European Journal of Human Movement

OPEN ACCESS

Original Research

Factors associated with Physical Activity Level in doctors during Covid-19 pandemic: An Online-based Cross-sectional study

Pradeep P[1], Chandra Sekara Guru S[2], Manish Bhartiya[1], Uma Mahajan[3], Deep Sharma[4]

1 151 Base Hospital, Guwahati, India.
2 Dte Gen Medical Services (Air), New Delhi, India.
3 Sports Sciences Faculty, Army Sports Institute, Pune, India.
4 173 Military Hospital, India.

*Correspondence: (Guru CS) drscsguru@gmail.com 0000-0001-6032-4689

Received: 09/04/2022; Accepted: 02/12/2022; Published: 31/12/2022

Abstract: Physical activity is an important therapeutic strategy in reducing the severity of Covid-19 disease. There is a lack of studies evaluating the level of physical activity among doctors who are the frontline responders of Covid-19 pandemic. The online survey aimed at evaluating the effect factors associated with physical activity levels of doctors during Covid-19 pandemic using International Physical Activity Questionnaire Short Form (IPAQ- SF). The survey included doctors from government and private health sectors of India. Snowballing technique was used to conduct the survey. About 266 Indian doctors with a median age of 36 (IQR = 31, 46) years responded to the anonymous survey consisting of demographic details and IPAQ- SF. Median MET-minutes/week and Inter Quartile Range (IQR) were used to describe the physical activity levels of the doctors. All the data analysis was done in STATA 12.1. The total median MET-duration of doctors was 834 (IQR = 495, 1620) MET-minutes/week with 988 (IQR = 564.3, 2067.9) Kcal/week of total energy expenditure. Low, moderate and high physical activity levels of doctors were 21.4%, 54.5% and 24.1% respectively. Age, gender, doing Covid-19 duties and regular involvement in physical activity before the pandemic have significantly affected PA levels. More than 55% of doctors who reported high or moderate physical activity before the pandemic were doing significantly low physical activity during the pandemic ($p < 0.0001$). The Covid-19 pandemic has significantly affected the physical activity level in doctors. Doctors aged 31- 40 years performing Covid-19 duties during the conduct of the survey were likely to perform low physical activity. However, those doctors who regularly engaged in physical activity before the pandemic despite the restrictions were found to engage significantly in higher total MET-duration and expended higher energy.

Keywords: Exercise; MET; IPAQ; Physicians; Covid-19; Pandemics; SARS-CoV-2

1. Introduction

Governments to mitigate the effect of pandemic have enforced a number of unforeseen measures. Nation-wide lockdown led to an unprecedented impact on the outdoor movement of individuals and the long-time closure of recreational parks and gymnasiums. Lock down has significantly affected physical

health. Physical activity (PA) is an important tool to keep oneself physically and mentally fit. It is an effective therapeutic strategy to mitigate the consequences of SARS-CoV-2 infection (Filgueira et al., 2021; Sallis et al., 2021). Multiple variants of the virus have emerged since the onset of the pandemic with varying transmissibility and reinfection rate (He, Hong, Pan, Lu, & Wei, 2021). In this fight against the pandemic, doctors are the frontline warriors attending to the enormous number of Covid-19 patients. PA among doctors and students has been reported to benefit them in tackling Covid-19 by maintaining good mental health and wellbeing (Coyle, Ghazi, & Georgiou, 2020). Moreover, studies have shown moderate levels of physical activity also directly influence one's immunity (Jones & Davison, 2019).

The Covid-19 pandemic decreased step counts worldwide in the period after Covid-19 (Geoffrey et a l., 2020). It also increases physical inactivity and sedentary behavior (Pinha et al., 2020). Studies have found that the PA levels have been affected during the pandemic among physiotherapy professionals and students. There is a lack of studies evaluating the effect of Covid-19 on PA levels among doctors who are the frontline Covid-19 warriors (Srivastav, Sharma, & Samuel, 2021). Hence, due to the lockdown measures and increased Covid-19 workload in hospitals, there is a felt need to assess the level of physical activity among doctors during this pandemic. Our study aimed to bring out the factors associated with physical activity levels of doctors who were practicing during Covid-19 pandemic.

2. Materials and Methods

Design and Subjects – After due ethical clearance, this cross-sectional online-based survey was undertaken between 30 Oct 20 and 20 Mar 21. The survey included doctors across multiple health sectors. Snowballing technique was used to conduct the survey wherein the respondents also recruited other respondents to participate in the survey (Datta, Yadav, Singh, Datta, & Bansal, 2020). The digital version of the questionnaire (google form) was circulated using various platforms. Active participation in the survey and submitting the response was taken as consent to participate in the study. Exclusion of duplicate entries/ responses was made using the respondent's email address. In order to maintain confidentiality and anonymity of the collected data, a separate account was created for the study. Submission of incomplete survey was not possible due to an inbuilt function of the survey.

