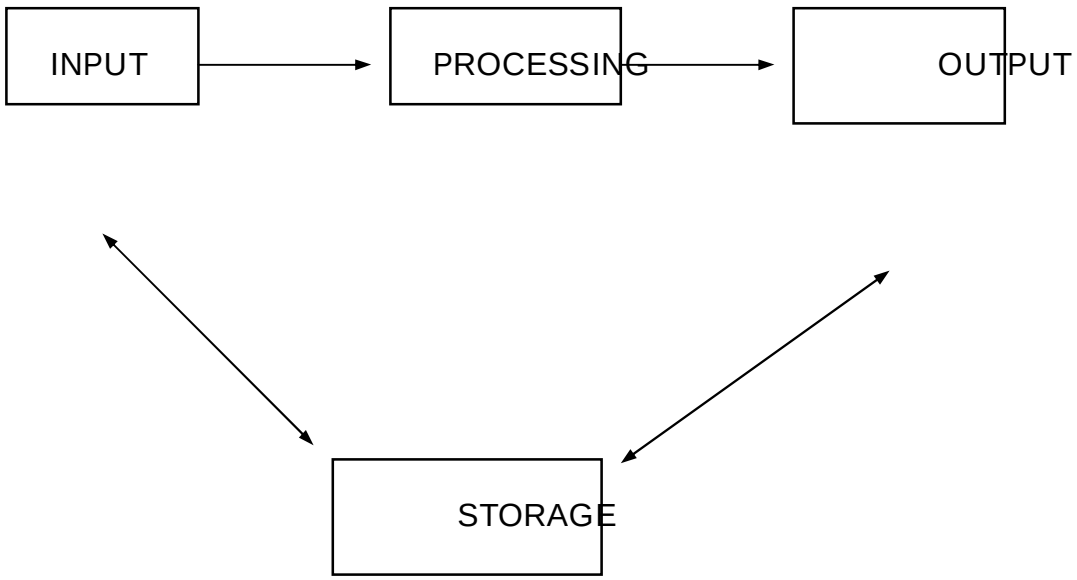
6:1 DATA PROCESSING CYCLE

Data processing, whether it is done manually or by computer, follows a cycle of input, process, output and storage.

Data processing is the acquisition, arrangement, storage and maintenance of data. The use of the computer is just to speed up and allow the use of complicated models compared to other methods.

A cycle refers to a sequence of activities performed in order, that produces expected dependable results.

The DP Cycle



The input function;

This involves gathering/collecting needed data items and entering the items into the information system for processing. This is done by the computer input devices.

Inputs can come from multiple sources. The quality, accuracy and completeness of data will affect the quality of the resulting information.

The processing function
This involves any method for using, handling, processing operations transforms transform data into meaningful information.

Processing creates new information which in turn is returned to files for updating and, or communicated to people.

The output information
Output delivers the results of processing i.e. information which can in turn be communicated to the people known as users of computers or information. This is normally done by the output devices.

The storage information
An information system needs a massive supply of data records and files. In this sense, storage is a vital part of an information system. The storage function also involves updating files to incorporate processed data. Storage can be done into the various types of storage peripherals that you already know.

6:2 DATA PROCESSING OPERATIONS

Files are used to store data and information that will be needed again in future or for the current use.
A file is a collection of records with similar characteristics.

The main types of data processing operations involving files are file updating, file maintenance and file enquiry or file interrogation.

Both manual and computer data processing can be divided into two broad types:
- ♦Batch processing
- ♦Real-time processing

Batch Processing
This is the processing as a group of a number of transactions of a similar kind which have been entered over a period of time to a computer system. Data is entered first, and then gets processed at a go as a group.

E.g. you may enter all the names into the system and then command it to arrange them in alphabetical order.

Transaction is any updating work on a database file. This can include entry of a new record, amending a record, deleting a record, etc.

Real-time processing
This is the continual receiving and rapid processing of data so as to be able or more less instantly to feed back the results of that input to the source of the data.

Real-time processing uses an ‘on-line’ computer system to interrogate or update files as requested rather than batching such requests together for subsequent processing.

On-line
On-line refers to a machine, which is under the direct control of the principal central processor for that hardware configuration.

Modern computers such as PCs are on-line by definition and likewise PCs in a network have permanent access to the server.

6:3 FEATURES OF A STORAGE AND RETRIEVAL SYSTEM

Whatever form documents and recorded information take, if they are to be of any use, they must be kept in a suitable way so that:
a) Authorised people can get to the information they require quickly and easily;
b) Information can be added to, updated and deleted as necessary;
c) Information is safe from fire loss or handling damage as long as it is required;
d) Accessibility, flexibility and security are achieved as cheaply as possible.

Classification of Files
Accessibility is a key point. When information is filed, it has to be filed in such a way that its users know where it is and how to retrieve it later when it is needed.

This means having different files for different types of information, and then holding each file in a particular order. Information might be divided into categories and then held in a particular order within each category.

There are various ways in which information can be grouped together, or classified.
a) By name (for example correspondence relating to a particular person)
b) By geography (for example all documents relating to a particular country, area or city).
c) By subject matter (for example all document relating to a particular contract, transaction or problem).
d) By date (for example all invoices for a certain month or year).
e) By department (for example profits or costs for each department or employee of each department).

Once broad classifications are established, the material can be put into a sequence which will make individual items easier to retrieve.

Again there are various systems for arranging files
a) Alphabetical order - for example customers listed in name order
b) Numerical order - for example invoices listed in numerical order of invoice numbers.
c) Alpha-numerical (A1, A2, A3, B1, B2, and so on).
d) Chronological order -f or example letters within a subject file listed by the date they were written.

CHAPTER SEVEN

SECURITY ISSUES

7:0 INTRODUCTION

Under this topic we shall look at the following,

- Risks to the computer user
- Risks to hardware
- Physical access control
- Controls over personnel
- Risks to storage media
- Risks to data
- Back-up procedures
- Telecommunication risks

A computer system consists not only of hardware, software, data and procedures but also of people.

