

Associations between physical activity and stress levels in medical doctors working in New Zealand and Australia during initial COVID-19 restrictions

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ABSTRACT

In 2020, the world was gripped by the COVID-19 pandemic which put an unprecedented strain on health care workers. The aim of this study was to assess the effects of the Australian and New Zealand lockdowns on physical activity, depression, and anxiety in medical doctors. We hypothesized that during stressful times such as the COVID-19 pandemic lockdown, physical activity would have a positive effect on the mental health of medical doctors. Convenience sampling (using mass emailing via professional networks including medical associations) and snowball sampling were used during the early period of COVID-19 government mandated restrictions (25 March to 27 April 2020) in New Zealand and Australia. All registered medical doctors working in New Zealand and Australia were eligible to participate in the survey. The short survey collected information demographics, levels of physical activity and mental health using the International Physical Activity Questionnaire: Short Form and the Depression, Anxiety and Stress Scale-42. Of 469 participants who completed the survey, over 81% met the recommended physical activity levels (150 minutes of at least moderate-intensity physical activity/week). Physically inactive New Zealand and Australian medical doctors reported significantly higher depression ($p = 0.006$), anxiety ($p = 0.008$) and stress ($p = 0.002$) scores compared to their active counterparts. This study demonstrated that less physical activity was associated with higher anxiety and depression in medical doctors. A key recommendation from this study is to incorporate greater access to physical activity in healthcare settings for medical doctors.

1. Introduction

Since late 2019, the world has been gripped by a pandemic caused by a novel Coronavirus- COVID-19 (Pappa et al., 2020). The virus was first identified in Wuhan, China (Huang et al., 2020) and spread to every continent. (Pappa et al., 2020). Following the confirmation of this pandemic by World Health Organization (WHO) on March 11th 2020 (Pappa et al., 2020), the respective governments in New Zealand (Keogh, 2020) and Australia (Burke, 2020) acted swiftly to institute state and nationwide lockdowns. Medical doctors, like the rest of the populace, were impacted by

the severe lockdown restrictions which had potentially significant impacts on access to physical activity.

Physically active individuals have a reduced risk of developing mental illness compared to those who are inactive (Taylor, Sallis, & Needle, 1985). Additionally, physical exercise has been associated with the successful treatment of depression, anxiety and psychological stress (Callaghan, 2004; Guskowska, 2004; Taylor et al., 1985). Hypothetically, during the lockdown when physical activity was restricted, an individual's ability to take part in exercise as a stress buffer was likely to be substantially reduced as many recreational opportunities were prohibited (e.g.,

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no sporting competitions, gyms closed, activities with others individuals outside one’s household limited) (Australian Government, 2020; New Zealand Government, 2020). This reduced access to activity may have compounded the stress of medical doctors, potentially impacting their wellbeing.

Data from previous epidemics/pandemics (i.e., Ebola and SARS) have shown that health care workers (HCWs) are particularly vulnerable to psychological and mental health issues. Factors thought to be related to increased stress include increased workload, lack of personal protective equipment, sleep deprivation, fear of becoming infected, anxiety about making ethical decisions while providing medical care, isolation and stress, working long shifts and having little information about COVID-19-related patient prognosis (Wu et al., 2009). Working in such an unpredictable environment could further aggravate the already existing “compassion-depleted state”, leading to burnout (Kumar, 2016).

Prior to the COVID-19 pandemic, mental health specialists had reported a higher incidence of psychological distress amongst doctors as compared to the general population (Feeney et al., 2016). These mental ill-health effects in combination with doctor burnout is not unique to Australia and New Zealand, having been reported globally in the medical profession (Shanafelt et al., 2015; Sharma, Sharp, Walker, & Monson, 2008; Thommasen, Lavanchy, Connelly, Berkowitz, & Grzybowski, 2001). Work-related mental ill-health which is not diagnosed or is not well-treated may not only affect a HCW’s capacity to care for their patients but may also illicit negative consequences on the HCW’s health (Wallace, Lemaire, & Ghali, 2009).

