Chapter 2
Review of Literature

CHAPTER – 2

REVIEW OF LITERATURE

Quite a numbers of studies have been conducted in India and abroad on occupational health hazards faced by health care workers. The review below presents an elaborate account of studies related directly or indirectly with the present study. It has been classified as follows:

1. Incidence of illness and injuries faced by health care workers while working in hospitals
2. Occupational health hazards faced by health care workers
   - ➢ Physiological hazards
     - ❖ Biological hazards
     - ❖ Chemical hazards
     - ❖ Physical hazards
     - ❖ Ergonomic factors
     - ❖ Violence
   - ➢ Psychological Hazards
     - ❖ Work stress
     - ❖ Job satisfaction
     - ❖ Burnout
3. Anthropometric variability
4. Work Height

1. Incidence of illness and injuries faced by health care workers while working in hospitals

Health and medical services is now a major employer in all countries. The health care is a labor intensive industry, and it covers a highly diversified range of activities. Although some risks and hazards are common to the whole sector, others are more specific to certain categories of HCWs or to certain work

practices of the industry. Health care workers know that they face serious hazards to their own health and well being in the course of their job. Hospital workers had a significantly greater incidence of acute conditions compared with all workers in all categories of sex, race, age & occupational status (Gun, 1983). The risk for hospital workers was about 1.5 times greater than that for all workers, and it was statistically significant for all conditions, including injections & parasitic disease, respiratory conditions, digestive system conditions and "other" conditions, disease of the ear, headaches, genitourinary disorders, problems associated with child birth, disorders of pregnancy & the puerperium, and disease of the skin & musculoskeletal system. The risk of injury for hospital workers was only slightly greater than for all workers.

Hospitals employ approximately 4.5 million of the 8 million health care workers (BLS, 1989). A 1972 National Survey of Occupational Health Services in more than 2600 hospitals reported an annual average of 68 injuries & 6 illnesses among workers in each institution (NIOSH 1974 - 1976). The most frequent injuries were strains & sprains, followed by puncture wounds abrasions and contusions, lacerations, back injuries, burns & fractures. The most frequent illness was respiratory problems, infections, dermatitis, and hepatitis and drug or medication reactions.

In 1978, the California State Department of Industrial Relations published injury & illness data for 1976 – 1977 from an intensive study of hospital personnel. The data revealed that the major causes of disabling injury & illness were strain or overexertion, falls or slips, being struck by or striking against objects, burns and exposure to toxic or noxious substances. Workers with the highest reported numbers of injuries & illness were aides, nursing attendants, orderlies, technicians and nurses.

A review of data from the Bureau of labour statistic (BLS, 1983) for compensable injury & disease showed that sprains and strains were by far the most common type of condition, constituting 51.6 per cent of the total HCWs.

The injuries and illness listed in table 2.1 was reported more commonly on hospital workers. Also show that cuts, lacerations & punctures account for a significant number of hospital workers' compensation claims, because these injuries also have a potential for contamination with blood & other body fluids, workers compensation claims injury or illness among hospital workers (SIC 806).

Table 2.1: Injuries and illness among hospital workers

Conditions	Claims No	Percent of Total
Sprains, Strains	35,405	51.6
Contusion, Crushing & Brushing	7,635	11.1
Cuts, lacerations & Punctures	7,374	10.8
Fractures	3,865	5.6
Multiple Injuries	1,473	2.1
Thermal Burns	1,343	2.0
Scratches, abrasions	1,275	1.9
Infections & Parasitic Disease	865	1.3
Dermatitis & Other Skin Conditions	850	1.2
All Other	8, 484	12.4
Total	**68,569**	**100**

In Florida, the annual rate of illness & injury reported for hospital workers was 10 per 100 workers about the same as that recorded for sheet metal workers (American Journal of Nursing, 1989).

Despite the scanty factual information concerning the actual extent of occupational safety and health risks to the HCWs, several countries have collected statistical data on occupational illness and injuries of HCWs. For example, in the Australia, the hospital and nursing homes industry occupational health and safety performance overview (1991-92) indicated the occupational safety and health performance of the hospitals and nursing homes was significantly below that of the Australian industry standards in general. As a whole, these employees experienced 25 percent more injuries per 1,000 employed than the incidence rate for Australian industries overall. Furthermore, nursing professionals experience the highest proportion of industries, and diseases within the health care industry, for example registered and enrolled nurses together made up 34 percent of injury/ disease occurrence in the sector.

In the U.S.A, a 1995 lobour Department report showed that nursing homes and hospitals, just as construction sites, were dangerous work places. Nursing aids and orderlies were absent 103,900 days in 1993 due to illnesses and injuries, and nurses were absent some 46,400 days. According to the same report when workers over- exerted them, nurses led the field, with 363 injuries per 10,000 workers in nursing and personal care facilities. Nurses also led in falling and slipping on the floor with 96 injuries per 10,000 workers (Niu, 2003).

As alarming as these numbers may seem, the problem is even bigger, as many workers do not report injuries out of fear of losing their jobs or other retaliation. Occupational illness and injuries resulting from an unsafe workplace impact the heath care organization by increased costs and a reduced ability to provide services. An unsafe workplace contributes to work related injuries and diseases that often result in physical, emotional and financial difficulties for HCWs.

2. Occupational health hazards faced by health care workers

➢ Physiological Hazards

Health care workers (HCWs) form the largest occupational group in many countries and they face a very wide range of occupational hazards to health (Ira, 2001) The multiple occupational hazards that create a risk of personal injury that HCWs face in the workplace are both Physiological and psychological. Physiological hazards could be broadly divided into following categories: Biological, chemical and Physical Hazards, Ergonomic factors, and Violence in workplace. A brief discussion on some of these hazards factors faced by HCWs in their work is given below:

❖ Biological Hazards

Worldwide, blood borne viruses are the major occupational, infectious occupational hazard for HCWs (Ira, 2001). Health care workers are in direct contact with patients and infectious diseases are big threat to their health. Tuberculosis, hepatitis, rubella, HIV/AIDS, cytomegalovirus (CMV) are just few examples of the threat faced by HCWs in their daily work. The risks of contracting an infection from the patients are high where the hygienic conditions in hospitals may be problematic and where infectious diseases are rampant. The HCWs may develop biological hazards from: -

- ✓ Exposure to blood borne pathogens from percutaneous injuries, splashes, and other contact
- ✓ Exposure to biological components of surgical smoke from use of lasers and electro surgical units
- ✓ Exposure to infectious microorganisms
- ✓ Exposure to the chemical and protein allergens in latex gloves
- ✓ Risk of contracting nosocomial diseases as a result of prick from syringe needle (e.g. infectious hepatitis, syphilis, malaria, tuberculosis)
- ✓ Possibility of contracting palm and finger herpes (Herpes whitlow)

Health care workers (HCWs) are at risk of occupationally acquired hepatitis, with transmission of **Hepatitis B Virus (HBV)** regarded as a bonafide occupational health risk for more than a decade (Dienstag, 1982).

The risk of acquiring occupational hepatitis B virus and human immunodeficiency virus (HIV) infection has been extensively investigated among health care workers (Centers for Disease Control, 1988 and Ippoleto, 1993).

In a study carried out in a hospital in Chiang Mai, Thailand, during 1989-90,hepatitis B profiles were studied in 1772 hospital employees, including nurses, practical nurses, aides and manual workers. The surveyed population included 329 males and 1443 females. It was found that all symptoms for Hepatitis B virus (HBV) were significantly more common among manual workers than in the other groups, and significantly higher in males than in females. Within the same age and working year's groups, nurses were at a higher risk that other categories of workers (Chokbunyasit, 1995).

Hepatitis B is usually transmitted through the blood and enters a susceptible individual through a break in the skin – often via an accidental needle prick. It could be a specific risk to people working in laboratories, renal – dialysis units, blood – transfusion centers, drug addiction clinics, dental surgeries and Stimulated Trauma Diseases (STD) clinics (Niu, 2001). Medical laboratory and nursing staff have the highest contact with infected blood & body fluids & are therefore more at risk. The average risk of infection following percutaneous exposures is estimated to be in excess of 30 per cent.

Hepatitis C threatens to be the next health care epidemic. Hepatitis C is an infection of the liver, which is caused by the **Hepatitis C Virus (HCV).** Symptoms range from loss of appetite, nausea, and vomiting to fatigue,

abdominal and joint pain, fever and jaundice. Chronic hepatitis C can cause cirrhosis (hardening and shrinking of liver tissues), end stage liver diseases and cancer. The diseases can be fatal. HCV is primarily transmitted through direct blood-to-blood contact. For health care workers contaminated needles and syringes cause the bulk of infections. Health care workers also have an increased risk of acquiring Hepatitis C Virus (HCV) infection from exposure to infected patients and their blood. The risk is greatest among those who have the highest degree of exposure. Needle stick injuries are believed to account for a large number of cases. The risks of acquiring HCV infection by needle stick from an infected patient is very low but could nevertheless have grave consequences.

