# *The Impact of COVID-19 Restrictions on Perceived Health and Well-Being of Active Australian Older Adults*

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# The impact of COVID-19 restrictions on perceived health and wellbeing of active Australian older adults

**Abstract**

The aim of this study was to determine the impact of COVID-19 restrictions on older adults' perceived health and wellbeing, according to different types of participation in sport and physical activity by gender and region. A survey was implemented during the first COVID-19 lockdown in Australia (June 2020) and collected information on demographics, sport and physical activity patterns pre-COVID-19, and health and wellbeing outcomes during lockdown and compared to one year earlier. During COVID-19 lockdown, older adults who participated in both club sport and informal activities had significantly better general health, physical health and resilience than those who participated solely in a single setting. Those participating in both team and individual activities reported better general wellbeing. Older adults that were active in a range of settings and modes had improved health and wellbeing. Social support is especially important for older adults to become and remain active.

**Key words**: ageing, physical activity, sport participation, settings

## Introduction

[Removed for anonymity] had its first reported COVID-19 case in January 2020, and on March 11th the World Health Organisation declared COVID-19 a pandemic, and following this all [removed for anonymity] borders were closed on March 25th (Karg et al., 2021). Throughout March 2020 there was widespread cancellation of elite and community sport in [removed for anonymity], and then in May, there were return to sport guidelines developed by National and State Governments. By mid-October restrictions were significantly eased in the [removed for anonymity] State of Victoria which was the most impacted State until then (Karg et al., 2021). From early August to the 21st of October, 2021, the city of [removed for anonymity] was in lockdown again with another cancellation of community sport competitions and restrictions on general exercise (Chief Health Officer, 2021).

The lockdowns and restrictions on movement and social connectedness throughout 2020 and 2021 impact vulnerable groups like older adults to a greater extent, and in particular relation to their health (De Pue et al., 2021; Manca et al., 2020). Older adults are a susceptible population group to critical and fatal COVID-19 (Piniella-Ruiz et al., 2021; Shahid et al., 2020), and often have underlying health conditions and sometimes few economic resources (Henning-Smith, 2020; Li & Mutchler, 2020; Shahid et al., 2020). A Belgian study demonstrated that 93% of COVID-19 related deaths were people aged 65 or older (De Pue et al., 2021). Studies have demonstrated that the virus can cause worse physical health outcomes and a higher mortality rate in older adults and those with comorbidities such as hypertension, cardiovascular disease, diabetes, chronic respiratory disease, and chronic kidney disease (Shahid et al., 2020).

Further, COVID-19 presents unique risks to the emotional and social well-being of older adults (Henning-Smith, 2020). Older adults are disconnected from society through COVID-19 restrictions and many without online virtual connectedness are at greater risk of loneliness and isolation (Henning-Smith, 2020). Further they are challenged to meet their basic daily needs, with grocery shopping, accessing health care and having assistance in their homes all adding additional health risks (Henning-Smith, 2020). Whilst social distancing is supposed to protect at-risk population groups like older adults, it in fact introduces further complications to their health and wellbeing (Tyrrell &

Williams, 2020). Loneliness and social isolation have substantial effects on mental and physical health and specifically for older adults (Tyrrell & Williams, 2020). Globally, many older adults were and continue to be separated from family members and other close friends, which restricts caregiving and other resources and connections (Tyrrell & Williams, 2020).

The social isolation and loneliness negatively impacts mental health in older adults, and may predispose to cognitive decline (Manca et al., 2020) and contribute to depression and anxiety in older adults (García-Portilla et al., 2020). There is also evidence that older women may be more impacted than men (García-Portilla et al., 2020). In a Spanish study of adults aged 60 years or older, women scored significantly worse in the five psychological domains. Further, 53% of women and 34% of men were emotionally distressed, and a 29% of women and 14% of men were depressed (García-Portilla et al., 2020). In a cross-sectional Belgian study of older adults 65+, depression was strongly related to reported declines in activity level, sleep quality, wellbeing and cognitive functioning (De Pue et al., 2021). With regard to wellbeing, a study of older adults reported that the most prominent decreases were for general life satisfaction, safety, community connectedness and future security (De Pue et al., 2021).

The social distancing restrictions for older adults also places them at risk of a decline in their physical health (Tyrrell & Williams, 2020). Many of the studies of physical activity and older adults also report other psychological, mental health and general wellbeing outcomes (Carriedo et al., 2020; De Pue et al., 2021; Suzuki et al., 2020; Visser et al., 2020). In a Belgian study, half of all older adults reported a significant decrease in physical activity in the past week compared to before COVID-19, as well as deteriorating sleep quality and wellbeing (De Pue et al., 2021). Similarly, in a Dutch study of older adults, approximately half reported a decrease in physical activity, and those in self-quarantine had significantly lower levels of physical activity (Visser et al., 2020). Similarly, a Japanese study of older adults reported that 48% were less active and there was a significant decrease in subjective wellbeing in the less active group of older adults (Suzuki et al., 2020). The COVID-19 restrictions impacted the physical activity of older adults, and especially those who had higher levels of physical activity and lower health-related quality of life before COVID-19 (Suzuki et al., 2020). A Spanish

study of older adults (60+ years) reported that those older adults who met the physical activity recommendations during lockdown had higher resilience, positive affect and lower depressive symptoms (Carriedo et al., 2020).

As summarised above, much of the literature on the impact of COVID-19 on older adults' health and wellbeing has focused on social and mental health and wellbeing. Some also focus on levels of physical activity in surveys of the general population. However, there is no detail of the different modes and settings of participation in physical activity. This may be an important factor above and beyond the health benefits of general physical activity, because we know that being active in different ways can impact health differently (Eime et al., 2013). For example, participation in sport specifically can have greater psychological and social health benefits than being active alone (Eime et al., 2013). There is consistent evidence that older adults are motivated to be active for social reasons, that is to be active with others, which sport can provide (Jenkin et al., 2018; Lindsay-Smith et al., 2019). This relates to both physical activity in general (Lindsay-Smith et al., 2019; Lindsay Smith et al., 2017), and specifically to sport (Jenkin et al., 2018). The social aspects of participation in physical activity contributes to enjoyment and positive mental health benefits (Lindsay-Smith et al., 2019) and helps to prevent loneliness (Lindsay Smith et al., 2017). In relation to sport, older adults report benefits of participation to include social, physical and mental health (Jenkin et al., 2018). The most prominent reported outcome is social health and wellbeing (Jenkin et al., 2018)

There is limited research on older adults' participation in community sport. Most research has been targeted at the young and elite sport participants, or has focused on physical activity in general and not specifically on participation in community sport. In this paper we seek to determine the association between various demographic and sport participation characteristics of older adults and their perceived health and perceived changes in health under the impact of COVID-19 related restrictions. Specifically, we investigated the levels of perceived health and perceived changes in health across genders, age groups, regions and different modes (e.g. team versus individual activities) and settings (e.g. club-based versus informal activities) of participation in sport and physical activity.

## Methods

This study is part of a broader program of research in [removed for anonymity] which involves the longitudinal measurement of sport and physical activity participation and the physical, mental and social health and wellbeing outcomes of this participation. This study was conducted via two waves of online surveying during the COVID-19 period (2020 and 2021), the first of which also included participation and health data that related to the pre-COVID-19 baseline in 2019. Ethics approval was granted by the Human Research Ethics Committee of [removed for anonymity] (HRE20-049), and [removed for anonymity] (8654), and thus conducted in accordance with the Declaration of Helsinki. In the online survey, potential respondents were first presented with an information sheet about the study, which detailed all the research procedures, including their rights to anonymity and confidentiality. Following this information, survey respondents had to indicate their consent to participate in this study before commencing the survey.

