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Socioeconomic Inequalities in Staff Physical Activity: Evidence from the SHAHWAR Cohort Study in Iran

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Abstract:

Background: This study was aimed to investigate socioeconomic-related inequality in physical activity (PA) among Staff of Medical Sciences University in Shahroud, Iran.

Methods: Data were extracted from the first phase of the SHAHWAR cohort study. The Concentration index (CI) and Wagstaff decomposition method were applied to determine socioeconomic-related inequality in PPA and its contributors, respectively.

Results: CIs of poor total PA (PTPA) and poor work-related PA (PWRPA) were 0.092 and 0.141, indicating their more concentration among staff of higher socioeconomic groups. Furthermore, the negative CI of poor leisure-time PA (PLTPA) (-0.191) suggests that it disfavors staff from lower socioeconomic groups. While PWRPA, Subjective social status (SSS), socioeconomic status (SES), and gender were positively contributed to the measured inequality in PTPA (65.3%, 37.9%, 18.6%, and 16.6%, respectively), residence in urban areas and PLTPA have negative contributions (64% and 27%, respectively). Similarly, SES, marital status, and residence in urban areas positively contributed to the inequality of PLTPA by 53.4%, 36.2%, and 23.5% respectively. Whereas, gender had the most negative contribution by 28.7%. Residence in urban areas, SES, SSS, and shift work were all positively contributed to the measured inequality in PWRPA (its more concentration among staff from high SES groups) by 28.4%, 20%, 15.2%, and 12.7%, respectively, while the opposite is true for gender by the contribution of 13.3%.

Conclusions: Different patterns of PPA inequality revealed that health promotion programs should aim to educate and support higher SES staff to increase their PA in workplace, leisure time, and transportation, and lower SES staff to increase their leisure-time PA.

Keywords: Physical activity, Socioeconomic Inequalities, Staff, Medical Sciences University, Iran

Background

Physical activity (PA) has several health benefits, including lower risk of heart disease, stroke, type 2 diabetes, breast cancer, colon cancer, [1] and better mental health, [1] [2] and it increase life expectancy. [1] It also could increase the employees' productivity [3, 4] and reduce their sick leave, [4, 5] and healthcare costs [6] by creating a healthier workforce. The results of a study indicates that healthcare costs for employees who were active and very active were about \$250 less than that of sedentary employees. [6]

Studies around the world indicate that several demographic and socioeconomic factors such as age, gender, education, occupation, income and mental health are associated with PA and its four domains. [2, 7-9] Furthermore, there are different patterns of the impact of SES on PA among its different domains. [10] There are some evidence which indicate that while occupational PA was further prevalent among the lower socioeconomic groups, [7, 10, 11] leisure time PA was more prevalent among people with higher SES. [10, 12]

Governments often implement health promotion programs to increase public health. In this regard, the workplace of people is one of the appropriate settings for the implementation of these programs. [13, 14] Because employed people spend a significant proportion of their time at work. [10] Moreover, the return on investment on employees' PA is high [15] because of its favorable effects on productivity, absenteeism, and healthcare costs. Designing cost-effective interventions requires analyzing the current situation of PA distribution among different socioeconomic groups and understanding its contributing factors. In Iran, some studies have been conducted on the impact of socioeconomic status on PA in the general population. However, the employees' PA has not been the focus of these studies. [16-18] This study was designed to provide further evidence for

public health policy to address socioeconomic inequalities of poor physical activity (PPA) and its different domains among staff of medical sciences university in Shahroud, Iran.

Methodology

Source of data and variables

In the present study, data were extracted from the first phase of the SHAHWAR (SHAhroud Healthcare Workers Associated Research) cohort study which was started from 2, OCT, 2019 in Shahroud, located in the Northeast of Iran. SHAHWAR is a subset of PERSIAN Cohort study [19] and focuses on the health of employees. In this cohort study, data from 1178 personnel of Shahroud University of Medical Sciences was prospectively collected after obtaining informed consent. After cleaning data and excluding subjects with missing observations, a total of 1157 staff were included in the analysis. The SHAHWAR cohort study was approved by the Ethics Committee of Shahroud University of Medical Sciences (IR.SHMU.REC.1397.033).

In the SHAHWAR cohort study, data for participants' PA were measured using the Persian version of the International PA Questionnaire (IPAQ), a valid and reliable questionnaire that was prepared to assess the participants' PA in the PERSIAN cohort study. The questionnaire measures the amount of PA in four domains of occupational, transportation, household or gardening, and leisure-time activities. The outcome variables were poor physical activity in total (PTPA) and in its four domains including: poor leisure-time PA (PLTPA), poor domestic and gardening activities (PDGA), poor transport-related PA (PTRPA), and poor work-related PA (PWRPA). Participants were categorized as having poor physical activity in total and in each domain of PA if their activity was less than its median level. The medians (interquartile ranges) for leisure time PA, domestic and gardening activities, work-related PA, transport-related PA, and total PA were 3.3 (0, 12.6), 6 (2.3, 14), 20.8 (5, 63.4), 30.9 (20, 47.4), and 89.5 (53.6, 133.1) METs-hour/week, respectively.

