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ORIGINAL ARTICLE

Exploring the quality of life (QOL) in the Indian software industry: a public health viewpoint

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Abstract
Objectives Our objectives were to describe the QOL and its determinants among software professionals of Kolkata, and to compare the same according to information technology (IT) and IT-enabled services (ITeS) sub-sectors.
Methods An institution-based cross-sectional study was conducted among software professionals of Kolkata applying a two-stage stratified random sampling technique. The WHO QOL BREF questionnaire was administered along with a list of pertinent variables.
Results Overall, the analysis for 338 software professionals (177 IT and 161 ITeS) clearly demonstrated significant differences between mean scores of these two sectors for each of the six outcome domains of WHO QOL BREF. Multilevel multivariate analysis outlined 13 significant predictors of QOL—four positive (age, regular fitness regimes, foreign placements and changing companies frequently) and the rest of the nine, negative (multiple sex partners, multiple addictions, extended working hours, night-shift duties, income, expenditure, carrying office work home, current illness and ITeS company type).
Conclusions Our study helps in obtaining a clear understanding of the multifaceted risk factors prevailing in this sector, the majority of which can be effectively addressed by specific health promotional interventions. A dedicated health policy is mandated at both government and company levels.

Keywords Quality of life · WHO QOL BREF · Software industry · IT and ITeS professionals

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Introduction

Quality of life (QOL) is defined by the World Health Organization (WHO) as "individuals' perceptions of their position in life in context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns" (Division of Mental Health and Prevention of Substance Abuse 1998). Quality of life, as an outcome measure, encompasses a holistic assessment of the health situation, and reorients our focus from traditional morbidity and mortality statistics (Wallace 2008).

Zahran et al. 2005 examined surveillance-based health-related QOL (HRQOL) data of the USA (1993–2002) and concluded that public health monitoring should be

broadened to include missing populations, such as the institutionalized, to address the personal and community determinants of HRQOL. More recently, QOL research has focused on cities, with successful understanding of the needs of target communities, reflecting vast changes in life and thereby evolving desirable futuristic interventions (Ali et al. 2009). A literature review on the impact of computerized work environment on professional occupational groups by Griffiths et al. 2007 found that work-related stress and deadlines compel employees to engage overtime with their machines: a risk factor for musculoskeletal morbidities. They stressed on the importance for organizations to identify and measure health-related risks associated with such modern occupational settings.

The Indian software industry, comprising information technology (IT) and IT-enabled services (ITeS), has ushered brand-new concepts of employment—job demands, deadlines set by predominantly overseas clients, efficiency in "multitasking" and high remunerations. The US $4 billion industry of 1998, grew into a US $52 billion sector in 2008, employing over 2 million people (NASSCOM 2010). For every rupee (the monetary unit of India) spent by the IT–ITeS sector (on domestically sourced goods/services), there is a total output of 2 rupees in the economy. In addition, for every job created in this sector, four new jobs are created elsewhere in the economy (NASSCOM 2010).

Kolkata boasts of a rather emerging software industry and a young workforce, with rapid changes in lifestyles, socio-economic status and efficiency. As a distinct occupational group, they have their unique identities, attitudes, interests, status and work consciousness.

Unfortunately, very little research has been conducted in this sector despite its dynamic and economically productive workforce, whose role in nation building is unquestionable. Chaturvedi et al. 2007 found 36% psychiatric morbidity among IT–ITeS professionals of Bangalore. Distress, wellness and organizational role stress of IT professionals of Kolkata were studied by Bhattacharya et al. (Bhattacharya and Basu 2007). Sharma et al. 2006 studied 200 IT–ITeS professionals of Delhi and found 93% suffering from computer-related morbidities. A similar work by Talwar et al. 2009 diagnosed 76% study population with visual and musculoskeletal disorders. Pinto et al. 2004 studied the prevalence of occupational diseases among 89 IT professionals in Goa. However, to the best of knowledge, no study has yet focused on assessing the overall health situation (QOL) among Indian software professionals.

Our objectives were to study the QOL of professionals in the software industry of Kolkata (using WHO QOL BREF) and to assess the determinants. We also aimed to compare the QOL of software professionals according to the industry sub-categories (IT and ITeS). We started with the research hypothesis that there was a significant difference in QOL between the professionals of these two sectors of the software industry.

The Software Technology Parks of India (STPI), Kolkata, an autonomous society (for registration of software companies) under the Ministry of Communications and IT, Government of India, granted us permission to perform our research among registered and operational companies of the city.

Methods

The Ethical Committee of the All India Institute of Hygiene and Public Health, Kolkata, gave permission to conduct an institution-based cross-sectional study among professionals of the software companies (IT and ITeS) of Kolkata from July 2009 to March 2010. All participating companies and their employees were assured of confidentiality in data collection and analysis. Informed written consent was obtained from all study participants.

Software companies were defined as companies engaged in software product development and export (IT) and companies engaged in core ITeS activities (business process outsourcing or BPOs and call centers).