The possibility of acquiring the **Human Immunodeficiency Virus (HIV)** from patients concerns health care workers & potentially threatens their participation in the case of patients with acquired immunodeficiency syndrome (AIDS) (Roger, 1989; Goldsmith, 1990: Dworken, 1991; Colombotos, 1994; Gershon, 1994).

Through December 1995, 49 confirmed cases & 102 suspected cases of occupationally acquired HIV injection in U.S. has been documented, Nurses account for the largest number of cases (HIV / AIDS Surveill, 1995).

According to many incidence (Ippolito, 1997) the average estimated risk of HIV injection to health care workers percutaneous (through the skin, as in the case of injection needles) or mucous exposure is less than 0.5 per cent. As analysis of the documented cases of occupational HIV injection acquired by health care workers as of September 1997 showed that the majority of documented injections occurred in nurses after contact with the blood of a patient with AIDS by means of percutaneous exposure, with a device placed in an artery or vein, Transmission occurred also through splashes, cuts & skin contamination.

Up to December 1997, 286 cases of occupational transmission of HIV from contact with infected blood had been reported worldwide, most related to needle stick and other percutaneous injuries (Gerberding, 1994). HIV / AIDS are mainly transmitted through sexual intercourse, blood and from mother to infant. Most HIV positive HCWs have acquired this HIV infection outside the workplace by sexual transmission from an HIV positive partners / spouse and in work place by infected blood. Needle prick injuries are the most common injuries in the health care sector. Nursing staffs particularly nursing students are at the highest risk from needle – prick incidents (Health and Safety, 1999).

It is estimated that approximately one million accidental **Needle stick injuries** occur each year, although the number is undoubtedly much higher, since most needle stick injuries go unreported. Needle stick can expose workers to deadly blood borne illnesses. Roughly 18,000 health care workers contract hepatitis B or C annually and 250 to 300 die each year as a result. As many as 75 HCWs contract HIV each year (Heath Focus 1999;Guo, 1999).

Needle stick injuries in health care workers may be quite common, thereby making the risks of contracting blood borne infectious disease very high. At least 20 different pathogens have been transmitted by needle stick injuries (Collins, 1987; Jagger, 1988, Davies G.L., 1996;) including hepatitis B, which accounted for 1000 cases of health care workers infection in 1994 (Centers for Disease control & prevention, 1996). Among which the primary agents of significant concern are hepatitis B virus (HBV), hepatitis C virus (HCV), & human immunodeficiency virus (HIV) (Gerberding, 1995)

Needle stick injuries (NSIs) are the most common type of occupational hazards for health care workers (HCWs) (Sepkowity, 1996). The reported incidence of needle stick injuries over the 12-month period was 1.30 per person and of injuries from other sharp objects 1.21 per person. In more than half (54.8 per cent) of the needle stick injuries, the needles had been used in

patients, 8.2 per cent of whom were known to have hepatitis B or C, syphilis or HIV infection (GUO, 1999).

Linda (1997) conducted a study on Hospital Nurses Occupational exposure to blood; prospective, retrospective and institutional reports. This study examined nurse's risk of exposure to blood resulting from injuries with needles and sharps. The method of estimating those risks & the factors affecting risks, Based on the prospective reports, the rate of injuries to staff nurses was 0.8 per nurse /year. Factor associated with increased injuries included recapping needles and temporary work assignments injuries from needle stick are more common than institutional reports suggest.

Lukas and Hsiarn (2001) conduced, a study on procedure – specific rates for needle stick injuries in health care workers to assess the rates of needle-stick injuries in health care workers. The corresponding numbers of injection procedures were collected during the study period to estimate the denominator of medical procedures. A total of 81 cases of contaminated needle stick injuries were activity collected over a 9-month period compared with 54 needle stick injuries from a routine self – reporting system. Procedures involving intravenous catheter had the highest needle stick injury rate, 43.5 /100,000 followed by blood transfusion and blood drawing, 17.7 and 13.3 / 1,00,000 respectively. These rates may aid priority setting to introduce safer needle devices when resources are limited.

The resurgence in cases of active **Pulmonary Tuberculosis (TB)** and the emergence of drug- resistant strains of TB have increased the risks that health care workers may acquire serious TB infections which may not respond to usual therapy (American college of occupational and environmental medicine's (ACOEM's), 1998).

Tuberculosis is a highly communicable disease. Its spread is enhanced by the way TB organisms destroy lung tissue that they infect often-giving rise to

cavities containing infected secretions. These secretions stimulate cough, which can help transmit the infection to other parts of the lung, as well as to other persons. Infective droplet nuclei may also be produced by sneezing, singing, or talking. Laryngeal TB is highly infectious and may be more difficult to diagnose and present without coughing. TB organisms tend to remain airborne after being coughed or exhaled into the surrounding air, often creating clusters of infection among exposed individuals in the patient's dwellings, workplace, at aircraft or other transport vehicles, and social settings.

Tuberculosis (TB) infection by mycobacterium tuberculosis has been common for the past 400 years. The increasing rate of TB infection in heath cares workers (HCWs) an occupational group with particular risk is of concern (Armstrong, 1995). In the 1970s, conversion rates were usually less than 2 per cent among hospital workers (Price, 1987; Adler, 1993). Chan and Tabak, 1985 found that Miami hospital employees had conversion rates between 1.3 percent and 3.0 percent between 1979 to 1981. Raad, 1989, reported universally hospital employee conversion rates between 0.5 per cent to 2.3 per cent during the years 1984 through 1987. In the early 1990s, the centers for disease control and preventive (CDCs) documented outbreaks of TB involving nearly 300 patients and at least 17 HCWs in eight hospitals.

❖ **Chemical Hazards**

Health care workers are exposed to a large variety of chemical agents, which are being used in hospitals and other health facilities. Many sensitizers and allergens are in use in the health care industry. These agents include anaesthetic agents, disinfectants and chemical sterilizing agents, drugs and cytostatic or laboratory reagents. Some of these substances are irritating to the skin & respiratory tract and can cause allergy. Some others, such as ethylene oxide formaldehyde, hexachlorophene, are known mutagens teratogens and human carcinogens. (Cullian P. 1992). Among the occupational allergic agents,

acrylates & epoxy chemical in orthopedics & dentistry, laboratory chemicals such as formaldehyde, chromium, cobalt and organic solvents can cause irritant dermatitis. Occasionally HCWs develop allergies as a result of exposure to medication for eg. handling chlorpromazine can give rise to photoallergic dermatitis substances such as animal protein & antibiotics – particularly the penicillin groups are well-recognized allergic agents, which may cause not only asthma but also dermatitis and conjunctivitis. Staff at risk of exposure includes pharmacists, nurse and doctors, who prepare and administer the cytotoxic agents and cleaners, who dispose of waste from patients who have been given the drugs. It is important to know that once an allergy has developed, it is extremely difficult to keep the exposure levels low enough to prevent exacerbation of the disorders. These chemicals hazards include: -

- ✓ Danger of exposure to anesthetic gases (ethyl bromide, ethyl chloride, and ethyl ether, halothane, Nitrous Oxide etc)
- ✓ Skin defatting, irritation and dermatoses because of frequent use of soaps, detergents, disinfectants etc
- ✓ Irritation of the eyes noses and throat because of exposure to airborne aerosols or contact with droplets of washing & cleaning liquids
- ✓ Chronic poisoning because of long term exposure to medications, sterilizing fluids (e.g. glutaraldehyde), Anesthetic gases etc
- ✓ Latex allergy caused by exposure to natural latex gloves & other medical devices.

(International Occupational Hazard Datasheets – Nurses, 2003)

Formaldehyde and acrylates (Used in orthopedics and dentistry) have also been implicated in the causation of occupational asthma, as has the processing of X-ray films, which may be associated with the release of various respiratory irritants, such as sulphur di oxide, glutaraldhyde, and acetic acid (Cullinan, 1992).

Many sensitizers and allergens are in use in the health care industry. **Glutaraldehyde** is widely used as a sterilizing agent for the cleaning of gastroscopes and bronchoscopes and there are many reports of HCWs developing rhinitis, conjunctivitis and occupational asthma following in adequately controlled exposures to these chemicals (Stefano, 1998).