Because of people, computer systems may be used for both good and bad purposes.

7:1 RISKS TO THE COMPUTER USER

If you have ever worked for long periods at a computer, you may have experienced some discomfort. This might have been caused by your use of the screen or the keyboard.

The VDU

If the screen is too bright, it can cause eyestrain. There are two ways of dealing with the problem. The first is to turn down the brightness; all monitors have a brightness and a contrast switch.
The second is to fit some kind of anti glare filter. All VDUs must have a swivel and tilt capability.

The physical health matters related to computer that have received the most attention recently are the following:-

1. Eye strain and headache

VDUs require using the eyes at close range for a long time, this can create eye strain, headaches and double vision.

And this is normally when the screen is too bright. To avoid this, take a 15 minute break every hour or two. Turn the brightness down.

Use of special anti-glare screen coatings and glare filters. Keep everything
You are
focusing on at about the same distance e.g. the screen, key board, document holder containing your work.

Clean the screen of dust from time to time.

2. Back on neck pain

Many people work at VDU screens and key boards that are in improper positions resulting in back and neck pain.

To avoid such problems;

♦Make sure the equipment is adjustable. Your chair should be adjustable for height and angle and should have good back support.
♦The table on which the monitor stands should be adjustable.
♦The monitor should be detachable.
♦ Document holders should be adjustable.

3. Electro magnetic fields effects
Like many household appliances, VDUs generate invisible electro magnetic fields (EMF) emissions which can pass through the human body.

Recommendations include;
♦Use of low emission monitors.
♦Computer users should sit 2 feet or more from screens and at least 3 feet from neighbouring terminals, as the strongest fields are emitted from the sides and back sides of terminals.
♦Use of glare filters which also reduce the emissions getting to an individual from the screen.

Repetitive Strain Injury (RSI)
Data entry operators in some companies may make as many keystrokes a day as possible. Some have fallen victim to a disorder known as RSI. This name is given to this disorder, which results from fast repetitive work that can cause neck, wrist, hand and arm pains.

Avoidance of RSI includes;
♦Taking short rest breaks
♦Getting plenty of sleep and exercise
♦Loosing weight, sitting straight
♦ Learning stress management techniques

Other computer health risks include:
♦Injury from electric shock

7:2 RISKS TO HARDWARE
Threats to hardware security are computer crimes including virus, electronic break-ins and natural, etc. Keeping information private in part depends on keeping computer systems safe from criminal acts, natural hazards and other threats.

Physical Threats

Fire and Flood
Fire is the most serious hazard to computer systems. Destruction of data can be even more costly than the destruction of hardware.

A fire safety plan is an essential feature of security procedures. It includes;

♦Site preparation - appropriate building materials, fire doors, etc.
♦Detection - e.g. smoke detectors

♦Extinguishing - e.g. sprinklers
♦Training staff in observing fire safety procedures e.g. the smoking in computer rooms

Water is a serious hazard. Flooding and water damage are often encountered following fire fighting activities else where in a building.

This problem can be countered by water proof ceiling and floors together with provision of adequate drainage. In some areas, floods are a natural hazards and therefore basements are generally not regarded as appropriate sites for computers.

Weather
The weather may be a threat. Wind, rain and storms can all cause substantial damage to buildings. Lightning and electrical storms pose an additional threat, as they can play havoc with power supply, causing power failures and power surges.

One way of combating this is by the use of un interrupted (protected) power supplies (UPS) Power failure may be solved by obtaining a separate generator.

Theft
Office break-ins are common. This can be combated by use of burglar proof windows and doors, etc.

7:3 PHYSICAL ACCESS CONTROL
The way to minimise many of the risks discussed in the above section is to introduce a series of physical access controls, to prevent intruders getting near the computer equipment or storage media. Methods of controlling human access include:

♦ Personnel (Security guards)
♦Mechanical devices (e.g. keys, whose issues is recorded)
♦Electronic identification devices (e.g. card-swipe systems, where a card is passed through a reader.

Personal identification numbers (PINs)
In some systems, the user might have a special PIN, which identifies him or her to the system. According to what the user's PIN is, the user will be allowed access to certain data and parts of the system but forbidden access to other parts.

Door locks
Connectional door locks are of value in certain circumstances, particularly where users are only required to pass through the door a couple of times a day. If the number of people using the door increases and the frequency of use is high, it will be difficult to persuade staff to lock the door every time they pass through it.

The major difficulty with this is the fact of key control. And the solution would be installing a combination door lock. This is where a numbered keypad is located

outside the door and access allowed only after the correct 'code', or sequence of digits has been entered.

This will be effective if users keep the combination secret and the combination is changed frequently.

Card Entry Systems
This is a more sophisticated means of control than the use of locks, as cards can be programmed to allow access to certain parts of a building only, between certain times.

Security guards
These can be deployed at each entrance in the building to restrict access as may be required.

Video Surveillance
These (video cameras) are normally placed in certain strategic areas say corners, corridors, inside the rooms, etc. to cover any moving object. They are normally connected to a certain surveillance room of several TVs and a person to see the moving objects on TV.

7:4 CONTROL OVER PERSONNEL

Personnel Selection
The personnel who are to operate in the IT departments need to be fully scrutinised at the recruitment state and after recruitment, they need to be managed properly.

Controls related to personnel include the following:
i) Checks and balances so that a security violation must pass through several steps before being implemented.
ii) Segregation of duties (division of responsibilities)
iii)Job rotation so that employees change jobs at random intervals.
iv) Enforced vocations
v) Access to information granted not on rank in the management hierarchy or precedent, but on a need-to-know basis.
vi)Careful selection of personnel especially those to work in the IT departments.

Fraud
Computer frauds come from disgruntled employees, organised crime and hackers.
Networks make certain types of fraud easier; this is because many people/employees can have access to the computer system.

