



Occupational Health Effects of Self Employed Personnel with Reference to Auto Drivers and Photocopy Workers

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ABSTRACT

Occupational health remains neglected in developing countries because of competing social, economic, and political challenges. Self-employment is one of the best employment sources for low income group, which will enable feasibility of own work place and conditions. This study focused on two of self-employed jobs i.e., photocopy workers and auto drivers. Occupational health effects of these jobs were studied through a cross sectional survey. Results from the study indicated musculo-skeletal disorders in auto drivers and respiratory disorders, physical stress in photocopy workers. This study suggests that reduction of exposures to various pollutants and change in working environments is likely to improve the health of the workers.

INTRODUCTION

Work is a central element of an individual's life, and is the main reference for determining patterns of identity and sociability, political activities, family life, access to economic resources and opportunities for achieving good health and wellbeing (Siegrist 2000, Lynch & Kaplan 2000, Dias et al. 2011). Working conditions and the nature of employment tend to have major repercussions on the health of a workman. The concept of 'occupational health' has evolved from work-related ailments. Occupational health broadly means any injury, impairment or disease affecting a worker or employee during his course of employment. Further, it not only deals with work-related disorders, but also encompasses all factors that affect community health within it. The inadequate surveillance of employees is the most important reason for the increased prevalence of work related and other non-communicable life style diseases at work place (Kulkarni 2005).

Self-employment has been one of the major chosen occupations in low income groups, which does not have a complete understanding of the individual regarding the working conditions. The only factor that drives an individual for self-employment is earning for a living. The various sectors of self-employment in a community of developing nations like India range from small vendors, including vegetables to hardware, auto/taxi driving and photocopy shops. Among these auto driving and photocopy work have been seen to escalate in the past decade due to the increase in requirement of private transportation, and of course the individual can choose

his timings to work. Another sector is photocopy work that has tremendously increased with change in education pattern, increase in ease of obtaining data through various sources like computer, text book and others. The photographic copying of books and other materials is a modern technique that started at the beginning of the 20th century. Since then, photocopying has remained the most popular technique of document reproduction (Igbeneghu 2009). Photocopying is nowadays an indispensable tool in the modern offices. It has been of tremendous value to education and dissemination of information that today it is commonly found in different places like libraries, information and documentation centres, archives, higher educational institutions, commercial enterprises, government and non-governmental organization and so on.

The bus supply in cities varies from a low of 0.12 buses/1000 population in size I cities to 0.46 in size VI cities reflecting inequities in public supply provisions (RITES 1995). Public transport supply in Indian cities is characterized by a multiplicity of modes ranging from two seated manually driven cycle rickshaws to fifty seated buses compatible with local conditions and demand patterns available for use. The level of intermixing of the two types of systems in a city is determined by the prevailing city's socioeconomic fabric, travel patterns and road network. Auto rickshaws supply, in particular in Indian cities, indicates that major metro cities exhibit a higher share of auto rickshaws ranging between 7 and 13 per 1000 population, compared to smaller cities supply ranging between 0.3 and 2 auto rickshaws per 1000 popu-

lation (Wilbur Smith 2007).

There are numerous reports on the high incidence of work-related musculo-skeletal disorders (WMSD), especially low back pain in different occupational groups contributing to large economic losses to individuals as well as to the community (Bureau of Labour Statistics 2003). Professional drivers have been found to be at high risk of developing such problems due to prolonged sitting and vibratory exposure (Anderson 1992, Magnusson et al. 1996, Massaccesi et al. 2003, Van Der Beek & Frings-Dresen 1995, Hulshof et al. 2006, Krause et al. 1997, 1998, 2004, Chen et al. 2005, Funakoshi et al. 2004).

Photocopying has become one of the common modes of employment in India. Toner is used in the photocopiers to produce an image on paper or transparency. Two essential components of dry toners are colorants (most common being carbon black) and binder resins. According to Rosenkranz et al. (1980) the toners comprise polycyclic aromatic hydrocarbons and styrene. The operators are exposed to the toners (while reloading and unloading the machines) and to toxic gases like ozone, nitrogen dioxide, volatile organic compounds and extremely low frequency electromagnetic fields during their operation (Rosenkranz et al. 1980, Selway et al. 1980, Lofroth et al. 1980, Venier et al. 1987, Tuomi et al. 2000). Iravathy Goud et al. (2004) has reported parallel genotoxic effect on the workers occupationally exposed to print copying machine.