The use of latex surgical gloves is increasing as a result of stricter infection control procedures; however, the latex protein present in the gloves can result in severe sensitization manifested by angio- oedema, occupational asthma and urticaria. **Latex allergy** is a reaction to certain proteins in latex rubber, which is found in most latex gloves as well as many medical, household and other common products. An allergic reaction can be caused either by direct contact or by inhaling a product which manufacturers sprinkle inside latex gloves to help them slip onto the hand easily. Allergic reactions range from skin rashes, and itching to mild and serious respiratory problems and even shock.

In 1990, three Mayo medical centers HCWs presented within a one – week period with symptoms occurring while working in intimate contact with disposable rubber gloves. All reported urticarial reactions on the hands, face, or neck & two reported, in addition, nasal pruritus, congestion and sneezing; ocular pruritus, watering and infection; & chest tightness, cough and wheezing (Hynt, 1996).

Allergy to natural rubber latex (NRL) products is being recognized with increasing frequency in both health care workers and patients (Bubak, 1992; Hunt, 1995).

Natural Rubber latex (NRL) is contained in the milky fluid from the Hevea brasiliensis tree. It contains a variety of proteins capable of inducing antibody – mediated allergic reactions. Routes of exposure include dermal, mucosal, percutaneous and inhalation. There are three main type of reaction to

latex – containing objects: Irritant contact dermatitis, allergic contact dermatitis and immediate hypersensitivity (NIOSH, 1997).

The estimated prevalence of sensitization to latex manifested by either a positive skin – prick test (SPT) or the presence of antibodies to latex in serum, among health care workers has been reported to range from 2.9 per cent to 22 per cent (Turjanmma, 1987; Liss, 1997; Kibby T 1997; Leung, 1997) and from 0.12 percent to about 20 percent of occupational unexposed population.

In 1998, the National Institution for occupational safety and health (NIOSH) received a confidential employee request for a health hazard evaluation to investigate a hospital in Denver. The objective of this study was to determine the prevalence of sensitization among latex gloves using and non-using hospital staff. In this study, Self-administered questionnaires addressed job and personal characteristics, gloves use and symptoms in two groups of hospital workers: those who regularly used latex gloves and those who did not. The prevalence of latex sensitization was 6.3 per cent in the non-users and 6.1 per cent in the latex glove users ($P < 0.9$). Reporting of working related hand dermatitis was more common in the latex gloves users (23.4 per cent) than in the non-users (4.9per cent) and hand urticaria (9.9 per cent and 2.1 per cent, respectively, $P < 0.01$). Environmental Concentration of latex was higher in the clinical than in the non-clinical areas. (Elena, 2000).

No worker can consider themselves completely safe from this allergy, since the allergy can build up slowly, often beginning with a simple hand rash, which, complicating matters further, may or may not be caused by latex allergy.

Cytotoxic drugs are used for treating patients with cancer. Some of these are alkylating agents; others act as anti-metabolic or inhibit deoxyribonucleic acid (DNA) enzymes. Because of their action on cellular DNA, contact with these drugs by health care staff should be kept to a

minimum staff at risk of exposure include pharmacists, nurses, and doctors, who prepare and administer the Cytotoxic agents, and cleaners, who dispose of waste from patients who have been given the drugs (Ira, 2001).

Antincoplastic drugs include chemically unrelated classes of agents capable of inhibiting tumor growth by disrupting cell division & killing actively growing cells ((Klasslen, 1980).

❖ **Physical hazards**

Physical Hazards to HCWs are ubiquitous in hospitals and clinics. They include ionizing radiation, noise, heat and cold, vibration, electric and magnetic fields. In additions consideration needs to be given to the ergonomic aspects of health care work.

Ionizing radiation poses a threat to HCWs working not only in radiological and radiotherapy departments but also in laboratories, dental facilities & electro microscopy units as well as in nursing wards & operation rooms. Radiation is used in medical care for diagnostic & therapeutic purposes. Work involving the preparation & array of radio pharmaceuticals and therapeutic purposes, Therefore it is important that radiation protection measures are strictly followed. (Health and safety,1999).

Noise and vibration are not major problems in health care establishments except in dental & orthopedics surgery. High – Speed dental turbines & surgical drills can cause noises at the level of 80-90 db (A), which could damage the hearing of the operators if maintained for a prolonged period.

In some developing countries as well as for some categories of health staff performing certain procedures, extreme temperatures could be a health threat.

People who are exposed to **heat and cold** include operating health staff, boiler room workers, laboratory technicians as well as service & maintenance personnel.
(International Occupational Hazard Data Sheets – Nurses, 2004).

Poor building design and maintenance can cause indoor air quality problems. Particular attention to the ventilation of the building is needed to prevent the "sick building syndrome". This is also of particular importance in specific areas such as laboratories and operating theaters where there is a specific need to suppress, minimize or control hazardous gases, dusts, fumes, etc.

❖ **Ergonomic factors**

The biggest injury category among health care workers is perhaps musculoskeletal injuries (commonly manifest as back pain) associated with patient handling, followed by injuries related to material handling. The lifting of patients is a major problem for nurse. Back injury is the most common & most costly type of injury faced by HCWs. Nurses are at greatest risk of musculoskeletal injuries. The reason for the great number of musculoskeletal injuries is the great amount of lifting that HCWs are required to do. Injuries due to awkward work postures, such as the prolonged, standing, bending or kneeling can prevail among dentist, etologists, surgeons & especially micro-surgeons, obstetricians, gynecologists and other HCWs, such as operating room staff, cleaners & hospital laundry workers.

Back Injuries are widely regarded as an occupational hazards for nurses (Rogers and Savage, 1988) For many nurses an aching back is "Just part of the job", something they have to "Learn to live with" (Pheasant, 1992).

Back injuries are widely believed to be one of the most frequently occurring maladies among health care workers (Rogers and Savage, 1988 and Queensland Department of Health. 2000). For many years an aching back is "Just Part of the job", something they have to "learn to live with" (Pheasant, 1992).

Back strain damage to the muscles, ligaments or tendons occurs when the ligaments or tenders are over stretched or muscles are over used. The most common back problems result from strained or pulled muscles and may occurs in almost one of every two people sometime during their lifetimes. Back injuries have been associated with improper methods of lifting, pulling, pushing, carrying, bending or trusting. An unexpected load, a sudden slip or fall or cumulative trauma can cause back strain. (Lacurnce, 1990).

The common causes of back pain are:-

Lloyd *et.al* (1987) list the most common cause of all work related back pain as:-

- ✓ Job performance by a worker who is unfit or unaccustomed to the task
- ✓ Postural Stress, and
- ✓ Work that approaches the limit of a worker's strength. Factors that contributed to these causes of back pain are understaffing, the lack of regular training programs improper procedures for lifting and other work motions, and inadequate general safety precautions.

Specific Causes of Back Problems for Hospital Workers by type of workers are:

- ✓ Food Service Workers: Pushing or pulling carts, lifting heavy food trays and moving dishes, racks and containers.
- ✓ House Keepers: Lifting and setting down objects, and using scrubbing machines, brooms and mops
- ✓ Clerical Workers: Using chairs that are not designed for desk work and do not provide the proper support.
- ✓ Laundry Workers: Pushing or pulling carts.
- ✓ Maintenance Workers: Lifting moving and handling large packs, boxes or equipment.
- ✓ Patient Care Providers: Assisting patients and raising or lowering beds.

Where as in 2004 Times News Network – Reported some common causes of back pain as:

- ✓ A Sudden injury to the back due to an accident
- ✓ Obesity
- ✓ Lack of exercise and inactivity that leads to muscle wasting around the spine
- ✓ Smoking leads to inhibition of calcium absorption and weakens the spine
- ✓ Mental Stress
- ✓ Certain Jobs such as those that require repetitive movements
- ✓ Sitting in chairs that are not ergonomically suited for your back
- ✓ Maintaining a wrong posture while working long hours at a desk
- ✓ Standing for long periods of time with too much weight on one leg
- ✓ Holding the phone between the shoulders and the ear for a long time
- ✓ Gynecological conditions such as endometriosis, menstrual cramps, fibroid, tumors and pregnancy

Occupations, which call for frequent lifting, lifting of heavy weights and frequent lifting while twisting are among those with increased rates of back injury (Magora, 1970; Chaffin and Park, 1973; Frymoyes et al, 1983; Kelsey et al, 1984).