The COVID-19 pandemic has challenged the health care sector globally. A theoretical model proposed by the Australian Government in the early phase of the COVID-19 pandemic showed that an unchecked outbreak of COVID-19 would exceed the intensive care unit (ICU) bed capacity in Australian hospitals by 5 times (35000 ICU bed occupancy as compared to 7000 in routine expanded capacity) (Australian Government, 2020). Increased demand on resources in hospitals and primary care has been predicted and witnessed in other parts of the world (Christen et al., 2020). HCWs, as a consequence, worked more than their

normal hours, were required to execute new policies, had to ration life-saving equipment and health-protecting resources, had restricted autonomy with extreme physical tiredness, mental fatigue and insomnia; with negative impacts on physical and mental health (Kang et al., 2020; Rossi et al., 2020; Shaukat, Ali, & Razzak, 2020).

The primary aim of this study was to assess the effect of the COVID-19 pandemic restrictions on the physical activity and mental health of doctors in Australia and New Zealand. It was hypothesized that the mental health of doctors in this stressful work environment may be negatively impacted by a reduction in physical exercise levels secondary to the imposed restrictions. The study aimed to inform the medical sector about the physical and mental health impact on the doctors who offer services when under extreme duress in a pandemic.

2. Methods

We used Qualtrics survey software (Qualtrics, Provo, Utah) to collect cross-sectional data during the lockdown stages (April-June 2020) of government-led containment measures in New Zealand and Australia (see Table 1 for restrictions) (Wikipedia, 2020a) (Wikipedia, 2020b). The containment measures were aligned with WHO guidelines (World Health Organisation, 2020). The research was approved by the local Institutional Human Ethics Committee in New Zealand and Australia (New Zealand reference # 2020-18, Australia reference # 2057014.1). The study adhered to current epidemiological guidelines (Strengthening the Reporting of Observational Studies in Epidemiology- STROBE) (Von Elm et al., 2007). All participants provided informed consent at the start of the survey.

Convenience sampling (using mass emailing via professional networks including medical associations) and snowball sampling were used during the early period of COVID-19 government-mandated restrictions (25 March to 27 April 2020) in New Zealand. All medically trained health professionals working in New Zealand and Australia were eligible to participate in the survey.

Table 1: Covid-19 restrictions to human movement and physical activity.

	New Zealand	Australia
Physical distancing (>2m)	Yes	Yes
Self-isolation for >70 year olds and people with pre-existing health conditions, or Covid-19 symptoms or diagnosis	Yes	Yes
Exercise (e.g., walk, jog, and cycle etc.)	Two or more forms of exercise/day	Only one form of exercise/day
Only shopping for basic necessities (e.g., food/medicine)	Yes	Yes
Travel for specific medical needs	Yes	Yes
Essential travel for key workers only, everyone else works from home	Yes	Yes
Pubs/gyms/playgrounds/cinemas/restaurants/schools/places of worship closed	Yes	Yes

Note: Key workers included primary health care, supermarkets, pharmacies, food production including farming, delivery personnel, emergency services, businesses that support essential services.

A short survey collected demographic and physical activity information (International Physical Activity Questionnaire: Short Form [IPAQ-SF], Craig et al., 2003), along with doctors mental health (Depression, Anxiety and Stress Scale-42, DASS-42). The IPAQ was developed to use as a global tool to measure physical activity and the 9-item short form records the activity of four intensity levels including vigorous-intensity, moderate-intensity, walking, and sitting over the last 7 days (Craig et al., 2003). While accelerometer-derived physical activity measures are superior to questionnaires (Lee, Macfarlane, Lam, & Stewart, 2011), the design of this study did not allow for such monitoring. Using the IPAQ-SF on large populations is a validated tool to measure physical activity (Grimm, Swartz, Hart, Miller, & Strath, 2012). The DASS-42 is a commonly used self-report scale that assesses symptoms of depression, anxiety and stress (Lovibond & Lovibond, 1995). The 42-item questionnaire consists of 3 subscales (depression, anxiety and stress) and has been shown to have acceptable to excellent internal consistency and concurrent validity (Antony, Bieling, Cox, Enns, & Swinson, 1998).