The scope of this study is to investigate the occupational health effects of self-employed individuals with a distinctive orientation to auto drivers and photocopier workers by conducting a cross-sectional survey.

MATERIALS AND METHODS

Study area: Visakhapatnam is a major port and the second largest city in the state of Andhra Pradesh and the third largest city on the east coast of India after Kolkata and Chennai, with a population of approximately 1.3 million. It is located 625 kilometres east of the state capital, Hyderabad. The city is nestled among the hills of the Eastern Ghats and faces the Bay of Bengal to the east.

Subjects: The subjects were selected by random sampling. The study subjects comprised 208 healthy age matched individuals. At the time of data and blood sample collection, the subjects signed a term of informed consent. All the individuals who agreed to participate in the study were healthy and they answered a detailed questionnaire.

Study design: During the face-to-face interview, the questions consisted of five parts:

- i. Occupational and personal factors: information included

age, gender, work history and daily work characteristics.

- ii. Working hours: to bring out the relationship between working hours and associated effects.
- iii. Health effects: to identify the specific health effects of the occupation.

While obtaining information on the work history and daily work pattern of the participants, they were also asked to identify common occupational risk factors that they perceived to be related to their exposure period. Additional questions regarding the severity of exposure, the number of days off work within the last 12 months and the type of medical care they received to alleviate these problems were included in the questionnaire.

The face-to-face interview was thought to be more reliable in obtaining accurate information from the subjects as they were from a wide range of backgrounds with different educational levels. This will also help to ensure that all questions were answered and that the answers were recorded in a consistent manner. Most of the questions utilized the checklist approach in order to reduce ambiguity and to facilitate quantitative analysis.

In order to qualify the above data, we have taken up clinical analysis in the next stage of our research in which the blood samples from the two categories of people who were observed to have both high and low effects were analysed for haemoglobin count, total cell count, differential cell count and erythrocyte sedimentation rate (ESR).

Collection of blood samples: The blood samples were collected from the participants by a technician who was hired from Sampath Vinayaka Diagnostics, Opposite King George Hospital, Maharanipecta, Visakhapatnam. All the analysis were performed in the above mentioned laboratory.

RESULTS

General health effects of photocopy workers: The general stress levels of the individuals were collected in order to have a record, in case they could not precisely explain regarding their particular health effects. It was observed from the study that 74.5% of them have a low level of stress when compared to 21.9% with no stress and 3.5% with medium level stress.

Physical pollutants which are observed in the working environment are the first ones to be observed and to alarm regarding the possible additional pollutants that can be released. In the study, the three main physical pollutants that were taken into consideration are toner dust, noise and heat. The striking point that was observed in the study was that, all of the respondents have reported a combination of these pollutants. 92.10% of the respondents have reported emis-

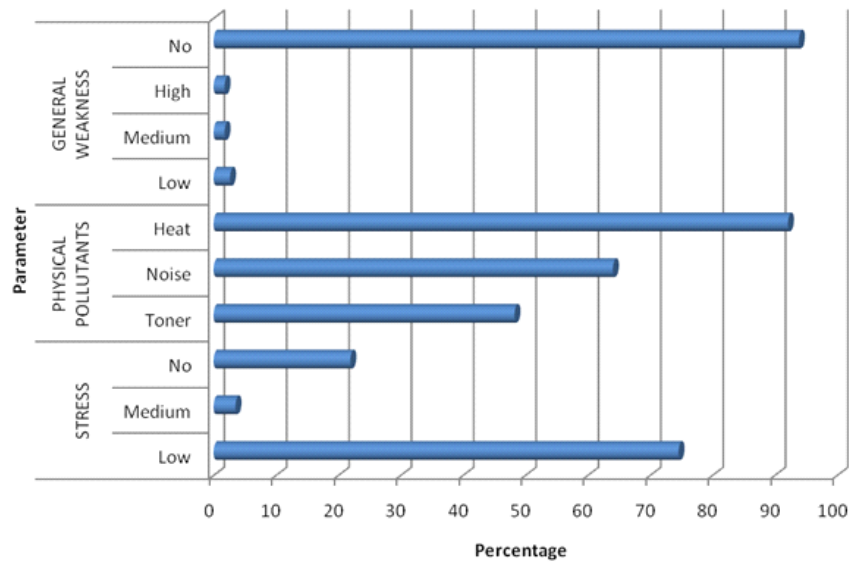


Fig. 1: General health effects of photocopy workers.

