# Chapter 1
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Ergonomics is an applied science that deals with the adaptation of work and the workplace to the characteristics and capabilities of the worker so that he or she may perform the duties of the job effectively and safely. It addresses the worker's physical capacities in relation to the physical requirements of the job (e.g., strength, endurance, dexterity, flexibility, ability to tolerate positions and postures, visual and auditory acuity) as well as his or her mental and emotional status in relation to the way the work is organized (e.g., work schedules, workload and work-related stress). Ideally, adaptations are made to the furniture, equipment and tools used by the worker and to the work environment to enable the worker to perform adequately without risk to himself/herself, co-workers and the public. Occasionally, it is necessary to improve the worker's adaptation to the job through, for example, special training and the use of personal protective equipment.

The term "Ergonomics" is derived from the Greek word "ergon" which means work and "nomos" which means laws of work and study of human machine system with the goals of –

- Protecting workers from serious physical or mental harm
- Maximizing workers well being
- Increasing user's acceptance

(Corlett, 2002)

"Ergonomics is the relationship between man and his occupation, equipment, and the environment in the widest sense, including work, play, leisure, and travel situations" (Brown and Hendricks, 1980).

"Ergonomics or human machine engineering is the scientific study of relationship between man and his working environment. The term environment includes the tools and materials, his method of work, ambient conditions and physical environment of work also the organization of work (Gite, 2002).

From the above concept it can be concluded that ergonomics is the study of relationship between man and his working equipment and working environment. Ergonomics is concerned, with the study of man's daily work. The intent is to ensure that working equipments and working environment are so designed to fit the job to the man rather than man to his job.

## Health Care Services

The health care services play an important role in the service sector. Health and medical services is now a major employer in all countries (Niu, 2000). The health care industry is the largest employer in all the countries. It is first in United States, (Sadik, *et. al*, 1999) the fourth in Sweden and the fifth in Norway (Niu, 2000). In 1996, this industry employed approximately 11.2 million persons, with over 5 million employed in Hospitals (National Centers for Health Statistics, Health, United States, 1996-97). It is estimated that there are 35 million health care workers (HCWs) world wide out of these some 18.5 million are doctors and nurses.

HCWs may include: all persons working in health care delivery units such as hospitals, pharmacies, ambulances and private practices; personnel working in health related institutions such as spas and rehabilitation units; personnel working in social service units supplying medical aid to elderly and disabled people, the administration of a health sector; teaching and research staff and catering and maintenance staff.

The HCWs can be classified into five categories on the basis of their qualifications and their actual role in the provision of health and medical services. Physicians, other graduate level professionals such as laboratory technicians and pharmacists, nurses and midwives, therapists and social workers and maintenance workers who repair and refurbish the building and equipment in the health care services. The job categories in health care are varied and include ancillary, laboratory and administrative support staff as well as staff dealing directly with patient care.

Thus Health care is a labour intensive industry and it covers a highly diversified range of activities. Although some risks and hazards are common to the whole sectors. Others are more specific to certain categories of HCWs or to certain work practices (Lipscomb, 2002).

In this health care industry, patient care demands 24 hours /day, 7days/week nursing coverage in hospitals and many other health care setting. In order to meet these demands, HCWs have historically been required to work a variety of schedules. The impact of extended work schedule of HCWs, health and safety is of concern because such schedule increase exposure to physical and psychological job demands and reduce time for rest and recuperative leisure time activities (Lipscomb *et. al*, 2002)

The costs of illness and injuries continue to rise, posing a problem of great human and financial cost. Many of these illness and injuries are caused by potentially controllable occupational hazards (Lowenthal, 1994)

Over the past decade, the health care industry has seen an increase in the number of injuries and illness, especially among hospital workers. Hospitals were among nine industries having at least 1,00,000 injuries, which accounted for 31 per cent of the total nonfatal injuries and illness in 1996 (National Center for Health Statistics, United States, 1996 - 97).

In 1997, more than 6,50,000 injuries were reported among the nation's 9.5 million health care workers. With an incident rate of 16 injuries per 100 full time workers, nursing and personal care facilities report the highest incident rate of any occupation (Health and Safety, 1999).

In 2001, the National Bureau of Labour statistics (BLS) reported that personnel working at extended care facilities, including nursing assistants, were approximately five times more likely to suffer an occupational injury than those in private or service industries and almost two and a times more likely than those in other health care services (United States Bureau of Labour Statistics, 2003)

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 infections and parasitic disease, respiratory conditions diseases of the ear, headaches, genitourinary disorders problems associated with child birth, disorder of pregnancy and puerperium and diseases of the skin and musculoskeletal system (Gun, 1983).

Health Care workers (HCWs) form the largest occupational group in many countries and they face a very wide range of occupational health hazards.

For example in the USA, 1995 Labour Department report showed that nursing homes, just as construction sites were dangerous workplaces. Nursing aids and orderlies were absent 1,03,900 days in 1993 due to illness and injuries and nurses were absent some 46,400 days, when workers over – exerted themselves, 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.