There are two main risk factors for back injury among HCWs: lifting and transferring patients, and bed-making (Ferguron 1970; Magora, 1970; Cust *et. al*, 1972;Dehlin *et. al* 1976; Bell *et. al.* 1979; Raistrick, 1981; Stubbs *et. al*, 1983 and 1996; Videman *et. al*, 1984; Klien *et.al*, 1984;Harber *et.al* 1985; Owen, 1985; Jensen 1985; Cren wood 1986; Arad and Nyran, 1986; Owen 1987; Personick; 1990; Jensen 1990). During a typical shift, on an average a hospital staff nurse will lift 20 patients into bed, and transfer 5-10 patients from bed to a chair. As with many hospital worker, bed making also increases the risks of back injury because of the bending and stretching in putting sheets onto a bed Patient handling activities are most likely to result in low-back pain, (Harber *et. it al* 1989). In a safety analysis of the Finish nursing profession, the rate of accidents attributed to patient handling was 20.5 percent of all occupational accidents and diseases (Vilen and Partanen, 1984). Of the enrolled nurses questioned, 79 percent considered lifting accidents i.e. those damaging nurses back- to be very common, (Jokienen and Poyhnonen, 1980). The lifting burden in many nursing tasks often equals or exceeds the recommendations of various authors concerning permissible maximum weight loads during different types of lifts (Dehlin and Lindberg, 1975) There are variety of mechanical aids for lifting and transferring patients (Troup *et. al*, 1981). In a Swedish study (Dehlin, *et. al* 1976) only 5.6 percent of the nursing aides stated that HCWs sometimes used one i.e. when they considered it appropriate or necessary. Indeed a few quantification studies have found high levels of biomechanical stress induced by patient lifting & transferring tasks (Stubbs *et. al*, 1983; Gagnon *et. al, 1986*; Torma - Krajewski, 1986; Carlson 1989).

Bureau of labour statistics reported that in 1994 approximately 7,05,800 cases (32%) resulted from over exertion or repetitive motion. Specifically 367,424 – 65 per cent injuries were due to over exertion, in lifting and pushing or pulling objects; 52 per cent HCWs selected for the study affected the back. In addition, 68,992 injuries were due to over exertion in holding, carrying or turning objects; out of these 58 per cent affected the back. Totaled across three categories, 47,861 disorders affected the shoulder. The median time, away from work due to over exertion was 6 days for lifting, 7 days for pushing / pulling and 6 days for holding / carrying / turning 92, 576 injuries or illnesses occurred as a result of receptive motion, including typing or re-entry, repetitive use of tools and repetitive placing grasping or moving of objects other than tools; of these repetitive motion injuries, 55 per cent affected the wrist, 7 per cent affected the shoulder, and 6 per cent affected the back.

Where as Hedge. A, 1998 reported that nearly 12 out of 100 nurses in hospitals and 17.3 out of 100 nurses working in nursing homes reported work related musculoskeletal injuries, including back injuries.

Nearly 50 per cent of all compensation claims for hospital workers involved back injuries (Health Alert, 1978;Klein *et.al* 1984; Jensen, 1986; Personick, 1990).

Jensen, (1986) reported that in 1978, back injuries accounted for approximately 25 million lost workdays about $ 14 billion in treatment cost among all workers (Goldberg *et. al*, 1980). Data from the Bureau of labour statistics for 1980 indicate that nurses aids, orderlies and attendants suffered from back sprains and stains more frequently than did workers in any other occupation (8.26 claims / 1000 eligible workers). Claims from licensed practical nurses ranked third (5.62 claims / 1000 eligible workers), while those from registered nurses ranked sixth (2.20 claims / 1000 eligible workers), other

health care categories ranked in the top included heath aids (not nursing aide), radiology's technicians and health – record technicians.

In a review of back pain in the nursing profession Buckle (1987) found on annual prevalence of 400-500 nurses at risk per 1000, with approximately 7,64,000 working hours per year being lost of the nurses leaving the profession, 0.8 per cent cited lower backache as the sole reason while 3.5 per cent reported back pain as a main or contributory reason.

The back pain experienced by nursing personnel is greater than the published statistics indicate and nurses perceive back pain as an inevitable part of nursing practice (Owan, 1987; Grag *et. al* 1992).

NIOSH guidance on weight lifting gives 55 pounds as a safe level for the average person.

Several studies have concluded that frequent manual lifting and/or transferring of patients are the primary, or at least the most recognized, causal factors for low-back pain among nursing personnel. Patient handling activities are most likely to result in low-back pain (Harber *et.al* 1989).

Corlett, *et.al* (1979) developed a technique for recording whole body postures by making ten marks on a chart, these marks indicating the positions of the head, trunk, upper and lower limbs with reference to a standard position. Training in the technique was given to groups of subjects, including 32 work-study practitioners, and tests of accuracy and repeatability conducted. This technique gives reliable records which can be used in many ways with little further translation. It provides a measuring instrument for the study of posture, which will permit limb and trunk positions to be, related to other dimensions e.g. time frequency, force or subjective judgments. The procedure was found to be easy to lean, highly repeatable and accurate except where postures were held for short periods and not repeated.

Both Stubbs *et.al* (1980) and Aryad and Ryan (1986) have studied the mode of onset of back pain in nurses and both found a preponderance of episodes of acute onset (59 percent and 65 percent respectively) as against cases in which the pain came on insidiously.

In the study by Stubbs *et. al* (1980) 30 percent of all episodes of back pain was associated in their onset with patient handling procedures. The results, shown in Table 2.2 indicate statistically significant excess in areas of nursing work, which are traditionally regarded as heavy. There was no such difference in the point of prevalence as a whole.

Table 2.2 Incidence of back-pain of acute onset associated with patient handling per 1000 whole time equivalents per years

	Incidence (Per 1000 WTE (Per annum)
Significantly high (P<0.01)	
General Medicine	365
Geriatrics	339
Orthopedics	339
District Nursing	209
Overall average for all nurses	190
Significantly low (P<0.01)	
Obstetrics	61
Out Patients	43
Accidents & emergency	16
Administrations	8

Imbeau and Hortie (1984) analyzed occupational accidents affecting nursing aides employed in a geriatric hospital. Back injuries were the most frequent results with an incidence of 62 percent and injury to the lower back region accounted for two - thirds of these accidents. The incidence of accidents to the upper arm is also particularly high among female nursing aides and represented 22 percent of all accidents.

Comparisons between nurses, nursing aids and other hospital workers add to this picture. Videman *et.al,* 1984 found a higher one - month period prevalence of back pain in nursing aids that in qualified nurses. The nursing aids also reported more back pain leading to unfitness for daily activities (over the preceding five year period) and had heavier jobs (as measured by reported lifting & time spent in bent or twisted positions)
Stubbs and Buckle (1984) found that 36 percent of all episodes of low back pain among nurses were associated with patient handling.

A subsequent ergonomics study by Lortie (1985) found that the activities presenting the greatest risk were primarily associated with horizontal effort like turning the patient over in bed and bed making. This was the most frequent operation required of female nursing aides and was associated with 19 percent of all accidents. This task consists of two phases: transfer of the patient over to the side of the bed followed by rotation, after which the patient is lying on his or her side in the center of the bed. When handling patients in bed the female nursing aides in the hospital studied generally used the pique as an aid, the pique being a waterproof and padded sheet placed under the patient.

In the study by Arad and Ryan (1986), a clear association emerged between the number of lifts per shift and the one - month period prevalence of back pain as a whole and both the number of lifts per shift and the prevalence of back pain decline with age.

Whereas in a study involving 813 nurses at an Australian hospital it was concluded that 87 percent of the participants had experienced at least one episode of back pain during their lifetime. Forty- two percent had an episode of low back pain within the previous month or at, the time of the survey and 53 percent of these nurses with low back pain reported that the injury was sustained during normal nursing duties. Such as lifting of patients, and making beds adopting different postures. (Arad, 1986 cited in Fvortes *et. al.* 1994)

It was also assessed that the personal and job - related factors as determinants of incidence of reported back injuries among nurses. The study population included 5,649 nurses who were surveyed by questionnaire and then observed for a 12 - month study period. An annual injury rate of 4.9 percent was observed. Four factors were found to be significant (P<. 01) predictors of back injury. All four factors- service area, lifting, job category and previously reported back injury-maintain significance when a forward stepping model of logistic regression is applied. The adjusted odds ratios observed are 4.26 for service areas, where lifting occurs least; 2.19 for daily lifters vs. light, occasional, and non lifters; 1.77 for nursing aides vs registered nurses and supervisory personnel; and 1.73 for individuals who have previously reported back vs those who have not reported previous injury. These findings strongly suggest that job related rather that personal characteristics are the major predictors of back injury in nurses.