The present study is based on data collected in the first wave using an online survey conducted during May and June 2020. Recruitment to the survey was primarily facilitated by sports including Australian football, bowls, cricket, golf, tennis and football (soccer). The present study is one of three age-based studies, each focusing on a different stage of the lifespan. The other studies are focused on adolescence (13-17 years) and adults (18-59 years). The current study is focused on older adults. The target population was adults aged 60+ years at the time of the survey who were registered in the 2019 and/or 2020 playing seasons to participate in one or more sports. The sports organisations that sent out the invitation to the survey to their registered participants, represent major sports in Victoria and Australia (Eime et al., 2020). The research team has previous experience with working with all these sports at national, state and local levels.

In order to broaden the scope of the survey sample to include people who participate in recreational physical activity only, in settings other than sports clubs, and potentially also people who do not participate in any recreational physical activity, the primary recruitment strategy was supplemented by

the use of snowball sampling, through social media pages of sports organisations and research-oriented social media pages (e.g. research teams social media pages).

The first wave, or baseline, of the longitudinal survey included, among many other, questions about:

- Demographic characteristics – gender, date of birth, and residential postcode
- Types of sports and other recreational physical activities participated in
- Settings in which the participation occurred – sports clubs and other less structured informal settings
- Modes of participation – team and individual modes of activity
- Self-assessed general health, physical health and mental health.
- Measures of wellbeing – general wellbeing, resilience and life satisfaction.

Date of birth was used to determine age in years at the time the survey was completed. Residential postcode concordances (Australian Bureau of Statistics, 2016) were used to assign each postcode to one of two broad geographical zones or regions: Metropolitan, comprising the capital cities of the Australian states; and non-metropolitan, comprising regional cities, towns and rural areas.

Regarding sport and physical activity, two separate sections of the survey dealt respectively with two 'settings': organised club sport involving membership and registration (designated 'club'), and more informal sport and recreational physical activity (designated 'informal'). In each section, a list of the most common activities was presented – 16 for club sports and 26 for informal (including 12 of the 16 club sports). Respondents indicated which activities they participated in, with provision for adding other activities that were not listed. On the basis of these responses, a combined list of 88 activities was established. Further, each of the 88 activities was classified as either 'team' or 'individual'. Each respondent was then assigned a category for each of 'settings' (club only, club and informal, informal only, and inactive) and 'modes' (team only, team and individual, individual only, inactive).

Six survey items were devoted to self-assessed health – three pertaining to the time of the survey (during COVID-19 lockdown) and three comparing current health to health 12 months prior to the survey (before COVID-19). The general health item was a 5-point Likert scale item (poor, fair, good,

very good, excellent) derived from the Short-form Health Survey (SF-36) instrument (Ware Jr et al., 1993). The same format was used for the assessment of physical health and mental health. The three comparative items used a 5-point Likert scale (much worse, somewhat worse, about the same, somewhat better, much better).

General wellbeing was assessed using a scale derived by averaging the responses to a battery of 14 items regarding frequency of positive and negative feelings in the two weeks prior to the survey. Most of the content was informed by the existing literature (Australian Institute of Health and Welfare, 2012; Ware Jr et al., 1993), supplemented by three items developed by the research team to address negative feelings likely to be exacerbated by COVID-19. Each item was scored on a 5-point scale (all of the time, most, some, a little, none), with reverse coding of the negative items so that higher average scores represented greater wellbeing.

Resilience was similarly assessed using a scale derived by averaging the responses to a battery of four items, three derived from the brief resilience scale (BRS) (Smith et al., 2008) supplemented by an item framed regarding challenges, regarded by the research team as appropriate wording for sport-focused respondents. Each item consisted of a statement about the respondent, with responses on a 5-point scale (strongly agree, agree, neutral or unsure, disagree, strongly disagree).

Life satisfaction was assessed using a direct question (Women's Health Australia, 2008

) with the response on a 10-point scale from 1 (least satisfied) to 10 (most satisfied).

*Statistical analysis*

For the purpose of tabulation and statistical analysis, the six 5-category health items were recoded into three categories. Regarding sport and physical activity settings and modes, there were insufficient 'inactive' responses in the older adult cohort for valid and meaningful statistical analysis, and so these were excluded from the analysis. Consequently, the variable 'settings of sport and physical activity' was reduced to three categories (club including club and informal, informal only) and the variable 'modes of sport and physical activity' was similarly reduced to three categories (team only, team and individual, individual only).

The six recoded health items were each cross-tabulated against four respondent characteristics: gender, region, settings of sport and physical activity, and modes of sport and physical activity. Chi-square tests of independence were conducted to identify differences in the health profiles of the groups defined by each of the characteristics.

For the measures of general wellbeing, resilience and life satisfaction, mean values for the groups defined by each of the five characteristics were tabulated, and group differences were analysed using independent samples t-tests (for two groups) and F-tests (for three groups).

**Results**

The survey was completed by 1836 active older adults (60+ years) – 1188 men (65%) and 648 women (35%) (Table 1). Their age ranged from 60 to 92 years, with mean 69.8 years and SD 6.4 years. Most respondents resided in metropolitan cities (60%) compared to non-metropolitan regions (40%) (Table 1). The majority participated in both club and informal sport and physical activity (71%) followed by club only (26%) and informal only (3%). Nearly half participated in team and individual sport and physical activities (46%), followed by individual only activities (38%) and then team only sports (16%) (Table 1).

[Insert Table 1 about here]

***Health outcomes during COVID-19 lockdown/restriction***

There was a significant difference between reports of general health during COVID-19 lockdown for men and women (p=0.006) (Table 1). Men were more likely to report poor/fair general health (11%) than women (9%) and women were more likely to report very good or excellent general health than men. There was no significant difference between men and women for physical health or mental health. Of all respondents, over 40% reported very good or excellent physical health (men 44%, women 48%) and over half reported very good or excellent mental health (men 60%, women 56%) (Table 1).

When comparing non-metropolitan and metropolitan residents there were some significant health differences. Older adults living in non-metropolitan regions were significantly more likely to report poor or fair physical health, and in contrast those living in metropolitan cities were significantly more likely to report higher rates of very good or excellent physical health (p=0.022). Older adults living in metropolitan cities were more likely to report very good or excellent general health compared to those living in non-metropolitan areas, however this difference was not significant (p=0.07)

With regards to the settings of participation in sport and physical activity, older adults participating in both club sport and informal sport and physical activity were significantly more likely than those who only participated in one type of setting (club or informal) to report better general health and physical health (both p<0.001). They were also more likely to report better mental health, however this was not quite significant (p=0.054).

In terms of the mode of participation, those participating in individual-only activities had significantly higher reported general health and physical health (both p<0.001), than those who participated in team-only or in both team and individual activities. There was no significant difference in reported mental health, and over 50% of people within each sport and physical activity mode reported very good or excellent mental health.