The sampling frame consisted of all software companies of Kolkata, registered with STPI, currently operational and with at least 100 employees (Kolkata office). The study population was defined as all professionals working in these companies (above-mentioned criteria), with a minimum of 2 years of experience in the industry (and not in the present company only).

The sample size estimation was based on a pilot study in which the mean difference in the perceived QOL scores between IT and ITeS professionals was found to be 8.78 with standard deviations of 18.2 (IT) and 16.9 (ITeS). Considering a two-sided alpha error of 0.05 and 80% power, we derived a sample size of 63 professionals in each group. This was next multiplied by a design effect factor of 2.5 to account for the two-stage stratified random sampling procedure; thus, the final sample size for each group was 158. Taking into consideration 25% probable non-response, it was decided to target at least 200 professionals in each group. This sample size estimation was done using nMaster v1.0 software, developed by the Department of Biostatistics, Christian Medical College, Vellore, India.

A two-stage stratified random sampling technique was adopted for the current study. A total of 165 registered and operational software companies were scanned as per our preset criteria; 90 were eligible. This list was stratified into 55 IT companies and 35 ITeS companies (exhaustive and mutually exclusive groups).

Considering our limited resources, it was decided to randomly select 20% companies (11 IT and 7 ITeS) from each group by simple random sampling without replacement (SRSWRL) method, using computer-generated randomization tables. However, the STPI Kolkata, on our behalf, could seek consent from only seven IT and six ITeS companies. From each company, a list of eligible employees, satisfying the study population criterion was made, and 35 individuals were randomly selected (SRSWRL).

In the current study, we used the WHO QOL BREF questionnaire with due permission from the Division of Mental Health, WHO, Geneva. The WHO QOL BREF has four outcome domains—physical health (seven questions), psychological domain (six questions), social relationships (three questions) and environment (eight questions), as well as two additional items, the perceived QOL (overall) and perceived health status (total 26 questions). It is a rapid means of scoring domain profiles; it does not, however, allow assessment of individual facets within these domains (Division of Mental Health and Prevention of Substance Abuse 1998).

Scaled in a positive manner, domain scores are calculated by taking the means of all items included in each domain. The final scores are obtained in a 4–20 scale or in a 0–100 scale (used in the current study). When more than 20% data are missing from an assessment, it is discarded. When an item is missing, the mean of the other items in the domain is substituted. When more than two items are missing from a particular domain, the domain score is not calculated (except for domain 3, where the score can be calculated only if a maximum of one item is missing) (Division of Mental Health and Prevention of Substance Abuse 1998). The relevant SPSS syntax file which automatically checks, recodes data and computes domain scores was sent by the WHO along with the BREF questionnaire.

In addition to the above, a list of pertinent variables was prepared in consultation with the STPI authorities and professionals from the software industry. This list of variables was administered as a specially designed, semi-structured questionnaire, finalized after pre-testing (vide Table 1 for complete list of variables). There was also a question on current illness (additional BREF question).

The statistical analysis was performed using SPSS Statistics v17.0 (SPSS Inc., Chicago) and MLwiN v2.13 (SPSS Inc.) software. The data were analyzed and tabulated as number (percentage) for categorical and mean (standard deviation) for continuous variables. Univariate analysis was done with independent samples t test. The 95% confidence intervals (CI) of mean differences were calculated. Two-tailed p value of <0.05 was considered to be significant (univariate analysis is provided as an online resource.)

Multivariate linear regression (MLR) analysis was done for each of the six WHO QOL BREF outcome scores (continuous dependent variable) and the stepwise method was followed. Random coefficient analysis (multilevel multivariate) was done by deriving the random intercept (RIM) ± random slope (RSM) models at the company level, adjusting for the intra-class correlation coefficients (ICC).

Each such model consisted of unstandardized regression coefficients (b), their standard errors and the 95% CI for (b). The model significance (p value) and adjusted R square (denoting percentage predictability) of MLR were also noted. In addition, random coefficient models showed the Wald statistics.

Results

Of the 455 distributed questionnaires, 373 (198 IT and 175 ITeS professionals) could be retrieved. The overall response rate was 81.98% (IT = 80.8% and ITeS = 83.3%). Common reasons for non-response were lack of time and/or interest, or they could not be contacted. Further, 35 cases (21 IT + 14 ITeS) were automatically rejected from analysis by the SPSS syntax file. Thus, the final results were analyzed for 338 software professionals, including 177 IT (52.37%) and 161 ITeS (47.63%).

Table 1 shows the baseline characteristics of the study participants. As much as 52.07% (176/338) belonged to the youngest age group, with the majority from the ITeS sector (64.2%). The male:female ratio was 2.56:1. One hundred and thirteen (33.43%) participants claimed to have monogamous sexual relationship with their spouses, and 81% of them were IT professionals. All of those who had multiple sex partners ($n = 27$) were ITeS professionals. About 32% (109/338) of the participants, almost equally distributed in the two sectors, followed a regular fitness routine. Nearly 50% (170/338) among the total study participants were not addicted. Of concern was the 26% (88/338) who had multiple addictions—63% of these people were in ITeS companies.