Method – The anonymous questionnaire consisted of two parts. First part included basic demographic details like age, gender, present clinical practicing status, health sector of practice, job role in the health sector, details regarding Covid-19 duty and regular involvement in PA at least 30 min/day or 150 min/week prior to the pandemic. The second part consisted of assessment of the

PA status over the last 7 days from the date of submitting the survey using the International Physical Activity Questionnaire Short Form (IPAQ- SF) questionnaire in English (Craig et al., 2003). The IPAQ questionnaire was developed to assess PA levels in terms of duration, frequency and intensity among the adult population between 18 and 79 years with good validity and reliability (Ács et al., 2021). Self-rating questions regarding level of PA based on their own IPAQ responses 'before' pandemic and 'during' Covid pandemic expressed in Likert scale were included to evaluate the impact of pandemic. The sample size was calculated with an assumption that around 50% of doctors would have been involved in PA. The calculated sample size was 267 using the formula n= where n = number of doctors needed for carrying out the survey, P = proportion of doctors engaged in PA (50%) i.e. 0.50, d = absolute precision (6%) =0.06, = Level of statistical significance = 0.05, and = 1.96 (Lwanga, Lemeshow, & Organization, 1991).

PA intensity levels namely vigorous, moderate and walking obtained from IPAQ responses were converted into metabolic minutes per week (MET-minutes/week) using IPAQ short form scoring protocol. (Ács et al., 2021; Cleland et al., 2018; Craig et al., 2003) One metabolic equivalent (MET) is defined as the amount of oxygen consumed while sitting at rest which is commonly used to express the energy cost of any PA as multiples of resting metabolic rate (Jetté, Sidney, & Blümchen, 1990). Median MET-minutes/week and Inter Quartile Range (IQR) was used to describe the PA levels of the doctors. Response to time spent sitting was expressed as MET-hours/day. MET-min/week of PA was also converted to Kcal/week of energy expended using the equation Total MET-min * weight / 60 as per the IPAQ scoring protocol ("IPAQ Scoring Protocol - International Physical Activity Questionnaire,").

Further, based on the IPAQ scoring protocol three groups namely low, moderate and high PA groups were formulated. High PA group included doctors who performed PA with vigorous intensity of at least 1500 MET-minutes/week or moderate intensity of at least 3000 MET-minutes/week. Moderate PA group consisted of doctors who performed physical activity with vigorous or moderate intensity of at least 600 MET-minutes/week and the low PA group included the remaining doctors. Based on the self-rating questions on PA before and during pandemic, doctors who reported not doing any physical activity or very low or low activities were categorized as low PA, doctors who reported moderate activities were classified as moderate PA, and the doctors who reported high or very high activities were classified as high PA group.

Statistical Analysis – Kolmogorov-Smirnov test was applied to test the normality of continuous variables. The Mann-Whitney U test and Kruskal-Wallis test were used to study the differences in median MET duration of PA among the study population. The Chi-square test of independence was used to test the profile factors associated with the three PA

levels. Univariate and multivariate logistic regression analysis were carried out to identify the factors of low PA level. Factors significantly associated with the low PA in univariate models p-value ≤ 0.1 were entered in the multiple ordinal logistic regression models. Three multiple ordinal logistic regression models were developed. High PA and moderate PA levels were considered as reference categories in all these models and were controlled for age, gender and the involvement in Covid duties during the previous seven days of the study. Odds ratios (OR), Adjusted Odds Ratios (AOR) and 95% confidence intervals (95% CI) were reported. All the data analysis was done in STATA 12.1 (Stata-Corp LP, Texas, USA). Statistical significance was set at p-value ≤ 0.05.

3. Results

About 278 doctors participated in the survey. After data-cleaning and removing duplicate entries, data of 266 subjects were included for analysis. Table 1 shows the profile summary of doctors who participated in the survey. Analysis of the survey responses based on age categories and gender has revealed no significant difference statistically (p = 0.128). PA levels of Indian doctors who participated in the study are depicted in Table 2. Physical activity in MET is classified into walking, moderate and vigorous. Level of physical activity and characteristics of doctors are compared statistically. Median duration of total PA of Indian doctors was 834 (IQR = 495, 1620) MET-minutes/week with 150 (IQR = 60, 180) MET-minutes of walking per week and 6 (IQR = 4, 8) MET-hours of sitting per day. Total PA Kilocalories expended was 988 Kcal/week. Distribution of Indian doctors PA levels as per IPAQ scoring protocol groups-categorization showed 21.4% in Low PA, 54.5% in Moderate PA and 24.1% in High PA level. Chi square test is used to analyze factors associated with PA level among doctors. It showed age, gender, regular involvement in PA even before pandemic and performance status of Covid-19 duties were statistically associated with these PA level groups (Table 3).

Factors associated with Low PA levels - The factors for low PA levels among Indian doctors i.e. less than 600 MET-minutes/week were analyzed using univariate ordinal logistic regression model. Significant factors i.e. $p < 0.10$ in the three univariate models were used to derive three multiple ordinal regression models namely Low vs High PA, Low vs Moderate PA and Moderate vs High PA. Supplementary tables (Tables S1- S3) depict the data of univariate and multiple ordinal regression models. Figure 1 depicts the factors for Low PA derived from the multiple ordinal regression models. Age of doctors between 31-40 years predisposed them 3 - 4.5 times to engage in low PA and engaging in regular PA even before pandemic reduced the odds of engaging in low PA levels during pandemic.

Figure 2 shows that doctors performing Covid duty [AOR: 2.062, (95% CI: 1.005, 4.234)] were two times more likely to do low PA than the doctors who were not

doing Covid duty (p = 0.049). In Moderate versus High PA multiple ordinal regression analysis (Figure 3), it was observed that male doctors [AOR: 2.397, (95% CI: 1.173, 4.899)] were two times more likely to engage in moderate activities than high PA with reference to their women colleagues (p = 0.017). Also 21.5% doctors who regularly engaged in PA before the pandemic [AOR: 0.215, (95% CI: 0.061, 0.757)] were more likely to engage in moderate PA as compared to those who did not regularly engage in PA (p = 0.017).

