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Lost productivity among military personnel with cardiovascular disease

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ABSTRACT

Objective Cardiovascular disease (CVD) is associated with significant productivity loss among all occupational groups. However, the increased occupational requirements of military personnel pose physical and psychological demands that could lead to greater lost productivity of CVD. The aim of this study was to determine the economic cost of lost productivity of military patients with CVD.

Methods A prospective cross-sectional study was undertaken on all military patients attending a specialist CVD clinic in Tehran, Iran. All participants were interviewed using face-to-face questioning using a Valuation of Lost Productivity questionnaire. Data captured included paid and unpaid time lost due to CVD, military job characteristics and their work environment. Ordered logistic regression was used to examine the determinants of lost productivity.

Results The mean time of lost productivity was 118 hours over a 3-month period, of which 70 and 48 hours were paid and unpaid work, respectively. The average cost per patient of total lost productivity was estimated to be US$303 over a 3-month period.

Conclusions CVDs are associated with significant lost productivity among military personnel. There is a statistically significant relation between some military occupation characteristics and lost productivity from CVD. Level of income, teamwork and physical activity have the greatest effects on lost productivity. Military workers who were suffering from other chronic conditions (in addition to CVD) were four times more likely to lose productivity. A supportive work environment should be created for military personnel with emphasis on developing teamwork, improving worker's attitudes towards disease and giving priority to workers with comorbidities.

Key messages

- Cardiovascular diseases (CVDs) are associated with significant lost productivity among military personnel.
- There is a statistically significant relation between some military occupation characteristics and lost productivity from CVD.
- Level of income, teamwork and physical activity have the greatest effects on lost productivity.
- Military workers who were suffering from other chronic conditions (in addition to CVD) were four times more likely to lose productivity.
- A supportive work environment should be created for military personnel with emphasis on developing teamwork, improving worker's attitudes towards disease and giving priority to workers with comorbidities.

INTRODUCTION

Cardiovascular disease (CVD) is responsible for 25%–45% of all deaths worldwide and is the main cause of death in a majority of countries.[1 2] More than 80% of deaths from CVD occur in low-income and middle-income developing countries.[3] With an ever increasing prevalence of CVD, it is estimated that 23 million persons worldwide will die from CVD annually by 2030, and perhaps four to five times this number will experience chronic disability from the disease.[3] As the prevalence of CVD increases at lower ages,[2] working-age individuals are more affected by CVD.[4] It is estimated that by 2030, over 20 million workers will have a chronic disease in the UK.[5] Lost productivity due to CVD is an important consequence of long-term disability,[6] as well as early retirement, short-term absence from work (absenteeism) or reduced performance while working (presenteeism).[7] In such situations, controlling risks and adapting workers to their jobs will play an essential role in preventing and reducing workers' lost productivity.

The occupational requirements of military personnel pose greater physical and psychological demands that in turn could lead to increased risk of CVD and sudden cardiac death.[8] Intense physical exercise and high psychological stress before, during and after military missions can trigger the occurrence of morphological changes such as cardiac hypertrophy.[9] As the civilian population exhibits increasing trends in major cardiovascular[5] risk factors in younger work-age groups, the military population is observing similar trends.[8] The aim of this study was to measure and determine the monetary value of lost productivity among military personnel with CVD.

METHODS

Study design and sample size

A cross-sectional descriptive and analytical study was undertaken to measure and determine the monetary value due to lost productivity from CVD among military personnel. All armed forces personnel with clinically confirmed CVD who visited a specialist military heart clinic between 15 September 2016 and 15 March 2017 were invited to participate in the study. Inclusion criteria included being active military personnel with at least 5 years of work experience in one of the military occupational groups as well as having approved CVD at medical record (Figure 1).