Two types of fraud can be identified

i)Single large-scale funds - usually the stealing of large amounts of money.
ii)Small-scale, but long-term frauds.

Examples of methods of fraud are given below:

i) Creation of fictitious supplier accounts and submission of false invoices, usually for services rather than goods, so that payments are sent to the fictitious supplier.
ii) Corruption and bribery, particularly where individuals are in a position of authority as regards making decisions or suppliers or selecting between tenders.
iii) Misappropriation of incoming cheques from bonafide customers.
iv) Theft of portable fixed assets.
v) Giving unauthorised discounts to customers.
i) Fictitious staff on the pay roll.

These frauds do not all involve computers in the commission, but many could be detected by appropriate use of computer controls, perusal of exception reports, analysis of expenditure ratios and the like.

7:5 RISKS TO STORAGE MEDIA

Handling floppy disks, CDs and tapes

Floppy disks and CDs should be handled with care just as you would treat a valuable CD with care.

i)They break when you bend them or you run them over with the castors of your chair.
ii) Spilling hot drinks over them and leaving them on sunny windows sills will damage them.
i) CDs should particularly be protected from dust, scratches and finger prints.
ii) For floppies write on the label before you stick it on to the disk and write only with a felt tip pen, never a ball point.
iii) Floppies are affected by magnets sot hey should be kept far from magnets.

Tapes can be snipped with scissors, or get knotted up, and they can also be damaged by magnets and heat and liquid. Treat them with the same care you would give to your favourite audio/video tape.

7:6 RISKS TO DATA

Risks to data can be in the form of deliberate or accidental:
i))Destruction (or alteration)
ii)Theft
iii) Unauthorised disclosure

There are therefore two types of controls used to restrict access.

♦Physical access controls (analysed earlier)
♦Logical access control

Basically logical access control consists of a password system. Data destruction can be protected against by taking back-ups and the risk of alteration of data minimised by a variety of basic precautions.

Passwords

Passwords are a set of characters, which may be allocated to a person, a terminal or a facility, which are required to be keyed into the system before further access is permitted.

Passwords can be applied to data files, program files and parts of a program.

i) One password may be required to read a file, but another to write new data to it.
ii) The terminal user can be restricted to the use of certain files and programs (e.g. in a banking system, junior grades of staff are only allowed to access certain routine programs).

In order to access a system the user needs first to enter a string of characters. If what is entered matches a password issued to an authorised user or valid for that particular terminal the system permits access. Otherwise the system shuts down and may record the attempted unauthorised access.

Disadvantages of passwords

i)By experimenting with possible passwords, an unauthorised person can gain access to a program or file by guessing the correct passwords. This can usually be easy especially where users pick on to use obvious password like their names, etc.
ii) Some one authorised to access a data or program file may fell an unauthorised person what the password is, perhaps through carelessness.
iii)Many password systems come with standard passwords as part of the system. It is always better not to use such standard systems.
i) Passwords can be left in the open and any one gains access to them.

7:7 BEST PASSWORD PRACTICE (BPP)

These are points that have to be observed by computer users to whom passwords have been allocated.

- Keep your password secret - don't reveal it to anyone.
- Do not write it down as any body may come across it.
- Change your password regularly.
- Change and use your password discretely - some body can watch the movement of fingers to determine the password.
- Do not use obvious pass words e.g. your name, etc.
- Change your password if you suspect that any one else knows it.

7:8 TELECOMMUNICATIONS DANGERS

When data is transmitted over a network or telecommunications link (especially the internet) there are numerous security dangers.

a) i)Corruptions such as viruses on or single computer can spread through the network to all of the organisation's computers.

b) Staff can do damage through their own computer to data stored on other computers. E.g. transferring a file of the same name to the colleague's which may cause an over write.
c) Disaffected employees have much greater potential to do deliberate damage to valuable corporate data or systems.
d) If the organisation is linked to an external network, persons outside the company (hackers) may be able to get into the company's internal network, either to steal data, or to damage the system.
   Systems can have firewalls - these are used to prevent a particular network from intrusion from any other network e.g. a company network and the Internet.
e) Employees may down load inaccurate information or imperfect or virus-ridden software from an external network.
f) Information transmitted from one part of an organisation to another may be intercepted.
   Data can be encrypted (scrambled) in an attempt to make it meaning less to those who are not entitled for it.
g) The communications link it self may break down or distort data.

Encryption and other safety measures on telecommunication

♦Encryption involves scrambling the data at one end of the line, transmitting the scrambled data, and unscrambling it at the receivers end to the line.

Authentication

This involves adding an extra field to a record, with the contents of this field Derived from the remainder of the record by applying an algorithm that has previously been agreed between the senders and recipients of data.

Dial-back security

This operates by requiring the person wanting access to the network to dial into it and identify themselves first. The system then dials the person back on their authorised number before allowing them access.

Hacking

A hacker is a person who attempts to invade the privacy of a system. There are normally skilled programmers, and have been known to crack system passwords with consummate ease.

CHAPTER EIGHT

DATA BASE MANAGEMENT SYSTEMS

8:0 INTRODUCTION

Under this Chapter we shall look at the following:
- Data base management system (DBMS) structures
- Designing a data base
- Verification and validation checks

8:1 DBMS STRUCTURES

Data within databases (or most other computerised filing systems) is organised in a specific hierarchy. The aim of the organisation method is to provide generally accepted and workable method of storing and accessing data in computer files. The basic concepts to be understood are as follows.

- **Database** -stores information about the organisation within individual files
- **File** - information concerning one aspect of the organisation, such as details of debtors.
- **Record** - all the detailed information about one person or item within a file. E.g. in a debtors file, there will be information about the debtor.
- **Field** - one item of data e.g. within the debtor's record this could be the debtor name.
- **Byte** - one character
- **Bit** - the smallest unit of computer storage - one area of memory, which can hold the value 0 or 1.
- **Entry set/type** – Group of similar objects of concern to an organisation for which it maintains data transactions, courses, employees, students, non academic staff etc.