*Self-rating of PA level before and after pandemic*_ Respondents self-rated PA levels before and during Covid pandemic on 5- point scale from lowest (very low) to highest (very high). Out of 266 doctors, 88 (33.1%), 103 (38.8%) and 75 (28.2%) reported low (very low or low, moderate and high (very high or high) PA respectively before the pandemic. This self- rating of PA varied to 169 (63.5%) low PA, 56 (21.1%) moderate PA and 41 (15.4%) high PA during pandemic (Figure 4). Figure 5 shows that more than 55% who reported high or moderate PA before pandemic, were doing significantly low PA during the pandemic (p < 0.0001).

Table 1. Profile Summary of Respondents of the survey

Profile of Indian Doctors	Respondents n (%)
Total number of respondents	**266**
Age (years)	
≤ 30 years	56 (21.1)
31-40 years	114 (42.9)
Above 40 years	96 (36.1)
Median (IQR)	36 (31, 46)
Gender	
Male	175 (65.8)
Female	91 (34.2)
Height (cm) Median (IQR)	168 (162, 175)
Weight (kg) Median (IQR)	72 (64.8, 80.0)
Currently practicing/ consulting or treating patients	
Yes	241 (90.6)
No	25 (9.4)
Health sector	
Armed Forces Services	101 (38.0)
Govt /Pvt medical college	37 (13.9)
Govt Primary or secondary Health care centre/ equivalent	30 (11.3)
Tertiary care hospital/ equivalent/Corporate hospital	43 (16.2)
Private practice/Other	55 (20.7)
Job role	
Super specialist/Specialist	124 (46.6)
Medical officer/General Physician/Physician	66 (24.8)
Senior/PG resident	45 (16.9)
Administrator	31 (11.7)
Involved in regular PA before pandemic	
Yes	210 (78.9)
No	56 (21.1)
Have you done Covid-19 duties?	
Yes	186 (69.9)
No	80 (30.1)

Have you done Covid-19 duties in the last 7 days?	
Yes	62 (23.3)
No	204 (76.7)
Self-rating of PA level before Covid pandemic	
Low	88 (33.1)
Moderate	103 (38.7)
High	75 (28.2)
Self-rating of PA level during Covid pandemic	
Low	169 (63.5)
Moderate	56 (21.1)
High	41 (15.4)

Govt = Government, IQR = Inter Quartile range, PA = Physical activities, PG = Post Graduate, Pvt = Private.

Table 2. Physical activity level in MET duration and Kilocalories as per profile of the doctors.

Characteristics of doctors	Physical Activity in MET (minutes/week)				Sitting time (hours/day)	Total PA (Kilocalories)
	Vigorous	Moderate	Walking	Total		
	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)
All respondents	0 (0, 120)	30 (0, 120)	150 (60, 180)	834 (495, 1620)	6 (4, 8)	987.7 (564.3, 2067.9)
Age (years)						
≤ 30 years	0 (0, 75)	20 (0, 80)	140 (43, 180)	660 (462, 1317)	6 (5, 10)	736.02 (490.27, 1526.13)
31-40 years	0 (0, 90)	10 (0, 90)	140 (60, 180)	713 (410, 1474)	6 (4, 8)	884.05 (527.53, 2033.2)
> 40 years	0 (0, 180)	60 (0, 178)	180 (90, 180)	1138 (594, 1965)	6 (5, 8)	1255.63 (696.5, 2321.35)
p-value*	0.551	**0.036**	0.064	**0.014**	0.553	**0.011**
Gender						
Male	30 (0, 135)	30 (0, 125)	150 (60, 180)	1017 (594, 1794)	6 (4, 8)	1208.7 (693, 2275.53)
Female	0 (0, 60)	0 (0, 90)	150 (60, 180)	594 (379, 1314)	6 (5, 10)	702.9 (429, 1397.25)
p-value◎	**0.001**	**0.022**	0.925	**0.006**	0.285	**0.0001**
Health sector						
Armed Forces services	0 (0, 80)	30 (0, 120)	180 (80, 180)	834 (594, 1458)	6 (5, 9)	1000.8 (567.6, 1919.04)
Govt/ Pvt medical college	0 (0, 120)	0 (0, 80)	150 (40, 180)	594 (462, 1868)	6 (5, 8)	899.25 (564.3, 2257.5)
Govt Primary/ Secondary/equiv center	10 (0, 120)	20 (0, 90)	103 (10, 180)	714 (330, 1560)	6 (4, 8)	839.25 (434.5, 2314)
Tertiary/equivalent care/Corporate hospital	0 (0, 180)	10 (0, 120)	150 (90, 180)	594 (410, 1794)	6 (4, 10)	877.1 (475.2, 2154)
Private practice/Other	0 (0, 180)	60 (0, 180)	150 (60, 180)	1080 (594, 1907)	6 (4, 8)	1188 (683.1, 2203.5)
p-value*	0.908	0.365	0.160	0.625	0.295	0.785
Job role						
Super specialist/Specialist	30 (0, 150)	30 (0, 143)	180 (75, 180)	1074 (594, 1845)	6 (4, 8)	1187.25 (707.85, 2212.43)
Medical officer/General physician/ Physician	0 (0, 60)	15 (0, 90)	145 (50, 180)	594 (396, 1314)	8 (5, 9)	747.42 (475.2, 1688.47)
Senior/PG resident	0 (0, 120)	20 (0, 80)	120 (40, 180)	594 (396, 1516)	6 (4, 8)	792 (423.67, 1919.04)