2.1. Data Preparation

Data from the IPAQ-SF was coded and analysed using the recommended guidelines found on the IPAQ website (www.ipaq.ki.se). Using the IPAQ scoring system, the total number of days and minutes of physical activity were calculated for each participant in the areas of moderate and vigorous-intensity activity along with walking and sitting. In addition, we also calculated a physical activity continuous variable (MET-min.week⁻¹) according to the recommended guidelines. Each participant was also given a categorical score of “Low”, “Moderate” or “High” according to their level of activity as outlined in the IPAQ guidelines (e.g., high; ≥ 7 days of any combination of walking, moderate-or-vigorous intensity activity achieving ≥ 3000 MET-min.week⁻¹; moderate, ≥ 5 days of any combination of walking, moderate-or-vigorous intensity activity achieving ≥ 600 - 2999 MET-min.week⁻¹; low, achieving < 600 MET-min.week⁻¹ of physical activity. A further categorical score of meeting physical activity guidelines (i.e., had a categorical score of moderate or high = active), or not (received a categorical score of low = inactive) was calculated.

2.2. Data Analysis

The dataset obtained from the Qualtrics website was downloaded as a Microsoft Excel spreadsheet and was initially transferred to the Statistical Analysis System v 9.4 (SAS Institute; Cary, NC, USA) for further analysis. The data was then visually checked for outliers and inaccurate data by investigating the distribution and probability plots. Means and standard deviations along with frequencies and percentages were calculated for the various dependent variables (physical activity, DASS-42). Independent t-tests were used to determine significant differences between groups (e.g., New Zealand versus Australia, active versus inactive). Spearman correlation coefficients were calculated to measure associations between DASS-42 scores and physical activity variables including sitting time. Additionally, nominal

variables representing the proportion of participants (and subgroups) meeting physical activity thresholds were compared by categorical modelling using the PROC FREQ procedure in SAS. A type I error of 5% was chosen for declaration of statistical significance; precision of estimates was represented by the 95% confidence limits.

3. Results

3.1. Demographics

A total of 469 participants completed the survey, 43 contained incomplete responses, and these were removed, leaving 426 participants. This led to a 90.8% inclusion rate. The New Zealand sample comprised of more females (65%) than males (34%) (Table 2). The Australian respondents were evenly spread with 52% female and 46% male. The overall gender distribution was 49.5% female, 33.3% male and 15.6% unknown (did not complete this question). In both samples, Caucasians were the predominant ethnic group (70%), with Asian 6.6%, Indian 4.2%, Māori 2.1%, Aboriginal 0.2%, and Pasifika 0.7% also being represented. The average age was 47.2 ± 11.9 years (mean \pm SD).

3.2. Physical Activity Levels

During the COVID-19 lockdown, 81% of participants in both countries met the recommended physical activity guidelines. Within this group, 50% of participants reported a high IPAQ-SF score. There were no differences in physical activity levels between countries or genders (Table 3). Sitting time was similar between participants from both countries, averaging 350 min (5.8 hours) per day overall.

3.3. DASS-42

Depression, anxiety and stress were similar in participants from both countries. The levels of stress and depression were higher than for anxiety in both samples. (Table 3).

3.4. DASS-42 and Physical Activity

Data from both countries combined, demonstrated statistically higher depression ($p = 0.006$), anxiety ($p = 0.008$) and stress ($p = 0.002$) scores in the inactive compared to the active participants (Table 4).

The Spearman correlation coefficients demonstrated small to moderate negative correlations between physical activity levels measured by MET-min.wk⁻¹ and DASS-42 with females tending to have slightly stronger associations than males (Table 5). Although the correlations are relatively small the combined male and female data indicates that a lower physical activity level was associated with higher depression, anxiety, and stress. We also found small to moderate positive correlations between sitting time and DASS-42 scores. These associations tended to be stronger in males than females, and indicates increased depression, anxiety and stress with increased sitting time.

Table 2: Population characteristics of the study sample.