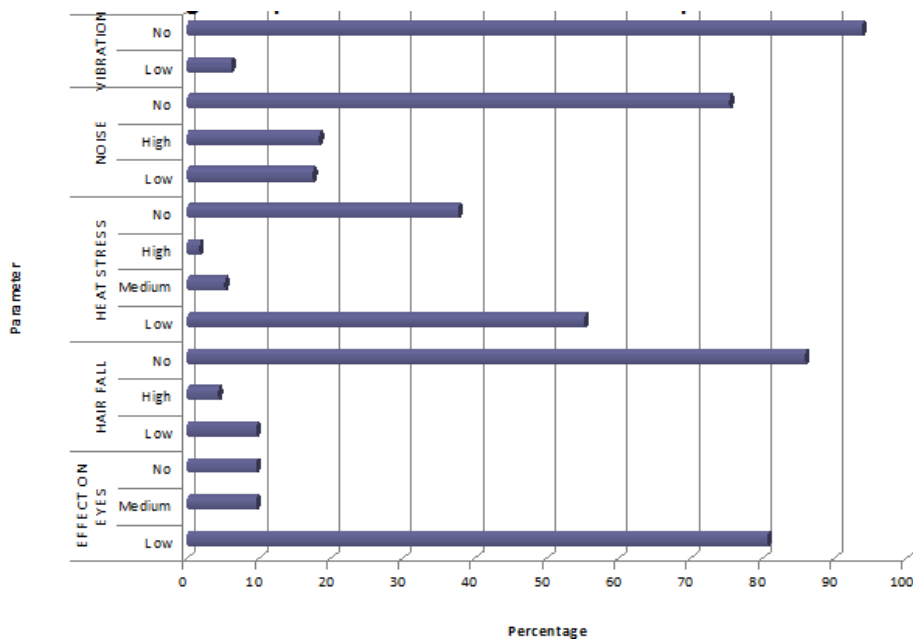


Fig. 2a: Specific health effects of auto drivers.

sion of heat, which was above the tolerance level. 64.03% of them have reported regarding the noise which was disturbing. The release of toner dust was observed and reported by 48.24% of the respondents.

General weakness was observed in the photocopiers in different magnitude as low (2.63%), medium (1.75%), and high (1.75%). Photocopiers had most effect on the eyes. In our study, we observed that the effect on the eyes is at low magnitude (8.70%) and medium effect in 9.64%. Hair fall is another effect we observed (Fig. 1).

Specific health effects of photocopy workers: The specific health effects of the participants recorded were significant to their occupation. Most of the respondents have reported to have less effect on their eyes (80.7%), and 9.64% of them reported to have medium and no effect on their eyes. Hair fall was not reported by 85.9% of the participants. While 9.64% had less hair fall and 4.38% of them with high volume of hair fall. It is to be focused on that 55.26% of the respondents were feeling heat stress at a lower level, while 5.26% of them had a medium level of stress and about 37.7%

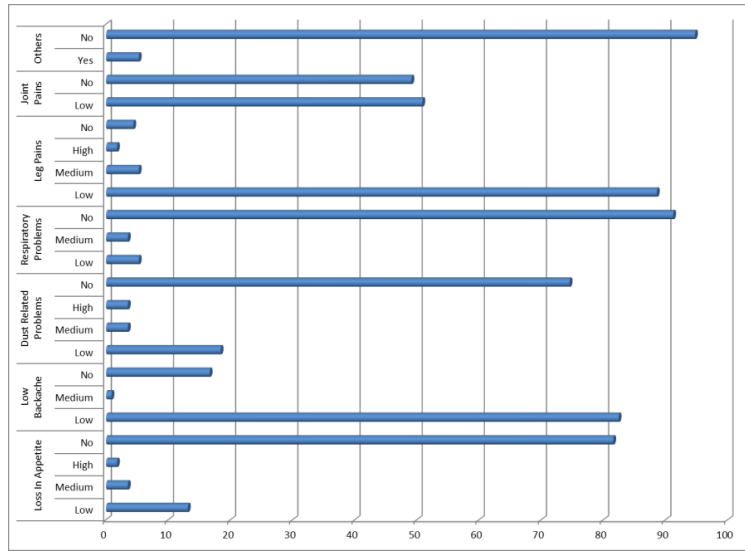


Fig. 2b: Specific health effects of auto drivers.

