ORIGINAL ARTICLE

Work-related morbidity profile among software professionals in Chennai, Tamil Nadu: A pre-pandemic, cross-sectional study

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ABSTRACT

Introduction: Computers have become ubiquitous in today's world and have considerable impact on human health. This study was planned to assess the common work-related morbidity among software professionals in a selected software firm in Chennai, Tamil Nadu and to identify the role of occupational characteristics and ergonomics of workstation on morbidity profile of the participants. **Materials and methods:** This was a descriptive, cross-sectional study conducted between January and February 2020 among 160 employees of a software firm in Chennai, Tamil Nadu, using a pretested, semi-structured questionnaire consisting of sociodemographic and occupational characteristics, morbidity profile including perceived stress scale and workstation ergonomics. A p value of ≤0.05 was considered statistically significant. **Results:** The response rate was 98.1% (152 participants). Among the 152 employees who participated, 88.8% reported work-related morbidity; 75.7% and 74.3% reported visual and musculoskeletal symptoms respectively. Eye strain (52%) and pain (49.3%) respectively were the commonest visual and musculoskeletal symptoms reported; 56.6% employees reported moderate and 12.5% reported high levels of stress. The occurrence of visual symptoms were significantly associated with gender, duration of work experience, work-hours per day and poor workstation ergonomics (P<0.05). **Conclusion:** Our study identifies a high burden of work-related morbidity among software professionals. It is essential to adopt a pro-active, multi-disciplinary approach with focus on social and occupational factors in prevention of work-related morbidity.

KEYWORDS

Computer professionals; work-related morbidity; occupational morbidity; ergonomics

INTRODUCTION

Computers have become a universal aspect of modern work life, extending their influence on all occupational sectors. Worldwide, an approximate 53.2 million people were employed full-time in information and communication technology (ICT) industry in 2019 and these figures are projected to increase to about 63 million in 2023.(1)

Computers despite being a vital tool in global economic development are capable of causing considerable harm to individual health in the form of posture-related injuries, overuse injuries, eye strain and specific health problems from laptop computers which are primarily designed for short term use.(2) The continuous exposure to computer systems with inadequate ergonomic adjustments increases the occurrence of musculoskeletal disorders and vision defects. In addition, the sedentary and monotonous nature of the job increases susceptibility to stress, anxiety and lifestyle diseases such as diabetes mellitus, hypertension and cardiovascular diseases.(3,4,5)

Occupational health assessment of computer professionals by various authors has identified that 50% to 93.3% participants have symptoms of one or more work-related morbidity.(3,6,7,8) Musculoskeletal and ocular symptoms were the commonly reported complaints.(3,6,7,8) About 40% of employees were identified to have psychosocial symptoms or various degrees of

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stress.(3,6) Inadequate awareness about recommended work postures, faulty ergonomic practices and increased duration of work were found to be important risk factors for work-related morbidity among computer professionals.(3,6,7,8) Use of antiglare screen and soft keypads was identified to offer protection among workers who used them regularly.(3
)With close to two-third of working population employed in ICT sector and increasing use of technology in other sectors, there is a substantial human capital using computers for work. Identification, management and prevention of work-related morbidity in this subset of population are essential for a healthy workforce and overall economic productivity.

Hence this study was planned to assess the common work-related morbidity among software professionals in a selected software firm in Chennai, Tamil Nadu and to identify the role of occupational characteristics and ergonomics of workstation on morbidity profile of the participants.

MATERIAL & METHODS

This was a cross-sectional, descriptive study conducted among employees of a software firm in Chengalpattu district during the month of January and February 2020. The sample size was calculated using the formula 4pq/d2, based on similar study among computer professionals in Mumbai with p as the prevalence of morbidity of among computer professionals (89%) and d as absolute error of 5%.(3)The final sample size was estimated to be 160. The required number of participants was obtained by simple random sampling from the list of employees as obtained from the Human Resource department. Anyone who has been in the current job for the previous 6 months and working on the computer for a minimum of 4 hours per day were considered eligible for participation in the study. The date and time of the study were selected according to the convenience of both participants and the investigator. A pre-tested, semi-structured questionnaire consisting of the following sections was used to collect the required information- sociodemographic details, occupational characteristics, morbidity profile including Nordic musculoskeletal questionnaire, self-assessment checklist for ergonomics of workstation.