	New Zealand	Australia	Unknown	Total
Sample (n)	199	172	55	426
Sex (n, %)				
Male	64 (33.7%)	78 (45.8%)		142 (33.3%)
Female	123 (64.7%)	88 (51.8%)		211 (49.5%)
Prefer not to say	3 (1.6%)	4 (2.4%)		7 (1.6%)
Unknown			66	66 (15.6%)
Age (mean ± SD)	47.2 ± 12.4	47.2 ± 11.2		47.2 ± 11.9
Age groups (n, %)				
18-29 years	13 (6.8%)	6 (3.5%)		19 (4.5%)
30-39 years	40 (21.0%)	40 (23.7%)		80 (18.8%)
40-49 years	56 (29.5%)	50 (29.6%)		106 (24.9%)
50-59 years	44 (23.2%)	46 (27.2%)		90 (21.1%)
60-69 years	30 (15.8%)	22 (13.0%)		52 (12.2%)
70-79 years	6 (3.2%)	5 (3.0%)		11 (2.6%)
80 + years	1 (0.5%)	0 (0.0%)		1 (0.2%)
Unknown			67	67 (15.7%)
Ethnicity (n, %)				
Caucasian	167 (83.9%)	131 (76.2%)		298 (70.0%)
Asian	14 (7.1%)	14 (8.1%)		28 (6.6%)
Indian	2 (1.0%)	16 (9.3%)		18 (4.2%)
Māori	8 (4.0%)	1 (0.6%)		9 (2.1%)
Aboriginal/Torres Strait Island	0 (0.0%)	1 (0.6%)		1 (0.2%)
Pacific Island	1 (0.5%)	2 (1.2%)		3 (0.7%)
Other	7 (3.5%)	7 (4.0%)		14 (3.3%)
Unknown [^]			55	55 (12.9%)

Note: [^]Unknown were participants that completed the questionnaire but left some questions unanswered (e.g., 66 participants did not answer the gender question). Prefer not to say includes 1 non-binary individual.

Table 3: Physical Activity during the Covid-19 restrictions along with the DASS.

	New Zealand	Australia	Total
Met PA guidelines (n, %)			
Male and females	151 (80.7%)	136 (81.9%)	287 (81.3%)
Males only	56 (87.5%)	65 (83.3%)	121 (85.2%)
Females only	95 (77.2%)	71 (80.7%)	166 (78.7%)
Prefer not to say	2 (66.7%)	4 (100.0%)	6 (85.7%)
IPAQ-SF (mean ± SD)			
Total PA (MET·min·wk ⁻¹)	3081.6 ± 2920.7	2885.7 ± 3217.2	2943.6 ± 3009.7
Sitting time (min·d ⁻¹)	401.9 ± 235.2	362.2 ± 191.3	349.7 ± 231.9
IPAQ-SF Classifications (n, %)			
Low	39 (19.6%)	31 (18.0%)	80 (18.8%)
Moderate	60 (30.2%)	54 (31.4%)	133 (31.2%)
High	100 (50.2%)	87 (50.6%)	213 (50.0%)
DASS score (mean ± SD)			
Depression	6.1 ± 7.6	5.8 ± 8.2	6.0 ± 7.9
Anxiety	2.6 ± 3.8	2.8 ± 4.1	2.7 ± 4.0
Stress	9.2 ± 8.0	9.7 ± 8.4	9.4 ± 8.2

Note: No significant differences between sexes for Physical Activity (PA) guidelines. No significant differences between countries for guidelines. No significant different between countries for total PA or sitting time. No significant differences between countries for DASS scores.

Table 4: DASS score in the participants deemed active or inactive from the IPAQ criteria.

	Inactive (Not meeting PA guidelines)	Active (meet PA guidelines)	Mean difference between groups; 95% confidence limits
DASS score			
Depression	8.3 ± 9.1	5.4 ± 7.5	2.9; 2.0*
Anxiety	3.8 ± 4.2	2.5 ± 3.9	1.3; 1.0*
Stress	12.1 ± 9.1	8.8 ± 7.8	3.3; 2.1*

Note: Data are mean ± SD. *Statistically significant ($p < 0.05$) between the active and inactive groups.

Table 5: Correlation between physical activity, sitting time and DASS.