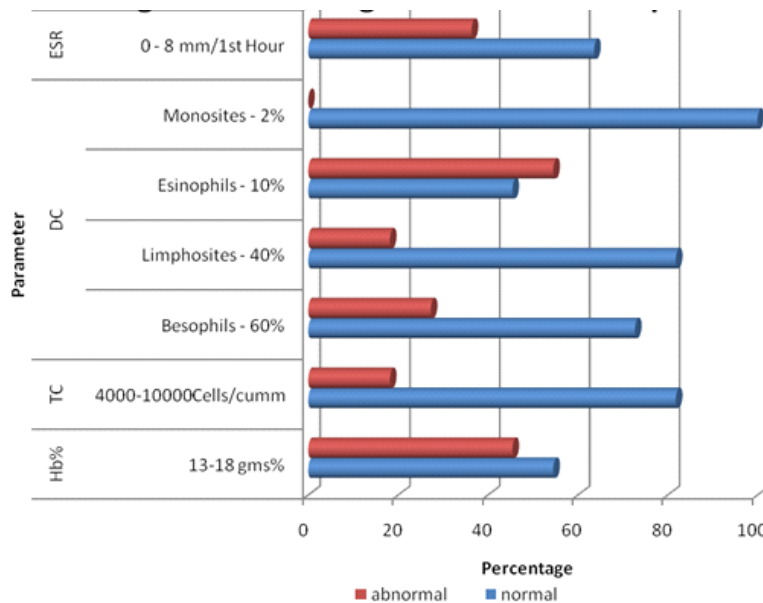


Fig. 3: Haematological data of photocopy workers.

of them have not reported any heat stress. With the advent of newer machines a remarkable observation was made that the noise was not reported by 75.4% of the respondents, while higher and lower levels were reported by 18.4% and 17.5% respectively. This is similar to the vibration effects, wherein 93.8% had not reported any vibration during the process (Fig. 2a).

13.1% of the respondents have reported to have a reduction in their appetite, while 81.5% of them had no change. 82.45% of the respondents have reported to have low back

pain at a lower level when compared to 16.66% and 0.87% of respondents reporting medium and no effect. The fact that new machines come up with dust free toners and this was remarkably observed from 74.5% of the respondents who have not reported dust from the machine in the survey. A notable effect was observed as the respondents reported to have 88.59% which was in relation to the joint pains reported by 50.87% of the respondents (Fig. 2b).

Clinical analysis: The haematological analysis of the photocopy workers has not shown considerable results except

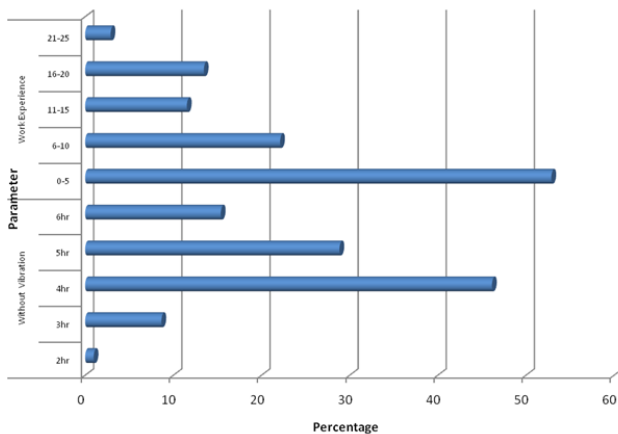


Fig. 4: Working experience and vibration duration among auto drivers.