The majority of the professionals had regular 7–10 h of office work (315/338); 48% of the ITeS employees (77/161) had regular night-shift duties. The more experienced ones belonged to IT companies (70%), and indulged more in job switchovers. About 77% of the 161 ITeS professionals earned below $500 per month (pm). The higher income groups (above $1,000 pm) absolutely belonged to the IT sector. Expenditure followed a similar distribution with the majority of the ITeS employees (53%) spending less than $200 pm. Over 95% of those who had at least one foreign placement with financial benefits in the preceding 1 year were IT professionals.

Table 1 Baseline characteristics of the study participants (Quality of life in Indian software industry, Kolkata, 2009–2010)

	Type of company				Total ($n = 338$)	
	IT company professionals ($n = 177$)		ITeS company professionals ($n = 161$)			
	(n)	(%)	(n)	(%)	(n)	(%)
Variables: socio-demographic						
Age (years)						
18–27	63	35.8	113	64.2	176	52.1
28–37	90	70.9	37	29.1	127	37.6
38 and above	24	68.6	11	31.4	35	10.4
Gender						
Male	123	50.6	120	49.4	243	71.9
Female	54	56.8	41	43.2	95	28.1
Highest education received						
Up to higher secondary	1	1.4	72	98.6	73	21.6
Graduation	95	56.2	74	43.8	169	50.0
Postgraduate and above	81	84.4	15	15.6	96	28.4
Permanent residence						
Kolkata (city)	137	53.1	121	46.9	258	76.3
Outside Kolkata, within state	15	34.9	28	65.1	43	12.7
Outside state (West Bengal)	25	67.6	12	32.4	37	10.9
Stay in Kolkata						
Single	14	48.3	15	51.7	29	8.6
With friends	17	42.5	23	57.5	40	11.8
Nuclear family[a]	87	58.0	63	42.0	150	44.4
Joint family[b]	59	49.6	60	50.4	119	35.2
Marital status						
Single	70	43.5	91	56.5	161	47.6
Committed relation	13	31.7	28	68.3	41	12.1
Living in	1	50.0	1	50.0	2	0.6
Married	93	71.5	37	28.5	130	38.5
Divorced/separated/widowed	0	0	4	100	4	1.2
Sexual relationship						
Only wife/husband	92	81.4	21	18.6	113	33.4
Only committed partner	12	32.4	25	67.6	37	10.9
Friend or colleague	52	54.2	44	45.8	96	28.4
Any other	9	22.5	31	77.5	40	11.8
Multiple	0	0	27	100	27	8.0
Nil	12	48.0	13	52.0	25	7.4
Recreational activity (mainly)						
At home	52	66.7	26	33.3	78	23.1
Shopping	64	62.7	38	37.3	102	30.2
Movies	29	43.9	37	56.1	66	19.5
Dining	4	14.8	23	85.2	27	8.0
Pubs/nightclubs/discos	28	56.0	22	44.0	50	14.8
Others	0	0	14	100	14	4.1
Regular fitness routines						
Yes	58	53.2	51	46.8	109	32.2
No	119	52.0	110	48.0	229	67.8

Table 1 continued

	Type of company				Total ($n = 338$)	
	IT company professionals ($n = 177$)		ITeS company professionals ($n = 161$)			
	(n)	(%)	(n)	(%)	(n)	(%)
Variables: work profile						
Daily working hours (average)						
7–10 h	157	49.8	158	50.2	315	93.2
11–14 h	20	87.0	3	13.0	23	6.8
Work shift						
Day	177	67.8	84	32.2	261	77.2
Night	0	0	77	100	77	22.8
Work experience						
2–5 years	102	44.0	130	56.0	232	68.6
6 years and above	75	70.8	31	29.2	106	31.4
Number of companies worked in						
Only 1 company	55	50.0	55	50.0	110	32.5
2–4 companies	100	51.0	96	49.0	196	58.0
5 and above companies	22	68.8	10	31.2	32	9.5
Carrying work home affects life						
Yes	25	45.5	30	54.5	55	16.3
No	74	48.4	79	51.6	153	45.3
Not applicable	78	60.0	52	40.0	130	38.5
Gross monthly income[c]						
Below $500	43	25.6	125	74.4	168	49.7
$500–below $1,000	77	68.8	35	31.2	112	33.1
$1,000–below $1,500	31	100	0	0	31	9.2
$1,500–below $2,000	13	92.9	1	7.1	14	4.1
$2,000 and above	13	100	0	0	13	3.8
Average monthly expenditure[c]						
Below $200	38	30.9	85	69.1	123	36.4
$200–below $400	62	51.7	58	48.3	120	35.5
$400–below $600	45	72.6	17	27.4	62	18.3
$600–below $800	18	94.7	1	5.3	19	5.6
$800–below $1,000	4	100	0	0	4	1.2
$1,000 and above	10	100	0	0	10	3.0
Foreign placements (last 1 year)						
At least 1 with financial benefit	21	95.5	1	4.5	22	6.5
Office tours, without financial benefits	22	95.7	1	4.3	23	6.8
No such benefits	134	45.7	159	54.3	293	86.7
Variables: addiction and current illness						
Addiction profile						
No addictions	106	62.4	64	37.6	170	50.3
Only smoking	23	54.8	19	45.2	42	12.4
Only tobacco chewing	3	42.9	4	57.1	7	2.1
Only alcohol	13	52.0	12	48.0	25	7.4
Any other addiction	0	0	6	100	6	1.8
Multiple	32	36.4	56	63.6	88	26.0
Smoking tobacco products						
Yes, >70/week	10	43.5	13	56.5	23	6.8
Yes, ≤70/week	44	42.7	59	57.3	103	30.5