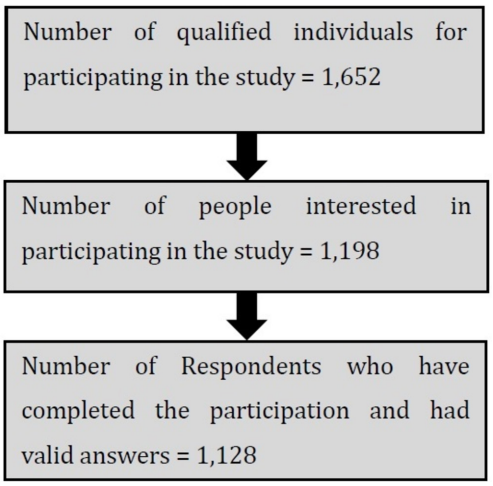

Figure 1 Flow chart of sample selection

Valuation of Lost Productivity questionnaire

Lost productivity among patients with CVD was measured using the Valuation of Lost Productivity (VOLP) questionnaire.[10] Access to and use of VOLP questionnaire was done after obtaining permission under the non-commercial license from the questionnaire website. The use of this questionnaire has been validated in multiple previous studies.[11 12] The VOLP questionnaire measures all the time input loss components in paid works (including absenteeism, presenteeism, employment status changes) and unpaid works (voluntary activities, work in the household, etc.). VOLP also captures some aspects of job and workplace characteristics (ie, the team work status, availability of substitutes and their substitutability), which enable calculation of multipliers to adjust wage to represent the value of productivity loss considering the impact of work environment.[10]

Data collection

All participants were interviewed using the baseline version of the questionnaire. Before the interviews began, the objectives and methods of the study were fully explained to participants. Questionnaires were completed anonymously. Participants were free to leave the study or not to answer the questions at any stage.

Baseline data in the questionnaire included employment status, job characteristics, working environment, and paid and unpaid work lost productivity. Moreover, socioeconomic status and CVD-related symptoms were collected for all participants prior to answering the VOLP questionnaire. To ensure maximum accuracy of data collection process, questionnaires were completed with direct collaboration of five trained and educated interviewers through face-to-face interview. All data collectors were trained on the objective, confidentiality of information, respondents' rights and interview techniques prior to data collection.

Data analysis

Data analysis was undertaken in Microsoft Excel 2007. Determining the monetary value from lost productivity was undertaken using the 'Guideline for the Valuation of Lost Productivity (VOLP)'. All costs expressed were expressed in US dollars, applying the exchange rate (US$1=32 624 Rials) for the fiscal year 2016.

To evaluate effective factors on lost productivity, an ordered logistic regression model was used with quarter hours of total productivity loss as the dependent variable, and a large set of explanatory variables related to work environment, workplace, job and workers' characteristics. The strength of the association between effective factors and level of lost productivity were assessed through the magnitude of the OR. Statistical analysis performed by Stata V.12.0.

Table 1 Work and workers' characteristics

Variable	Number of patients	Per cent (%)
Demographic status		
Sex		
Male	952	84.4
Female	176	15.6
Age (years)		
<35	296	26.2
35–44	424	37.6
45–54	216	19.2
55≤	192	17
Marital status		
Married	936	83
Unmarried	192	17
Education level		
Under the diploma	96	8.5
Diploma	408	36.2
BSc	512	45.4
MSc/MD	112	9.9
Health status		
Onset of CVD (months)		
≤3	176	15.6
3–6	192	17
6–9	200	17.7
9–12	160	14.2
12–15	120	10.7
15≤	280	24.8
Other chronic conditions		
Yes	296	26.2
No	832	73.8
History of CVD surgery		
Yes	200	17.7
No	928	82.3
Usually sit	488	43.3
Job characteristics		
Level of physical activity in work		
Stand or walk	460	40.8
Lift light loads	140	12.4
Lift heavy loads	40	3.5
Level of team work		
None of the time	416	36.9
A little of the time	192	17
Some of the time	184	16.3
Most of the time	176	15.6
All the time	160	14.2

CVD, cardiovascular disease.

RESULTS

Table 1 shows the work and workers' characteristics of the study population. Most respondents were men (84.4%), married (83%) and with BSc (45.4%) education level. Also, most of them

Table 2 Work performance of participants' characteristics

Variable	Number of patients	Per cent (%)	Average
Work more harder than coworkers			
Yes	632	56.03	–
No	496	43.97	
Absenteeism* (days)			
No	664	58.9	3.04
<7.5	280	24.8	
7.5–15	120	10.6	
≥15	64	5.7	
Presenteeism† (hours)			
No	568	50.4	0
<7.5	288	25.5	7.71
7.5–15	232	20.6	
≥15	40	3.5	

*Absent days from work during 3 months (sum of days and part of days absent).
†Hours of reduced performance while working during a week.