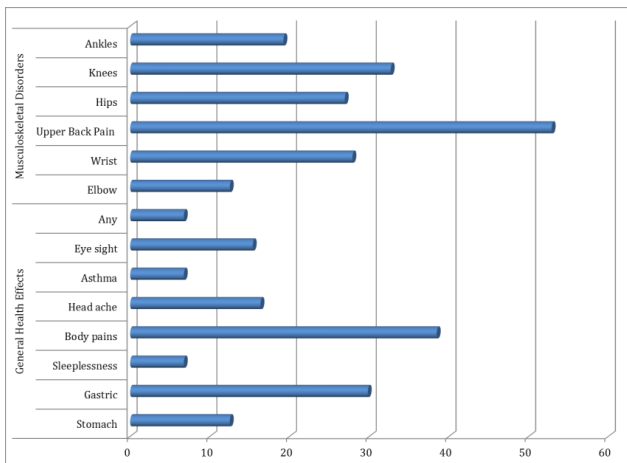


Fig. 5: Musculoskeletal discomfort and general health effects among auto drivers.

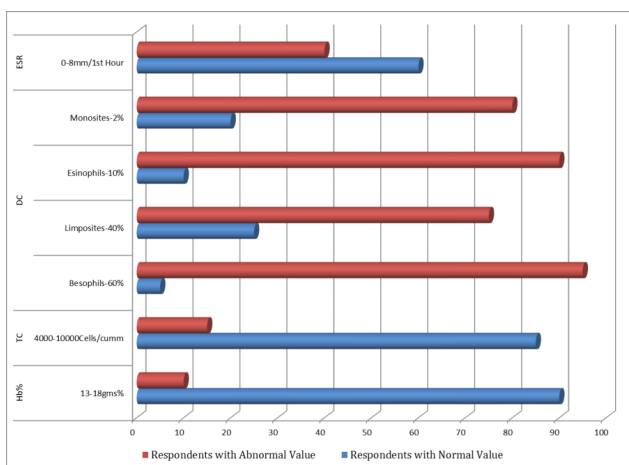


Fig. 6: Haematological data of auto drivers.

for the differential count (Fig. 3).

Working experience and vibration duration among auto drivers: The maximum numbers of respondents were having the work experience of 0-5 years which relate to the maximum respondents in the age group. 22.1% of the respondents were having 6-10 years of experience, followed by 13.4% with 16-20 years. The least number of respondents were observed in the 20-25 years experience (2.8%) Fig. 4.

As far as the working hours in a day are concerned almost all of them reported longer duration and hence the duration wherein they are not exposed to vibrations was thought to be the better data to consider. Only 46.15% of the respondents were having 4 hours of non-vibration period, whereas 28.85% and 15.38% were having 5 hour and 6 hour non-vibration period and only 8.65% and 0.96% of them have reported 3 and 2 hours of non-vibration period respectively.

Musculo-skeletal discomfort and general health effects among auto drivers: Knowledge on the general health effects of the respondents was crucial as it will prove to be useful in judging the health effects whether related to the occupation or not. A good number of the respondents (38.4%) had reported body pains, 29.8% of them had gastric problem, headache was a problem in 16.3% of the respondents, 12.5% of them were having various stomach related problems and sleeplessness was reported by 6.7% respondents (Fig. 5).

The vital part of the study is the knowledge of the musculoskeletal disorders owing to whole body vibrations. As it was obvious, the majority of the respondents (52.88%) were suffering from upper back pain, followed by knee pain (32.6%). 27.8% and 26.9% of the respondents have reported to be suffering from wrist and hip pains respectively. Ankle and elbow pains were reported by 19.2% and 12.5% of the respondents respectively.

Clinical analysis: The haematological analysis of the auto drivers has not shown considerable results except for the differential count (Fig. 6).

DISCUSSION

Work-related causes of injuries and illness range from toxic chemicals to heavy and repetitive physical labor (Clougherty et al. 2010). These exposures are disproportionately common in many of the jobs where low-income workers are employed.

Just as workplace conditions can affect health and well-being, exposures and conditions outside of work can also influence health, work productivity, and susceptibility to occupational exposures during work (Braveman et al. 2010, Hutch et al. 2011). The present study examined the drivers'

musculo-skeletal discomfort in all body areas with reference to the whole body vibrations and effects of photocopying on photocopy workers.