Table 1 continued

	Type of company				Total ($n = 338$)	
	IT company professionals ($n = 177$)		ITeS company professionals ($n = 161$)			
	(n)	(%)	(n)	(%)	(n)	(%)
No	123	58.0	89	42.0	212	62.7
Alcohol						
Yes, >7 pegs/week	5	38.5	8	61.5	13	3.8
Yes, ≤7 pegs/week	35	40.2	52	59.8	87	25.7
No	137	57.6	101	42.4	238	70.4
Are you currently ill?						
Yes	19	45.2	23	54.8	42	12.4
No	158	53.4	138	46.6	296	87.6

[a] Only married couple with dependent children

[b] Otherwise

[c] 1 US dollar ($) = Rupees 50 (INR) (approx. conversion rate)

Overall, the analysis clearly demonstrated that there were significant differences between the mean scores of IT and ITeS sectors of the software industry for each of the six outcome domains of WHO QOL BREF (Table 2). The maximum mean difference was observed for social relationships domain (10.1; 95% CI = 6.1, 13.9); and lowest for the psychological domain (3.9; 95% CI = 0.9, 6.9).

The MLR analysis (Table 3) eliminated 8 of the 21 variables introduced, after adjusting. Thus, there were four positive predictors for the different domains of WHO QOL BREF and nine negative ones.

Though only 32% of the participants adhered to a regular fitness regime, it was the the strongest positive predictor of QOL across five domains—perceived QOL (95% CI = 1.69, 9.97), perceived health status (95% CI = 7.94, 16.72), physical health (95% CI = 2.04, 8.00), psychological domain (95% CI = 1.01, 7.24) and environment (95% CI = 2.12, 8.19).

Table 2 WHO QOL BREF domain scores of the study participants according to the type of company (Quality of life in Indian software industry, Kolkata, 2009–2010)

WHO QOL BREF domains	Type of company		Mean difference	95% CI of mean difference
	IT company professionals ($n = 177$) Mean (sd)	ITeS company professionals ($n = 161$) Mean (sd)		
Perceived QOL	68.1 (17.0)	58.7 (20.0)	9.4	5.4, 13.4
Perceived health status	63.9 (18.2)	57.8 (23.4)	6.1	1.7, 10.7
Physical health domain	63.9 (14.4)	57.7 (13.6)	6.2	3.2, 9.3
Psychological domain	64.2 (13.5)	60.3 (14.6)	3.9	0.9, 6.9
Social relationships domain	70.1 (14.6)	60.0 (21.2)	10.1	6.1, 13.9
Environment domain	60.7 (13.5)	53.7 (14.1)	7.0	4.1, 9.9

Increasing age improved the perceived QOL, physical health, as well as social relationships and environment domains. Foreign placements, especially with added finances, had a positive effect on physical and psychological QOL. Changing companies frequently improved physical health and psychological domains.

In contrast, current illness, though affected only 12%, emerged as a strong negative predictor for five BREF domains (except perceived QOL). The ITeS company type itself emerged as a strong negative independent variable affecting perceived QOL (95% CI = −14.08, −5.52), physical health (95% CI = −11.46, −5.15), social relationships (95% CI = −12.62, −3.68) and environment (95% CI = −7.96, −0.76) domains.

Female sex was negatively associated with the physical heath domain. Increasing working hours in office had a negative impact over the QOL in physical health, and psychological and environmental domains. Night-shift duties, an exclusive feature of the ITeS sector, decreased psychological and environmental QOL. Both higher income (affecting social relationships domain) and higher expenditure (affecting perceived QOL and physical health domains) were found to be negative predictors.

Understandably, addiction profile was negatively related to the physical health and social relationships domains of QOL. Multiple sexual relationships were also negatively related to QOL in the social relationships domain.