Patient handling habits were studied on seven geriatric wards in five hospitals by Takala, (1987). The methods used were workplace analysis, questionnaire and video analysis of lifts. Three of the wards had no patient hoists, three had patients hoists and one ward the hoist was used only by nurse for bathing patients. The mean height of nursing staff was 164.3 cm and weight 62.4 kg. Their mean age was 35.4 years. The mean time on the present ward or in similar work was 10.5 years. The results snowed that mechanical hoists were regularly used only on the ward that had well organized on the job- training.

The reasons given for not using the hoist (lack of space or time, etc) were similar on this and the other wards where hoists were used irregularly. Lifting with hoists is slower than without aids, but the total extra time needed for their use is only 3-6 percent then of the 8 hours work shift. Stopped and twisted trunk positions occurred less often when lifting aids were used than without aid. However some nurses worked in back spine- loading position, even when using lifting aids.

Gagnon, *et. al* (1987) found that handling patients in bed using a pique (a waterproof padded sheet place under the patients) is associated with a high incidence of risks for the spine while performing the activity of pulling and turning the patient with the pique representing the highest risk. Fifteen female nursing aides were evaluated for compression and shear forces at the LS / S1, joint and for selected muscular activities in the trunk and shoulders. Films, force platforms and EMG recording supplied the data; dynamic segmental analyses were performed to calculate reaction forces at LS/ S1 and a single muscle equivalent was used to estimate internal loads Different execution parameters were examined including execution velocity, height of bed, direction of effort, leg position and knee support. A 'free" task, and a manual task not involving the pique, were also investigated. Recommendations are made for reducing spinal loading. The results also suggest that a change of direction in the trunk motion may present some risks when associated with handling of heavy loads. In order to reduce spinal loads it was recommended that the action of pulling and turning the patient over in the bed should be accomplished with the forces being exerted in the vertical direction, with the bed in the high position (Hip level) and with rapid motion if the patients condition permits.

Skowron, *et. al* (1987) suggested that work organization as one facto playing a part in the etiology of occupational low back pain. Baseline data for a prospective epidemiology study were gathered by means of a questionnaire.

One part of questionnaire elicited characteristics of work organization, perceived autonomy, the relationship with co-workers. Information on history of musculoskeletal problem, reported frequency of lifting and personal characteristics was also gathered of 87 nursing staff at two acute care hospitals, 154 (19.6 per cent) reported troublesome low back pain occurring within the previous 6 months. Form univariate analysis, such characteristics was also gathered of 787 nursing staff at two acute care hospitals, 154 (19.6 percent) reported troublesome low back pain occurring within the previous 6 months. Form univariate analysis, such characteristics of work, organization as shift, type of schedule and primary versus functional nursing were not associated with low back pain. The relationship with head nurse and perceived autonomy of the job also were not related to recent back pain. Recent low back pain was significantly, associated with younger age, the job category registered nurse and greater satisfaction in relationships with co-workers.

Gagon. *et.al.* (1987) reported in their study mechanical work and energy transfers while turning patients in bed that the task of pulling and turning a patients in bed is risky for female nursing aides, in terms of its loads on the spine. The purpose of the present study was to investigate the mechanical work and energy transfers both between and within the body segments, and the relative contribution of the body segments to production of the work. Fifteen female nursing aides took part in the experiment. Different task execution parameters were examined execution velocity, height of the bed, direction of effort, leg position, and support on the bedside. A 'free' task and a manual task not involving the use of the pique were also examined. Cinematography and force platforms were used to generate the data. Internal work was calculated on the basis of potential and kinetic segment energy. External work was calculated from the integration of power applied to the patient over time. The results suggest that forces should be applied vertically and at slow speed to minimize energy use, however, speed reduction leads to higher spinal loads. The type of task examined was associated with little energy conservation (about 30 percent

substantial use of the trunk segment to produce work might account for the back problems female nursing aids encounter with this type of task.

Pheasant, *et.al* (1987) used a questionnaire study to show a weak but significant relationship between increased back problems and hospital work areas requiring increased lifting..

Harber, *et.al* (1987) came to the same conclusion finding a correlation between specific manual handling patient care tasks and increased injury rates.

Harber, *et.al* (1988) conducted a study on occupational back pain of nurses.:- special problems and prevention to assess the nature and relative frequency of special circumstances of nursing which might contribute to occupational back pain and of preventive methods unique to nursing practice. The activities of 63 nurses were observed and coded in a behavioral scoring system. The group included registered nurses, licensed vocational nurses, aides and orderlies, and they worked in several different nursing units including intensive care units medical surgical units, Post anesthesia room and delivery room. Physical obstruction to easy contact with patients and fragile, extended attachments to patients were the most frequently observed problems.

Stubbs *et.al* (1988) in a comparison of two groups, frequent and infrequent patient handlers, they found that patient handling was a significant factor in the production of low back injuries in nursing.

Cato (1989) reported a questionnaire study which unidentified client (Patient) handling as a key factor leading to musculoskeletal injury for nursing personnel

Owen and Garg (1989) reported significantly higher rating of perceived exertion for patient transfers than for non-transfers Owen (1987) reported that

89 percent of the back injuries reports field by hospital nursing personnel implicated a patient handling tasks as important factor in their back pain.

This conclusion was also reached by Jensen (1986) that the prevalence rate of nursing staff who handles patients frequently was 3.7 times that of infrequent patient handlers.

Feldstein *et. al* (1993). Conducted a back injury prevention project. This was a pilot of study of "Back attack and educational program designed to prevent back injuries among nurses, nurses' aides, and orderlies. The pilot tested program feasibility, developed and tested instruments, and generated preliminary data measuring program effectiveness Fifty-five nurses, aides, and orderlies on two medical / surgical units at two Kaiser permanent medical centers in Portland, Oregon participated in the study. A 19 percent improvement in scores for quality of patient transfer was observed for the intervention group (P<. 0003), while the control group did not show any significant improvement during the same time period. Results of the pilot suggest that the back attack programme change behavior at least in the short term.

Similar study was conducted by Garg, *et.al* (1998) on "An ergonomic evaluation of nursing assistants job in a nursing home". Thirty-eight nursing assistants (NAs) in a nursing home ranked and rated 16 different patient handling tasks for perceived stresses to the low back. The nursing assistants were observed by 79, 4 hr shifts and were videotaped for 14, 4 hr shifts to describe a typical workday and to determine the number of patient-handling tasks performed per shift, the use of assistive devices, and bio mechanical stresses to the low back. In addition data were collected on nursing assistants' and patients characteristics. The top eight ranked tasks included transferring patient from toilet to wheelchair (WC), WC to toilet, WC to bed, bed to WC, batch tub to WC, Chair lift to WC, weighing patients and lifting patients up in bed. The mean rating of perceived exertion for these tasks were between

somewhat hard' and hard'. The estimated compressive force on L5/ S1, disc for the 50th percentile patient weight ranged from 3.7 to 4.9 KN. Nursing assistants worked in teams of two and performed 24 patient transfers per 8hr shifts by manually lifting and carrying patients. Patient safety and comfort lack of accessibility, physical stresses associated with the devices, lack of skill, increased transfer time, and lack of staffing were some of the reasons for not using these assistive devices. Environmental barriers (Such as confined work spaces. an uneven floor surface, lack of adjustability of beds, stationary ratings around the toilet, etc, made the job more difficult Nursing assistants had a high prevalence of low back pain and 51 percent of nursing assistants visited a health care providers in the last three years for work related low back pain.

Hignett (1996) concluded in a study of postural analysis of nursing work that nurses performing patient handling tasks adopt more harmful and hazardous postures. The author suggested a change in attribute in both the members of the nursing profession as well as the health care industry in general to lesson the manual-handling load performed by nursing personnel. This study used OWAS (Ovako working posture Analysis system) to measure the severity of the working posture adopted by nurses on care of the elderly wards when carrying out manual handling operations for animate and inanimate loads. Twenty-six nurses were observed on 31 occasions to obtain 4299 observations. These data were collected and processed using the OWASCO and OWASAN programs, and then analyzed by grouping the results into defined patient (animate) handling and non – patient (inanimate) handling tasks. A statistical comparison was made between the two groups using the percentage of action categories two, three and four, to the total number of action categories. A significant difference ($P<0.5$) was found, demonstrating that the percentage of harmful postures adopted during patients handling tasks were significantly higher than during non-patient handling tasks.