***(Perceived) changes in health outcomes before and during the COVID-19 lockdown***

Table 2 summarises the results of self-assessed health during COVID-19 lockdown compared to a year ago (and pre-COVID-19). Overall, most (over 60%) of all older adults reported their general, physical and mental health during COVID-19 lockdown restrictions were about the same as a year ago, pre-COVID-19. However, women were significantly more likely than men to report poorer physical health (p=0.035) and mental health (p=0.008) during COVID-19, compared to a year ago. There was no significant difference in the reporting of changes in general health for men and women, nor in the change of any health status (general, mental and physical) for those living in metropolitan cities compared to non-metropolitan regions (Table 2).

[Insert Table 2 about here]

However, there were significant differences in change of health status by participation settings for general and mental health, but not physical health. For general health, older adults participating only in clubs were more likely to report lower general health than those participating only in informal activities or those participating in both club and informal activities. Informal-only respondents were more likely to report improvement in general health scores (p=0.011). Changes in physical health did not significantly differ according to participation setting, and over 60% of all older adults reported that their physical health was about the same as last year. However more respondents reported that their physical health was worse (in comparison to those who reported it was better) during COVID-19 compared to pre-COVID-19. Regarding mental health, those participating only in informal activities were more likely than the other two groups to report either better or worse mental health during COVID-19 lockdowns. Those participating in only club activities or in both club and informal activities were more likely to report having about the same level of mental health during COVID-19 lockdown (p=0.014).

Regarding modes of participation, the only significant difference between older adults participating only individually, or only in team, or both, was in mental health changes. Those participating only in individual activities were more likely to report having worse mental health during COVID-19 lockdown, compared to those participating only in team activities or in both team and individual activities, and team-only respondents had the highest rates of improved mental health (p=0.002).

The results of general wellbeing, resilience and life satisfaction are presented in Table 3. Older men were reported higher general wellbeing and resilience than older women, although the difference was not significant. However, men reported significantly greater life satisfaction (mean 7.62; p=0.002) than women (mean 7.35). While there were no significant differences between those living in metropolitan or non-metropolitan areas, measures of wellbeing varied substantially across sport and physical activity settings and modes, with four of the six comparisons being statistically significant, and the remaining two falling just short of significance (Table 3). Regarding sport and physical activity settings, participants in both club and informal settings had the highest levels of general wellbeing (mean 3.88; p<0.001) and resilience (mean 3.88; p=0.025), Regarding modes of

participation, participants in both team and individual activities had the highest level of general wellbeing (mean 3.88; p=0.009). This group also scored high on life satisfaction (mean 7.67), but not quite as high as the team-only group (mean 7.69), with the individual-only group scoring significantly lower (mean 7.30; p<0.001).

[Insert Table 3 about here]

## Discussion

This study investigated the impact COVID-19 restrictions on perceived health and wellbeing of active Australian older adults. Specifically, we compared perceived levels of general health, physical health, and mental health during COVID-19, and changes in each from one year earlier before COVID-19, on the basis of gender, residential location, and activity modes and settings.

Many other studies on physical activity and COVID-19 are focused on youth and adults, and studies including older adults generally focus on changes in activity levels and mental health (Carriedo et al., 2020; Esain et al., 2021; Suzuki et al., 2020). Further, many other studies focus on total activity levels and change in activity but do not differentiate between different modes and settings of participation (García-Esquinas et al., 2021; Suzuki et al., 2020; Visser et al., 2020). This study focused on a range of health and wellbeing indicators and how these differ according to a variety of sport and physical activity participation modes and settings. In this study there were significant differences in perceived health, wellbeing and life satisfaction according to the type of activity and gender and residential location.

Overall, most (over 60%) of all older adults reported their general, physical and mental health during COVID-19 lockdown restrictions were about the same as a year ago, pre-COVID-19. This is somewhat surprising, however it could be related to the underlying health conditions and social isolation which are associated with older adults (Manca et al., 2020, Tyrrell & Williams, 2020). During COVID-19 lockdown in 2020 the older men reported significantly poorer general health, but significantly better life satisfaction, than older women. With regard to changes in health compared to pre-COVID-19, women were more likely than men to report a decline in physical and mental health.

This may be related to the fact that women often seek out social groups more than men (Drummond et al., 2017), and there is evidence that social isolation impact mental health more for older women than men (García-Portilla et al., 2020). However, these gender differences in health for older adults are not consistent. A study of older adults in Spain, which did not report gender differences (García-Esquinas et al., 2021). Noteworthy, while men's and women's health have largely been reduced to a discussion around men not accessing health services as much as women, there are underpinning reasons why some groups of men do not access health services. Indeed Mahalik and Dagirmanjian (2018) argue that this needs to be understood within a gendered and social context, and specifically traditional masculine norms (Mahalik & Backus Dagirmanjian, 2018). Traditional masculinities heavily underpinned by physical strength and toughness is the cornerstone of this ideology that influences men's decision making. Mahalik and Dagirmanjian (2018) claim in their research that men value the notion of annual check-ups and visiting health practitioners. However, it is the next step in getting them to there that is the difficult part (Mahalik & Backus Dagirmanjian, 2018).

Those living in non-metropolitan areas reported poorer physical health than for metropolitan areas. This is not surprising given the previously reported underlying health differences between these regions with those living in non-metropolitan areas generally having poorer health than those living in metropolitan cities (Wakerman & Humphreys, 2019). These health inequalities by region are further exacerbated by the lack of health care services and issues with access to care including telehealth due to poor internet, in regional and rural areas (Peters, 2020). No other regional differences were observed. There may be cultural differences in attitudes which are compounded by literal social isolation which is further amplified during the pandemic, and/or fewer opportunities to play sport and be active. Further in regional and rural communities sport plays such an important social role for the whole community. However, regional areas in general have limited choice for organised leisure-time physical activity compared to metropolitan areas (Eime et al., 2017). Therefore, older adults lost opportunity to spectate and volunteer in community sport, and be engaged socially with their communities in non-metropolitan regions many have impacted their health and wellbeing.

In terms of sport and physical activity status during COVID-19 lockdown, older adults who participated in diverse settings, in both club sport and informal sport and physical activity, had significantly better general health and physical health than those who participated solely in one of these settings or the other, with club-only participants reporting the poorest general health and physical health. The same pattern was observed for measures of general wellbeing and resilience. Also, regarding modes of participation, those participating in both team and individual activities reported better general wellbeing than those who participated solely in either team or individual activities. From a Self-Determination theory perspective, this could reflect how a combination of team and individual sport involvement optimally satisfy human psychological needs of control, competence and relatedness (Deci & Ryan, 2008). For example, an individual may possess several opportunities to remain socially connected if they are involved in a team sport environment. They may also benefit from demonstrating autonomy through having a wider range of sport and physical activity choices that can be sought out during the pandemic. By additionally engaging in individual-only sport and physical activity, the same individual may be able to satisfy their needs to feel competent through task choice and design (e.g. electing to go for a hard, fast run, or a slow leisurely walk). In this way, involvement in team and individual sport may have led to better general wellbeing compared to those who participated solely in either team or individual sports because they were more readily able to satisfy their basic psychological needs.

The pattern was slightly different for general and physical health, with the worst health reported by those who participated solely in team activities, and similar better response profiles for those who participated solely in individual activities or in both individual and team activities. Individual sports can be more readily adapted, modified and maintained in non-traditional settings compared to team-based sports. This has implications for how team sports develop resources and support for members to engage with during the next unexpected event. It seems that more diversity in activity status is associated with improved health and wellbeing and that may also be related to social support or social nature of participation. Particularly important for older adults' activity status is the social support (Lindsay Smith et al., 2017). Social support to be physically active for older adults helps them to be

physically active, especially when that support comes from family members (Lindsay Smith et al., 2017). Therefore, sports organisations need to consider how to support participation for older adults, especially those without immediate support from their families.