All MLR models were significant ($p < 0.001$). Except for the perceived QOL domain (10.5%) and psychological

Table 3 Multivariate linear regression models (stepwise method) with each of the six WHO QOL BREF domains as the dependent (outcome) variable (Quality of life in Indian software industry, Kolkata, 2009–2010)

Models	Unstandardized coefficients		95% Confidence interval for (*b*)	
	Regression coefficient (*b*)	Std. error of (*b*)	Lower boundary	Upper boundary
Perceived quality of life				
Constant	67.22	6.16	55.09	79.34
Type of company	−9.79	2.17	−14.07	−5.52
Regular fitness routine	5.83	2.1	1.69	9.97
Age	0.52	0.15	0.21	0.82
Monthly expenditure	−2.85	1.00	−4.82	−0.88
Perceived health status				
Constant	46.32	4.58	37.30	55.34
Regular fitness routine	12.33	2.23	7.93	16.72
Are you currently ill?	−16.89	3.17	−23.13	−10.65
Age	0.51	0.14	0.22	0.80
Addiction profile	−1.09	0.48	−2.05	−0.13
Physical health domain				
Constant	105.64	7.36	91.15	120.14
Type of company	−8.30	1.60	−11.46	−5.15
Daily working hours	−3.03	0.66	−4.34	−1.72
Foreign placement	3.37	1.40	0.60	6.14
Regular fitness routine	5.02	1.51	2.04	8.00
Number of companies worked in	1.38	0.49	0.41	2.35
Are you currently ill?	−5.85	2.14	−10.06	−1.63
Monthly expenditure	−2.31	0.69	−3.68	−0.95
Gender	−4.07	1.61	−7.25	−0.90
Psychological domain				
Constant	79.32	7.11	65.33	93.31
Work shift	−4.47	1.82	−8.05	−0.89
Regular fitness routine	4.12	1.58	1.00	7.24
Number of companies worked in	1.30	0.50	0.31	2.29
Are you currently ill?	−5.10	2.25	−9.52	−0.67
Daily working hours	−1.78	0.69	−3.14	−0.41
Foreign placement	2.99	1.42	0.18	5.80
Social relationships domain				
Constant	77.83	6.46	65.12	90.55
Sexual relationship	−2.13	0.67	−3.46	−0.80
Type of company	−8.15	2.27	−12.61	−3.68
Are you currently ill?	−9.55	2.82	−15.11	−3.99
Addiction profile	−1.22	0.44	−2.09	−0.34
Age	0.49	0.15	0.19	0.80
Monthly income	−3.54	1.12	−5.75	−1.33
Environment domain				
Constant	76.53	8.02	60.75	92.32
Type of company	−4.35	1.83	−7.96	−0.75
Are you currently ill?	−7.19	2.20	−11.53	−2.86
Regular fitness routine	5.15	1.54	2.12	8.18
Daily working hours	−1.62	0.67	−2.94	−0.30
Age	0.22	0.10	0.02	0.44
Work shift	−4.43	2.09	−8.56	−0.31

domain (8.6%), satisfactory adjusted *R*-squared values were obtained for perceived health status (17.5%), physical health (20.1%), social relationships (18.4%) and environment (14%) domains.

Since randomization was done at both company and individual levels, multilevel multivariate analysis was applied to adjust for the ICC (Table 4). For the perceived health status and environment domains, this was not necessary as the RIMs were insignificant from likelihood ratio tests, denoting that the responses were not clustered within the company level.

The ICC within the responses of the perceived QOL domain question at the company level was 0.05. The RIM clearly retains all significant variables of the MLR model. In contrast, the physical health domain facilitated both RIM and RSM at the company level, with an ICC of 0.19. Company type, working hours and current illness were significant negative predictors, while following regular fitness regime and increased changing of companies were of positive influence. Compared to MLR, three variables (monthly expenditure, gender and foreign placements) were not present in this model, while a new negative

Table 4 Linear multilevel analysis with random intercept ± random slope models at the company level for each of the six WHO QOL BREF domains as dependent (outcome) variable (Quality of life in Indian software industry, Kolkata, 2009–2010)