The principal component analysis (PCA) was used to construct an index of socioeconomic status (SES) for participants. [20] SES index is derived from a factor analysis of preliminary variables that included: household assets and properties, entertainment and travel related variables, education and access to information and occupational variables. SES scores obtained from PCA were used to classify participants into the five SES quintiles from the lowest (1st quintile) to the highest (5th quintile).

One another variable which was measured in this study was subjective social status (SSS); the social class that staff consider to belong it (lowest, low, medium, high, highest). Other the study explanatory variables were as follows: gender, age, household size, marital status, job profession, having secondary job and shift working.

Inequality measurement

In this study, we used the familiar concentration index (CI) approach [21] to measure socioeconomic inequalities in staff PPA. The calculation of CIs for PPA was based on the concentration curve (CC) which shows the degree of inequality by plotting the cumulative percentage of PPA on the Y-axis against the cumulative percentage of SES score on the X-axis. The CI is calculated as twice the area between the CC and the line of equality. The value of CI ranges from -1 to $+1$. If CC lies above (below) the line of equality, the CI takes a negative (positive) value, indicating that PPA was more concentrated among staff with lower (higher) SES. When the CC crosses the line of equality, the CI equals zero which implies that PPA was equally distributed among staff from different socioeconomic strata. The conventional CIs of the PPA as a whole and in its four domains were calculated as follows:

$$c = \frac{2}{n\mu} \sum_{i=1}^n y_i r_i - 1 \quad (1)$$

114

115 In the equation above, c is the conventional CI, y_i is PPA of i -th staff, r_i is the fractional rank of
116 i -th staff in the distribution of their SES, and μ is the mean of PPA. Since the outcome variables
117 were binary, we used the Wagstaff approach [22] to normalize the conventional CIs of PPA using
118 the formula below:

$$119 \quad C = \frac{c}{(1 - \mu)} \quad (2)$$

120 Where C is the Wagstaff normalized CI.

121 **Decomposition of inequality**

122 As it is shown by Wagstaff et al [23], measured inequality in health outcomes can be decomposed
123 to the sum of contributions of its associated factors (the explained component) and an unexplained
124 residual component. In the present study, we used this approach to quantify the contribution of the
125 study explanatory variables to the measured inequality in PPA using the formula below:

$$126 \quad C = \sum_k \left(\frac{\beta_k \bar{X}_k}{\mu} \right) C_k + \frac{C_e}{\mu} \quad (3)$$

127 Where β_k is the marginal effect of the k_{th} explanatory variable on the PPA (estimated using the
128 legit regression model), $\bar{X}_k$ is the mean of k_{th} explanatory variable and μ is the mean of PPA. The
129 first component of the C is the sum of absolute contributions of the explanatory variables to the
130 measured CI which was calculated through multiplying the elasticity of PPA with respect to the
131 explanatory variables $(\frac{\beta_k \bar{X}_k}{\mu})$ by their CIs (C_k). The residual component $(\frac{C_e}{\mu})$ is the part of the
132 measured inequality in PPA that has not been explained by the study explanatory variables.

133 All the study analyses were performed by the Stata software version 14. [24]

134 **Results**

Table 1 shows descriptive statistics for staff of Medical Sciences University in total and by all types of PPA. The results of the descriptive analysis indicated that prevalence of PTPA among females was higher than males (53.1% vs. 45.3%) and it increased with age. Divorced/Widowed staff have the lowest prevalence of PTPA compared to the single and married staff (29.3% vs. 51.1% and 51%, respectively). Also the proportion of PTPA was highest in office workers (67.9%) and lowest in technical/service staff (36.3%). Staff who have the household size of 5 and more, were shift worker, have secondary job, and use car have lower prevalence of PTPA than their counterparts. Furthermore, PTPA among staff with the highest SES was more prevalent than who have the lowest SES (54.6% vs. 41%). Staff with the highest SSS have the lowest prevalence of PTPA (41.5%) than other social strata. Also, the proportion of PTPA among staff who have PLTPA, PDGA, PTRPA, and PWRPA was higher than their counterparts. In the same way, the prevalence PPA in different domains of PA in terms of the staff characteristics was shown in Table1.

The CCs and CIs of all types of PPA are presented in Figure1 and Table 2, respectively. The CCs of PTPA and PWRPA which are below the line of equality, and their positive and statistically significant CIs show that poor total PA and work-related PA were more prevalent amongst staff from higher socioeconomic strata. However, The CC of PLTPA lies above the line of equality and its CI was negative and statistically significant, indicating that socioeconomic inequality in leisure time PA favors higher SES groups (e.g. it is more concentrated among staff from lower SES groups). The CCs of PDGA and PTRPA cross the line of inequality and their CIs were not statistically different from zero, suggesting that there were no socioeconomic inequalities in distribution of poor domestic and gardening activities and transport-related PA.