Regarding changes compared to pre-COVID-19, those who participated only in informal settings generally had the most positive profiles of health changes, while club-only participants had the most negative profiles of health change. It may be that sports club-only participants rely on sport more than others for their mental health and wellbeing (Elliott et al., 2021). The comparison was clearest and strongest for general health, weaker for physical health, and more complex for mental health, where the informal-only group exhibited the greatest variability, with the highest reported proportions of both better and worse health. These results may be a consequence of inability to engage in club-based sports during COVID-19 restrictions, while participation in informal activities such as walking or cycling was still possible.

On the other hand team-only respondents reported the most positive profile of health changes and the highest life satisfaction during COVID-19, which may be related to better social connectedness and sense of community through teammates and other club personnel providing a buffer effect on their wellbeing (Eime et al., 2013; Lindsay Smith et al., 2017). There are perceptions that team-based sports with large membership of players and volunteers have the access, infrastructure and literacy to remain connected during the pandemic using social media and online events to sustain connectedness (Elliott et al., 2021). It is plausible that sports with smaller membership, often characterised by individual and informal sports, experienced more barriers to remain connected with its membership by virtue of capacity. Such a perspective might encourage team-only and individual-only to share resources, ideas and platforms in order to keep older Australian adults in sport and physical activity as a strategy to support general, physical and mental health.

This study has limitations. It is based on data from a convenience sample, predominantly of Australian sports participants recruited with the assistance of NSOs and SSOs, in May and June 2020. The primary sample was supplemented by recruitment through social media, which resulted in an additional smaller sample of participants in only informal sport or other physical activity settings, and

an even smaller sample of physically inactive people. Consequently, the sample is subject to both known and unknown sources of bias, and caution must be exercised in generalising the results. Even within the primary club sport sample, the geographical coverage was uneven, depending on the strength of the relationships between the research team and the SSOs in the various states, and the capacities and priorities of different SSOs in the context of the unfolding COVID-19 situation. Nevertheless, on the other side of the ledger, the sample obtained was extremely large, and because respondents provided information about the multiple sports and other physical activities that they engaged in, there was comprehensive representation of the sporting codes and other types of recreational physical activity that are participated in by older adults in Australia.

## Conclusions

In conclusion those older adults active in a range of settings and modes had improved health and wellbeing. Perhaps those who were more active pre-COVID-19 had greater motivation and/or support to continue being active during COVID-19 restrictions. Social support is very important for people to become and remain physically active, and especially for older adults. Further, social support impacts the health and wellbeing of active adults. It is recommended that sport and community groups encourage diversity of activities for older adults and ensure social support mechanisms to maximise participation and health outcomes. The nature of diversifying activities and sporting opportunities must be engineered in a way that meets the needs of older Australian adults who seek informal, formal, individual and team sports and can be maintained in diverse settings (e.g. at home and at the local club) if long-term engagement in sport and physical activity are to be sustained. It is recommended that future research continue to measure participation and the range of health outcomes associated with participation and see how the return to sport post-COVD-19 can impact our health and wellbeing.

## AUTHOR'S NOTE

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*Conflict of interests*

The Author(s) declare(s) that there is no conflict of interest.

*Availability of data and materials*

The corresponding author can be contacted with regards to access to the study data.

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Table 1. Self-assessment of current health: by respondent characteristics

| Health assessments | Characteristics | p-value[1] |
|---|---|---|
| | Gender | |

| | Male | | Female | | |
|---|---|---|---|---|---|
| | N | % | N | % | |
| General health | | | | | .006 |
| Poor or fair | 130 | 11.0 | 57 | 8.8 | |
| Good | 438 | 36.9 | 203 | 31.3 | |
| Very good or excellent | 619 | 52.1 | 388 | 59.9 | |
| Total | 1187 | 100.0 | 648 | 100.0 | |
| Physical health | | | | | .329 |
| Poor or fair | 197 | 16.6 | 123 | 19.0 | |
| Good | 804 | 67.8 | 433 | 67.0 | |
| Very good or excellent | 185 | 15.6 | 90 | 13.9 | |
| Total | 1186 | 100.0 | 646 | 100.0 | |
| Mental health | | | | | .213 |
| Poor or fair | 181 | 15.4 | 90 | 14.0 | |
| Good | 481 | 40.9 | 245 | 38.0 | |
| Very good or excellent | 514 | 43.7 | 309 | 48.0 | |
| Total | 1176 | 100.0 | 644 | 100.0 | |
| | Region | | | | |
| | Metropolitan | | Non-metropolitan | | |
| | N | % | N | % | |
| General health | | | | | .070 |
| Poor or fair | 97 | 8.8 | 89 | 12.1 | |
| Good | 387 | 35.1 | 256 | 34.7 | |
| Very good or excellent | 618 | 56.1 | 393 | 53.3 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Total | 1102 | 100.0 | 738 | 100.0 | | | |
| | | | | | | | |
| Physical health | | | | | | | .929 |
| Poor or fair | 191 | 17.4 | 129 | 17.5 | | | |
| Good | 745 | 67.8 | 495 | 67.1 | | | |
| Very good or excellent | 163 | 14.8 | 114 | 15.4 | | | |
| Total | 1099 | 100.0 | 738 | 100.0 | | | |
| | | | | | | | |
| Mental health | | | | | | | .022 |
| Poor or fair | 144 | 13.2 | 127 | 17.3 | | | |
| Good | 430 | 39.4 | 297 | 40.5 | | | |
| Very good or excellent | 517 | 47.4 | 310 | 42.2 | | | |
| Total | 1091 | 100.0 | 734 | 100.0 | | | |
| | Sport and physical activity settings | | | | | | |
| | Club only | | Informal only | | Club and informal | | |
| | N | % | N | % | N | % | |
| General health | | | | | | | <.001 |
| Poor or fair | 75 | 15.9 | 6 | 9.7 | 106 | 8.1 | |
| Good | 207 | 43.9 | 22 | 35.5 | 415 | 31.7 | |
| Very good or excellent | 190 | 40.3 | 34 | 54.8 | 788 | 60.2 | |
| Total | 472 | 100.0 | 62 | 100.0 | 1309 | 100.0 | |
| | | | | | | | |
| Physical health | | | | | | | .024 |
| Poor or fair | 102 | 21.7 | 9 | 14.8 | 210 | 16.1 | |
| Good | 311 | 66.0 | 39 | 63.9 | 892 | 68.2 | |
| Very good or excellent | 58 | 12.3 | 13 | 21.3 | 206 | 15.7 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Total | 471 | 100.0 | 61 | 100.0 | 1308 | 100.0 | |
| Mental health | | | | | | | <.001 |
| Poor or fair | 108 | 23.1 | 12 | 19.4 | 152 | 11.7 | |
| Good | 204 | 43.7 | 20 | 32.3 | 504 | 38.8 | |
| Very good or excellent | 155 | 33.2 | 30 | 48.4 | 643 | 49.5 | |
| Total | 467 | 100.0 | 62 | 100.0 | 1299 | 100.0 | |