Administrator	0 (0, 80)	40 (0, 150)	140 (70, 180)	675 (347, 1615)	6 (4, 9)	821.25 (346.5, 1857.25)
p-value*	0.080	0.382	0.085	**0.014**	0.403	**0.013**
Involved in regular PA before COVID pandemic						
Yes	30 (0, 135)	40 (0, 135)	178 (80, 180)	1074 (594, 1823)	6 (4, 8)	1170.98 (683.1, 2203.5)
No	0 (0, 5)	0 (0, 45)	73 (20, 150)	479 (218, 716)	8 (5, 10)	544.5 (232.01, 914.93)
p-value◎	**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**	0.221	**0.0001**
Done COVID duties in last 7 days						
Yes	0 (0, 90)	10 (0, 90)	140 (60, 180)	594 (297, 1458)	6 (4, 8)	791.42 (346.5, 1927.2)
No	20 (0, 120)	30 (0, 120)	150 (60, 180)	954 (594, 1625)	6 (5, 9)	1025.5 (618.75, 2084)
p-value◎	**0.034**	0.198	0.473	**0.041**	0.168	0.102

Govt = Government, IQR = Inter Quartile range, PA = Physical activities, PG = Post graduate, Pvt = Private.
**p-values are from Kruskal-Wallis test, ⁺p-values are from Mann-Whitney U test, p-values in bold are significant at 5%.*

Table 3. Factors associated with PA levels among doctors

Factors	No. of doctors	Low	Moderate	High	p-value
		n (%)	n (%)	n (%)	
All Respondents	266	57 (21.4)	145 (54.5)	64 (24.1)	
Age (years)					**<0.0001**
≤ 30 years	56	12 (21.4)	35 (62.5)	9 (16.1)	
31-40 years	114	36 (31.6)	56 (49.1)	22 (19.3)	
Above 40 years	96	9 (9.4)	54 (56.3)	33 (34.4)	
Gender					**0.025**
Men	175	36 (20.6)	88 (50.3)	51 (29.1)	
Women	91	21 (23.1)	57 (62.6)	13 (14.3)	
Health sector					0.163
Armed Forces Services	101	19 (18.8)	64 (63.4)	18 (17.8)	
Govt/Pvt medical college	37	7 (18.9)	21 (56.8)	9 (24.3)	
Govt Primary/Secondary/ equivalent health care centre	30	11 (36.7)	11 (36.7)	8 (26.7)	
Corporate/Tertiary/equivalent care hospital	43	11 (25.6)	19 (44.2)	13 (30.2)	
Private practice/Other	55	9 (16.4)	30 (54.5)	16 (29.1)	
Job role					0.058
Super specialist/Specialist	124	17 (13.7)	69 (55.6)	38 (30.6)	
Medical officer / General Physician/Physician	66	18 (27.3)	37 (56.1)	11 (16.7)	
Senior/PG resident	45	13 (28.9)	25 (55.6)	7 (15.6)	
Administrator	31	9 (29.0)	14 (45.2)	8 (25.8)	
Involved in regular physical activity before COVID pandemic					**<0.0001**
Yes	210	33 (15.7)	116 (55.2)	61 (29.0)	
No	56	24 (42.9)	29 (51.8)	3 (5.4)	
Done COVID duties in last 7 days					**0.024**
Yes	62	21 (33.9)	28 (45.2)	13 (21.0)	
No	204	36 (17.6)	117 (57.4)	51 (25.0)	

*Govt = Government, PA = Physical activities, PG = Post graduate, Pvt = Private; *p-values are from Chi-square test of independence, p-values in bold are significant at 5%*

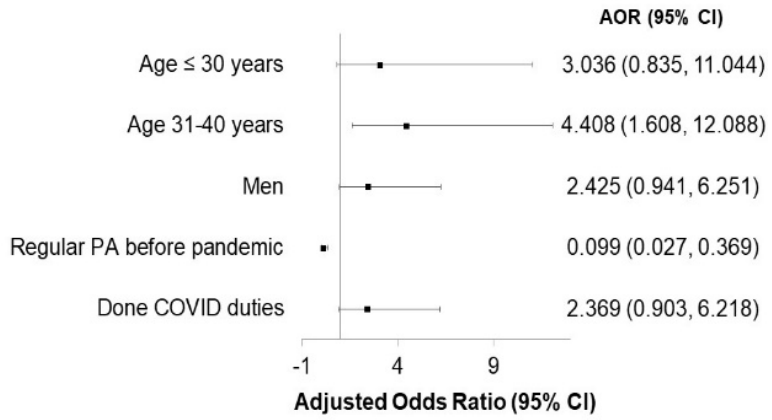

Figure 1. Factors associated with Low vs High physical activity levels using multivariate ordinal logistic regression model.