Table 3 represents the results of decomposition of socioeconomic inequality in PTPA, PLTPA, and PWRPA. Having PWRPA, SSS, SES, and gender were the main contributors that increase the prevalence of PTPA among staff from higher SES groups by 65.3%, 37.9%, 18.6%, and 16.6%, respectively. In contrast, the more negative contributions of residence in urban areas (64%) and having poor leisure time PA (27%) show that these factors mainly reduce the concentration of PTPA among staff from the higher SES groups. Similarly, SES, marital status, and residence in urban areas positively contributed to the more concentration of PLTPA among staff of lower SES groups by 53.4%, 36.2%, and 23.5% respectively. Also, gender had the most negative contribution (28.7%) to the measured inequality in PLTPA. Residence in urban areas, SES, SSS, and shift work were all positively contributed to the measured inequality in PWRPA (its more concentration among staff from high SES groups) by 28.4%, 20%, 15.2%, and 12.7%, respectively, while the opposite is true for gender by the contribution of 13.3%

Discussion

The present study is the first study which investigated socioeconomic inequalities in PPA among the Iranian staff of medical sciences universities.

Our study revealed several issues: 1) the positive CI of 0.092 indicates that higher SES staff tend to have more PPA than their lower SES counterparts; 2) different areas of PA show different patterns of socioeconomic inequality; and 3) the positive CI of 0.141 indicates that PWRPA was found more often among staff belonging to higher socioeconomic strata, while the negative CI of -0.191 suggests that PLTPA was found more often among the staff from lower socioeconomic strata.

This study also showed that more than half (65.3%) of the measured inequality in PPA was attributable to the PWRPA. In contrast, PLTPA and PTRPA were accounted for 27% and 18.6%

of the measured inequality in PPA, respectively. In consistence with the results of Vandelanotte et al's study, [25] the results of the present study indicated that both PWRPA and PLTPA could increase the likelihood of PPA as a whole. This also was true for PPA in transportation. However, more PA in leisure time and active transportation (including cycling and walking) could not fully compensate the less occupational PA. Being from higher socioeconomic groups provides more opportunities to have more PA in leisure time [26] and active transportation. [27] There seem to be reasons why despite having more opportunities for being physically active in leisure time and active transportation, total PA among the staff with higher SES stay low: one reason is that the high opportunity cost of leisure-time PA and active transportation may reduce tendency of higher SES staff to increase their PA in these domains. [8, 28, 29] Furthermore, some studies have shown that walkable built environment has a greater impact on active transportation in higher socioeconomic groups than their lower counterparts. [30, 31] Therefore, unsuitable walkable environment could be the reason for lower active transportation of higher SES staff in our study. SSS, SES, and female gender were the next important factors that positively contributed to the socioeconomic inequality in staff PPA, whereas residence in urban areas had the most negative contribution to this inequality. In our study, the probability of PPA was different among staff with different SSSs. This is consistent with the results of Frerichs ET als' study in four Asian countries which shows that there is an association between SSS and people's weekly or daily PA. [32] The results of other studies indicate that people's social norms, values and beliefs play an important role in their health behaviors, including PA. [33, 34] In our study, it seems that social norms, values and beliefs towards PA among higher SES staff has led them to be less physically active than their lower SES counterparts.

202 Our study highlighted the more percentage of PPA among higher SES staff. The results of
203 Humphreys and Ruseski's study show that people with higher SES (including income, education,
204 and employment), are less probable to participate in PA. Due to their higher wages, being
205 physically active outside the workplace have more opportunity cost for them. So, they are less
206 likely to spend a lot of time on PA outside the workplace. [8] The results also suggested that female
207 participants were more likely to have PPA than their male counterparts. Other studies in Iran show
208 that PPA is significantly more common in women than men. [35, 36] Similar finding was seen in
209 Abu Saad et al's study which indicated that female health care workers were less physically active
210 than males. [7] With a different result a study was performed in Malaysia indicate that gender is
211 not related to PA in health care workers. [37] It seems the smaller sample size in Jamil et al's study
212 to be the main reason for this difference. Lack of structure for opportunities within their
213 communities, cultural constraints, economic, social, and personal home expectations are the main
214 factors that restrict women's leisure-time PA [38] which could decrease their total PA as a whole.
215 Residence in urban areas decreased the probability of staff's PPA. This result is in line with the
216 results of Bauman et al's study in six Asia-Pacific countries. [39] Since urban resident staff found
217 more frequently among higher socioeconomic groups, they usually have more access to the parks,
218 recreation and sport facilities which were cited as the facilitators of leisure-time PA in other
219 studies. [40, 41] In addition, as it is showed in other studies, even though people have equal access
220 to recreational and other facilities for PA, the extent to which they use these facilities is affected
221 by the quality of them [42-44] and social and cultural factors inherent in their residential area [42,
222 45] which could negatively affect the rural resident staff's decisions related to their PA in leisure
223 time.