Meta data – is data used to define other data

Attributes – Characteristics of object category.
Entity- Basic units used in modelling.
Modelling – Some basic common functions.
Database – Collection of related files
Key - Single attribute
Primary key – unique entity identifier
Supper Key – Additional attributes to a primary key
Candidate Key – 2 or more attributes uniquely identifying an entity set
Secondary Key- An attributes/combination of attributes that may not be candidate keys but classifies the entity set
Meta data – Using data to describe/define data
External View of data – Highest level of application
Global view of data – lowest level of actual data storage

Naïve user
♦Not aware of DB (Database systems)
♦Responds by processing a coded Key
♦Then operations are very limited

On-Line User
♦Communicate with database directly via a user interface and application programme
♦Aware of database system (DBS)
♦Use data manipulation language
♦Need additional help like merits
There are three basic database structures having different levels of sophistication hierarchical databases, network databases and relational databases.

As hierarchical and network data bases are rare these days, we shall confine on describing the relational model.

Relations Database
The concepts behind relational databases were developed by EF Codd of IBM.

The data is stored in tables, which are derived by a mathematical form of analysis on the sources of data for the system e.g. input screens, reports.
In a relational database, data is split between different two-dimensional tables, which are linked together via a set of unique keys

Commercially available relational databases include IBM's DB2 and Oracle. Ms Access is also a relational database.

APPLICATION PROGRAMME.
♦Are professional programmers
♦Develop application programme user interface utilised by
♦The naïve & online users
♦Are programme written in general purpose programming language e.g. Assembler, COBOL, Fortran, Pascal etc.

DATA BASE MANAGEMENT SYSTEMS

Definition:
A database is a file (or files) of data so structured that many applications can use the file and update it, but which do not themselves constrain the file design or its contents.

This is of major benefits to the organisation including data sharing between applications.

DBMS
This is specialist software used to create and maintain a database.

Organisations collect and use vast amounts of data. One method of storing and accessing this data is to place it within one large store and use a DBMS to effectively control that data.

The DBMS is normally located between the main database of the organisation and the different applications that want to access and use that data.

Elements of a DBMS
A DBMS comprises three separate sections i.e.

a) Data Definition Language (DDL)
b) Data Manipulation Language (DML)
c) Data Dictionary

DDL is used to specify the content and structure of the database. The DDL defines the form of each item of data in the database so that the data can be accessed and used by the various application programs accessing the database.
Entry set/Type – Group of similar objects of concerned to an organisation for which it maintains e.g. data transactions, courses, employee, students, non-academic staff etc.

♦Defines the conceptual scheme
♦Curves details how to implement the conceptual scheme and stores data

DML is a specialist language used to manipulate data within the database. The DML is a fourth generation language.
♦Involves retrieval of data from the database
♦Inserts raw data into the database

The Data Dictionary is a program used to store and organise the data in the database. The dictionary stores key information about the data, such as who uses the data, what the access rights to data are and who owns the data and is therefore responsible for updating it. Deletes and modifies existing data.

Facilities offered by database management systems

The DBMS will offer the following facilities:
a) The ability to add, amend and delete records
b) The ability to retrieve data
c) The ability to present data in different formats and combinations as required
d) The ability to control access to records by means of passwords and other security procedures
e) The ability to allow the database to evolve without requiring modification to applications programs
f) The ability to recover from systems break down and avoid data loss
g) The ability to record transactions and identify redundant data.

8:2 DATABASE ADMINISTRATORS (DBA)

Centralised control of data base under one controller that is sole administrator.
The DBA's work can be split into strategic and organisational activities.

a) Strategic Tasks

(i) Working with strategic management to help define the organisation's present and future needs.
(ii) Choosing suitable file structure for data storage.
(iii) Analysing the data required for each application.
(iv) Preparation of a data model.
(v) Preparation, modifying and maintenance of a data dictionary.
(vi) Defining hardware needs and plan for any change and internal levels.
(vii) Administrator of internal and external view of data (3 levels)
(viii) Specifies conceptual view of various users and applications
(ix) Defines and implements the internal level and storage structure
(x) Controls changes to external Global
(xi) Custodian and controller of database structure
(xii) Defines mapping between levels structures
(xiii) Okays users of the database and their dismissal.
(xiv) Fore sees the maintenance and preservation of the integrity of the database
(xv) Defines procedures to receive and recover the database system

b) Organisational Tasks

(i) Ensuring data integrity by implementing and controlling database procedures.
(ii) Production of operating manuals.
(iii) Provision of training for users and applications programmers on a regular basis.
(iv) Assessing the ongoing performance of the database.

Benefits/advantage of database filing systems

There are basically three major benefits from database filing system; i.e. integrity, independence and integration.

Integrity

Database integrity means that data is kept secure and that amendments are only made as effectively authorised by the DBMS.

Independence

The principle of independence relates the splitting of data away fro the programs that use that data.

Making this split ensures that;

- Applications can be written and amended independently of the data they use, and
- Amendments can be made to the data without having to amend all the different applications that use the data.

Integration

This refers to the maintenance of data in one location rather than spreading and possibly duplicating, that data around the organisation in separate individual databases.

8:3 BENEFITS OF A DATABASE MANAGEMENT SYSTEM (DBMS)

a) Integration of data needs
Data should be shared between the different applications using it. This can mean That different applications using the DBMS can access the same data at the same time.

b) Data security
Data should be accessible only to those authorised to see it, and should be capable of modification only under controlled conditions.

c) Flexibility
The DBMS should allow for different uses with a range of applications.

d) Minimum redundancy
Duplication of data should be kept to a minimum. This achieves the benefit of reduced space and avoids inconsistent data.

e) Evolutionary capability
The DBMS must be capable of evolving to adapt to changing organisational Needs without requiring extensive modifications to application programs.