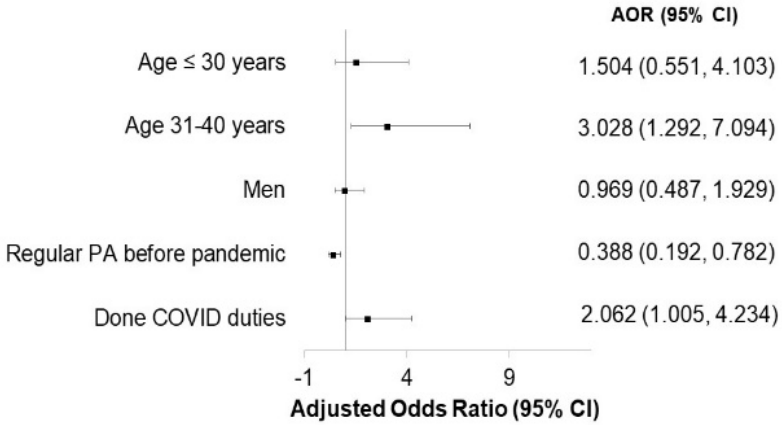

Figure 2: Factors associated with Low vs Moderate physical activity levels using multivariate ordinal logistic regression model.

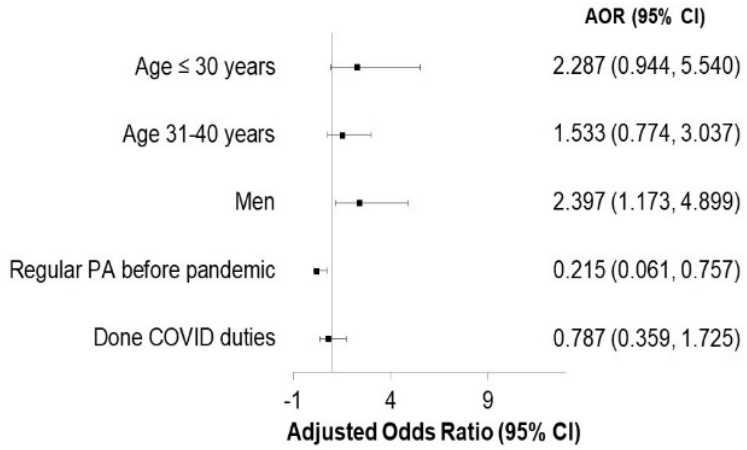

Figure 3: Factors associated with Moderate vs High PA levels using multivariate ordinal logistic regression model.

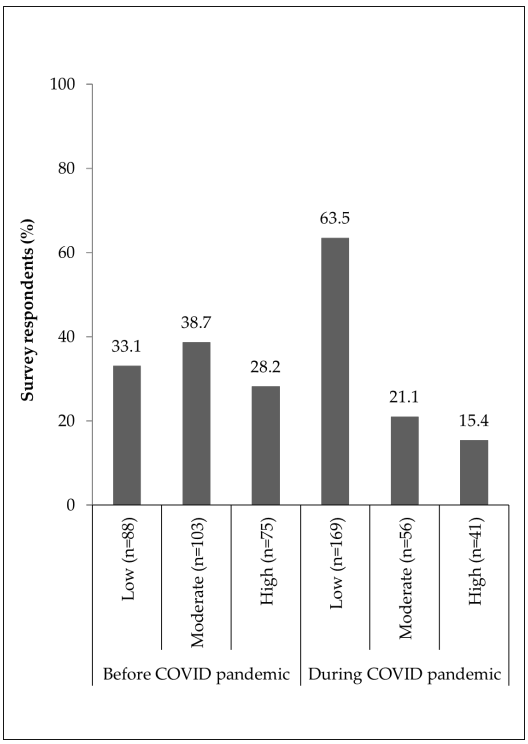

Figure 4. Self-rated Physical Activities (PA) before and during COVID pandemic.

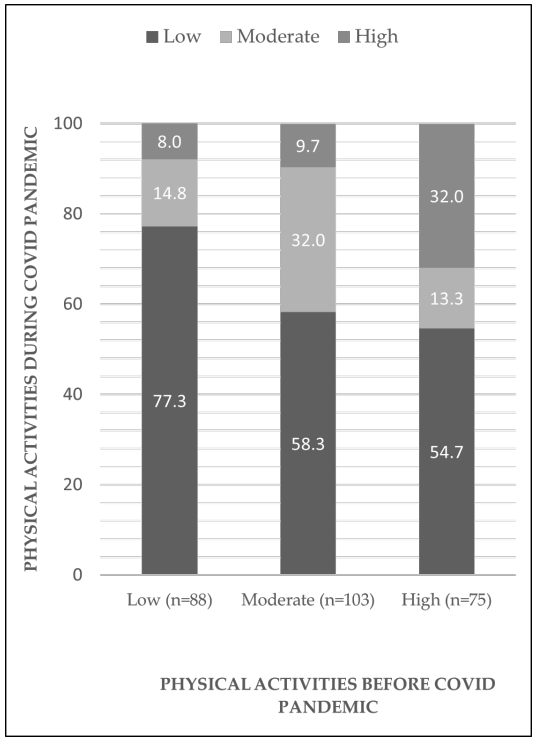

Figure 5: Change in Self-rated Physical Activity (PA) during Covid pandemic

4. Discussion

Our study aimed to analyze the effect of Covid-19 pandemic on PA levels of Indian doctors. To the best of our knowledge, this study is unique in assessing the PA levels as well as various factors associated with low physical activity among doctors during this pandemic.