224 Studies show that workplace and leisure time PA each have different effects on an individual's
225 health. [46, 47] In this regard, the findings of the present study provide some evidences to design
226 interventions on socioeconomic inequalities in two domains of work-related and leisure-time PA.
227 Residence in urban areas was positively contributed to the both measured inequalities in PWRPA
228 and PLTPA. Staff living in urban areas have different occupations in the university. The results of
229 our study show that office workers and medical staff who have the higher levels of PWRPA and
230 were more likely to be from higher SES groups, constitute 78.6% of the total university staff.
231 However, most of the medical university staff in rural areas are primary health staff (Behvarz) who
232 work in health houses. The job of primary health staff is more physically demanded because it
233 requires a lot of work outside the health houses in the village. [48] These results implies that staff
234 who live in urban areas were less physically active in their work place than their rural counterparts.
235 As it is explained before, difference in PA environment and social and cultural factors could be
236 the main reasons for the less PLTPA among urban resident staff compared to their rural
237 counterparts.

238 Our study indicated that SES was accounted for about one-fifth (19.9%) and more than half
239 (53.4%) of the measured socioeconomic inequality in WRPPA and PLTPA, respectively. Staff
240 from the higher socioeconomic groups usually work in jobs that require less PA due to their higher
241 education, more work experience or a more stable job position. Similar results was also seen in
242 other studies. [7, 11, 25] In this regard, having less physically demanded jobs could be the reason
243 for more PWRPA among staff from higher socioeconomic strata. Results of our study for PLTPA
244 was quite different; lower SES staff were more probable to have more PLTPA compared to their
245 higher SES counterparts. This result is in line with the results of a systematic review conducted by
246 Kirk MA and Rhodes. [12] Due to their higher demanded activity jobs, these staff usually do most

of their daily physical activities in the workplace. [10] Therefore, they have less energy to do PA in their leisure time. In addition, many leisure time activities involve monetary costs that these individuals may not be able to afford. [49, 50] Additionally, lower SES staff may live in rural areas and urban neighborhoods in which access to recreational and other facilities, their quality, and social and cultural factors could decrease their tendency to engage in leisure time PA compared to higher SES groups. The role of these factors in individuals' decisions about PA in their leisure time has been well documented in the literature. [40-42, 45]

SSS is another factor which positively contributed to the measured inequality in PWRPA. In our study, the prevalence of PPA was different among staff from different social strata. It seems that social norms, values and beliefs towards PA among higher SES staff has led them to be less active in work place than lower SES staff. Moreover, the results of our study indicated that shift work jobs positively contributed to the more concentration of PWRPA among high SES staff by 12.6%. Shift worker staff were less likely to have occupational PPA than their non-shift worker counterparts. This finding is in line with the results of previous studies. [51-53] Staff, who were shift-worker, often have more physically demanded jobs such as medical and technical and service jobs. Findings of the study showed that percentage of PWRPA among medical and technical/service staff was 40.2% and 37.5%, respectively, which was much lower than that of office workers (77.2%). Since shift-workers were more from lower socioeconomic groups, more PA related to shift work has reduced PWRPA among lower SES staff rather than their higher SES counterparts.

Furthermore, we found that higher likelihood of PLTPA among female staff increased its concentration among lower SES staff by 19.5%. In consistence with the findings of other studies, [54, 55] the results of our study suggested that female participants were more likely to have PLTPA

than their male counterparts. The reasons have pointed out in our study for women's PPA in Iran, can be also applied to justify their higher PLTPA. It seems that employed female from lower socioeconomic strata were more probable to encounter with inhibitors of leisure-time PA than their higher SES counterparts. Marital status was another factor which was contributed to the measured inequality in PLTPA by 36.2%. Married staff were more likely to have PLTPA than staff without spouse (divorced/widowed and single staff). This finding is in line with the results of other studies. [56, 57] More requirements of married life and associated economic problems to meet them could be the reasons for more PLTPA of married staff from lower socioeconomic groups.

This is the first study which investigated socioeconomic inequalities in PPA and all its domains among medical sciences university staff. To do this, we used a composite measure of staff's living standards, education and occupational characteristics as the SES indicator. The findings of this study provide new evidence of the current status of inequalities in PPA of employees and its contributing factors which can be used to design targeted interventions to reduce these inequalities in future. However, this study is subject to some limitations. First, in decomposition analysis, 43.5% of the measured socioeconomic inequality in PPA was explained by the study explanatory variables. However, presence of the main contributors which have either positive or negative contributions to the PPA inequality, provides sufficient evidence to reduce inequality in staff PPA. Second, because to the use of cross-sectional level data from SHAHWAR cohort study, casual interpretations should be done with caution.