The Self-assessment checklist for ergonomics of workstation was developed based on the self-assessment checklist recommended by National Institutes of Health, Office of Research Services, Division of Occupational Health and Safety and modified to suit the study setting and the best ergonomic practices to be implemented.(9) The final checklist consisted of 13 items with options Yes or No. Positive practice was assigned a score of 1 and negative or unhealthy ergonomic practice was assigned a score of 0. The individual scores were added to estimate the final score with the interpretation, of increasing score implying better ergonomic practices.

Ethical considerations: Clearance from Institutional Ethics Committee and written informed consent from the participants was obtained. Complete privacy of the participants and confidentiality of their responses was ensured.

The data collected was coded and entered in Microsoft Excel 2007 and statistical analysis was performed using Statistical Package for Social Sciences version 23. Quantitative and categorical variables were summarized as mean with standard deviation (SD) and percentages respectively. Chi-square test was used for statistical analysis of categorical variables. A p value of ≤0.05 was considered statistically significant.

RESULTS

A total of 152 employees participated in the study. The mean age of the participants was 31 years (SD: +6.1 years).

TABLE 1: DISTRIBUTION OF BASELINE CHARACTERISTICS OF PARTICIPANTS (N=152)

Variable	Frequency (N=152)	Percentage
Age group		
≤ 25 years	40	26.3
26 to 35 years	75	49.3
More than 35 years	37	24.3
Gender		
Males	102	67.1
Females	50	32.9

Variable	Frequency (N=152)	Percentage
Marital status		
Married	87	57.2
Unmarried	65	42.8
Years of work experience		
5 years or less	66	43.4
6 to 10 years	56	36.8
More than 10 years	30	19.7
Work-days per week		
5 days	18	11.8
6 days	134	88.2
Work-hours per day		
≤ 7 hours	16	10.5
8 hours	123	80.9
> 8 hours	13	8.6
Number of breaks		
1	89	58.6
2	49	32.2
3	14	9.2
Work-shift		
Day	126	82.9
Night	26	17.1
Rotation of shifts		
No	69	45.4
Yes	83	54.6
Overtime		
No	42	27.6
Yes	110	72.4

Among the 110 employees who worked overtime, 94 employees (85.5%) reported working overtime for a maximum of 10 days per month, while 16 employees (14.5%) worked overtime for more than 10 days to a maximum of 25 days per month. Table 2 displays the distribution of ergonomic features of workstation of employees.

TABLE 2: DISTRIBUTION OF WORKSTATION ERGONOMICS (N=152)

		Yes	No
a.	Can the height of chair be adjusted to achieve correct posture?	119 (78.3)	33 (21.7)
b.	Are your feet fully supported by the floor when you are seated?	107 (70.4)	45 (29.6)
c.	Does your chair provide support for your lower back?	97 (63.8)	55 (36.2)
d.	Do your armrests allow you to get close to your workstation?	107 (70.4)	45 (29.6)
e.	Are your keyboard, mouse & work surface at your elbow height?	113 (74.3)	39 (25.7)
f.	When using your keyboard & mouse, are your wrists straight and your upper arms relaxed?	104 (68.4)	48 (31.6)
g.	Is your monitor positioned directly in front of you?	133 (87.5)	19 (12.5)
h.	Is your monitor positioned at least an arm's length away?	122 (80.3)	30 (19.7)
i.	Is your monitor & work surface free from glare?	112 (73.7)	40 (26.3)
j.	Do you have appropriate light for reading or writing documents?	132 (86.8)	20 (13.2)
k.	Do you take postural breaks every 30 minutes? E.g. standing, walking to printer/ fax etc.	71 (46.7)	81 (53.3)

		Yes	No
l.	Do you take regular eye breaks from looking at your monitor?	78 (51.3)	74 (48.7)
m.	Are you using a headset or speaker phone if you are writing or keying while talking on the phone?	28 (18.4)	124 (81.6)

The mean Workstation Ergonomics Checklist score was 8.7 (+2.43). With a score of 9 or more, 85 (55.9%) respondents were identified to practice good workstation ergonomics and 67 (44.1%) respondents had poor workstation ergonomics (score less than 9).