8:4 DESIGNING A DATABASE

Where an organisation uses a central database, it is crucial that the database operates effectively. This requires adequate hard ware, software and personnel, but most importantly it needs a well-designed database.

The main stages in design and use of a database are as follows;

a) Analysis of information needs
b) Logical design of the database
c) Physical design and set up of the data base
d) Data entry and upkeep
e) Data retrieval and reporting
f) Monitoring and maintenance

Analysis of information needs

In order to identify the information needs of the organisation, a fundamental understanding of its objectives is necessary.

a) The business plans of the company provide the basis of this understanding, identifying the organisation's critical success factors (CFS) and the information that is needed for these factors to be achieved.
b) An information audit will be carried out to identify the needs of particular users and groups of users.

Logical design of the database

a) The information gathering process will help to determine the data required on the database for existing and foreseeable future applications. This list of data is recorded in the data dictionary.
b) The rules relating different items of data together are determined.
c) The analyst will then determine the rules relating particular application to items in the database.

Physical design and set up of the organisation
The rules that have been specified are then programmed to support the database management system. This procedure is so specialised that it may require a special Data Description Language (DDL).

Data entry and upkeep
a) Data is added (or appended) to the database. Its integrity is ensured by validation and verification checks.
b) Existing data may be changed (or amended). This process will also be subject to validation and verification (see later in next section).
c) Existing data may be deleted from the database. This is normally a two-stage process, i.e. making and then physically deleting - this ensures that only intended data is deleted.
d) A specialised language called a Data Manipulation Language (DML) may be used to carry out the processes of addition, amendment and deletion.

Data Retrieval and Reporting
Most database systems provide a wide variety of ways in which data may be accessed and analysed.

a) Individual records may be retrieved and inspected.
b) Items may be retrieved according to a set of specific parameters.
c) Data may be sorted or indexed on any field or combination of fields. This makes lists and other outputs easier to use.
d) Simple summarises and calculations can be carried out on the data contained in the database.
e) Report generators are supplied with many databases management packages. This enables users to summarise and report data quickly and in an easily digested format.
f) A specialised language called a Structured Query Language or SQL may be used to retrieval and report information.

8:5 VERIFICATION AND VALIDATION CHECKS
The verification and validation checks have been designed to deal with the common human errors as regards data entry. This is in databases, accounting systems, spreadsheets, etc. So this means that these checks do not only apply to databases but also to accounting systems, word processors, spreadsheets, etc.

Verification is the process of ensuring that the data that has been input is the same as the data on the source document.

Validation is the process of ensuring that the data that has been input has a value that is possible for that kind of data. For example there is no month with 33 days.

Data Verification

The most common method of verification is encouraging staff to look for errors e.g. if data is input using a key board, it will be shown on the screen and visual checks on the data can be made.

Validation Checks
When a validation check identifies an error, the record concerned will probably be rejected and processed no further without correction. Rejection reports or massages will be displayed on a VDU screen.
Some of the data validation checks are outlined below:

♦**Range Checks**
These are designed to ensure that the data in a certain record field lies within predetermined limits e.g. day of a month can be from 1 to 31 not 0 or beyond 31.
♦**Limit Checks**
These check that data is not above or below a certain value.
♦**Existence Checks**
These are checks to ensure that the data is valid within a particular system. E.g. Checking items in stock.
♦**Format Checks**
These help to ensure that the format (and size) of the data in a field is correct.
E.g. check that the formal is all numeric or alphabetic, etc.
♦**Consistency checks**
These involves checking that data in one field is consistent with data in another field. For example, in a payroll system, there might be a check that if the employee is a Grade C worker, he or she must belong to department 5,6 or 9.
♦**Completeness Checks**
A check can be made to ensure that all records have been processed.
♦**Check digits**
This check is used to detect especially transposition errors.
Transposition errors are those that arise when correct digits in a figure, e.g. 123,907, are unintentionary interchanged, e.g. 132, 907.

CHAPTER NINE

OFFICE AUTOMATION

9:0 INTRODUCTION
Under this Chapter we shall look at the following:
♦Spreadsheet
♦Word Processing, DTP and Graphics
♦Communication
♦The Internet

Office automation tries to analyse the application programs that are normally used in offices and office communication.

9:1 SPREAD SHEET

A spreadsheet is a general-purpose software package for modelling. The name is derived from its likeness to a spreadsheet of paper divided into rows and columns.

♦A spreadsheet program can help you manage personal and business cash flow analysis and forecasting. General ledger, stock records, profit projections, sales projections, etc.
♦You can use the spreadsheet to perform calculations, analyse data and present information.
♦You can store large collections of information i.e. a mailing or product list.
♦Spreadsheets program include tools for organising, managing, storing and retrieving data-through a bigger control over a list stored on your computer would need a Database program.

Features of Spreadsheets
Cell is one box in a spreadsheet.
Column is a vertical line of boxes or cells. Each column is identified by a unique letter e.g. a,b,c, aa, ab, aaa, aab, etc).
Row is a horizontal lie of boxes of cells. Each row is identified by a different number (e.g. 1,2,3,11,12,13,111,112, etc).

Active cell (Current cell)
This identifies the location of each cell in a spreadsheet. It consists of a column letter followed by a row number.

Formula
In a spreadsheet, a formula helps you calculate and analyse data. When entering formulas cell references or cell addresses are used. E.g. [+D2+D4] instead of typing in the actual data whenever possible.

Calculations
Spreadsheet programs perform calculations using the following.
* - multiply, + - Add, - - Subtract, /- divide, / exponents.

Automatic Recalculation
Spreadsheets have a facility where by if you change a number used in a formula, all the other figures affected by the formula will change automatically displaying the new results.

This feature is so useful if you want to evaluate possible scenarios. E.g. how differently interest rates affect your mortgage payments.