| | Sport and physical activity modes | | | | | | |
|---|---|---|---|---|---|---|---|
| | Team only | | Individual only | | Team and individual | | |
| | N | % | N | % | N | % | |
| General health | | | | | | | <.001 |
| Poor or fair | 43 | 14.6 | 72 | 10.3 | 72 | 8.4 | |
| Good | 134 | 45.6 | 215 | 30.9 | 295 | 34.6 | |
| Very good or excellent | 117 | 39.8 | 409 | 58.8 | 486 | 57.0 | |
| Total | 294 | 100.0 | 696 | 100.0 | 853 | 100.0 | |
| Physical health | | | | | | | .128 |
| Poor or fair | 58 | 19.7 | 136 | 19.6 | 127 | 14.9 | |
| Good | 194 | 66.0 | 456 | 65.7 | 592 | 69.5 | |
| Very good or excellent | 42 | 14.3 | 102 | 14.7 | 133 | 15.6 | |
| Total | 294 | 100.0 | 694 | 100.0 | 852 | 100.0 | |
| Mental health | | | | | | | <.001 |
| Poor or fair | 64 | 22.0 | 100 | 14.5 | 108 | 12.8 | |
| Good | 132 | 45.4 | 249 | 36.0 | 347 | 41.1 | |
| Very good or excellent | 95 | 32.6 | 343 | 49.6 | 390 | 46.2 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Total | 291 | 100.0 | 692 | 100.0 | 845 | 100.0 |

[1] Chi-square test of independence

Table 2. Self-assessment of current health compared to one year ago: by respondent characteristics

| Health assessments | Characteristics | | | | p-value[1] |
|---|---|---|---|---|---|
| | Gender | | | | |
| | Male | | Female | | |
| | N | % | N | % | |
| General health | | | | | .032 |
| Worse or much worse | 229 | 19.4 | 158 | 24.6 | |
| About the same | 758 | 64.1 | 389 | 60.5 | |
| Better or much better | 196 | 16.6 | 96 | 14.9 | |
| Total | 1183 | 100.0 | 643 | 100.0 | |
| Physical health | | | | | .157 |
| Worse or much worse | 135 | 11.4 | 79 | 12.3 | |
| About the same | 334 | 28.2 | 205 | 31.9 | |
| Better or much better | 716 | 60.4 | 359 | 55.8 | |
| Total | 1185 | 100.0 | 643 | 100.0 | |
| Mental health | | | | | .009 |
| Worse or much worse | 218 | 18.4 | 156 | 24.1 | |
| About the same | 863 | 72.8 | 446 | 68.9 | |
| Better or much better | 105 | 8.9 | 45 | 7.0 | |
| Total | 1186 | 100.0 | 647 | 100.0 | |
| | Region | | | | |
| | Metropolitan | | Non-metropolitan | | |
| | N | % | N | % | |
| General health | | | | | .990 |
| Worse or much worse | 231 | 21.1 | 156 | 21.2 | |
| About the same | 688 | 62.8 | 462 | 62.9 | |
| Better or much better | 177 | 16.1 | 117 | 15.9 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Total | 1096 | 100.0 | 735 | 100.0 | | | |
| Physical health | | | | | | | .293 |
| Worse or much worse | 118 | 10.8 | 97 | 13.2 | | | |
| About the same | 328 | 30.0 | 212 | 28.8 | | | |
| Better or much better | 649 | 59.3 | 428 | 58.1 | | | |
| Total | 1095 | 100.0 | 737 | 100.0 | | | |
| Mental health | | | | | | | .834 |
| Worse or much worse | 222 | 20.2 | 153 | 20.7 | | | |
| About the same | 784 | 71.3 | 529 | 71.6 | | | |
| Better or much better | 93 | 8.5 | 57 | 7.7 | | | |
| Total | 1099 | 100.0 | 739 | 100.0 | | | |

| | Sport and physical activity settings | | | | | | |
|---|---|---|---|---|---|---|---|
| | Club only | | Informal only | | Club and informal | | |
| | N | % | N | % | N | % | |
| General health | | | | | | | .046 |
| Worse or much worse | 114 | 24.3 | 9 | 14.8 | 265 | 20.3 | |
| About the same | 295 | 62.8 | 37 | 60.7 | 820 | 62.9 | |
| Better or much better | 61 | 13.0 | 15 | 24.6 | 218 | 16.7 | |
| Total | 470 | 100.0 | 61 | 100.0 | 1303 | 100.0 | |
| Physical health | | | | | | | .051 |
| Worse or much worse | 69 | 14.7 | 8 | 12.9 | 138 | 10.6 | |
| About the same | 150 | 31.9 | 17 | 27.4 | 374 | 28.7 | |
| Better or much better | 251 | 53.4 | 37 | 59.7 | 791 | 60.7 | |
| Total | 470 | 100.0 | 62 | 100.0 | 1303 | 100.0 | |
| Mental health | | | | | | | .012 |
| Worse or much worse | 87 | 18.4 | 14 | 22.6 | 274 | 21.0 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| About the same | 349 | 73.8 | 36 | 58.1 | 930 | 71.2 | |
| Better or much better | 37 | 7.8 | 12 | 19.4 | 102 | 7.8 | |
| Total | 473 | 100.0 | 62 | 100.0 | 1306 | 100.0 | |

| | Sport and physical activity modes | | | | | | |
|---|---|---|---|---|---|---|---|
| | Team only | | Individual only | | Team and individual | | |
| | N | % | N | % | N | % | |
| General health | | | | | | | .253 |
| Worse or much worse | 67 | 22.9 | 160 | 23.1 | 161 | 19.0 | |
| About the same | 185 | 63.1 | 421 | 60.8 | 546 | 64.3 | |
| Better or much better | 41 | 14.0 | 111 | 16.0 | 142 | 16.7 | |
| Total | 293 | 100.0 | 692 | 100.0 | 849 | 100.0 | |
| Physical health | | | | | | | .200 |
| Worse or much worse | 38 | 12.9 | 94 | 13.6 | 83 | 9.8 | |
| About the same | 87 | 29.6 | 200 | 28.9 | 254 | 29.9 | |
| Better or much better | 169 | 57.5 | 397 | 57.5 | 513 | 60.4 | |
| Total | 294 | 100.0 | 691 | 100.0 | 850 | 100.0 | |
| Mental health | | | | | | | .002 |
| Worse or much worse | 45 | 15.3 | 174 | 25.0 | 156 | 18.4 | |
| About the same | 220 | 74.6 | 470 | 67.5 | 625 | 73.5 | |
| Better or much better | 30 | 10.2 | 52 | 7.5 | 69 | 8.1 | |
| Total | 295 | 100.0 | 696 | 100.0 | 850 | 100.0 | |