(83%) were in their peak time of working productivity and only 17% were almost close to retirement (over 55 years old).

Work performance of participants is presented at Table 2. Fifty-six per cent of respondents reported that their CVD condition constrained their performance in the way that they are forced to work harder than their coworkers to do their duties during the last week (Table 2). Work absence due to CVD during 3 months was 7.5>, 7.5–15 and ≥15 days in 24.8%, 10.6% and 5.7% of military workers, respectively.

The average time of total lost productivity among participants was 117.7 hours during 3 months, which for paid and unpaid works was 70.1% and 47.6, respectively (Table 3). Also, the average cost of total lost productivity was US$303.3 (9 896 583 Rial) for 3 months, while the average cost of lost productivity for paid and unpaid work was US$186.7 and US$116.6, respectively.

A significant association between lost productivity and onset of CVD was found (OR 6.09, p=0.001). Workers at 12–15 months from onset of illness were significantly 6.09 times more likely to lose their productivity (Table 4). A significant association was found between presence of other chronic conditions and lost productivity (OR 3.59, p<0.001). Workers who were suffering from other chronic conditions (in addition to CVD) were 3.59 times more likely to lose their productivity.

Table 3 Amount and value of lost productivity during 3 months

Variable	Mean (±SD)	Sum
Paid work productivity loss		
Days of lost productivity	8.21 (±8.59)	2315.8
Hours of lost productivity	70.09 (±76.42)	19 765.12
Cost of lost productivity (Rial)	6 090 625.5 (±8 546 114.7)	1 717 556 394
Cost of lost productivity (US$)	186.69 (±261.95)	52 647.02
Unpaid work productivity loss		
Hours of lost productivity	47.57 (±119.76)	13 416
Cost of lost productivity (Rial)	3 805 957.4 (±9 580 760)	1 073 280 000
Cost of lost productivity (US$)	116.66 (±293.67)	32 898.47
Total of lost productivity		
Hours of total lost productivity	117.7 (±141.4)	33 181.12
Cost of total lost productivity (Rial)	9 896 583 (±12 930 819.9)	2 790 836 400
Cost of total lost productivity (US$)	303.35 (±396.35)	85 545.50

Workers' attitude towards CVD had a significant effect on lost productivity (OR 3.23, p=0.008). Workers who believed that CVD highly affects their life were 3.2 times more likely to lose productivity. An association was found between lost productivity and living location (OR 0.51, p=0.015), income level (OR 0.44, p=0.028), team working (OR 0.38, p=0.021) and physical activity (OR 0.25, p=0.031) in the work.

DISCUSSION

In our study, most participants were at the top age for work productivity. More than half of them were engaged in duties requiring moderate to high physical activity and 12% had to lift or carry light loads, or climb sloping surfaces during work. This can lead to a significant reduction of productivity during work. Research has demonstrated that lost working days for workers with heart disease can be reduced by four times by matching job characteristics to health status.[13] The average number of days absent from work due to CVD was 3.049 days over a 3-month period. This is less than for comparable civilian studies.[14 15] Half of the participants in our study reported that CVD affected their job performance, with the average productivity reduction approximately 8 hours per week.

The total lost productivity in military personnel with CVD was 117 hours per person or 14.6 working days (assuming eight working hours per day) for 3 months. In a similar study conducted by Meraya and Sambamoorthi in the USA, the average of lost productivity in adults with heart disease and hypertension was 6 days in a year (average 1.5 days for 3 months).[16] Wang *et al* demonstrated average lost productivity due to heart disease of 16 days (averagely 4 days for 3 months),[14] higher than in our study. This difference can be due to specific conditions of the military work environment, including the volume of physical activity, specific ergonomics, stress and psychological pressure during duty and the different working hours of military personnel.