In this study, we also included few demographic characteristics namely age categories, gender, health sector of practice, job role, engaging regularly in physical activity and Covid-19 duties to correlate preliminarily with the reported PA levels. Multi-ordinal regression analysis was done to find out the factors compromising PA levels among doctors during pandemic.

Overall PA levels of Indian doctors. - Among the respondents, about 54% of doctors were engaged in moderate levels of PA mainly consisting of walking amounting to 150 (60, 180) MET-min/week and 24% of doctors were engaged in high levels of PA. Any type of PA has been found to affect the body's immune status. Studies have shown that even a single bout of exercise boosts the immune system and tends to increase the neutrophil count together with decrease in eosinophil count (Romeo et al., 2010). Several studies have also reported that moderate regular PA as compared to sedentary behaviour can help reduce the risk of infection and modulate autoimmune function (Gleeson, 2007; Shimizu et al., 2008). Many cross sectional as well as longitudinal studies have demonstrated that long term anti-inflammatory effect develops due to regular engagement in PA (Kasapis & Thompson, 2005). Thus, by participating in mild to moderate PA, one can boost the immune system to reduce the risk of infections like Covid-19 and its complications.

PA among Indian doctors calculated as MET duration and total kcal expenditure were 834 (IQR = 495, 1620) MET-minutes/week and 987 (IQR = 564.3, 2067.9)

Kcal/week respectively (Table 2). MET duration of PA recorded in our study falls within the current recommended guidelines for an average adult of 500 – 1000 MET-min/week of moderate to vigorous PA to lead a healthy and disease-free lifestyle (Jeong et al., 2019; Lauer at al., 2017). The median total calories expended by PA over a week by Indian doctors was found to be close to the recommended weekly minimum target energy expenditure by any PA which is at least 1000 Kcal/week for an adult (Kokkinos, 2012; Lee & Skerrett, 2001; Leitzmann et al., 2007).

Factors associated with PA levels in Indian doctors - Demographic factors, namely age, gender, involved in regular PA before pandemic and performing Covid-19 duties were significantly found to impact PA levels in doctors during Covid-19 pandemic (Table 2). Neither health sector of practice nor the job role significantly affected the PA levels among doctors i.e. low, moderate or high PA level (Table 3).

Age - Both, total MET duration of 660 (IQR = 462, 1317) minutes/week and total energy expenditure of 660 (IQR = 495, 1620) Kcal/week, were lowest in the age group of doctors less than 30 years of age as compared to doctors aged more than 30 years (p = 0.014). Moreover, doctors more than 40 years recorded that they spent significantly more time in moderate PA i.e. 60 (IQR = 0, 178) min/week as compared to the other age groups (p = 0.036), thereby amounting to higher weekly energy expenditure of 1255.6 (IQR = 696.5, 2321.5) kcal/week (p = 0.011). This weekly energy expenditure by performing PA was found to be highest among any other factor/ subgroup stratification (Table 2).

Further, comparative analysis of the age group of doctors and other factors showed that doctors aged more than 40 years were super-specialists, specialists/ administrators and reported that they were not actively involved in Covid-19 duties. This probably could be a reason for higher PA energy expenditure in this group of doctors. Thus, corroborating to another finding wherein super-specialist/ specialists recorded higher MET-duration i.e. 1074 (IQR = 594, 1845) min/week and total energy expenditure i.e. 1187.25 (IQR = 707.85, 2212.43) Kcal/week when compared to General Physician/ Medical officer or Senior/ PG resident doctors (p=0.013).

Gender - About 34% were female doctors who responded to this survey. They reported significantly lower total MET-duration of 594 (IQR = 379, 1314) min/week and total energy expenditure of 702.9 (IQR = 429, 1397.25) Kcal/week as compared to the male doctors (p = 0.0001). Female doctors spent significantly less time engaging in vigorous (p = 0.001) as well as moderate (p = 0.022) PA as compared to male counterparts. Male doctors engaged in a moderate level of physical activity 2.4 times more as compared to female doctors (p = 0.017). These findings were similar to earlier research studies wherein male gender was associated with increased odds of compliance with WHO recommended physical activity guideline and performing moderate to high level of PA compared to females (Macek et al., 2019; Trost et al., 2002).

Covid-19 duties: About 23% of the doctors who responded that they did Covid-19 duties during the survey spent significantly less time in physical activity i.e. total MET-duration of 594 (IQR = 297, 1458) min/week (p = 0.041) and vigorous PA (p = 0.034) (Table 2). Moreover, low PA level was reported by about 34% of these doctors as compared to only 18% of doctors who did not perform Covid-19 duties during the survey (p = 0.024). This finding from our study implies that performing Covid-19 duties has significantly affected the PA levels of doctors

that might hamper the immune status indirectly in the fight against Covid-19.

Engaging in regular physical activity - Almost 79% doctors responded that they regularly engaged in physical activity before pandemic. We found that almost 84% of these doctors despite Covid-19 pandemic still engaged in moderate –high levels of physical activity as compared to only 57% of doctors who regularly did not engage in PA before the pandemic (p = <0.0001). These doctors were significantly involved in higher total physical activity MET-duration as well as total energy expenditure (p = 0.0001). Compared to doctors who were not regularly involved in PA before pandemic, only 3.9% of doctors who were involved in regular PA before pandemic undertook low PA level in the last 7 days of the survey (p = 0.008). This is an important finding of this study, which further emphasizes the importance of promoting behavioural habit formation to engage in regular physical activity. Studies have also shown that health care professionals personally engaging in higher PA levels and positive attitude towards physical activity also promote physical activity amongst their clientele (Fie, Norman, & While, 2013).