Using parenthesis [ ]
In a formula, a spreadsheet program will calculate the data inside the parentheses then with those outside it. E .g. +A1 * [B6/B7] + A5.

Copying a Formula

After entering a formula in a spreadsheet, you can save time by copying a formula to other cells. The spreadsheet program will automatically change the cell references in the new formula for you.

Functions
A function is a ready-to-use formula that helps you to perform calculations e.g. sum, Average, Maximum, Minimum, etc.

Examples:
♦SUM [D1: D4] calculates the sum of the numbers in addresses D1 to D4.
♦AVERAGE [A6: A10] calculates the average value of the lists of numbers in addresses A6 to A10.
♦MAXIMUM[A2; A7] finds the largest value in the lists of numbers in addresses A2 to A7.

Facilities offered by a spreadsheet.

Editing
Data can easily be copied for moved from one part of the spread sheet to another using a mouse and cut and paste or drag and drop facilities.

♦Column width, row height can also be changed.
♦Rows and columns can be inserted and most operations can be reversed.

♦Modern spreadsheets can help you complete a series, e.g. type 'Monday' - it will type the rest up to Sunday.

Formatting a Spread sheet
This involves changing font (type style), number appearance, boarders, shading and colour. Data alignment centre left or right, etc. You can format the entire spreadsheet or a specified range of cells.

Charts and graphics
Most spreadsheets contain graphic and chart facilities which enable you illustrate data using a suitable chart type.

Sorting
Data can be sorted alphabetically or numerically.

File commands
Opening, naming, saving, printing and closing the spreadsheet file are the key tasks.

Potential problems/disadvantages of spreadsheets

Spreadsheets are immensely popular and can be used for a very wide range of modelling tasks. However, because they are essentially single - user packages and because each one is designed from scratch. There are risks in their use.

a) Although users are some times trained in how to use a spread sheet, they are rarely trained in spread sheet discipline or best practice. This means that spread sheets may be badly designed, increasing the risk of errors or inefficiency.

E.g. a user may put a second large table immediately below the first, rather than diagonally offset. If he or she then deletes a column of data from the first table, then data may be unintentionally lost from the second one as well.

b) Users are unlikely to document the workings of their spreadsheet, as they consider it 'obvious'. This makes it difficult for other staff to understand use or modify the model.

c) The lack of proper audit trail can be a disadvantage. Because the user works with a spreadsheet in memory (RAM), only saving it at certain intervals, it is unlikely that a record of the intermediate stages will be maintained, even if output from the intermediate stages is important.

9:2 WORD PROCESSING

WORD PROCESSORS

Word processing is the processing of text information. Typically word processing soft ware may be used for production of standard documents.

Features of a word processor

The following are some of the features of a typical word processor.

(i) Adding headers and footers
(ii) Inserting footnotes
(iii) Using different characters fonts in a variety of services.
(iv) Changing texts to bold italic, underlined, double underlined, etc.
(v) Spell checking - for spelling errors and in some programs checking for grammatical errors.

Some word processors especially modern one have additional features not available in older word processor e.g.

(i) Adding lines or boxes in a variety of width and style.
(ii) Inserting digitised photos and artwork.
(iii) Creating charts and tables with newly entered data or by linking to data that already exists in a data file.
(iv) Drug and drop editing.
(v) Creating a table of contents or index automatically.
(vi) Main merging - where automatic formats for different types of letter may exist.
(vii) Importing data from other -programs like spreadsheets.
(viii) Compatibility - where major packages are very similar and highly compatible e.g. a WordPerfect file may be opened, edited and saved in Ms Word.

9:3 DESK TOP PUBLISHING (DTP)

DTP is the use of office computers to implement computerised typesetting and composition systems. They can be used for producing master pages for a book, newspapers, leaflets, etc.

Graphics (Computer Graphics)

Another use of computers is the production of information in the form of pictures, diagrams or graphs. A widely used office package is corel draw.

9: 4MICROSOFT ACCESS
This is used to design data bases and create management reports.

9:5 COMMUNICATION
Under this topic, we shall see how telecommunication hardware is used in office work.

Telex
Telex is a service which enables users to transmit and receive printed message over a telephone line. Users have to be telex subscribers, with their own telex equipment and code number in order to send or receive messages.
Telex services started in the 1930's
Data transmission speeds are very slow with Telex as compared to other methods telecommunication and only restricted set of characters can be used in messages.

Fax (or Facsimile)
This involves the transmission of messages by a data link of exact duplicate copies of documents. The original is fed into the fax machine, which reads it and converts it into electronic form so it can be transmitted over the telephone.

It is printed by the recipient fax machine.
The latest fax machines can also be used to scan data into a PC, as printers for PC output and as photocopies.

Electronic Mail (E-mail)
The term 'electronic mail' or 'e-mail', is used to describe various systems of sending data or messages electronically via a telephone or data network and a central computer, without the need to post letters or place memos in pigeon-holes, etc.

E-mail has the following advantages
a) Speed E-mail is far faster than post or fax. It is a particular time saver when communicating with people over seas.

b) Economy (no need for stamps, envelopes, etc) it is far cheaper than fax or post.
c) Efficiency. Messages are prepared once but can be sent to thousands of employees at the touch of a button.
d) Security. Access can be restricted by the use of passwords.

Voice Mail
Voice mail systems enable the caller's message to be recorded at the recipient's voice mail box. It requires a telephone, and no keying or typing is necessary.
A voice mail message is basically a spoken memo.

THE INTERNET

The Internet is the name given to the technology that allows any computer with a telecommunications link to exchange information with any other suitably equipped computer.

Also Internet refers to the international network.

Web sites/page
As you are no doubt aware, most companies of any size now have a 'site' on the Net.
A site is a collection of screens providing information in multi media form (text, graphics and often sound and video), any of which can be viewed simply by clicking the appropriate button, word or image on the screen.