Models	Regression coefficient (*b*)	Std. error of (*b*)	Wald statistics	95% confidence interval	
				Lower boundary	Upper boundary
Perceived quality of life					
Constant	58.02	4.98	11.65	48.26	67.78
Type of company	−10.73	3.04	−3.53	−16.69	−4.77
Regular fitness routine	5.76	2.05	2.81	1.74	9.78
Age	0.45	0.16	2.81	0.14	0.76
Monthly expenditure	−2.18	1.01	−2.16	−4.16	−0.20
Perceived health status					
Not applicable					
Physical health domain					
Constant	85.76	6.09	14.08	73.82	97.70
Type of company	−10.55	2.68	−3.94	−15.80	−5.30
Daily working hours	−2.29	0.61	−3.75	−3.49	−1.09
Carrying work home affects life	−3.72	0.89	−4.18	−5.46	−1.98
Regular fitness routine	5.09	1.36	3.74	2.42	7.76
Number of companies worked in	1.02	0.44	2.32	0.16	1.88
Are you currently ill?	−5.69	2.68	−2.12	−10.94	−0.44
Psychological domain					
Constant	72.11	7.02	10.27	58.35	85.87
Work shift	−1.82	2.06	−0.88	−5.86	2.22
Regular fitness routine	4.04	1.52	2.66	1.06	7.02
Number of companies worked in	0.94	0.49	1.92	−0.02	1.90
Are you currently ill?	−3.86	2.18	−1.77	−8.13	0.41
Daily working hours	−1.29	0.68	−1.90	−2.62	0.04
Foreign placement	2.85	1.39	2.05	0.13	5.57
Social relationships domain					
Constant	68.58	5.58	12.29	57.64	79.52
Sexual relationship	−2.05	0.65	−3.15	−3.32	−0.78
Type of company	−10.59	3.66	−2.89	−17.76	−3.42
Are you currently ill?	−8.28	2.74	−3.02	−13.65	−2.91
Age	0.45	0.15	3.00	0.16	0.74
Monthly income	−3.33	1.11	−3.00	−5.51	−1.15
Addiction profile	−1.34	0.57	−2.35	−2.46	−0.22
Environment domain					
Not applicable					

predictor (carrying work home affects life) was introduced.

Major changes from the MLR were also noted in the RIM for psychological domain with an ICC of 0.09. Only two variables, foreign placements and following regular fitness regime, were of positive significance. Others, though retained in the model, were not significant. For the social relationships domain with an ICC of 0.09, all positive predictors of the MLR counterpart were retained with their significance.

Interestingly, this final analysis (Table 4) outlined 13 significant predictors of QOL, of which all but 1 were in agreement with the MLR models (with minor changes in regression coefficients and related values).

Discussion

The effect of computerized work environment on the health of employees has been an area of concern for long (Griffiths et al. 2007); however, research has been mainly focused on physical morbidities (Pinto et al. 2004; Sharma et al. 2006; Talwar et al. 2009) or mental health alone (Bhattacharya and Basu 2007; Chaturvedi et al. 2007; Pinto et al. 2004). In sharp contrast, QOL does not necessarily depend on absence of disease, but on the chemistry between the "body, mind and spirit" (Albrecht et al. 1999). Quality of life assessments can best work out in settings-based research where much concrete scope for implementation of specific health promotion measures exists. Our study attempted to explore the health and well-being, or the relative absence of it, in the software industry of Kolkata.

The software workforce is an essentially young one, more so for the ITeS sector. Strikingly, the male–female ratio was low, being 2.28:1 in the IT sector, and 2.93:1 in the ITeS. Talwar et al. 2009 studied 200 software professionals of Delhi with the mean age of 28.23 years and 58.5% between 20 and 29 years. Sharma et al. 2006 reported the mean age of participants to be 29.8 years, 53.5% between 21 and 30 years. The male:female ratio was 7:3.

Indeed, age was one of the most important positive predictor variables associated with the four domains of the WHO QOL BREF. Increasing age improved perceived QOL, physical health domain, as well as the social relationships and environment QOL domains. The results can be interpreted in two ways. As the mean age of IT professionals was more than their ITeS counterparts, the significantly better QOL of the IT sector was reflected through the age variable. Also, this could indicate that with increasing time, the professionals got better settled with the demands of the industry vis-à-vis their own expectations, standards and goals.

We studied the association of sexual relationships with QOL and found that it had a negative impact on the social relationships domain (95% CI = −3.32, −0.78). What stands out from the data is that a much younger ITeS population indulged in sexual adventurism, considering the usual conservativeness of the Indian society. Also, the fact that 16.8% (27/161) of the call center/BPO employees had multiple sex partners should raise an alarm considering their age, educational status and income.

Interestingly, though only 32% (109/338) of the participants swore on a regular fitness regime (diet/gym/yoga), this variable emerged as one of the strongest positive predictors of QOL across all domains barring the social relationships one. Brand et al. conducted a randomized controlled trial of workplace exercise and used WHO QOL as the principle outcome. Encouraging improvements were noted in the perceived QOL, and psychological and physical health domains (Brand et al. 2006). Studying the association between the stages of exercise and health-related QOL, researchers found that poor self-perceived QOL was associated with people unwilling to accommodate a regular exercise routine in their daily schedules (Laforge et al. 1999).

Work-profile analysis revealed that while extended working hours negatively affected the physical and environmental domains (mainly concerning IT workers), graveyard-shift duties had a similar impact over the environmental QOL (ITeS). Job switchover, more common in the IT sector (comprising 68% of those who changed five or more companies), surprisingly played a positive role in the physical domain (95% CI = 0.16, 1.88). Though only a small percentage of the 338 software professionals (16%) complained that carrying office work home was interrupting their normal family and personal lives, it was found to be negatively influencing the physical QOL. Foreign placements were a psychological stimulus enjoyed by the IT employees.