Factors influencing Low PA level - Doctors aged between 31 to 40 years were four times more likely of doing low PA than doctors of other age groups (p = 0.004). This significant difference is because about 73% of those doctors who reported that they did Covid-19 duties during the last 7 days of the survey period were less than 40 years of age. Low PA or increased sitting time have been directly related to mortality and morbidity of non-communicable disease as well risk of severe Covid-19 outcomes (Medina et al., 2021; Sallis et al., 2021). This highlights the importance of promoting physical activity behaviour among young doctors during pandemic, especially adhering to WHO physical activity recommendation, namely 150 – 300 min/week of moderate PA or 75-150 min/week of vigorous PA (Bull et al., 2020).

Impact of Covid-19 pandemic on PA levels among doctors - Self-rating of physical activity by the respondents before and after pandemic was used to assess the impact of Covid-19 pandemic on physical activity level among doctors. Analysis showed that Covid-19 pandemic has resulted in more than 63% of doctors engaging in low levels of physical activity as compared to 33% of doctors before the pandemic. It was found that more than 55% of doctors who self-rated that they performed moderate to high levels of physical activity before pandemic were significantly engaged in low physical activity after onset of pandemic (p = <0.001). A scoping review of about 41 articles showed evidence of decrease in physical activity level due to social distancing measures during Covid-19 restrictions (Caputo & Reichert, 2020). In addition, in our study Covid-19 duties that doctors were performing also would have contributed to the change in the physical activity level among doctors.

Limitations of the study - Even though an attempt was made to include a wide diaspora of doctors in the study, the findings of this study cannot be generalised to overall physical activity level among doctors during pandemic due to the specified sample population who participated in the online survey done using snowballing technique. Even though the IPAQ-SF questionnaire is a validated questionnaire, the limitations of recall bias and probability of over/ under-rating of physical activity levels cannot be undermined.

5. Practical Applications.

Covid-19 pandemic has significantly influenced the level of PA levels in doctors

such that doctors who earlier engaged in moderate to high level of PA before pandemic could now engage in low level of physical activity only. Such a finding might have been due to long working hours during the pandemic or even lack of sports facilities during lockdown. Future studies incorporating these factors in the study design could address this issue. Doctors aged 31- 40 years performing Covid-19 duties during the conduct of the survey were at likely risk of performing low physical activity. However, those doctors who regularly engaged in physical activity before pandemic despite the restrictions were found to engage significantly in higher total physical activity MET-duration and expended higher energy. These findings suggest that there is a need to promote indoor-based physical activity among doctors on a regular basis especially during this Covid-19 pandemic.

Conflicts of Interest: The authors declare no conflict of interest.

References

Ács, P., Veress, R., Rocha, P., Dóczi, T., Raposa, B. L., Baumann, P., … Makai, A. (2021). Criterion validity and reliability of the International Physical Activity Questionnaire – Hungarian short form against the RM42 accelerometer. *Bio-Med Central Public Health*, *21*(Suppl 1), 1–10.

Bull, F. C., Al-Ansari, S. S., Biddle, S., Borodulin, K., Buman, M. P., Cardon, G., … Willumsen, J. F. (2020). World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *British Journal of Sports Medicine*, *54*(24), 1451–1462.

Caputo, E. L., & Reichert, F. F. (2020). Studies of Physical Activity and Covid-19 During the Pandemic: A Scoping Review. *Journal of Physical Activity and Health*, *17*(12), 1275–1284.

Cleland, C., Ferguson, S., Ellis, G., & Hunter, R. F. (2018). Validity of the International Physical Activity Questionnaire (IPAQ) for assessing moderate-to-vigorous physical activity and sedentary behaviour of older adults in the United Kingdom. *BMC Medical Research Methodology*, *18*(1), 1–12.

Coyle, C., Ghazi, H., & Georgiou, I. (2020). The mental health and well-being benefits of exercise during the Covid-19 pandemic: A cross-sectional study of medical students and newly qualified doctors in the UK. *Irish Journal of Medical Science (1971 -)*.

Craig, C. L., Marshall, A. L., Sjöström, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., … Oja, P. (2003). International physical activity questionnaire: 12-Country reliability and validity. *Medicine and Science in Sports and Exercise*, *35*(8), 1381–1395.

Datta, R., Yadav, A. K., Singh, A., Datta, K., & Bansal, A. (2020). The infodemics of Covid-19 amongst healthcare professionals in India. *Medical Journal, Armed Forces India*, *76*(3), 276–283. https://doi.org/10.1016/j.mjafi.2020.05.009

Fie, S., Norman, I. J., & While, A. E. (2013). The relationship between physicians' and nurses' personal physical activity habits and their health-promotion practice: A systematic review. *Health Education Journal*, *72*(1), 102–119.

Filgueira, T. O., Castoldi, A., Santos, L. E. R., de Amorim, G. J., de Sousa Fernandes, M. S., Anastácio, W. de L. do N., … Souto, F. O. (2021). The Relevance of a Physical Active Lifestyle and Physical Fitness on Immune Defense: Mitigating Disease Burden, With Focus on Covid-19 Consequences. *Frontiers in Immunology*, *12*(February), 1–23.

Gleeson, M. (2007). Immune function in sport and exercise. *Journal of Applied Physiology*, *103*(2), 693–699.