Internet Service Providers (ISPs)
Connection to the Internet is made via an Internet Service Provider (ISP). The user is registered as an Internet subscriber and pays a small monthly fee together with local telephone call charges. Examples of ISPs include American On-line (AOL), Spacenet in Uganda, Uganda Telecoms, etc.

Browsers and Search Engines
Browsers
These are programs that are used to run the internet. Example is Netscape Navigator.

Search Engine
These are used to guide the users surfing the net examples include, Yahoo! Aita Vista.

Uniform resource locator (Website address) (URL)

Each web page has a unique address called the uniform resource locator (URL)

All you need is type in the URL for the website you want to visit and enter.
An example of URL could be like http!//w.w.w.TBC.co.ug.

URL Element	**Explanation**
http!//	Hyper text transfer protocol, the portico used on the world-wide web for the exchange of documents produced in what is known as 'hyper text mark-up language (HTML). The forward slashes after the colon introduce the 'host name' such as www.
www	This stands for World Wide Web. As noted before, to put it simply the web (via its use of HTML), is what makes the internet user-friendly.
TBC	This is the domain name of the organisation or individual whose site is located at this URL.
Co	This part of the VRL indicates the type of the organisation concerned. The Internet actually spans many different physical

networks around the world including commercial (Com or Co), schools (ac or edu) and other research networks (org, net) military (mil) net works, and government networks.

Ug — As you can possibly guess, this indicates that the organisation is located in Uganda commercial use of the Internet.

Marketing

Organisations used the Internet to provide information about their own products and services. Customers simply log on to the appropriate website and get to know the latest products on the market and so many other things.

Sales

Interactive electronic purchasing is possible with the Internet, the customer simply provides details of her/his credit card on the internet along with the order. This facility is not yet very common here in Uganda but its very attractive in Europe and America.

Distribution

The Internet can be used to get certain products directly into people's homes. Any thing that can be converted into digital form can simply be up loaded on to the seller's site and then down loaded onto the customer's PC at home. The Internet thus offers huge opportunities to producers of text, graphics/video and sound-based products. Much computer soft ware is now distributed in this way.

Other uses of the Internet

Entertainment

A variety of quality games are available on the net.

Information

On the net you can have access to information of any subject imaginable e.g. newspapers, magazines, job listings, airline schedules, college prospectus, movies, etc.

Discussion group

You can join discussion groups on the net to meet people with similar interests. You can ask questions, discuss problems and read interesting stories.

E-mail

Exchanging email is the most popular feature on the Internet. You can exchange e-mail on computers around the world.

Problems with the Internet

Being owned by no one, there are no clear guidelines on how the internet should develop. Today you can find the good, bad and different items on the net e.g. Bible preaching and phonography.

Employees of an organisation may spend so much time on the net surfing useless sites - thus wasting the organisation's useful time.

Lack of security on the Internet is another problem. This is especially with the e-mails - information such as credit card details is not communicated comfortably.

Cost is another major problem. You need a relatively high quality PCs, which are expensive; in addition, connection fees, access time fee and web site designing fees are also high.

With much less powerful equipment e.g. a slow modern and a slow processor, gaining access to useful information becomes slow and quiet painful.

Getting connected to the Internet

You need specific equipment and program to connect to the Internet.

1. Computer - any type of computer, which is relatively strong.
2. Programs - you need special programs to use the Internet e.g. e-mail programs, etc.
3. Modems - you need a modem to connect to the Internet. A modem of at least 14,400 bps is recommended.
4. Telephone line.

Other forms of the Internet

Intranets
This is an internal Internet, available to individuals with in a specific organisation.

The intranet is used to provide a relatively quick and easy method of providing and information sharing system in an organisation.

Extranets
This is an extension of the intranet where some third party access is allowed to the internal web sites.

Uses and benefits of the intranets
Allowing access to databases, no matter where they are located with in the organisation.

This helps to support the obtaining and sharing of information between worker throughout an organisation as well as minimise the need to keep the data in more than one place.

An intranet will allow the creation of on-line catalogues, handbooks, and directories that can be accessed and up dated as necessary e.g. an internal telephone directory for an organisation of say 100,000 employees world wide will change on a daily basis as a new staff are hired and existing staff leave.

Intranet will save the organisation costs in terms of printing and distributing the paper based manuals and handbooks etc.

Some intranets can be linked to legacy system allowing older corporate data to be obtained and analysed along side more recent transaction data.

Information is provided in a more user-friendly format, which helps encourage the use of the internet.

Training costs are limited because users will already be familiar with browser technology from using the Internet.

Uses and Benefits of the Extranets

They provide on-line information for customers and suppliers provide 'added value' to the products and services provided by the organisation.

Allowing authorised buyers of the organisations' products access to information about those products to help them decide which product is appropriate for a specific use.

Linking with existing EDI (Electronic Data Interchange) applications to provide full stock control, procurement and payment systems.

Full Meanings of the words as applied in information technology/system

LIST OF ABBREVIATIONS

ABBREVIATION	ABBREVIATION IN FULL
4.GL	Fourth Generation Language
ALU	Arithmetic Logic Unit
AOL	America on Line
AS II	America National Standard Code for Inform date Interchange
ATM	Automated Teller Machine
BASIC	Beginners All Purpose Symbolic Codes
BIOS	Basic Input – Output System
BIT	Binary Digit
BTM	Business Teller Machine
CD	Compact Disk
CIS	Computer Information System
CLS	Clear Screen
COBOL	Common Business Oriented Language
CPU	Central Processing Unit
CU	Control Unit
DBMS	Database Management System
DDL	Data Definition Language
DEEP BLUE	Computers are modern computers that are an IBM computer programmed to play Chess with the world class champion, Garry Kasorok. Programmed to make 1 million moves in a second, which defected the world chess champion in the world.
DEL	Delete
Dir	Directory
Disk Drives	Media where computer programme files reside e.g., Hard disks, floppy Disks, CD-ROM, Magnetic tapes etc.
DML	Data Manipulation Language
DOS	Disk Operating System
DPC	Desktop Personal Computer
Drives	External storage medium storage capacity more than floppy and less then hard disk drive, designed with letters D...E.
DTP	Desk top Publishing
DVD	Digital Video Disk
E-mail	Electronic Mail
EMF	Electronic Magnetic Fields
EPOS	Electronic Point of Scale
EWN	Enterprise Wide Network – Any Private Network connects all of organization CPS no matter what they run or where they are located.
Expansion Slots	are access slots on the C.P.U where new