A study involving mid-level managers across 110 large Japanese companies found that prolonged working hours were associated with irregularities in day-to-day activities, such as sleeping, lack of exercising, food habits, overindulgence in tea/coffee, thereby affecting the subjective QOL (Maruyama et al. 1995). Extended working hours, coupled with lack of sleep and job strain, predicted physical and mental distress among IT professionals (Nishikitani et al. 2005). Work–family balance, if hampered by spending more time on work than on family, has been shown to produce a poorer QOL (Mo and Winnie 2010) and the same has been documented among both IT and ITeS sectors (Hyman et al. 2003). Occupational health experts of Bangalore opined that permanent night-shift duties resulted in serious health concerns for the call center employees. Labeled as the "computer vision syndrome", morbidities

included soreness and dryness of eyes, blurring of vision, headache and photosensitivity. Digestive disorders were also serious consequences (Sudhashree et al. 2005).

On the other hand, changing jobs frequently was a positive predictor in our study. A common practice in this industry, timely and judicious switchovers, usually after 3–5 years of experience in a company, is typically associated with higher positions, enhanced pay packages and new opportunities in terms of projects and foreign visits. But, perhaps, of more significance is the growing concern of the young professionals about striking the correct work–life balance with increasing age and experience. In the Indian software industry, this concern is rapidly becoming a prime reason for shifting companies and a means to attain a better QOL, as evidenced in our study.

Negative role on QOL was played by both a higher income (social domain) and increasing expenditure (perceived QOL domain). An interesting paper on income and QOL controlled for factors, such as the affection for money, work satisfaction, marital status, working status and gender, and found that income had a negative influence on QOL (Tang 2007). In contrast, a cross-sectional study on an adult Greek population found that disadvantaged socio-economic status, i.e., low educational levels and lower per capita income, was associated with decline in HRQOL (Pappa et al. 2009). However, it needs to be understood that the social (socio-economic) determinants of health vary widely across geographical populations and cultures. The negative effect of money (income/expenditure) on the QOL of software professionals, as found in the current study, needs further exploration.

Of the 26% (88/338) of the professionals who had multiple addictions, 63% were in ITeS companies. As much as 56% of the "more than pack-a-day" smokers and 61% of the "more than peg-a-day" drinkers worked in call centers/BPOs. Addiction profile was negatively related to the perceived health (95% CI = −2.05, −0.13) and social relationships (95% CI = −2.46, −0.22) domains of QOL. Alcohol was reported to decrease the health-related QOL of Taiwanese adolescents (Chen and Storr 2006). Alcohol dependency further worsens the situation (Foster et al. 1998). A Spanish retrospective cohort study documented healthy smokers to suffer a lower QOL compared to non-smokers (Cayuela et al. 2007).

Current illness during the study, though affected only 12% (42/338), emerged as a strong negative predictor for the four BREF domains (except perceived QOL and psychological domain).

At this juncture, it is very interesting to note that three of the nine negative predictors of QOL across the different BREF domains were predominant problems of the ITeS sector—multiple addictions, night-shift jobs and non-traditional/multiple sexual relationships. In contrast, two of the four positive predictors, namely foreign placements with financial gains and increased frequency of job changing, were mainly related to the IT professionals. Indeed, the type of company, i.e., ITeS emerged as a strong negative independent variable affecting the perceived (95% CI = −16.69, −4.77), physical (95% CI = −15.80, −5.30), social (95% CI = −17.76, −3.42) and environment (95% CI = −7.96, −0.75) domains of QOL. Previously, it was demonstrated (Table 2) that there were significant differences between the mean scores of the IT and the ITeS sectors for each of the six outcome domains of the WHO QOL BREF.

The study findings necessitate a call for specific health promotional interventions in the software industry, with special emphasis on the call centers/BPOs. Supportive smoke-free environment at workplace, including counseling and pharmacological measures, can minimize addictions. Youth can be sensitized about the physical, mental and social consequences of multiple sexual relationships and unprotected sexual encounters, especially in an era of HIV epidemic. Stress-management interventions need to be focused here.

Both prolonged working hours and night-shift duties are software-based industrial realities. Long-known principles of circadian adaptation by designing "work/sleep–light/dark" schedules can be implemented with help from occupational health practitioners (Martin 1999). Randomized trial on the effectiveness of workplace exercise intervention has clearly demonstrated multidimensional effects on QOL, with independent improvement of physical and psychological parameters (Brand et al. 2006). Web-based virtual workplace exercise programmes, with incentives such as cash discounts have been proven to reduce morbidities, boost anti-smoking efforts and improve perception of health (Herman et al. 2006).

In conclusion, it is only justifiable to say that notwithstanding the resource restrictions and compromised sample size, our research provides a rare insight into an extremely unexplored, yet demanding, occupational setting. The workforce is young and their contribution to the nation's economic growth undisputable. Similarly, their challenges are multifaceted and problems are unique. In an era where companies spend millions on health insurance schemes, the resources could be better utilized by implementing preventive and promotive measures.