Table 3 displays the distribution of common visual and musculoskeletal symptoms reported by the participants in the previous 12 months.

TABLE 3: MORBIDITY PROFILE OF PARTICIPANTS IN THE PREVIOUS 12 MONTHS (N=152)

Morbidity	**Frequency (%)**
Visual symptoms	
Itching	52 (34.2)
Dryness of eyes	60 (39.5)
Redness	47 (30.9)
Burning sensation	51 (33.6)
Blurring/ reduced vision	47 (30.9)
Eye strain	79 (52)
Musculoskeletal complaints	
Pain	75 (49.3)
Numbness	11 (7.2)
Swelling	5 (3.3)
Cramps in fingers	11 (7.2)
Tingling/ discomfort	15 (9.9)
Other symptoms	
Headache	69 (45.4)
Breathing difficulties	27 (17.8)
Acute respiratory infections	50 (32.9)
Prevalence of	
Any morbidity	135 (88.8)
Any visual symptom	115 (75.7)
Any musculoskeletal symptom	113 (74.3)
Either visual or musculoskeletal symptoms	42 (27.6)
Both visual and musculoskeletal symptoms	93 (61.2)

Among the 152 participants, 135 (88.8%) reported atleast one work-related symptom; 42 (27.6%) had either visual or musculoskeletal complaints, while 93 (61.2%) participants had both visual and musculoskeletal complaints. Blurring of vision (12.5%), dryness of eyes (11.2%) and eye strain (10.5%) were the commonest visual symptoms for which physician consultation was sought followed by itching (9.2%), burning sensation (8.6%) and redness (5.9%). Prevalence of musculoskeletal symptoms based on Nordic musculoskeletal questionnaire in the previous 12 months and 7 days was 74.3% and 40.8% respectively (Tables 3 and 4). Table 4 displays the distribution of commonest body regions involved based on Nordic musculoskeletal questionnaire with resultant limitation of normal activities and physician consultation.

TABLE 4: DISTRIBUTION OF MUSCULOSKELETAL SYMPTOMS BASED ON NORDIC MUSCULOSKELETAL QUESTIONNAIRE (N=152)

	Have you at any time in the last 12 months had trouble (such as ache, pain, discomfort, numbness etc.) in: (N=152) (A)	During the last 12 months have you been prevented from carrying normal activities (e.g. job, housework, hobbies) because of this trouble* (B)	During the last 12 months have you seen a physician for this condition?* (C)	During the last 7 days have you had trouble in: (N=152) (D)
Neck	87 (57.2)	23 (26.4)	12 (13.8)	33 (21.7)
Shoulders	77 (50.7)	27 (35.1)	12 (15.6)	32 (21.1)
Upper back	50 (32.9)	23 (46)	10 (20)	23 (15.1)
Elbows	16 (10.5)	8 (50)	4 (25)	11 (7.2)
Wrists/ hands	32 (21.1)	9 (28.1)	4 (12.5)	14 (9.2)
Lower back	65 (42.8)	28 (43.1)	14 (21.5)	34 (22.4)
Hips/ thighs	43 (28.3)	16 (37.2)	5 (11.6)	22 (14.5)
Knees	34 (22.4)	15 (44.1)	6 (17.6)	18 (11.8)
Ankles/feet	31 (20.4)	11 (35.5)	3 (9.7)	12 (7.9)

*The percentages are calculated with number of participants who had any trouble such as pain, discomfort, numbness etc. in the respective parts of body at any time in the last 12 months (frequencies entered in column A), as denominator

27 participants (17.8%) had availed leave for a maximum of 3 days due to any of the above complaints. The median duration of leave availed by the 27 participants was 2 days (Inter-quartile range: 2 days).