A Dutch questionnaire survey of back pain prevalence and physical work demands compared nurses working in institutional care with nurses working in patients private homes, where there was more frequent and heavy lifting and transferring of patients, plus more static workloads. Results showed that back pain prevalence was relatively high among these community nurses, as compared to rates among nurses in other health care sectors. Community nurses with back pain, who continued to work, reported providing less efficient home care work. Total sick leave incidence due to musculoskeletal disorders, other than back pain, exceeded due to back pain alone among this community nurses (Kinbbe, *et.al* (1996).

Similar results have been reported in an Australian retrospective questionnaire survey of manual handling activities and associated injuries among 269 nursing professional working as a large teaching and referral medical center in Melbourne, Australia (Retsas, *et. al,* 1999) Overall, 40.1 percent reported an injury associated with manual handling activity, of which 75.9 percent were back injuries. The prevalence of all manual handling and back injuries was lower among the 108 full-time nurses, 20.6 percent and 15.7 percent respectively. Direct patient care activities accounted for about two - thirds (67.6 percent) of all manual handling injuries. Lifting patients accounted for one half of all direct patient care activity associated injuries, and approximately one- third (34.3 percent) of all injuries similar results were found for manual handling practices and injuries among intensive care units (ICU) nurses over working in a large tertiary referral medical center in Australia where the rate of manual handling and back injuries among ICU nurses was high (52.2 percent and 71.4 percent respectively). (Retsas, *et.al* 1999).

A retrospective case-control study at the istitutiortopedici Rizzolo in Balogna (Italy) investigated the risk factors for low- back pain in hospital workers. Compared with a control group of hospital staff. The risks of low-

back pain were significantly higher in nursing and health aides. The risk of occupational back injury was highest in the orthopedic wards, in the plaster rooms, in the operating blocks and in the sterilization plants. (Rossi, *et.al*, 1999)

Elfering, *et. al* (2002) carried out a study on "Time control, catecholamines and back pain among young nurses", This study had two objectives. First, it addressed concern with the contribution of work stressrors and resources to the development of back pain, over and above the influence of biomechanical work factor. Second, using recent models about the role of the sympathetic adrenal medullar system in musculoskeletal problems as its basis, it tested whether low back pain is associated with higher level of catecholamines. Altogether 14 nurses filled out a questionnaire in their first year of practice and again one year later. In addition, in a sub sample of 24 nurses was studied intensively at follow-up. Daily stressful experiences and daily, mood were also recorded. With control of baseline pain, biomechanical workload, and other potentially confounding variables, time control at the begining of the study predicted low back pain a year later, In the sub sample, the epinephrine and non repinedhrine level were higher in those reporting more frequent episodes of back pain, the largest differences occurring at the end of work. The conclusion of the study was that time control is a risk factor for low-back pain among nurses beyond the influence of physical workload. Low control at work may increase the activity of the sympathetic-adrenal medullar system, which seems to play an important role in the development of musculoskeletal pain.

Kjellberg *et.al* (2003) carried out a study on work technique of nurses in patient transfer tasks and associations with personal factors. The objective of the study was to explore the work technique applied while nursing. The work technique used by 102 nurses to perform two common patient transfer tasks in orthopedic wards, transfer high up in bed and transfer from bed to wheelchair,

was examined with the use of video recordings and an observation instrument. A work technique score was calculated for each performed transfer. It indicated the level of musculoskeletal safety and hazards for the nurse. A variety of strategies were used by the nurses to perform the transfer tasks. Being older and suffering from low-back symptoms were factors associated with the use of poor work technique in both tasks There was also an association between male gender and poor technique in transferring patients form bed to wheelchair. The results indicate an association between poor work techniques and low-back symptoms. Special attention should be paid to older nurses, nurses with low back problems and possibly also to male nurses when training programs on patient transfer technique are designed, as these groups seem to apply comparatively poor work technique in patient transfer tasks.

Smedley *et al.* (2003) assessed the impact of ergonomics intervention on rates of low - back pain among hospital nurses. Altogether 1239 female nurses from two hospitals in southern England completed a baseline postal questionnaire about low-back pain and associated risk factors. Between 18 and 28 months after the baseline survey, major intervention was implemented at one hospital to minimize unassisted patient handling and high risk nursing tasks. At the other, no intervention was initiated and efforts to improve patient handling were more limited. Thirty-two months after the baseline, survey, a second postal survey was carried out in both hospitals (1167 respondents) to reassess the prevalence of symptoms and risk factors. After adjustment for non occupational risk factors prevalent low-back pain at baseline was associated with low job satisfaction and the performance of patient handling activities without mechanical aids. At the intervention site the prevalence of symptoms increased slightly (from 27 percent to 30 percent), whereas at the comparison site there was no change, the prevalence remaining constant at 27 percent there findings cast doubt on the means by which many hospitals are attempting to improve the ergonomics of nursing activities.

Cremilde, *et.al* (2004) developed an instrument for patient handling assessment and to determine its validity and reliability. Instrument validity was established based on content and construct validity. Reliability was estimated through homogeneity, stability (test- retest) and equivalence (interrater) tests. Reliability estimated by internal consistency reached a cronbach's Alpha coefficient of 0.81). Person's correlation coefficient for test - retest reliability was r=0.92. The results of the current study showed that the instrument seems to be reliable and valid for patient handling assessment.

Byrus, *et. al* (2004), reported in their study that back pain disability is a serious and costly problem affecting the nursing profession. The purpose of this study were to determine risk factors for work related low-back pain (WRLBP) in registered nurses and to record the reported use or reasons for nonuse of mechanical lifts. A random sample of 270, registered nurses was selected form two acute case hospitals in central Illinois to identify WRLBP risk factors. This study gathered information on individual physical workload, psychological and organizational factors that may present a risk for WRLBP. Information was also collected on the use of safety devices and back pain symptoms. The response rate was 50.4 percent. Nearly 84 percent of respondents had WRLBP in the past and., 36.2 percent had WRLBP in the past year that limited movement or interfered with routine activities. Among the risk factors significantly associated with WRLBP were more years in nursing frequent lifting and low social support. Only 11% reported that they routinely used mechanical lifting devices and the primary reason given for failure to use lifting equipment was unavailability of equipment.

❖ **Violence**

Violence at work is common among workers who are in contact with people in distress. Frustration and anger, arising out of illness and pain, problems of aging, psychiatric disorders, alcohol and verbal abuse can affect

people's behaviors & make them verbally & physically aggressive. HCWs are at special risk of workplace violence. Health service staff working in emergency care units & in psychiatric hospital are at high risk of violence. Female HCWs are particularly vulnerable to violence at work.

Work related violence, defined as violent acts, including physical assaults and threats of assault directed towards persons at work or on duty (NIOSH, 1996) has been recognized as a major problem. Nurses account for an important proportion of hospital workers and health care workers in general. Although violence against nurses has been identified, specifically as a major occupational problem, (Baxter E, 1992; Arnetz, 1998;Carter , 2000) the magnitude of violence against this occupational group and potential risk factor have been largely unknown. A study of risk 1992 Minnesota Worker's compensation files found that nurses, alone, accounted for over 7% of the total workers compensated for work related assault resulting in more than three days of lost time & that women had an assault rate twice that of men (Lamar , 1998).

- **Psychological Hazards**

When people are faced with demands from others from the physical or psychosocial environment to which they feel unable to respond adequately, a response of the organism is activated to cope with the situation. The nature of this response will depend upon a combination of different elements, including the extent of the demand, the personal characteristics and coping resources of the person, the constraints on the person in trying to cope and the support received from others. Job stress is defined as the harmful physical and emotional response of the worker, when the requirements of the job do not match his / her capabilities, resources or needs. The main cause includes heavy workload, conflicting or uncertain job responsibilities and job insecurity. Dealing with the very sick and dying persons can be a real problem for trainees. Long working hours a high level of responsibilities and shift work are

part of the life of many hospital workers. Junior doctors & nurses are more likely to face these stressful situations. Such health effects can be anxiety, aggressiveness, apathy, boredom, irritability, depression, exhaustion, or behavioral effects such as accident proneness, smoking, drug – taking alcohol, abuse, excess eating or restlessness. Adapted from information published in the supplementary data by the U.S. Department of Labour Bureau Statistics (1983).

Many of the effect of badly designed work, whether physical or mental, will be felt by individuals in terms of occupational stress caused by not coping with the workload (Drury ,1983).