	Males	Females	Total
DASS score and physical activity MET.min ⁻¹ .week ⁻¹			
Depression	-0.12	-0.21*	-0.19*
Anxiety	-0.12	-0.12	-0.13*
Stress	-0.08	-0.15	-0.15*
DASS score and sitting time			
Depression	0.16	0.12	0.15*
Anxiety	0.07	0.10	0.11*
Stress	0.24*	0.07	0.15*

Note: *Statistically significant ($p < 0.05$) correlations.

4. Discussion

The present study, to our knowledge is the first to investigate the effect of Covid-19 restriction on physical activity and mental health in medical doctors in New Zealand and Australia. It is well documented that doctors suffer from higher levels of mental health issues compared to the general population (Aiken, Clarke, Sloane, Sochalski, & Silber, 2002; Caplan, 1994) and the added challenges due to COVID-19 may exacerbate these conditions (Galbraith, Boyda, McFeeters, & Hassan, 2020).

The recruitment numbers of this study represent adequate participation of the medical fraternity. We were able to achieve a 90.8% completion rate and the population sampled was representative of the current age and gender mix in the medical cohort in the two countries. European doctors were more heavily represented and indigenous doctors were underrepresented in this survey (e.g., the distribution of Māori participants in this survey was 2.1% compared to 3.5% of doctors currently working in the area, while 0.8% of Pasifika were surveyed compared to 1.8% currently working as doctors (Ministry of Health, 2018)). There was significantly more female doctors surveyed (58.6%) (Table 2) and it is postulated this may be due to the increasing proportion of female doctors in Australia (Australian Institute of Health and Welfare, 2020) and New Zealand (Ministry of Health, 2018) in recent years. Another explanation for this could be the fact that female doctors are possibly more invested in their health and wellbeing and therefore were more committed to completing this survey.

It is well documented that depression, anxiety and stress are overrepresented in the medical profession even prior to the onset

of COVID-19 (Feeney et al., 2016). Preliminary data from Faulkner et al. (2021) indicates that DASS-42 scores in the general population during the COVID-19 pandemic were approximately one-third of the scores reported by the medical doctors of this study. Given the increased workload and stress on medical doctors at this time, the increased DASS-42 scores represent a real increase in doctors' levels of depression, anxiety, and stress.

Approximately 81% of the male and female doctors participating in this study met the recommended physical activity levels during the lockdown. While we did not collect data on the change in physical activity from before-to-during the lockdown, we postulate (based on data from normal populations at this time (Faulkner et al., 2021; Meiring, Gusso, McCullough, & Bradnam, 2021)), that physical activity in doctors was likely to be reduced which was likely to negatively affect mental health, as has been indicated in other studies (Faulkner et al., 2021; Meiring et al., 2021).

Severe limitations on access to physical activity and increased mental health issues have been reported in many countries across the globe both in HCWs (Kang et al., 2020; Pappa et al., 2020; Rossi et al., 2020) and in the general population (Lesser & Nienhuis, 2020). The negative effect of the COVID-19 pandemic restrictions on mental health (depression, anxiety, and stress) was seen to be significantly higher in doctors who were physically inactive during this time as compared to their more physically active peers. Our study indicated that rates of depression, anxiety and stress were increased in the cohort that did not complete the required physical activity levels.

The reduction in levels of physical activity could be due to pandemic-associated restrictions limiting doctors to in-home or outdoor activities, but this can also be due to heightened stress and mental ill-health, resulting in increased fatigue and/or less attention to self-care.

In New Zealand, most family practitioners were tasked with providing COVID-19 testing and tracing services with little or no support from the central government, which is likely to have led to increased stress while trying to maintain regular patient care. The increased demands on doctors during this time probably led to more physical and mental fatigue resulting in less time available for physical activity.

Although an exact causation cannot be derived by this observational study, a lack of physical activity and increased boredom accompanied by increased weight gain and consumption of alcohol can be potential reasons for synergistic effects of reduced physical activity and increased mental illness (Fallon, 2020). A recent estimation by the Foundation of Alcohol Research and Education in Australia found increased sales and consumption of alcoholic beverages during the COVID-19 restrictions (Foundation for Alcohol Research & Education, 2020).