Some case reports and a few studies have suggested that some common office environment exposures, such as exposure to carbonless copy paper (CCP) (Morgan & Camp 1986, Shehad et al. 1987, LaMarte et al. 1988, Skov et al. 1989, Kanerva et al. 1993 and Jaakkola & Jaakkola 1999) and fumes from photocopiers and printers (FPP) affect health adversely, (Skov et al. 1989, Jaakkola & Jaakkola 1999, Yassi et al. 1989, Fisk et al. 1993 and Stenberg et al. 1993) whereas some reviews have challenged this view (Buring & Hennekens 1991, Graves et al. 2000).

The general stress levels of the individuals were collected in order to have a record, in case they could not precisely explain regarding their particular health effects. It was observed from the study that 74.5% of them were having a low level of stress when compared to 21.9% with no stress and 3.5% with medium level of stress. Toner dust, noise and heat were the three main physical pollutants that were properly and precisely understood by the respondents. The respondents were competent in recognizing the particular health effects and the majority of them have reported heat stress (52.26%), effects on eyes (80.70%), low back pain (82.45%), leg pains and joint pains (88.59%, 50.87%).

A study by Chun-Yuh (2008), has shown that occupational exposure to pollutants emitted from photocopiers was not significantly associated with an excess of chronic respiratory symptoms and acute irritative symptoms in photocopy employees. Their study results suggest that the current exposure levels in photocopy centres may be sufficiently safe in well-controlled work environment, especially if the photocopier is handled carefully.

Some studies have shown that the photocopy machine workers with smoking habits also have more amount of DNA damage, as observed in smokers, which shows cigarette smoking has a synergistic effect on inducing DNA damage. Some previous findings reported similar results on bidi and smokeless tobacco users (Yadav & Thakur 2000a, Yadav & Thakur 2000b, Obe et al. 1980, Nakayama et al. 1985). This study confirmed the previous findings on the use of CCP and occurrence of eye symptoms (Jaakkola et al. 1999, Fisk et al. 1993, Marks 1981) general symptoms (Skov et al. 1989, Jaakkola et al. 1999, Fisk et al. 1993 and Stenberg et al. 1993) chronic phlegm production and chronic bronchitis, breathlessness, and sinus infections (Jaakkola et al. 1999).

Past studies have mainly examined the back and neck pain in drivers (Anderson 1992, Krause et al. 1997, Krause et al. 1998, Krause et al. 2004, Chen 2005, Porter & Gyi 2002). The present results show that beside back and neck

pain, shoulder and knee/thigh areas are also important areas of musculo-skeletal discomfort experienced by bus drivers. Some of the discomfort or pain experienced in the shoulder or knee/thigh regions may possibly be referred to pain from the spine, or they may have a local origin due to mechanical loading of these joints associated with sustained postures and repetitive movements in driving.

The six major parts of the body that could be affected due to the occupation has resulted in considerable results, as 52.88% of the auto drivers were suffering from the upper back pain as was reported in the previous studies. The effects on the other body parts were obviously due to the occupation and was proved in previous surveys done on drivers at different levels. The prevalence rates for these 6 major body areas in the present study can be considered high or comparable to figures reported in previous studies from other countries. However, the case definition of discomfort versus symptoms versus pain versus injury must be taken into consideration in comparing epidemiological data in different studies.

The high prevalence rates of musculo-skeletal discomfort in the back, neck, shoulder and knee areas may be related to occupational factors contributing to undue stress on the various body parts. The figures on the self-perceived risk factors corresponded well to the different areas of pain. This may either suggest that the subjects had good insight of the possible strain or loading imparted by the physical risk factors on the body; or this may be a good projection of the actual biomechanical exposure of this occupation.

Based on biomechanical knowledge and past research evidence, prolonged sitting not only induces greater biomechanical loading on the intervertebral discs in the lumbar region, the effects of low-load continuous vibration may also impart greater "creep" in the soft tissues (Magnusson 1996, Pope 1996). These factors would likely contribute to more rapid degenerative changes in the lumbar spine.