If health is considered as a dynamic equilibrium, stress is part of it, for there is no health without interaction with other people and with the environment. Some stress, then is normal and necessary. But if stress is intense, continuos or repeated, if the person is unable to cope or if support is lacking, then stress becomes a negative phenomenon leading to physical illness and psychological disorders. From early disorders to real illness, the harmful consequences of stress cover a broad range form chronic fatigue to depression, by way of insomnia, anxiety, migraines, emotional upsets, stomach ulcers, allergies, skin disorders, lumbago and rheumatic attacks and tobacco and alcohol abuse, and can culminate in the most serious consequences of all - heart attacks, accidents and even suicides. Negative stress has many causes. Some of these are to be found in an unsatisfactory fit between the individual and the physical environment. Other stresses are generated primarily by the relation between individuals and their psychosocial environment. These can depend on the level of autonomy and responsibility, the load of activities, the organisation of different activities, the arrangement of working time, the relationship with other individuals and communities and so on. (Griffiths 1996); T.Cox, 1989).

The work environment contributes many potential stressrors. The nature of the work environmental conditions and interpersonal relationships with

colleagues influence the experience of stress. In recent years there has been increasing interest in the topic of stress at work and it is widely recognised that the experience of stress has undesirable consequences for health and safety of individuals at work. The deleterious effects of stress are both widespread and diverse, to the extent that "Many people would regards stress as the principal threat to well-being in advanced industrial societies " (Pheasant, 1991).

❖ **Work stress**

Over the past three decades, the possible adverse effects of stressful work contents have been studied extensively in different areas, such as employees, physical health (Sales, 1969; Jenkins, 1976; injury (Caplan, Cobb, French, Harrison and Pinneau, 1975); mental health (Colligan, Smith and Hurrell, 1977; Kasl, 1973); job satisfaction, anger and anxiety (Depue and Monroe, 1986; peters and O'connor, 1998, Spector, 1987); turnover (Hendrix, Ovalle and Traxles 1985; O'connor peters, Pooyan, Weekley, Frank and Frenkrantsz 1984); and performance (Perters, O' Connor and Rudoly, 1980 ; Spector, Duryer and Jex, 1988; Steel, Mento and Hendrix, 1987). Little attention has been paid to potentially harmful behaviors such as aggressive acts (e.g. interpersonal aggression, hostility, complaining). These overlooked behaviors, however, have been studied in the domain of organizational frustration. For example, Spector (1975, 1978) indicated that frustrated events, which interfere with employee's goal attainment and or maintenance in organizational setting, might cause aggressive behaviors, theft and absence at work.

Health care workers appear to face stressors more than any other industry. The major stressors which have been documented include time related stress, fearful patients, high case loads, financial worries, staff problems, equipment break-down, defective materials, poor working conditions and the routine materials, and the routine nature of the job (Cooper, 1980; Dunlop and stewart, 1982; Furnham, 1983; Sebor 1984).

Chen. and Spector (1992) conducted a study on relationships of work stressors with aggression withdrawal, theft and substance use. Based on findings from the domain of organizational frustration, the conceptual similarity between stress and frustration, and the functional similarity between frustrated events and work stressors, the relationships of behaviors (aggression, withdrawal, theft and substance use) with work stressors and affective reaction were investigated in the study. 400 employees from 14 sources volunterred to participate in the study. Five work stressors were measured by using the scale of Spector *et al* (1988) Role ambiguity and conflict were measured by using Rizzo and Lirtzman's (1970) Scale. Results showed that relations between reported stressors and behaviours were strongest relations with theft and absence were modest. None of the stressors correlated with reported substance use at work. Among the relations between affective reactions and the reported behaviours anger and job satisfaction correlated with all behaviors.

Cooper *et.al* (1988) conducted a study on occupational stress among general practice dentists. This study assessed the mental well being and job satisfaction of a random sample of 488 dentists in England, Scotland, Wales and Northern Ireland. It was found that male dentists showed lower level of well being than the normative population. Using multiple regression and LISREL, It was found that time and scheduling demands and negative patients perceptions were consistent predictors of mental ill-health among both male and female dentists. While there was also a significant relationship between these factors and job satisfaction, the amount of variance explained was small.

❖ **Job satisfaction**

Satisfaction of the employee in their jobs is of paramount importance in determining the success with which any organization functions. Job satisfaction depicts the state of mind of an employee at a particulars point of time. i..e.

Whether he is satisfied or not with his job. The extent of job satisfaction among women is an important aspect of their labour market experience for it may signify the degree to which they have made a successful adjustment to the world of work, which has, and impact on satisfaction of home role performance of working women (Burge, and Culves, 1989).

Hamner, and Tosi, (1973) assessed relationship of role conflict and role ambiguity to job involvement measure. The objective of this study was to examine the relationship of role conflict and role ambiguity to various job involvement variables. The data were collected from 61-high level managers participating in an executive development programme from many industries. A 10-item instruments (Rizzo, 1970) was used to measure perception of role conflict & role ambiguity. The job satisfaction sub-scale used in this study was developed by Vroom (1963). Results of the study showed that role conflict was negatively related to the amount of reported influence and positively related to the amount of perceived threat and anxiety. While role ambiguity was negatively correlated with job satisfaction and influence, and positively related to job threat and anxiety. It was suggested that organizational level be taken into account when studying the relationship of role stress factors with job involvement measure.

Watson *et.al* (1987) discussed the role of negative affectivity (NA) in the measurement of organizational variables. They argued that NA parameters measure of job satisfaction and other job effects specifically, "the interrelationships among various measure of self reported stress, and symptoms, mood, personality and perception of frustration all reflect the same underlying construct of NA". They further concluded, "to the extent various self-report measures all the same underlying NA construct, presumed 'Interdependent variables' and 'dependent variables' in many stress studies.

Chen and Spector (1991) conducted a study entitled Negative affectivity as the underlying cause of correlations between stressors and strains. This study was conducted to examine the role of negative affectivity in observed relations between self-reported job stressors and strains. Consistent with the job-stress literature, significant correlations were found between job stressors and job strains. These relations were considerably stronger for affective reactions (e.g., anger, and job satisfactions) than for physical strains (e.g. physical symptoms and doctor visits). Significant correlation were also found between NA and both stressors and strains.

Murali *et. al* (1997) developed a scale to measure the level of job satisfaction of working women by using the Likert's technique of summated rating method. The developed scale was tested for reliability by using the spilt-half method. Seventy working women were randomly selected for the study. The final format of the scale consisted of 40 statements with higher 't' values out of which 20 statements were positive and other 2- statements were negative. The reliability co-efficient of the scale was 0.68 indicating a high internal consistency of the scale. Hence the scale is said to be a reliable instrument to measure the satisfaction level of job satisfaction.

❖ **Burnout**

In the 1970s, Freudenberger, coined the term "Burnout". Burnout syndrome and its effects have emerged in the 1980's as major concerns of organisation theorists, management and the media. The term 'Burnout' was first coined and applied to human beings by Herbert Freudenberger (1974) to denote a state of physical and emotional depletion resulting from conditions of work. Maslach and Jackson (1982) have described burnout as a syndrome involving emotional exhaustion, depersonalization and a reduced sense of personal accomplishment.

Burnout is characterized as psychological strain resulting from occupational stress. These symptoms of strain include changes in behaviour towards clients or others, and changes both in quality and involvement in work.

Definitions of burnout include: emotional exhaustion resulting from chronic tension and stress at work place (Maslach and Jackson, 1981); a process where by committed professionals disengage from their work in response to job stress (Silverstein, 1982); and a state resulting from repeated work experiences in which individuals expect few rewards and considerable punishment in their job, little control of reinforcement or little personal competence in obtaining reinforcement (Meier, 1983).

Causes of burnout proposed in the literature include poor economic conditions (Crase, 1980), work overload and lack of perceived success (Weiskopf, 1980), tedium and stress (Pines *et. al*, 1981), and career development crises (Cardinell, 1981).

Garden (1989) conducted a study to compare dimensions of burnout in a human services sample of 81 nurses and non- human services sample of 194 mid- career managers on an MBA course. A measure of burnout, and certain postulated facets of burnout, were assessed through a self - reported questionnaire. It was found that emotional demands and a lack of caring for others were associated with the measure of burnout only for that psychological type which is over represented in the human services. For a different psychological type, which is over represented in mangerial occupations, the measure of burnout was associated instead with mental demands and lower ambitiousness.

Firth *et. al* (1989) conducted a study on "Burnout" absence and turnover amongst British Nursing Staff. This study reports on a predictive study amongst qualified nursing staff working in long stay setting (medical wards, Psychiatric wards and mental handicap wards) over a two - year period. A total of 106 of the 200 qualified staff participated in the study. The Maslach burnout inventory frequency format (Maslach and Jackson 1981 (b)), a

measure of role ambiguity (Kahn, Wolfe, Ovinn and Snoek, 1964) and a questionnaire assessing their perceived support from their immediate nursing superior (Firth *et. al* 1986 (a)) was used to collect the data. The results of the study showed that perceived lack of support and emotional exhaustion predicted the frequency of absences of more than four days, and more than seven days, respectively, in the subsequent 12 months. Feelings of depersonalization were correlated with departure from the job during the subsequent two years. This study offers evidence that staff's perception of the strain experienced at work may indeed have an influence upon absence through sickness. The conclusion of this study was that emotional exhaustion and lack of perceived support both influence-generalized motivation to attend work and feelings of 'depression'.