In Australia, the hospital and nursing homes industry occupational health and safety performance overview (1991-92) indicated that 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 1000 employed than the incidence rate for Australian industries overall.

Furthermore, nursing professionals experience the highest proportion of injuries and diseases within the health care industry (Niu, 2000).

Since the mid 1970s, the application of ergonomics to hospital workers has broadened. It is directed now at those involved in direct patient care (e.g., physicians and nurses), those involved in ancillary services (e.g., technicians, laboratory staff, pharmacists and social workers) and those providing support services (e.g., administrative and clerical personnel, food service staff, housekeeping staff, maintenance workers and security staff).

Extensive research has been conducted into the ergonomics of hospitalization, with most studies attempting to identify the extent to which hospital administrators should allow hospital personnel latitude in developing strategies to reconcile an acceptable workload with good quality of care. Hospital ergonomics also includes workstation analysis- the distance between room and the amount and location of equipment.

Hospital ergonomics is a way of using specific information to bring about wide ranging and relevant improvements to the quality of care and to working life. It is the study of relevant human characteristics and their relationship with his/her working environment with the aim to improve efficiency, increase safety and well being of workers working in hospital.

## Justification of the study

Health care workers know that they face serious hazards to their own health and well being in the course of their jobs, which affect their family also (Health and Safety, 1999). Attention should be drawn to the fact that personnel working in the health care sector are generally viewed as "health service providers" and are rarely seen as "workers" in need of protection. Regulations governing hospitals are usually designed to protect patients, not the health care providers. As a result, the occupational safety and health problems faced by HCWs often receive scant attention; the rate of injuries and illnesses suffered by health care workers on the job continues to rise.

Physical strain is one of the primary determinants of the health of HCWs and the quality of care that they dispense. This being said, the frequent interruptions that hinder care giving and the effect of psychological factors associated with confrontations with serious illness, ageing and death must also be addressed. Employers and lawmakers however pay little attention to this problem. Similarly, patients' perception of the quality of their hospital stay is determined by the effectiveness of the care they receive, their relationship with physicians and other personnel, the food and the architectural environment.

Basic to hospital ergonomics is study of the sum and interaction of personal factors (e.g., fatigue, fitness, age and training) and circumstantial factors (e.g., work organization, schedule, floor layout, furniture, equipment, communication and psychological support within the work team), which combine to affect the performance of work. This helps to detect factors that may interfere with effective, safe, comfortable and healthy work. Analysis of strain related to the use of basic equipment (e.g., beds, meal carts and mobile x-ray equipment) may help clarify the conditions of acceptable use.

From an occupation health perspective it is essential to consider health and safety aspect and to ensure that HCWs are medically fit for their roles and do not themselves pose a risk to their patients and to their family. As home management experts we consider family as one of the important constituent of society and also for the individual living in it. The health of these individuals plays an important role on their performance both within family as well as in his work place. The family member is an important human resource and therefore his/her health is of primary concern to both family as well as society.

So, there is a need to identify occupational health hazards faced by HCWs that have direct effect on the physical and psychological cost of their work and to evaluate the work/worker/and-working environment for developing guidelines for safe work surface for reducing occupational health hazards.

With this background the present study was conducted to find out occupational health hazards i.e. physiological and psychological, which have direct effect on the physiological and psychological cost of work of HCWs working in hospitals. The main purpose of the study is to ergonomically assess the occupational health hazards faced by HCWs, which have direct bearing on their working performance.

The HCWs participation and active involvement is the key to a successful programme targeted at the safety and health problems in the health care sector.

## Objectives of the study

1. To gain insight into worker and work related aspects of health care workers.
2. To find out the nature of work carried out by health care workers in the hospitals.
3. To identify the nature and incidence of occupational health hazards faced by health care workers
4. To find out the selected anthropometric measurements of health care workers and dimensions of hospital furniture / equipments.
5. To ergonomically assess health care workers while working in hospital in terms of -
   1- Physiological cost of work.
   2- Psychological cost of work.
6. To develop guidelines for health care workers to reduce occupational Health hazards.

## Limitations of the study

1. The guidelines developed would be applicable to the health care workers working in hospitals only.

## Delimitations of the study

1. The present study was limited to 120 Health care workers (nurses and wardboys) working in selected hospitals from 3 districts i.e. Nainital, Udham Singh Nagar and Pauri of Uttaranchal for descriptive data.
2. For experimental study 12 physically fit health care workers were selected.
3. Only the limited wards of Hospital were studied for experimental study.

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## Hypotheses of the study

The following hypotheses were tested by employing appropriate statistical tests.

**$H1_1$ :** There is relationship between the selected work and worker- related variables and physiological cost of work i.e. musculoskeletal symptoms.

**$H1_2$:** There is relationship between the selected work and worker- related variables and psychological cost of work.

**$H1_3$:** There is relationship between selected worker related variables and physiological cost of work in terms of: -

1. Heart rate
2. Energy expenditure
3. Postural stress
4. Physical fitness Index