[1] Chi-square test of independence

Table 3. Measures of wellbeing[1]: by four respondent characteristics

| Measure | Characteristics | | | | | | | | | p-value[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| | N | Mean | SD | N | Mean | SD | N | Mean | SD | |
| | Gender | | | | | | | | | |
| | Male | | | Female | | | | | | |
| General wellbeing | 1105 | 3.85 | 0.555 | 596 | 3.80 | 0.60 | | | | .068 |
| Resilience | 1135 | 3.85 | 0.579 | 625 | 3.81 | 0.59 | | | | .291 |
| Life satisfaction | 1162 | 7.62 | 1.580 | 632 | 7.35 | 1.88 | | | | .001 |
| | Region | | | | | | | | | |
| | Metropolitan | | | Non-metropolitan | | | | | | |
| General wellbeing | 1023 | 3.85 | 0.571 | 682 | 3.82 | 0.57 | | | | .285 |
| Resilience | 1060 | 3.84 | 0.584 | 703 | 3.83 | 0.58 | | | | .590 |
| Life satisfaction | 1077 | 7.52 | 1.667 | 720 | 7.54 | 1.73 | | | | .861 |
| | Sport and physical activity settings | | | | | | | | | |
| | Club only | | | Informal only | | | Club and informal | | | |
| General wellbeing | 432 | 3.73 | 0.614 | 59 | 3.72 | 0.61 | 1217 | 3.87 | 0.55 | <.001 |
| Resilience | 451 | 3.78 | 0.612 | 59 | 3.77 | 0.53 | 1256 | 3.86 | 0.57 | .031 |
| Life satisfaction | 459 | 7.41 | 1.902 | 60 | 7.32 | 1.67 | 1281 | 7.58 | 1.61 | .109 |
| | Sport and physical activity modes | | | | | | | | | |
| | Team only | | | Individual only | | | Team and individual | | | |
| General wellbeing | 269 | 3.78 | 0.582 | 656 | 3.80 | 0.61 | 783 | 3.88 | 0.53 | .009 |
| Resilience | 281 | 3.77 | 0.586 | 672 | 3.83 | 0.60 | 813 | 3.86 | 0.57 | .087 |
| Life satisfaction | 287 | 7.69 | 1.689 | 684 | 7.30 | 1.88 | 829 | 7.67 | 1.50 | <.001 |

[1] General wellbeing: 14 items, scale 1-5. Resilience: 4 items, scale 1-5. Life satisfaction: 1 item, scale 1-10

[2] Independent samples t-test (2 groups) F-test (3 groups)

# The impact of COVID-19 restrictions on perceived health and wellbeing of active Australian older adults

**Abstract**

The aim of this study was to determine the impact of COVID-19 restrictions on older adults' perceived health and wellbeing, according to different types of participation in sport and physical activity by gender and region. A survey was implemented during the first COVID-19 lockdown in Australia (June 2020) and collected information on demographics, sport and physical activity patterns pre-COVID-19, and health and wellbeing outcomes during lockdown and compared to one year earlier. During COVID-19 lockdown, older adults who participated in both club sport and informal activities had significantly better general health, physical health and resilience than those who participated solely in a single setting. Those participating in both team and individual activities reported better general wellbeing. Older adults that were active in a range of settings and modes had improved health and wellbeing. Social support is especially important for older adults to become and remain active.

**Key words**: ageing, physical activity, sport participation, settings

## Introduction

[Removed for anonymity] had its first reported COVID-19 case in January 2020, and on March 11th the World Health Organisation declared COVID-19 a pandemic, and following this all [removed for anonymity] borders were closed on March 25th (Karg et al., 2021). Throughout March 2020 there was widespread cancellation of elite and community sport in [removed for anonymity], and then in May, there were return to sport guidelines developed by National and State Governments. By mid-October restrictions were significantly eased in the [removed for anonymity] State of Victoria which was the most impacted State until then (Karg et al., 2021). From early August to the 21st of October, 2021, the city of [removed for anonymity] was in lockdown again with another cancellation of community sport competitions and restrictions on general exercise (Chief Health Officer, 2021).

The lockdowns and restrictions on movement and social connectedness throughout 2020 and 2021 impact vulnerable groups like older adults to a greater extent, and in particular relation to their health (De Pue et al., 2021; Manca et al., 2020). Older adults are a susceptible population group to critical and fatal COVID-19 (Piniella-Ruiz et al., 2021; Shahid et al., 2020), and often have underlying health conditions and sometimes few economic resources (Henning-Smith, 2020; Li & Mutchler, 2020; Shahid et al., 2020). A Belgian study demonstrated that 93% of COVID-19 related deaths were people aged 65 or older (De Pue et al., 2021). Studies have demonstrated that the virus can cause worse physical health outcomes and a higher mortality rate in older adults and those with comorbidities such as hypertension, cardiovascular disease, diabetes, chronic respiratory disease, and chronic kidney disease (Shahid et al., 2020).

Further, COVID-19 presents unique risks to the emotional and social well-being of older adults (Henning-Smith, 2020). Older adults are disconnected from society through COVID-19 restrictions and many without online virtual connectedness are at greater risk of loneliness and isolation (Henning-Smith, 2020). Further they are challenged to meet their basic daily needs, with grocery shopping, accessing health care and having assistance in their homes all adding additional health risks (Henning-Smith, 2020). Whilst social distancing is supposed to protect at-risk population groups like older adults, it in fact introduces further complications to their health and wellbeing (Tyrrell &

Williams, 2020). Loneliness and social isolation have substantial effects on mental and physical health and specifically for older adults (Tyrrell & Williams, 2020). Globally, many older adults were and continue to be separated from family members and other close friends, which restricts caregiving and other resources and connections (Tyrrell & Williams, 2020).

The social isolation and loneliness negatively impacts mental health in older adults, and may predispose to cognitive decline (Manca et al., 2020) and contribute to depression and anxiety in older adults (García-Portilla et al., 2020). There is also evidence that older women may be more impacted than men (García-Portilla et al., 2020). In a Spanish study of adults aged 60 years or older, women scored significantly worse in the five psychological domains. Further, 53% of women and 34% of men were emotionally distressed, and a 29% of women and 14% of men were depressed (García-Portilla et al., 2020). In a cross-sectional Belgian study of older adults 65+, depression was strongly related to reported declines in activity level, sleep quality, wellbeing and cognitive functioning (De Pue et al., 2021). With regard to wellbeing, a study of older adults reported that the most prominent decreases were for general life satisfaction, safety, community connectedness and future security (De Pue et al., 2021).

The social distancing restrictions for older adults also places them at risk of a decline in their physical health (Tyrrell & Williams, 2020). Many of the studies of physical activity and older adults also report other psychological, mental health and general wellbeing outcomes (Carriedo et al., 2020; De Pue et al., 2021; Suzuki et al., 2020; Visser et al., 2020). In a Belgian study, half of all older adults reported a significant decrease in physical activity in the past week compared to before COVID-19, as well as deteriorating sleep quality and wellbeing (De Pue et al., 2021). Similarly, in a Dutch study of older adults, approximately half reported a decrease in physical activity, and those in self-quarantine had significantly lower levels of physical activity (Visser et al., 2020). Similarly, a Japanese study of older adults reported that 48% were less active and there was a significant decrease in subjective wellbeing in the less active group of older adults (Suzuki et al., 2020). The COVID-19 restrictions impacted the physical activity of older adults, and especially those who had higher levels of physical activity and lower health-related quality of life before COVID-19 (Suzuki et al., 2020). A Spanish

study of older adults (60+ years) reported that those older adults who met the physical activity recommendations during lockdown had higher resilience, positive affect and lower depressive symptoms (Carriedo et al., 2020).