Conclusions

While PTPA and PWRPA were more prevalent among staff from higher socioeconomic groups, PLTPA was found more frequently among staff with lower SES. Health promotion programs in

292 workplace should address both the goals of reducing the socioeconomic inequality of PTPA as a
293 whole and reduction of PPA in staff's workplace and leisure time.

294 **Abbreviations**

295 CC: Concentration Curve

296 CI: Concentration Index

297 IPAQ: International Physical Activity Questionnaire

298 METs: Metabolic Equivalent Rates

299 MoHME: Ministry of Health and Medical Education

300 PA: Physical Activity

301 PCA: Principal Component Analysis

302 PDGA: Poor Domestic and Gardening Activities

303 PLTPA: Poor Leisure-time Physical Activity

304 PPA: Poor Physical Activity

305 PTPA: Poor Total Physical Activity

306 PTRPA: Poor Transport-related Physical Activity

307 PWRPA: Poor work-related Physical Activity

308 SES: Socioeconomic Status

309 SHMU: Shahroud University of Medical Sciences

310 SHAHWAR: SHAhroud Healthcare Workers Associated Research

311 SSS: Subjective Social Status

312 **Declarations**

313 **Ethics approval and consent to participate**

314 The SHAHWAR cohort study was approved by the Ethics Committee of Shahroud University of
315 Medical Sciences (IR.SHMU.REC.1397.033) and the study data was collected after obtaining
316 informed consent.

317 **Consent for publication**

318 Not applicable.

319 **Availability of data and materials**

320 The datasets used and/or analyzed during the current study are available from the corresponding
321 author on reasonable request.

322 **Competing interests**

323 The authors declare that they have no competing interests.

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327 **Authors' contributions**

328 SM. M., F. Z., and F. S. contributed to the data gathering of the cohort study. M. Kh., SM. M., and
329 F. Z. designed and performed data analysis, SM. M., M. Kh., and F. S. contributed to drafting the
330 manuscript, and all authors contributed to the conceiving the original idea of the manuscript and
331 interpretation of the results. They also have read and approved the final version of the manuscript.

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Table1. Descriptive statistics for staff of Medical Sciences University by all types of PPA status in Shahroud, Iran						
Characteristics	Total N (%)	PLTPA [†] N (%)	PDGA [†] N (%)	PWRPA [†] N (%)	PTRPA [†] N (%)	PTPA [†] N (%)
Gender						
Male	468 (40.45)	182 (38.89)	276 (58.97)	246 (52.56)	183 (39.10)	212 (45.30)
Female	689 (59.55)	394 (57.18)	242 (35.12)	332 (48.19)	395 (57.33)	366 (53.12)
Age						
20-29	108 (9.33)	57 (52.78)	67 (62.04)	40 (37.04)	48 (44.44)	43 (39.81)
30-39	532 (45.98)	272 (51.13)	207 (38.91)	260 (48.87)	258 (48.50)	251 (47.18)
40-49	378 (32.67)	177 (46.83)	173 (45.77)	204 (53.97)	195 (51.59)	204 (53.97)
>=50	139 (87.99)	70 (50.36)	71 (51.08)	74 (53.24)	77 (55.40)	80 (57.55)
Household size						
<=2	185 (15.99)	87 (47.03)	105 (56.76)	94 (50.81)	96 (51.89)	95 (51.35)
3-4	850 (73.47)	424 (50.00)	354 (41.65)	429 (50.47)	420 (49.41)	425 (50.00)
>=5	122 (10.54)	64 (52.46)	59 (48.36)	55 (45.08)	62 (50.82)	58 (47.54)
Marital status						
Single	88 (7.61)	28 (31.82)	57 (64.77)	44 (50.00)	48 (54.55)	45 (51.14)
Married	1011 (83.38)	521 (51.53)	435 (43.03)	511 (50.54)	498 (49.26)	516 (51.04)
Divorced/Widowed	58 (5.01)	27 (46.55)	26 (44.83)	23 (39.66)	32 (55.17)	17 (29.31)
Job						
Office worker staff	324 (28)	139 (42.90)	140 (43.21)	250 (77.16)	155 (47.84)	220 (67.90)
Medical staff	585 (50.56)	304 (51.97)	250 (42.74)	235 (40.17)	311 (53.16)	268 (45.81)
Technical and service staff	248 (21.43)	133 (53.63)	128 (51.61)	93 (37.50)	112 (45.16)	90 (36.29)
Having secondary job						
Yes	200 (17.29)	75 (37.50)	93 (46.50)	101 (50.50)	78 (39.00)	90 (45.00)