Pope et al. (1996) also commented that when the spine is loaded axially for a prolonged period, the back muscles become fatigued and the discs are being compressed, this would result in a poorer condition to sustain larger loads; thus when there is any suddenly applied load such as a sudden stopping of the vehicle, there may be an increased risk of sustaining serious injuries to the spine.

In addition, sustained posture as in controlling the steering and the control pedals require static muscle activities in the cervical and lumbar spine, as well as in the large joints such as the shoulders, hips and knees (Chaffin et al. 1999, Westgaard 2000). Magnusson et al. (1996) noted that city bus-driving involved more rapid acceleration and deceleration, and more "gearing" actions.

In the large scale prospective study conducted by Krause and coworkers (Krause et al. 1997, Krause et al. 1998, Krause et al. 2004), a total of 501 low back injuries were reported in a cohort of 1,233 participants over a period from 1993-2001. Anderson (Anderson 1992) reported an extremely high rate of 80.5% of bus drivers (out of 128) with self reported back or neck pain. This study represents an initial attempt to look at the problems in Visakhapatnam, with its unique environment, related to transportation.

Haematological study of total RBS, total WBC, haemoglobin percentage and platelet count from photocopying machine operators and auto drivers did not reveal untoward variations and this goes with the findings of Gadhia et al. (2005). The general effects of decreased haemoglobin content may be due erythropoietin deficiency e.g. from kidney disease, red blood cell destruction associated with transfusion reaction, lead poisoning, malnutrition and the associated nutritional deficiencies of iron, folic acid, vitamin B-12 and vitamin B-6.

As majority of the participants have shown an abnormal differential count, the reason can be related to any or a combination of the following. Any infection or acute stress increases number of white blood cells. High white blood cell counts may be due to inflammation, an immune response, or blood diseases such as leukaemia.

An increased percentage of neutrophils may be due to acute infection, rheumatoid arthritis, acute stress and trauma. An increased percentage of lymphocytes may be due to chronic bacterial infection, infectious hepatitis, infectious mononucleosis, lymphocytic leukaemia, multiple myeloma, viral infection (such as infectious mononucleosis, mumps, measles), and recovery from a bacterial infection (Bagby 2007)

The factors that influence the ESR levels in humans are as follows: Rouleaux formation is a very important factor on which ESR depends. When the degree of rouleaux formation is more (the ratio of surface area to mass of RBC is less), ESR is more; rouleaux formation is influenced by different factors like: a. Shape of RBC-biconcave disc shape favour rouleaux formation; b. Plasma proteins, albumin reduces rouleaux formation.

Fibrinogen favours rouleaux formation, products of tissue destruction and inflammation favour rouleaux formation. The above plasma factors affect rouleaux formation by changing the electrical charges on the red cells. Size of RBC when more, faster sedimentation conditions in which ESR value is increased due to pathological conditions - rheumatic fever, rheumatoid arthritis, tuberculosis, malignancy, acute inflammatory diseases. Severe tissue breakdown occurs in the above conditions or it can also be due to anaemia (Bagby 2007).

CONCLUSIONS

There is no doubt that the photocopy machine has become an indispensable tool in the generation and dissemination of information in different organizations and institutions of learning. This study provides new evidence that exposure to paper dust and other pollutants from photocopying machines increases the risk of heat stress, joint pains, effect on eyes and general health effects. The study strengthens the evidence that such exposures to CCP is also associated with increased risk of eye symptoms and diarrhoea, suggesting that direct contact of fingers, after touching CCPs, with eyes and mouth may be an important exposure route.

The findings of the studies cited in this work, clearly shows that auto drivers are developing health problems from the effect of long hours of driving. Though this work places particular emphasis on auto drivers, drivers of other kinds like - taxis, buses, lift trucks, tractors and delivery trucks share the problems described here. Thus, it is safe to assume that the findings of the current study will also be relevant to those populations and the recommendations that will be offered will be equally helpful to all commercial and professional drivers.

The risk factors implicated in most of the studies show that the following are the causes of health problems in auto drivers: (a) Hypertension, cardiovascular disease and stroke, (b) Musculo-skeletal disorders, (c) Higher risk of lung cancer, and (d) Sleep disorders and psychological distress. This study suggests that reduction of exposure to pollutants in working environments and change in working patterns is likely to improve the health of the workers.

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