Higashiguchi *et.al* (1999) carried out a study on "Burnout and Related factors among Hospital Nurses". The overall goal of this study was to examine the relationship between burnout in the hospital nurses and three parameters: occupational factors, individual attributes, and workplace stressors. Two hundred and sixty-eight female nurses from two public general hospitals were surveyed. Three forms were used first, a demographic data from to ascertain personal attributes; second, the Japanese version of the Maslach Burnout Inventory (MBI) to assess burnout; and third, the Japanese version of the job content questionnaire (JCQ) to assess workplace stressors. The Japanese version of MBI consists of three sub-scales. Physical /Exhaustion (PE), Emotional exhaustion / depersonalization (EE+DP) and personal accomplishment (PA). The results were as follow: (1) There was significant correlation between both PE and EE + DP and years of nursing experience as well as the age of children. (2) There was a significant correlation between PE and the work schedule or work place. (3) There was no significant correlation between the Japanese MBI sub-scales and job rank, marital status, or the number of children. (4) There was a significant correlation between the three sub-scales of Japanese MBI and the Japanese JCQ Scales.

Escriba, *et.al* (2004) conducted a study on psychological well being among hospital personnel: The role of family demands and psychosocial work environment. This study investigates the effect of gender role and the psychosocial work environment on the psychological well being of hospital staff in two general hospitals in the province of Valencia (Spain). A cross-sectional survey was carried out among 313 workers by means of self-answered questionnaire. The outcome variable (Psychological well being) was evaluated with four dimension of the "SF-36 Health survey" (Mental health vitality, limitations in the emotional role and limitation in the social function). The explanatory variables were: characteristics related to gender role, professional characteristics and the psychosocial working environment evaluated according to Karasek and Johnson's demand -control - support model. The adjusted odds ratios (ORs) and their 95% Confidence intervals were calculated by logistical regression. Results: Those who have very good marital relations ship have less risk of presenting bad mental health and limitation in the social function, and in the emotional role, Those who dedicate more than 30 hrs a week to domestic chores have a higher risk of limitation of social function. Those exposed to high psychological demand present a higher probability of having bad mental health. Those exposed to low job social support have a higher risk of bad mental health, low vitality and limitation in the social function.

It was concluded in the study that Gender role and psychosocial work environment have a negative influence on the psychological well being of hospital staff.

3. Anthropometric variability

Anthropometry is the subject, which deals with the measurements of the human external body dimensions in static and dynamic conditions. These

include measurements of body parts, their strength, speed and their ranges of motion (Chakrobarti, 1997).

Age, sex, race, geographical regions, even different occupations, all influence human body dimensions. Accurate dimensions of clothing and personal equipment used by persons, e.g. headgear, footwear, spectacles, lifesaving and support equipment would be of great value because human functional dimensions and the range of movements, demands that appropriate allowances should be made when specific designs are developed. From time to time, anthropometric data are generated amongst various populations in different countries and are used as ready reference on Indian design practices.

Some studies are related to definition of anthropometric measurements. Croney (1980) and Pheasant (1982) have expressed that the design of the work place needs to be based on the Anthropometry of the users. The anthropometric characteristics of any population are dependent variables. The authors have commented on the effects of such variables on body measurements. Therefore it is important to emphasize the differences between designing for a specific group and for the general population.

According to Chakrobarti (1997) the relevant anthropometric supports along with the intended user's behavioral pattern, should be seen together while designing. To make an article of the correct size, to create a system of multiple units and a workspace, or to design an article for a single individual's need, individuals own dimensional requirements may be of direct importance. But for mass production and use, proper percentile selections of the anthropometric data should be made and adequate allowance should be considered.

These studies are highlighted research on anthropometric measurements.

The anthropometric factors, which should be taken into account, in the design of products, equipment and / or the environment, are clearance reach, posture and strength requirements (Pheasant, 1986).

In a study of the anthropometric aspects of a workstation design, Pheasant (1987) examined the design of hospital equipment, hospital beds and found that HCWs lifting patients or equipments spend a vast period of time in the stopped position- either bending over a too-low work surface or reaching forward over obstacles. This can lead to postural stress.

In a study conducted by Manuaba (1989), ergonomic principles were applied to enhance the effectiveness and efficiency of the nursing personnel employed at a hospital in Denspasar, Bali, Indonesia. Anthropometric and equipment measurements, questionnaire surveys and direct observation were utilized both the anthropometric data and direct observation of the nurses and patient beds generally showed a suitable relationship with respect to posture. The nurses reported no pain and no complaints were made about the workstations. The authors concluded that the hospital management had enhanced the efficiency of the nursing personnel through the application of ergonomics principles.

Botha, and Bridger, (1998) examined the anthropometry and anthropometric fit of a group of nurses in Western Cape private hospitals in their study anthropometric variability, equipment usability and musculoskeletal pain in a group of nurses in the Western Cape. Anthropometric variables were measured using a sample of 100 nurses and a correlation matrix generated. All nurses were given questionnaire concerned with operational problems in the work environment and musculoskeletal pain. The nurses reported many problems related to the working environment, such as lumbar backache, workspace constraints, and design of workstations and general equipment usability problems that caused bodily discomfort. There were consistent, statistically significant associations between the frequency of occurrence of these problems and the anthropometric data indicating that the problems were caused or amplified by body type variability and were not simply general

usability problems which would affect all nurses irrespective of their body dimensions.

4. Work Height

Working heights is of critical importance in the design of work place. If the work surface is raised too high the shoulders must frequently be lifted up to compensate, which may lead to painful cramps in the neck and shoulders. If the working height is too low, the back must be excessively bowed, which again often causes back ache. Hence, the work height must be of such height that it suits the height of the operator, whether he/ she sits or stands at his/her work (Datar, 2003).

Bratton (1959) recommended the working heights for hand work while standing to be 50-100 mm (5-10 cm) below elbow height to be most favourable one. The average elbow height should be 1050mm (10.5 cm) for men and 980mm (9.8 cm) for women i.e. on an average working heights of convenient for men and women respectively.

Recommendations for working when standing are given as general guidelines based on average body measurements

- Delicate work - 5-10 cm above elbow height
- Light work - 5-10 cm below elbow height
- Heavy work - 15-40 cm below elbow height

Konz (1960) concluded from the experimental results that the best working height for a standing operator is about 2.5 cm below elbow height.

The recommendations for fine and precision work (Ayoub, 1973) are somewhat at odds with the second general principle of placing working heights at elbow height. Specially, the recommendations would place the working surface upon which fine and precision work is done at 6 and 2 inches (15 and 5 cm) above elbow height respectively. In such instances there should be a provision for arms rest on the work surface. The higher surfaces are

recommended so that the work is within close visual range which would be imported for such work.

Considering body structure and bio mechanics , the work surface should be at such a level that all arms can hang in a reasonably natural relaxed positions from the shoulder with elbow having satisfactory relationship to the working surface i.e., forearm should be approximately horizontal or sloping down slightly (Mc Cormick, 1976). Work surface height for standing, should be slightly below the elbow height namely 2inches -4 inches or 5-10 cm below elbow.

Grandjean (1988) stated that, the most favourable working height for hand work, while standing is 50-100mm below elbow height. The average elbow height is 980mm for women. Author consider that average working heights of 880-930mm for women will be convenient.

Grandjean (1988) has recommended heights for precision work, light work and heavy work as related to elbow height. For light and heavy work the recommended work surface heights are below elbow height, where as that for precision work is slightly above to provide elbow support for precision manual control.

The review of existing literature covers various topics, namely incidence of illness and injuries, occupational health hazards, musculoskeletal troubles and disorders, body discomfort and psychological aspects.

After reviewing the extensive literature it was found that although many researches has been conducted on occupational health hazards faced by nurses, there is dearth of information on occupational health hazards faced by wardboys and physiological cost of work in terms of energy expenditure , heart rate and total cardiac cost of work.It was also noted that there were very few studies conducted in India on HCWs working in hospitals.

Therefore a need was felt to conduct a study on HCWs including both wardboys and nurses to find out occupational health hazards faced by them while working in hospitals in India and to provide guidelines for safe work place.