No	957 (82.71)	501 (52.35)	425 (44.41)	477 (49.84)	500 (52.25)	488 (50.99)
shift work						
Yes	484 (41.83)	275 (53.10)	225 (46.49)	161 (33.26)	232 (47.93)	171 (35.33)
No	673 (58.17)	319 (47.40)	293 (43.54)	417 (61.96)	346 (51.41)	407 (60.48)
Socioeconomic status						
1st quintile (lowest)	232 (20.05)	135 (58.19)	116 (50.00)	90 (38.79)	121 (52.16)	95 (40.95)
2nd quintile	231 (19.97)	128 (55.41)	100 (43.29)	120 (51.95)	115 (49.78)	119 (51.52)
3rd quintile	232 (20.05)	123 (53.02)	88 (37.93)	112 (48.28)	125 (53.88)	122 (52.59)
4th quintile	231 (19.97)	112 (48.48)	106 (45.89)	121 (52.38)	112 (48.48)	116 (50.22)
5th quintile (highest)	231 (19.97)	78 (33.77)	108 (46.75)	135 (58.44)	105 (45.45)	126 (54.55)
Subjective social status						
Lowest	35 (3.03)	16 (45.71)	17 (48.57)	21 (60.00)	17 (48.57)	18 (51.43)
Low	384 (33.19)	110 (44.53)	101 (40.89)	132 (53.44)	124 (50.20)	119 (48.18)
Medium	660 (57.04)	335 (52.43)	294 (46.01)	313 (48.98)	325 (50.86)	327 (51.17)
Higher	67 (5.79)	87 (47.54)	82 (44.81)	89 (48.63)	90 (49.18)	92 (50.27)
Highest	11 (0.95)	28 (52.83)	24 (45.28)	23 (43.40)	22 (41.51)	22 (41.51)
Using car						
Yes	631 (54.54)	288 (45.64)	289 (45.80)	318 (50.40)	289 (45.80)	310 (49.13)
No	526 (45.46)	288 (54.75)	229 (43.54)	260 (49.43)	289 (54.94)	268 (50.95)
Having PLTPA						
Yes	576 (49.78)	-	246 (42.71)	283 (49.13)	299 (51.91)	326 (56.60)
No	581 (50.22)	-	272 (46.82)	295 (50.77)	279 (48.02)	252 (43.37)
Having PDGA						
Yes	518 (44.77)	246 (47.49)	-	269 (51.93)	271 (52.32)	287 (55.41)
No	639 (55.23)	330 (51.64)	-	309 (48.36)	307 (48.04)	291 (45.54)
Having PTRPA						

Yes	578 (49.96)	299 (51.73)	271 (46.89)	301 (52.08)	-	385 (66.61)
No	579 (50.04)	277 (47.84)	247 (42.66)	277 (47.84)	-	193 (33.33)
Having PWRPA						
Yes	578 (49.96)	283 (48.96)	269 (46.54)	-	301 (52.08)	459 (79.41)
No	579 (50.04)	293 (50.60)	249 (43.01)	-	277 (52.08)	119 (20.55)
[†] Abbreviations; PLTPA: poor leisure time PA, PDGA: poor domestic and gardening activities, PWRPA: poor work-related PA, PTRPA: poor transport-related PA, PTPA: poor total PA						

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Table 2. Concentration indices for all types of PPA among staff of Medical Sciences University in Shahroud, Iran			
Types of PPA[†]	Wagstaff normalized concentration index	Robust standard error	p-value
PLTPA [†]	-0.191	0.034	<0.01
PDGA [†]	-0.021	0.034	0.53
PWRPA [†]	0.141	0.034	<0.01
PTRPA [†]	-0.059	0.034	0.08
PTPA [†]	0.092	0.034	<0.01

[†]Abbreviations; PPA: PPA, PLTPA: poor leisure time PA, PDGA: poor domestic and gardening activities, PWRPA: poor work-related PA, PTRPA: poor transport-related PA, PTPA: poor total PA

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Table 3. Decomposition of socioeconomic inequalities in all types of PPA among staff of Medical Sciences University in Shahroud, Iran

Characteristics	Marginal effect			Elasticity			C_k	Absolute contribution to CI			Relative Contribution			% Contribution		
	PTPA	PLTPA	PWRPA	PTPA	PLTPA	PWRPA		PTPA	PLTPA	PWRPA	PTPA	PLTPA	PWRPA	PTPA	PLTPA	PWRPA
Gender																
Male	0.000	0.000	0.000	0.000	0.000	0.000	-0.205	0.010	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00
Female	0.062*	0.223*	-0.076*	0.074	0.267	-0.091	0.205	0.015	0.055	-0.019	0.166	-0.287	-0.133	16.55	-28.71	-13.31
Sum								0.025	0.055	-0.019	0.166	-0.287	-0.133	16.55	-28.71	-13.31
Age																
20-29	0.000	0.000	0.000	0.000	0.000	0.000	0.205	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00
30-39	0.092	-0.049	0.049	0.022	-0.045	0.045	0.072	0.002	-0.003	0.003	0.017	0.017	0.023	1.74	1.69	2.29
40-49	0.065	-0.088	0.078	0.042	-0.058	0.051	-0.104	-0.004	0.006	-0.005	-0.048	-0.031	-0.038	-4.83	-3.14	-3.79
>=50	0.092	-0.018	0.052	0.022	-0.004	0.012	-0.116	-0.003	0.001	-0.001	-0.028	-0.003	-0.010	-2.80	-0.27	-1.03
Sum								-0.005	0.003	-0.004	-0.059	-0.017	-0.025	-5.89	-1.72	-2.53
Household size																
<=2	0.000	0.000	0.000	0.000	0.000	0.000	0.346	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00