Based on Perceived Stress Scale Scores, 47 employees (30.9%) had low levels of stress, 86 (56.6%) had moderate levels of stress and 19 (12.5%) had high levels of stress.

Among the 152 respondents, 5 employees were diabetic (3.3%), 12 had hypertension (7.9%) and 3 (2%) had Coronary heart disease.

TABLE 5: DISTRIBUTION OF ANY MORBIDITY, VISUAL AND MUSCULOSKELETAL MORBIDITY AMONG BASELINE CHARACTERISTICS (N=152)

Variable	n	Any morbidity (N=135)	P	Visual morbidity (N=115)	P	Musculoskeletal morbidity (N=113)	P
Age group in years							
≤ 25	40	34 (85%)	0.697	33 (82.5%)	0.311	32 (80%)	0.597
26 to 35	75	63 (84%)		57 (76%)		55 (73.3%)	
> 35	37	29 (78.4%)		25 (67.6%)		26 (70.3%)	
Gender							
Males	102	83 (81.4%)	0.477	72 (70.6%)	**0.038***	78 (76.5%)	0.391
Females	50	43 (86%)		43 (86%)		35 (70%)	
Marital status							
Married	87	70 (80.5%)	0.356	61 (70.1%)	0.065	62 (71.3%)	0.352
Unmarried	65	56 (86.2%)		54 (83.1%)		51 (78.5%)	
Years of work experience							
≤5	66	59 (89.4%)	0.109	57 (86.4%)	**0.024***	53 (80.3%)	0.190
6 - 10	56	42 (75%)		37 (66.1%)		37 (66.1%)	

Variable	n	Any morbidity (N=135)	P	Visual morbidity (N=115)	P	Musculoskeletal morbidity (N=113)	P
> 10	30	25 (83.3%)		21 (70%)		23 (76.7%)	
Work-days per week							
5 days	18	15 (83.3%)	0.958	15 (83.3%)	0.419	12 (66.7%)	0.404
6 days	134	111 (82.8%)		100(74.6%)		101 (75.4%)	
Work-hours per day							
≤ 7 hours	16	13 (81.3%)	0.811	13 (81.3%)	**0.033***	10 (62.5%)	0.242
8 hours	123	103 (83.7%)		96 (78%)		95 (77.2%)	
> 8 hours	13	10 (76.9%)		6 (46.2%)		8 (61.5%)	
Number of breaks							
1	89	76 (85.4%)	0.483	73 (82%)	0.092	68 (76.4%)	0.619
2	49	38 (77.6%)		33 (67.3%)		36 (73.5%)	
3	14	12 (85.7%)		9 (64.3%)		9 (64.3%)	
Work-shift							
Day	126	103(81.7%)	0.408	93 (73.8%)	0.242	94 (74.6%)	0.871
Night	26	23 (88.5%)		22 (84.6%)		19 (73.1%)	
Rotation of shifts							
No	69	55 (79.7%)	0.342	50 (72.5%)	0.403	47 (68.1%)	0.136
Yes	83	71 (85.5%)		65 (78.3%)		66 (79.5%)	
Overtime							
No	42	36 (85.7%)	0.568	34 (81%)	0.347	30 (71.4%)	0.679
Yes	110	90 (81.8%)		81 (73.6%)		83 (75.5%)	
Workstation ergonomics score							
Good	85	72 (84.7)	0.07	58 (68.2)	**<0.05***	59 (69.4)	>0.05
Poor	67	63 (94)		57 (85.1)		54 (80.6)	

DISCUSSION

This cross-sectional study was conducted to assess the work-related morbidity profile among software professionals in a selected software firm in Chennai, Tamil Nadu and identify the influence of occupational characteristics and workstation ergonomics on reported morbidity.