	computer cards can be fixed when upgrading (expanding) a computer. When adding another floppy drive, adding a CD ROM Drive a higher memory chip.
Floppy Disks Drives.	External storage medium, less storage capacity than Hard disks drive designed with letters
FORTAN	Formula Transaction
GB	Byte
GUI	Graphical User Interface - medium through user interacts with a CP
Hard Disk Drive	Internal Storage mechanism stores most computer applications. Capacity 100MB designed work letters
HLL	High Level Language
IBM	International Business Machine
ILL	Intermediate Level Language
INTERNET	International Network
IRR	Internal Rate of Return
ISP	Internet Service Provider – Provides Internet to users who register at 15 P using other dial to dedicated access.
IT	Information Technology
KB	Kilo Bytes
KIPS	Kilo Instructions Per Second - its Speed
KISS	Keep it small Simple
LAN	Local Area Network
LLL	Low Level Language
MAN	Metropolitan Area Net – Work
MB	Mega Byte
MICR	Magnetic Ink Character Recognition
MIPS	Millions Instructions per Second
MODEM	Modulation Demolecular
MS DOS	Micro Soft Disk Operating System
Ms Excel	Micro soft Excel
MULT	Multiply
NPV	Net Present Value
NT	Net Work
OCR	Optical character Recognition
OS	Operating System
OUR	Optical Work Reading
PC	Personal Computer
PIN	Personal Identification Number
Ports	Are connections (sockets) on the C.P.U which a computer components (Device) like a printer, mouse, modern etc. Can be connected.
RAM	Random Access Memory
ROM	Read only Memory
SAN	Storage Area Network
SDLC	System Development Life Cycle

SSDM	Special Standard System Development management maintenance
SSM	Special Standard System Management/maintenance
SQL	Structured Query Language
SUB	Subtract
TCP/IP	Transmission Control Protocol/internet Protocol system used to transfer information from one computer to another.
UPS	Uninterrupted Power Supply
URL	Uniform Resource Locater
VAN	Value Added Network
VDU	Visual Display Unit
W.W.W	World Wide Website
Web Server	Software that delivers web pages and contains of web sites.

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AFRICA POPULATION INSTITUTE
PSYCHOLOGICAL AND SOCIOLOGICAL ISSUES IN PUBLIC HEALTH
PAPER CODES: **APDPH 301**

1.(a)Account for reasons why divorce rates have gone up since the turn of the century.
(b) Five reasons why some children do not do as well in school as others

2. (a)Briefly explain five reasons why and how women's lives have changed
(b) Account for five ways in which people from another culture are different from us 20 marks
(c) What threat do human rights violations pose to the world, and what is currently being done about them?

3.(a) Discuss the changing conception of health and illness in modern communities
(b) Assess the psychotically factors contributing to a successful behavior change
(c) Briefly name and explain about five herbs used to treat illness and ailments in the local community you come from

DEMOGRAPHY
PAPER CODES: **APDPH 302, APDSW 301**

1. a) Discuss the common causes and consequences of Rural-urban migration in your country.
b) How can rural – urban migration be controlled
c) Explain the processes through Populations can change

2. a) How do you understand the term gerontology as used in agingby humans?
b) Describe any five (5) theories that you know about an aging population.
c) Demonstrate the population equation as used in demography

3. a) Clearly elaborate how is legal death different from premature burial?
b) Examine the causes and effects of death in sub-Saharan countries.
c) With illustrations, Cleary talk about demographic transition

RESEARCH METHODS
PAPER CODES: **APD(FA 303, PH 303, HR 302, IR 304, PA 304, LPS 303, SW 304, BA 303, PM 303)**

1. a) Research and experimental development comprise creative work undertaken on a systematic basis in order to increase the stock on knowledge;
Explain the different types of variables used in research.
b) Using relevant examples, explain the difference between discrete and continuous variables

2. a) Descriptive research are designed to gain more information about a particular characteristic within a particular field of study
b) Explain how it is different from exploratory research
c) What is the difference between a research proposal and a project proposal?

3. a) With some form of detail, illustrate the structure of a research report
b) Examine the different forms of experimental designs
c) Assess the different levels of data analysis

SANITATION AND ENVIRONMENTAL HEALTH SCIENCE

PAPER CODES: **APDPH 304**

Question 1

a) By the sanitation standards of the world health Organisation, Your country has not yet achieved it's international standard of sanitation. As a public health student what measures would you recommend for the government to adopt in order to achieve a global standard?

b) What are the consequences of poor hygiene and sanitations to the communities within and around you?

Question 2

a) What are the relevant aspects to be considered in order to manage good sanitation?
b) What is environmental epidemiology and the relevancy to sanitation or in other words what environmental epidemiology seeks?

Question 3

a) What are the constraints to Success in Sanitation
b) What are the strategies to achieve success in sanitation

INFORMATION TECHNOLOGY

PAPER CODES: **APD --- 105**

1. Information technology always deals with organizational need
Examine the stages involved in the systems development life cycle

2. File are used to store data and information that will be needed again in future or for the current use
a) Explain the different data processing operation
b) What are the features of storage and retrieval systems?

3a) with relevant examples, Analyse the different forms of security issues as used in information technology
b) A spread sheet is a general purpose software package for modelling
i) Explain the different applications of spread sheet
ii) What are features of a word processor?