Table 3. Decomposition of socioeconomic inequalities in all types of PPA among staff of Medical Sciences University in Shahroud, Iran

Characteristics	Marginal effect			Elasticity			C _k	Absolute contribution to CI			Relative Contribution			% Contribution		
	PTPA	PLTPA	PWRPA	PTPA	PLTPA	PWRPA		PTPA	PLTPA	PWRPA	PTPA	PLTPA	PWRPA	PTPA	PLTPA	PWRPA
3 to 4	-0.007	-0.023	-0.027	-0.010	-0.034	-0.039	-0.053	0.001	0.002	0.002	0.006	-0.010	0.015	0.59	-0.95	1.48
>=5	-0.021	0.010	-0.091	-0.005	0.002	-0.019	-0.383	0.002	-0.001	0.007	0.019	0.004	0.053	1.89	0.43	5.26
Sum								0.002	0.001	0.009	0.025	-0.005	0.067	2.48	-0.52	6.73
Marital status																
Single	0.000	0.000	0.000	0.000	0.000	0.000	0.411	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00
Married	-0.012	0.181*	-0.023	-0.021	0.317	-0.040	-0.217	0.004	-0.069	0.009	0.049	0.361	0.061	4.89	36.08	6.13
Divorced/Widowed	-0.189*	0.023	-0.107	-0.019	0.002	-0.011	-0.102	0.002	0.000	0.001	0.021	0.001	0.008	2.12	0.12	0.78
Sum								0.006	-0.069	0.010	0.070	0.362	0.069	7.001	36.20	6.91
Place of residence																
Rural	0.000	0.000	0.000	0.000	0.000	0.000	-0.399	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00
Urban	-0.081*	-0.062	0.055	-0.147	-0.113	0.100	0.399	-0.059	-0.045	0.040	-0.640	0.235	0.284	-63.98	23.47	28.38
Sum								-0.06	-0.045	0.010	-0.640	0.23	0.28	-63.98	23.47	28.38
Job																
Office worker	0.000	0.000	0.000	0.000	0.000	0.000	0.292	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00
Medical staff	-0.036	0.041	-0.272*	-0.036	0.042	-0.275	0.271	-0.010	0.011	-0.075	-0.107	-0.059	-0.531	-10.70	-5.91	-53.13
Technical and service staff	-0.041	0.070	-0.258*	-0.018	0.030	-0.111	-0.752	0.013	-0.023	0.083	0.145	0.118	0.592	14.54	11.81	59.18

Table 3. Decomposition of socioeconomic inequalities in all types of PPA among staff of Medical Sciences University in Shahroud, Iran

Characteristics	Marginal effect			Elasticity			C _k	Absolute contribution to CI			Relative Contribution			% Contribution		
	PTPA	PLTPA	PWRPA	PTPA	PLTPA	PWRPA		PTPA	PLTPA	PWRPA	PTPA	PLTPA	PWRPA	PTPA	PLTPA	PWRPA
Sum								0.004	-0.011	0.008	0.038	0.059	0.060	3.84	5.90	6.05
Having secondary job																
No	0.000	0.000	0.000	0.000	0.000	-0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00
Yes	-0.005	-0.058	-0.007	-0.002	-0.020	-0.002	0.144	0.000	-0.003	0.000	-0.003	0.015	-0.002	-0.26	1.53	0.00
Sum								0.000	-0.003	0.000	-0.003	0.015	-0.002	-0.26	1.53	0.00
Shift work																
No	0.000	0.000	0.000	0.000	0.000	0.000	0.135	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00
Yes	-0.044	0.034	-0.157*	-0.037	0.029	-0.131	-0.135	0.005	-0.004	0.018	0.055	0.020	0.126	5.46	2.02	12.65
Sum								0.005	-0.007	0.018	0.055	0.020	0.126	5.46	2.02	12.65
Objective SES																
1st quintile (lowest)	0.000	0.000	0.000	0.000	0.000	0.000	-1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00
2nd quintile	0.052	-0.028	0.083	0.021	-0.011	0.033	-0.499	-0.010	0.006	-0.017	-0.112	-0.029	-0.118	-11.22	-2.88	-11.78
3rd quintile	0.067	-0.067	0.057	0.027	-0.027	0.023	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.03	0.02	0.02
4th quintile	0.029	-0.095	0.047	0.011	-0.038	0.019	0.501	0.006	-0.019	0.009	0.063	0.100	0.068	6.27	10.01	6.76
5th quintile (highest)	0.054	-0.220*	0.088	0.022	-0.088	0.035	1.000	0.022	-0.088	0.035	0.235	0.462	0.249	23.52	46.23	24.95
Sum								0.017	-0.102	0.028	0.186	0.534	0.199	18.61	53.38	19.95