The response rate was 98.1% (N=152). About one-fourth of our participants were aged less than 25 years and one-fourth participants were above 35 years. The age distribution varied markedly from Sudharshini et al study where all participants were less than 35 years and half of them were aged less than 25 years.(10) More than two-thirds of our study participants were males (67.1%). Close to 80% were employed for 10 years or less (80.2%). A similar proportion was employed for less than 6 years in Sudharshini et al study.(10) More than 80% of them worked 6 days in a week; about 80% participants had 8 hours per day schedule and 8.6% worked for more than 8 hours per day; 58.2% availed one break in between work hours and only 9.2% availed three breaks in between work hours. Kaliniene et al reports a similar work-life pattern with 78.2% working for more than 6 hours per day; but the proportion of workers availing two-hourly breaks (13.5%) was marginally higher compared to our study population.(7) In Khan et al study, 21% participants worked more than 8 hours per day.(5) Less than one-fifth of our respondents (17.1%) were working in night-shifts at the time of study, but 54.6% of the participants had rotation of shifts regularly. Close to three-fourths (72.4%) of the participants reported working overtime; among them 14.5% of them reported working overtime for more than 10 days in a month, to a maximum of 25 days per month.

In our study, 85 participants (55.9%) reported good workstation ergonomic practices. Close to three-fourth participants (78.3%) reported adjusting seat height to achieve comfortable posture; which was higher than the proportion of

participants who practiced adjustment of seat height in Khan et al study (32%).(5) Similar difference was also noted in the placement of wrists in straight line with elbows; 68.4% of our study participants practiced correct posture compared to 40% in Khan et al study.(5) Khan et al study which compares the knowledge and practice of ergonomics among computer users, reports a considerable disparity between both.(5) Goplani et al study reported ergonomically better workstations with more than 80% participants having adjustable seats, arm rests, neck support and lumbar support.(8) Many studies including ours have information only on the reported practices, while the actual practices might be on the unhealthier side of spectrum, considering the high burden of visual and musculoskeletal morbidity reported by different authors and hence needs regular reinforcement. Less than half the participants (46.7%) took periodic postural breaks and 51.3% took regular eye breaks from the computer station. Only 18.4% reported using headset or speaker phone while taking phone calls while working on the computer.

In the present study, 88.8% (135) of the participants reported one or more work-related morbidity in the past 12 months; 27.6% reported either visual or musculoskeletal complaints, while 61.2% reported both visual and musculoskeletal complaints. Though the overall prevalence is comparatively lower than that reported by Giri et al, it is indicative of the high burden of occupational morbidity among computer professionals.(6) Sudharshini et al study reveals a lower burden with 71% participants reporting any one work-related symptom which could be due to the younger age structure of their study population.(10

)Prevalence of visual and musculoskeletal symptoms was similar, yet high in our study population; 75.7% participants reported atleast one visual symptom and 74.3% reported musculoskeletal symptoms involving atleast one body region in the previous 12 months. In Giri et al study, prevalence of visual symptoms (65.3%) was considerably lower than musculoskeletal symptoms (73.3%) among computer personnel of a Medical college hospital.(6) A similar high burden of musculoskeletal symptoms (56%) was also reported by Padma V et al among software employees from Chennai.(11) In contrast, Sudharshini et al study, with a predominantly younger study population, identified a very low prevalence of reported visual symptoms among computer professionals (30%) from a similar study area.(10)

Eye strain (52%) was the commonest visual symptom reported followed by dryness (39.5%) and itching (34.2%) of eyes. Blurring of vision (12.5%) was the commonest symptom which required physician consultation followed by dryness of eyes (11.2%) and eye strain (10.5%). Similar profile of visual symptoms was reported by Vyas S from Chennai city.(12) Giri et al and Mallik et al reported a different profile with watering of eyes and photosensitivity as commonest symptoms and dryness and itching were reported only by 12.6% participants.(6,13) In addition to direct visual symptoms, 45.4% participants reported headache related to work which was comparable to those reported by Giri et al and Vyas S.(6,12