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References

Albrecht Gary L, Patrick J Devlieger (1999) The disability paradox: high quality of life against all odds. Soc Sci Med 48(8):977–988

Ali Hikmat, Malkawi Fuad, Al-Betawi Yamen (2009) Quality of life in cities: setting up criteria for Amman-Jordan. Soc Indic Res 93(2):407–432

Bhattacharya S, Basu J (2007) Distress, wellness and organizational role stress among IT professionals: role of life events and coping resources. J Indian Acad Appl Psychol 33(2):169–178

Brand R, Schlicht W, Grossman K, Duhnsen R (2006) Effects of a physical exercise intervention on employees' perceptions quality of life: a randomized controlled trial. Soz Praventivmed 51(1): 14–23

Cayuela Aurelio, Rodríguez-Domínguez Susana, Otero Remedies (2007) Deteriorated health-related quality of life in healthy male smokers. Arch Bronconeumol 43(2):59–63

Chaturvedi SK, Kalyanasundaram S, Jagadish A, Vikram Prabhu, Vikram Narasimha (2007) Detection of stress, anxiety and depression in IT/ITES professionals in the Silicon Valley of India: a preliminary study. Prim Care Commun Psychiatry 12(2): 75–80(6)

Chen CY, Storr CL (2006) Alcohol use and health-related quality of life among youth in Taiwan. J Adolesc Health 39(5):752 e9–16

Division of Mental Health and Prevention of Substance Abuse, WORLD HEALTH ORGANIZATION (1998) WHO QOL User Manual. World Health Organization, Geneva

Foster JH, Marshall EJ, Hooper R, Peters TJ (1998) Quality of life measures in alcohol dependent subjects and changes with abstinence and continued heavy drinking. Addict Biol 3(3):321–332

Griffiths KL, Mackey MG, Adamson BJ (2007) The impact of a computerized work environment on professional occupational groups and behavioural and physiological risk factors for musculoskeletal symptoms: a literature review. J Occup Rehabil 17(4):743–765

Herman CW, Musich S, Lu C, Sill S, Young JM, Edington DW (2006) Effectiveness of an incentive-based online physical activity intervention on employee health status. J Occup Environ Med 48(9):889–895

Hyman Jeff, Baldry Christopher, Scholarios Dora, Bunzel Dirk (2003) Work–life imbalance in call centres and software development. British J Ind Relat 41:215–239

Laforge RG, Rossi JS, Prochaska JO, Velicer WF, Levesque DA, McHorney CA (1999) Stage of regular exercise and health-related quality of life. Prev Med 28(4):349–360

Martin SK (1999) How to use light and dark to produce circadian adaptation to night shift work. Ann Med 31(2):87–98

Maruyama S, Kohno K, Morimoto K (1995) A study of preventive medicine in relation to mental health among middle-management employees (Part 2)—effects of long working hours on lifestyles, perceived stress and working-life satisfaction among white-collar middle-management employees. Nippon Eiseigaku Zasshi 50(4):849–860

Mo Phoenix, Winnie W (2010) The influence of health promoting practices on the quality of life of community adults in Hong Kong. Soc Indic Res 95(3):503–517

NASSCOM (2010) Available at http://www.nasscom.in/. Accessed 1 Mar 2010

Nishikitani M, Nakao M, Karita K, Nomura K, Yano E (2005) Influence of overtime work, sleep duration, and perceived job characteristics on the physical and mental status of software engineers. Ind Health 43(4):623–629

Pappa E, Kontodimopoulos N, Papadopoulos AA, Niakas D (2009) Assessing the socio-economic and demographic impact on health-related quality of life: evidence from Greece. Int J Public Health 54(4):241–249

Pinto B, Ulman Shrutin, Assi Harneet (2004) Prevalence of occupational disease in information technology industries in Goa. Indian J Occup Environ Med 8(1):30–33

Sharma A, Khera S, Khandekar J (2006) Computer related health problems among information technology professionals in Delhi. Indian J Commun Med 31(1):36–38

Sudhashree VP, Rohith K, Shrinivas K (2005) Issues and concerns of health among call center employees. Indian J Occup Environ Med 9(3):129–132

Talwar R, Kapoor R, Puri K, Bansal K, Singh S (2009) A study of visual and musculoskeletal health disorders among computer professionals in NCR Delhi. Indian J Commun Med 34(4): 326–328

Tang TLP (2007) Income and quality of life: does the love of money make a difference? J Bus Ethics 72(4):375–393

Wallace RB (2008) Public health principles and methods. In: Wallace RB (ed) Wallace/Maxcy-Rosenau-Last public health and preventive medicine, The McGraw-Hill Companies Inc, USA, p 3, 36

Zahran HS, Kobau R, Moriarty DG, Zack MM, Holt J, Donehoo R (2005) Health-related quality of life surveillance–United States, 1993–2002. MMWR Surveill Summ 54(4):1–35