Table 3. Decomposition of socioeconomic inequalities in all types of PPA among staff of Medical Sciences University in Shahroud, Iran

Characteristics	Marginal effect			Elasticity			C _k	Absolute contribution to CI			Relative Contribution			% Contribution		
	PTPA	PLTPA	PWRPA	PTPA	PLTPA	PWRPA		PTPA	PLTPA	PWRPA	PTPA	PLTPA	PWRPA	PTPA	PLTPA	PWRPA
Subjective social status																
Lowest	0.000	0.000	0.000	0.000	0.000	0.000	-0.295	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00
Low	-0.384*	-0.021	-0.121	-0.044	-0.002	-0.014	-0.366	0.016	0.001	0.005	0.178	-0.005	0.036	17.78	-0.46	3.65
Medium	-0.252*	0.015	-0.065	-0.288	0.018	-0.074	-0.307	0.088	-0.005	0.023	0.965	0.028	0.161	96.51	2.85	16.14
Higher	-0.247	-0.021	-0.007	-0.164	-0.014	-0.005	0.390	-0.064	-0.005	-0.002	-0.699	0.028	-0.013	-69.89	2.79	-1.29
Highest	-0.246	-0.023	-0.192	-0.015	-0.001	-0.012	0.395	-0.006	-0.001	-0.005	-0.064	0.003	-0.033	-6.41	0.29	-3.26
Sum								0.035	-0.010	0.021	0.380	0.055	0.152	37.99	5.46	15.24
Using car																
No	0.000	0.000	0.000	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00
Yes	0.019	-0.017	-0.027	0.020	-0.019	-0.029	0.152	0.003	-0.003	-0.004	0.034	0.015	-0.031	3.40	1.51	-3.14
Sum								0.003	-0.003	-0.004	0.034	0.015	-0.031	3.40	1.51	-3.14
Having PLTPA																
No	0.000	-	0.000	0.000	-	0.000	0.191	0.000	-	0.000	0.000	-	0.000	0.00	-	0.00
Yes	0.130*	-	0.034	0.129	-	0.034	-0.191	-0.025	-	-0.006	-0.270	-	-0.046	-26.97	-	-4.60
Sum								-0.025	-	-0.006	-0.270	-	-0.046	-26.97	-	-4.60
Having PDGA																

Table 3. Decomposition of socioeconomic inequalities in all types of PPA among staff of Medical Sciences University in Shahroud, Iran

Characteristics	Marginal effect			Elasticity			C _k	Absolute contribution to CI			Relative Contribution			% Contribution		
	PTPA	PLTPA	PWRPA	PTPA	PLTPA	PWRPA		PTPA	PLTPA	PWRPA	PTPA	PLTPA	PWRPA	PTPA	PLTPA	PWRPA
No	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00
Yes	0.092*	0.015	0.030	0.083	0.014	0.027	-0.021	-0.002	0.000	-0.001	-0.019	0.001	-0.004	-1.90	0.15	-0.40
Sum								-0.002	0.000	-0.001	-0.019	0.001	-0.004	-1.90	0.15	-0.40
Having PTRPA																
No	0.000	0.000	0.000	0.000	0.000	0.000	0.059	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00
Yes	0.279*	-0.014	0.052	0.279	-0.014	0.052	-0.059	-0.017	0.001	-0.003	-0.181	-0.004	-0.022	-18.07	-0.43	-2.18
Sum								-0.017	0.001	-0.003	-0.181	-0.004	-0.022	-18.07	-0.43	-2.18
Having PWRPA																
No	0.000	0.000	-	0.000	0.000	-	-0.141	0.000	0.000	-	0.000	0.000	-	0.00	0.00	-
Yes	0.425*	0.040	-	0.425	0.040	-	0.141	0.060	0.006	-	0.653	-0.029	-	65.27	-2.92	-
Sum								0.060	0.006	-	0.653	-0.029	-	65.27	-2.92	-
Total observed								0.103	-0.107	0.064	0.435	0.953	0.741	43.54	95.31	74.10
Residual								-0.011	-0.084	0.077	0.565	0.047	0.259	56.46	4.69	25.90
Total								0.092	-0.191	0.141	1.000	1.000	1.000	100.00	100.00	100.00

†Abbreviations; PLTPA: poor leisure time PA, PDGA: poor domestic and gardening activities, PWRPA: poor work-related PA, PTRPA: poor transport-related PA, PTPA: poor total PA* P<0.05

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502 **Figure 1. Concentration curves for all types of PPA among staff of Medical Sciences**

503 **University in Shahroud, Iran**