Sitting time (which is a measure of sedentariness), showed a small positive correlation with measures of depression, anxiety and stress (Table 5). It has been known for some time that inactivity is an independent risk factor for chronic disease (Fung et al., 2000; Jakes et al., 2003), but a lack of activity is also associated with lower mental health status (Mummery, Schofield, & Caperchione, 2004). We suggest that this association was exacerbated during COVID-19 lockdown when work pressures were increased on medical doctors. Such associations need to be highlighted as areas of concern in the medical fraternity and appropriate steps need to be taken to alleviate this stress by increasing the access to physical activity options in the workplace or at home.

We are unaware of any participants contracting COVID-19. The physical symptoms related to a COVID-19 infection have the potential to cause heightened stress and restrictions in physical activity and the inability to continue providing care, as seen in a study involving HCW's from major hospitals in India and Singapore (Chew et al., 2020). Research from previous pandemics (such as SARS 2003, MERS 2012 and Ebola) have shown that HCWs can experience a broad range of psychological morbidities that can endure for many months after an outbreak (Maunder et al., 2004). Furthermore, negative effects on mental health can be found in doctors irrespective of whether or not they worked in the front line with infected patients (Um, Kim, Lee, & Lee, 2017).

The current global pandemic has identified the need for doctors to develop strategies to cope under pressure. Most HCWs feel a strong obligation to continue working despite the dangers posed to their own health (Gouliia, Mantas, Dimitroula, Mantis, & Hyphantis, 2010). Going forward, recognising that such a pandemic may occur again (or continue with a different COVID-19 variant), the authors recommend universities and professional colleges establish wellbeing strategies in the medical curriculum. It is well documented that HCWs especially medical doctors, find it difficult to disclose mental health issues with colleagues or seek professional help (Hassan, Ahmed, White, & Galbraith, 2009).

A plethora of global studies in the last 12 months have shown that physical activity levels have decreased, and sedentary JSES | <https://doi.org/10.36905/jses.2023.01.04>

behaviour increased during the COVID-19 pandemic lockdowns (Faulkner et al., 2021; Meiring et al., 2021; Stockwell et al., 2021). Decreases in physical activity have resulted in increased anxiety and depression (Di Corrado et al., 2020). The benefits of physical activity for both mental and physical wellbeing have been well established (Kohl 3rd et al., 2012). The current coronavirus pandemic is exacerbating physical inactivity and its associated problems. We propose that doctors and HCWs need to be at the forefront of the "exercise is medicine movement". There is a role for health boards to implement facilities and breaks to ensure that doctors are able to meet their recommended physical activity levels while at the workplace. It is critical that governments and health boards address the significance of the strain that is faced by doctors as a result of the pandemic and implement long term solutions.

One of the limitations of this study is that analyses did not specify between the medical sub-speciality doctors nor were differences between doctors working in public and private sectors investigated. Therefore, this study was unable to separate out those at higher risk of contracting COVID-19 to investigate whether the associations between mental health and physical activity were different in this group. Further, exact causation related to specific factors could not be derived from this cross-sectional, correlational study. Sub-group analyses of confounding factors such as pre-existing mental illness, private or public health care settings, socio-economic status and financial stress, lack of family or social support and ethnicity would be worthy research explorations in the future. Not only can these confounding variables have consequential impact on the mental health outcomes, but they may also be important to formulate preventative plans for doctors for future pandemics or subsequent waves of the same COVID-19 infections. Another limitation of the current study was that we were unable to investigate other causative factors that impair wellbeing such as poor sleep, high alcohol consumption and poor diet.

The SARS-COV2 virus outbreak led to a global pandemic in 2020 resulting in increased stressors on health systems worldwide which in turn led to greater demands on HCW. This study has found that doctors working during the COVID-19 pandemic lockdowns in New Zealand and Australia had high levels of depression, anxiety and stress. However, doctors that met the current physical activity guidelines showed significantly lower depression, anxiety and stress than doctors that did not meet the guidelines. Our data shows the importance physical activity has in maintaining wellbeing for doctors in the workplace. We suggest some simple measures such as ensuring access to regular breaks for exercise, along with better access to counselling could be initial starting points to improve doctor's response to increased work stress.

Conflict of Interest

The authors declare no conflict of interests.

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