)An approximate three-fourths of the participants (74.3%) reported musculoskeletal symptoms involving at least one of the body regions in the previous 12 months and 40.8% reported symptoms in the previous 7 days. This burden is comparable with that reported by Saleem et al, where the prevalence of musculoskeletal symptoms in the previous 12 months and 7 days was 69% and 49.2% respectively.(14) Pain (49.3%) was the frequently reported presentation followed by tingling or discomfort (9.9%). The commonest anatomical locations involved as reported by the participants in the previous 12 months were neck (57.2%) followed by shoulder (50.7%) and lower back (42.8%). Kumar et al in their study from Salt Lake city, Kolkata reported a similar pattern of musculoskeletal disorders with predominant involvement of neck (61.9%), lower back (52.9%) and shoulder (37.7%).(15) Similar predisposition to neck (58%) and back (50%) was reported by Giri et al, Saleem et al and Vyas S.(6,12,14) The predominance of lower back and shoulder pain was also observed by Kaliniene et al, though neck symptoms were not reported. Elbow pain was the least reported symptom which was similar to our study.(7) Majority of the participants reported being prevented from carrying out routine activities by symptoms at elbow (50%), upper back (46%) and knees (44.1%). Most participants sought physician consultation for symptoms of elbows (25%) followed by lower back (21.5%) and upper back (20%). We find that though symptoms of elbow were the least reported, 50% of the

symptomatics reported inability to carry out routine work and 25% sought physician consultation. The pattern of disability differed from Saleem et al study where symptoms of lower back and neck were most associated with disability.(14
)About 20% participants reported symptoms of neck, shoulders and lower back in the previous 7 days.

More than two-thirds (69.1%) of our study participants reported moderate (56.6%) or high (12.5%) levels of perceived stress. Vyas S study used a symptom-based assessment of stress and found that more than one-third participants had reported often experiencing nervousness (49%), restlessness (39%) and nail-biting (39%).(12)

Compared to males, a higher proportion of females reported visual complaints and the relationship was statistically significant. A statistically significant inverse relationship was also observed between number of working hours and prevalence of visual symptoms, with proportion of participants with visual symptoms reducing with increase in duration of work hours. This could be assumed to be due to spacing of work hours in between. No significant association was observed between number of work days or work hours and musculoskeletal symptoms. The proportion of participants reporting musculoskeletal symptoms was higher with male gender, longer years at job and poor ergonomic practices, though the relationship was not statistically significant. Our findings are in contrast to those by Kumar et al where prevalence of musculoskeletal symptoms showed a significant association with increasing age, male gender, longer duration of employment and poor ergonomics.(15) Giri et al and Saleem et al reported significant association between duration of work and physical symptoms.(6,14) Saleem et al also reported 5.11 times and 2.5 times risk of musculoskeletal symptoms among participants working more than 5 hours and avoiding breaks in between work hours respectively.(14)Poor workstation ergonomics was associated with a higher prevalence of visual symptoms (85.1%) and the association was statistically significant.

In our study, visual symptoms showed a difference in distribution between gender, work experience in years and working hours per day. No similar difference was observed in overall morbidity or musculoskeletal morbidity. This study is limited in the scope of generalization of results since it was conducted in a single software firm.

COVID-19 pandemic has heralded a paradigm shift in the work pattern of software employees with organizations adopting remote-working or hybrid-working under different international time zones. With this sudden change in the work style, and disturbed work-life balance, there is a high possibility of exacerbation of existing morbidity pattern and this study assumes importance as one of the few studies conducted during the early days of pandemic, before implementation of lockdown and travel restrictions. Hence this study could serve as a baseline study for comparison of morbidity pattern among the study population in future research.

CONCLUSION

Our study reinforces the high burden of work-related morbidity among software professionals. With computers becoming a ubiquitous part of all occupations it is crucial to focus on the prevention of resultant health problems using a multi-disciplinary approach taking into account the social and psychosocial factors, work-related demands and ergonomics of workstations.

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