The monetary value of lost productivity in military personnel during a 3-month period per person was 9 896 583 Rials or US$303. This is similar to other comparable studies.[17] Tella *et al*'s study reported that the average of lost productivity—measured by valuing sick leave—for a patient with ischaemic heart disease is €9673 per person for 4 years (average €604 per person for 3 months).[18] One of the likely reasons for the difference between studies lies in the different characteristics of the study population and different methods for measuring productivity loss. We measured lost productivity for both the paid and unpaid work, whereas only sick leave was used by Català Tella *et al*.[18]

In our study, we found a statistically significant relationship between some occupational characteristics and lost productivity. The odds of lost productivity in people with higher income level were lower. This may be due to greater access to healthcare services including rehabilitation.[19–21] The odds of lost productivity in people with a high level of teamwork were slightly lower. This can be attributed to the impact of the team on people with CVD.[22–25]

Living location had a significant effect on lost productivity. Living in the capital city decreased the chance of lost productivity, which can be attributed to more access to CVD treatment and rehabilitation services.[26–28 29] Participant attitude had a strong effect on lost productivity. Participants who had believed that the CVD can highly affect the patient's life were 3.2 times more likely to lose their productivity, similar to other studies.[30–32]

Time spent from the onset of CVD and presence of comorbidities had the highest effects on the amount of lost productivity

Table 4 Affecting factors of the lost productivity of CVD

Variable	Category	Coefficient (±SE)	OR (±SE)	Z	P values
Location	Capital	−0.657 (±0.270)	0.518 (±0.140)	−2.43	**0.015**
Attitude towards the disease effect on performance	Low	−0.319 (±0.327)	0.726 (±0.237)	−0.98	0.328
	Average	0.303 (±0.396)	1.354 (±0.537)	0.76	0.444
	High	1.173 (±0.445)	3.233 (±1.439)	2.64	**0.008**
	Very high	−0.440 (±1.159)	0.643 (±0.746)	−0.38	0.704
Onset of CVD (month)	3–6	0.618 (±0.414)	1.855 (±0.769)	1.49	0.136
	6–9	0.134 (±0.470)	1.144 (±0.538)	0.29	0.775
	9–12	0.855 (±0.511)	2.352 (±1.204)	1.67	0.095
	12–15	1.808 (±0.548)	6.099 (±3.343)	3.30	**0.001**
	15≤	−0.471 (±0.482)	0.623 (±0.301)	−0.98	0.329
Other chronic conditions	Yes	1.278 (±0.333)	3.592 (±1.197)	3.84	**0.000**
Level of physical activity in work	Stand or walk	−0.287 (±0.266)	0.749 (±0.199)	−1.08	0.280
	Lift light loads	0.093 (±0.386)	1.098 (±0.425)	0.24	0.808
	Lift heavy loads	1.354 (±0.628)	0.258 (±0.162)	−2.16	**0.031**
Income	Quartile 2	−0.067 (±0.359)	0.934 (±0.335)	−0.19	0.851
	Quartile 3	−0.260 (±0.364)	0.770 (±0.280)	−0.71	0.475
	Quartile 4	−0.818 (±0.371)	0.440 (±0.163)	−2.20	**0.028**
Level of teamwork	A little of the time	0.281 (±0.353)	1.324 (±0.468)	0.80	0.426
	Some of the time	0.408 (±0.352)	1.504 (±0.530)	1.16	0.246
	Most of the time	−0.950 (±0.411)	0.386 (±0.158)	−2.31	**0.021**
	All the time	0.107 (±0.380)	1.114 (±0.423)	0.28	0.776

CVD, cardiovascular disease.
Bold P-values (P<0.05) are considered as statistically significant.

due to CVD. Workers at 12–15 months from onset of illness were six times more likely to lose productivity. On the other hand, workers suffering from other chronic conditions in addition to CVD were four times more likely to lose productivity. This again correlated with similar studies.[16]

To our knowledge, this is the first study that has examined lost productivity among military occupations. We recognise that our study has limitations. First, information on missed workdays was based on self-reported data. Therefore, recall bias may have an effect on the measures of the variables. Second, we are unable to exclude lost productivity from other comorbidities than CVD. Thirdly, the cross-sectional design of the study does not enable a causal relationship between CVD and lost productivity to be determined. Finally, the survey respondents may have been healthier than non-respondents.

CONCLUSIONS

CVDs are associated with significant lost productivity among military personnel. Developing a supportive work environment for military personnel with an emphasis on developing teamwork, improving worker's attitudes towards disease and giving priority to workers with comorbidities may reduce lost productivity in this military cohort.

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