As summarised above, much of the literature on the impact of COVID-19 on older adults' health and wellbeing has focused on social and mental health and wellbeing. Some also focus on levels of physical activity in surveys of the general population. However, there is no detail of the different modes and settings of participation in physical activity. This may be an important factor above and beyond the health benefits of general physical activity, because we know that being active in different ways can impact health differently (Eime et al., 2013). For example, participation in sport specifically can have greater psychological and social health benefits than being active alone (Eime et al., 2013). There is consistent evidence that older adults are motivated to be active for social reasons, that is to be active with others, which sport can provide (Jenkin et al., 2018; Lindsay-Smith et al., 2019). This relates to both physical activity in general (Lindsay-Smith et al., 2019; Lindsay Smith et al., 2017), and specifically to sport (Jenkin et al., 2018). The social aspects of participation in physical activity contributes to enjoyment and positive mental health benefits (Lindsay-Smith et al., 2019) and helps to prevent loneliness (Lindsay Smith et al., 2017). In relation to sport, older adults report benefits of participation to include social, physical and mental health (Jenkin et al., 2018). The most prominent reported outcome is social health and wellbeing (Jenkin et al., 2018)

There is limited research on older adults' participation in community sport. Most research has been targeted at the young and elite sport participants, or has focused on physical activity in general and not specifically on participation in community sport. In this paper we seek to determine the association between various demographic and sport participation characteristics of older adults and their perceived health and perceived changes in health under the impact of COVID-19 related restrictions. Specifically, we investigated the levels of perceived health and perceived changes in health across genders, age groups, regions and different modes (e.g. team versus individual activities) and settings (e.g. club-based versus informal activities) of participation in sport and physical activity.

## Methods

This study is part of a broader program of research in [removed for anonymity] which involves the longitudinal measurement of sport and physical activity participation and the physical, mental and social health and wellbeing outcomes of this participation. This study was conducted via two waves of online surveying during the COVID-19 period (2020 and 2021), the first of which also included participation and health data that related to the pre-COVID-19 baseline in 2019. Ethics approval was granted by the Human Research Ethics Committee of [removed for anonymity] (HRE20-049), and [removed for anonymity] (8654), and thus conducted in accordance with the Declaration of Helsinki. In the online survey, potential respondents were first presented with an information sheet about the study, which detailed all the research procedures, including their rights to anonymity and confidentiality. Following this information, survey respondents had to indicate their consent to participate in this study before commencing the survey.

The present study is based on data collected in the first wave using an online survey conducted during May and June 2020. Recruitment to the survey was primarily facilitated by sports including Australian football, bowls, cricket, golf, tennis and football (soccer). The present study is one of three age-based studies, each focusing on a different stage of the lifespan. The other studies are focused on adolescence (13-17 years) and adults (18-59 years). The current study is focused on older adults. The target population was adults aged 60+ years at the time of the survey who were registered in the 2019 and/or 2020 playing seasons to participate in one or more sports. The sports organisations that sent out the invitation to the survey to their registered participants, represent major sports in Victoria and Australia (Eime et al., 2020). The research team has previous experience with working with all these sports at national, state and local levels.

In order to broaden the scope of the survey sample to include people who participate in recreational physical activity only, in settings other than sports clubs, and potentially also people who do not participate in any recreational physical activity, the primary recruitment strategy was supplemented by

the use of snowball sampling, through social media pages of sports organisations and research-oriented social media pages (e.g. research teams social media pages).

The first wave, or baseline, of the longitudinal survey included, among many other, questions about:

- Demographic characteristics – gender, date of birth, and residential postcode
- Types of sports and other recreational physical activities participated in
- Settings in which the participation occurred – sports clubs and other less structured informal settings
- Modes of participation – team and individual modes of activity
- Self-assessed general health, physical health and mental health.
- Measures of wellbeing – general wellbeing, resilience and life satisfaction.

Date of birth was used to determine age in years at the time the survey was completed. Residential postcode concordances (Australian Bureau of Statistics, 2016) were used to assign each postcode to one of two broad geographical zones or regions: Metropolitan, comprising the capital cities of the Australian states; and non-metropolitan, comprising regional cities, towns and rural areas.

Regarding sport and physical activity, two separate sections of the survey dealt respectively with two 'settings': organised club sport involving membership and registration (designated 'club'), and more informal sport and recreational physical activity (designated 'informal'). In each section, a list of the most common activities was presented – 16 for club sports and 26 for informal (including 12 of the 16 club sports). Respondents indicated which activities they participated in, with provision for adding other activities that were not listed. On the basis of these responses, a combined list of 88 activities was established. Further, each of the 88 activities was classified as either 'team' or 'individual'. Each respondent was then assigned a category for each of 'settings' (club only, club and informal, informal only, and inactive) and 'modes' (team only, team and individual, individual only, inactive).

Six survey items were devoted to self-assessed health – three pertaining to the time of the survey (during COVID-19 lockdown) and three comparing current health to health 12 months prior to the survey (before COVID-19). The general health item was a 5-point Likert scale item (poor, fair, good,

very good, excellent) derived from the Short-form Health Survey (SF-36) instrument (Ware Jr et al., 1993). The same format was used for the assessment of physical health and mental health. The three comparative items used a 5-point Likert scale (much worse, somewhat worse, about the same, somewhat better, much better).

General wellbeing was assessed using a scale derived by averaging the responses to a battery of 14 items regarding frequency of positive and negative feelings in the two weeks prior to the survey. Most of the content was informed by the existing literature (Australian Institute of Health and Welfare, 2012; Ware Jr et al., 1993), supplemented by three items developed by the research team to address negative feelings likely to be exacerbated by COVID-19. Each item was scored on a 5-point scale (all of the time, most, some, a little, none), with reverse coding of the negative items so that higher average scores represented greater wellbeing.

Resilience was similarly assessed using a scale derived by averaging the responses to a battery of four items, three derived from the brief resilience scale (BRS) (Smith et al., 2008) supplemented by an item framed regarding challenges, regarded by the research team as appropriate wording for sport-focused respondents. Each item consisted of a statement about the respondent, with responses on a 5-point scale (strongly agree, agree, neutral or unsure, disagree, strongly disagree).

Life satisfaction was assessed using a direct question (Women's Health Australia, 2008

) with the response on a 10-point scale from 1 (least satisfied) to 10 (most satisfied).

*Statistical analysis*

For the purpose of tabulation and statistical analysis, the six 5-category health items were recoded into three categories. Regarding sport and physical activity settings and modes, there were insufficient 'inactive' responses in the older adult cohort for valid and meaningful statistical analysis, and so these were excluded from the analysis. Consequently, the variable 'settings of sport and physical activity' was reduced to three categories (club including club and informal, informal only) and the variable 'modes of sport and physical activity' was similarly reduced to three categories (team only, team and individual, individual only).

The six recoded health items were each cross-tabulated against four respondent characteristics: gender, region, settings of sport and physical activity, and modes of sport and physical activity. Chi-square tests of independence were conducted to identify differences in the health profiles of the groups defined by each of the characteristics.

For the measures of general wellbeing, resilience and life satisfaction, mean values for the groups defined by each of the five characteristics were tabulated, and group differences were analysed using independent samples t-tests (for two groups) and F-tests (for three groups).

## Results

The survey was completed by 1836 active older adults (60+ years) – 1188 men (65%) and 648 women (35%) (Table 1). Their age ranged from 60 to 92 years, with mean 69.8 years and SD 6.4 years. Most respondents resided in metropolitan cities (60%) compared to non-metropolitan regions (40%) (Table 1). The majority participated in both club and informal sport and physical activity (71%) followed by club only (26%) and informal only (3%). Nearly half participated in team and individual sport and physical activities (46%), followed by individual only activities (38%) and then team only sports (16%) (Table 1).