He, X., Hong, W., Pan, X., Lu, G., & Wei, X. (2021). SARS-CoV-2 Omicron variant: Characteristics and prevention. *MedComm*, *2*(4), 838–845.

IPAQ scoring protocol—International Physical Activity Questionnaire. (2021). Retrieved from https://sites.google.com/site/theipaq/scoring-protocol

Jeong, S.-W., Kim, S.-H., Kang, S.-H., Kim, H.-J., Yoon, C.-H., Youn, T.-J., & Chae, I.-H. (2019). Mortality reduction with physical activity in patients with and without cardiovascular

disease. *European Heart Journal*, *40*(43), 3547–3555.

Jetté, M., Sidney, K., & Blümchen, G. (1990). Metabolic equivalents (METS) in exercise testing, exercise prescription, and evaluation of functional capacity. *Clinical Cardiology*, *13*(8), 555–565.

Jones, A. W., & Davison, G. (2019). Exercise, immunity, and illness. In *Muscle and Exercise Physiology* (pp. 317–344). Elsevier.

Kasapis, C., & Thompson, P. D. (2005). The effects of physical activity on serum C-reactive protein and inflammatory markers: A systematic review. *Journal of the American College of Cardiology*, *45*(10), 1563–1569.

Kokkinos, P. (2012). Physical Activity, Health Benefits, and Mortality Risk. *ISRN Cardiology*, *2012*, 718789.

Lauer, E. E., Jackson, A. W., Martin, S. B., & Morrow, J. R. (2017). Meeting USDHHS Physical Activity Guidelines and Health Outcomes. *International Journal of Exercise Science*, *10*(1), 121–127.

Lee, I. M., & Skerrett, P. J. (2001). Physical activity and all-cause mortality: What is the dose-response relation? *Medicine and Science in Sports and Exercise*, *33*(6 Suppl), S459-471; discussion S493-494.

Leitzmann, M. F., Park, Y., Blair, A., Ballard-Barbash, R., Mouw, T., Hollenbeck, A. R., & Schatzkin, A. (2007). Physical Activity Recommendations and Decreased Risk of Mortality. *Archives of Internal Medicine*, *167*(22), 2453–2460.

Lwanga, S. K., Lemeshow, S., & Organization, W. H. (1991). *Sample size determination in health studies: A practical manual*. World Health Organization.

Macek, P., Terek-Derszniak, M., Zak, M., Biskup, M., Ciepiela, P., Krol, H., … Gozdz, S. (2019). WHO recommendations on physical activity versus compliance rate within a specific urban population as assessed through IPAQ survey: A cross-sectional cohort study. *BMJ Open*, *9*(6), e028334.

Mallah, S. I., Ghorab, O. K., Al-Salmi, S., Abdellatif, O. S., Tharmaratnam, T., Iskandar, M. A., … Al-Qahtani, M. (2021). Covid-19: Breaking down a global health crisis. *Annals of Clinical Microbiology and Antimicrobials*, *20*(1), 1–36. https://doi.org/10.1186/s12941-021-00438-7

Medina, C., Jáuregui, A., Hernández, C., Shamah, T., & Barquera, S. (2021). Physical inactivity and sitting time prevalence and trends in Mexican adults. Results from three national surveys. *PLOS ONE*, *16*(7), e0253137. https://doi.org/10.1371/journal.pone.0253137

Pinho, C. S., Caria, A. C. I., Aras Júnior, R., & Pitanga, F. J. G. (2020). The effects of the Covid-19 pandemic on levels of physical fitness. *Revista da Associação Médica Brasileira*, *66*, 34-37.

Romeo, J., Wärnberg, J., Pozo, T., & Marcos, A. (2010). Physical activity, immunity and infection. *Proceedings of the Nutrition Society*, *69*(3), 390–399.

Sallis, R., Young, D. R., Tartof, S. Y., Sallis, J. F., Sall, J., Li, Q., … Cohen, D. A. (2021). Physical inactivity is associated with a higher risk for severe Covid-19 outcomes: A study in 48 440 adult patients. *British Journal of Sports Medicine*, *55*(19), 1099–1105.

Shimizu, K., Kimura, F., Akimoto, T., Akama, T., Tanabe, K., Nishijima, T., … Kono, I. (2008). Effect of moderate exercise training on T-helper cell subpopulations in elderly people. *Exercise Immunology Review*, *14*, 24–37.

Srivastav, A. K., Sharma, N., & Samuel, A. J. (2021). Impact of Coronavirus disease-19 (Covid-19) lockdown on physical activity and energy expenditure among physiotherapy professionals and students using web-based open E-survey sent through WhatsApp, Facebook and Instagram messengers: Impact of COVID-19 lockdown on physical activity and energy expenditure. *Clinical Epidemiology and Global Health*, *9*(July), 78–84.

Tison, G. H., Avram, R., Kuhar, P., Abreau, S., Marcus, G. M., Pletcher, M. J., & Olgin, J. E. (2020). Worldwide effect of Covid-19 on physical activity: a descriptive study. *Annals of Internal Medicine*, 173(9), 767-770.

Trost, S. G., Pate, R. R., Sallis, J. F., Freedson, P. S., Taylor, W. C., Dowda, M., & Sirard, J. (2002). Age and gender differences in objectively measured physical activity in youth. *Medicine and Science in Sports and Exercise*, *34*(2), 350–355.