[Insert Table 1 about here]

### *Health outcomes during COVID-19 lockdown/restriction*

There was a significant difference between reports of general health during COVID-19 lockdown for men and women (p=0.006) (Table 1). Men were more likely to report poor/fair general health (11%) than women (9%) and women were more likely to report very good or excellent general health than men. There was no significant difference between men and women for physical health or mental health. Of all respondents, over 40% reported very good or excellent physical health (men 44%, women 48%) and over half reported very good or excellent mental health (men 60%, women 56%) (Table 1).

When comparing non-metropolitan and metropolitan residents there were some significant health differences. Older adults living in non-metropolitan regions were significantly more likely to report poor or fair physical health, and in contrast those living in metropolitan cities were significantly more likely to report higher rates of very good or excellent physical health (p=0.022). Older adults living in metropolitan cities were more likely to report very good or excellent general health compared to those living in non-metropolitan areas, however this difference was not significant (p=0.07)

With regards to the settings of participation in sport and physical activity, older adults participating in both club sport and informal sport and physical activity were significantly more likely than those who only participated in one type of setting (club or informal) to report better general health and physical health (both p<0.001). They were also more likely to report better mental health, however this was not quite significant (p=0.054).

In terms of the mode of participation, those participating in individual-only activities had significantly higher reported general health and physical health (both p<0.001), than those who participated in team-only or in both team and individual activities. There was no significant difference in reported mental health, and over 50% of people within each sport and physical activity mode reported very good or excellent mental health.

***(Perceived) changes in health outcomes before and during the COVID-19 lockdown***

Table 2 summarises the results of self-assessed health during COVID-19 lockdown compared to a year ago (and pre-COVID-19). Overall, most (over 60%) of all older adults reported their general, physical and mental health during COVID-19 lockdown restrictions were about the same as a year ago, pre-COVID-19. However, women were significantly more likely than men to report poorer physical health (p=0.035) and mental health (p=0.008) during COVID-19, compared to a year ago. There was no significant difference in the reporting of changes in general health for men and women, nor in the change of any health status (general, mental and physical) for those living in metropolitan cities compared to non-metropolitan regions (Table 2).

[Insert Table 2 about here]

However, there were significant differences in change of health status by participation settings for general and mental health, but not physical health. For general health, older adults participating only in clubs were more likely to report lower general health than those participating only in informal activities or those participating in both club and informal activities. Informal-only respondents were more likely to report improvement in general health scores (p=0.011). Changes in physical health did not significantly differ according to participation setting, and over 60% of all older adults reported that their physical health was about the same as last year. However more respondents reported that their physical health was worse (in comparison to those who reported it was better) during COVID-19 compared to pre-COVID-19. Regarding mental health, those participating only in informal activities were more likely than the other two groups to report either better or worse mental health during COVID-19 lockdowns. Those participating in only club activities or in both club and informal activities were more likely to report having about the same level of mental health during COVID-19 lockdown (p=0.014).

Regarding modes of participation, the only significant difference between older adults participating only individually, or only in team, or both, was in mental health changes. Those participating only in individual activities were more likely to report having worse mental health during COVID-19 lockdown, compared to those participating only in team activities or in both team and individual activities, and team-only respondents had the highest rates of improved mental health (p=0.002).

The results of general wellbeing, resilience and life satisfaction are presented in Table 3. Older men were reported higher general wellbeing and resilience than older women, although the difference was not significant. However, men reported significantly greater life satisfaction (mean 7.62; p=0.002) than women (mean 7.35). While there were no significant differences between those living in metropolitan or non-metropolitan areas, measures of wellbeing varied substantially across sport and physical activity settings and modes, with four of the six comparisons being statistically significant, and the remaining two falling just short of significance (Table 3). Regarding sport and physical activity settings, participants in both club and informal settings had the highest levels of general wellbeing (mean 3.88; p<0.001) and resilience (mean 3.88; p=0.025), Regarding modes of

participation, participants in both team and individual activities had the highest level of general wellbeing (mean 3.88; p=0.009). This group also scored high on life satisfaction (mean 7.67), but not quite as high as the team-only group (mean 7.69), with the individual-only group scoring significantly lower (mean 7.30; p<0.001).

[Insert Table 3 about here]

## Discussion

This study investigated the impact COVID-19 restrictions on perceived health and wellbeing of active Australian older adults. Specifically, we compared perceived levels of general health, physical health, and mental health during COVID-19, and changes in each from one year earlier before COVID-19, on the basis of gender, residential location, and activity modes and settings.

Many other studies on physical activity and COVID-19 are focused on youth and adults, and studies including older adults generally focus on changes in activity levels and mental health (Carriedo et al., 2020; Esain et al., 2021; Suzuki et al., 2020). Further, many other studies focus on total activity levels and change in activity but do not differentiate between different modes and settings of participation (García-Esquinas et al., 2021; Suzuki et al., 2020; Visser et al., 2020). This study focused on a range of health and wellbeing indicators and how these differ according to a variety of sport and physical activity participation modes and settings. In this study there were significant differences in perceived health, wellbeing and life satisfaction according to the type of activity and gender and residential location.

Overall, most (over 60%) of all older adults reported their general, physical and mental health during COVID-19 lockdown restrictions were about the same as a year ago, pre-COVID-19. This is somewhat surprising, however it could be related to the underlying health conditions and social isolation which are associated with older adults (Manca et al., 2020, Tyrrell & Williams, 2020). During COVID-19 lockdown in 2020 the older men reported significantly poorer general health, but significantly better life satisfaction, than older women. With regard to changes in health compared to pre-COVID-19, women were more likely than men to report a decline in physical and mental health.

This may be related to the fact that women often seek out social groups more than men (Drummond et al., 2017), and there is evidence that social isolation impact mental health more for older women than men (García-Portilla et al., 2020). However, these gender differences in health for older adults are not consistent. A study of older adults in Spain, which did not report gender differences (García-Esquinas et al., 2021). Noteworthy, while men's and women's health have largely been reduced to a discussion around men not accessing health services as much as women, there are underpinning reasons why some groups of men do not access health services. Indeed Mahalik and Dagirmanjian (2018) argue that this needs to be understood within a gendered and social context, and specifically traditional masculine norms (Mahalik & Backus Dagirmanjian, 2018). Traditional masculinities heavily underpinned by physical strength and toughness is the cornerstone of this ideology that influences men's decision making. Mahalik and Dagirmanjian (2018) claim in their research that men value the notion of annual check-ups and visiting health practitioners. However, it is the next step in getting them to there that is the difficult part (Mahalik & Backus Dagirmanjian, 2018).

Those living in non-metropolitan areas reported poorer physical health than for metropolitan areas. This is not surprising given the previously reported underlying health differences between these regions with those living in non-metropolitan areas generally having poorer health than those living in metropolitan cities (Wakerman & Humphreys, 2019). These health inequalities by region are further exacerbated by the lack of health care services and issues with access to care including telehealth due to poor internet, in regional and rural areas (Peters, 2020). No other regional differences were observed. There may be cultural differences in attitudes which are compounded by literal social isolation which is further amplified during the pandemic, and/or fewer opportunities to play sport and be active. Further in regional and rural communities sport plays such an important social role for the whole community. However, regional areas in general have limited choice for organised leisure-time physical activity compared to metropolitan areas (Eime et al., 2017). Therefore, older adults lost opportunity to spectate and volunteer in community sport, and be engaged socially with their communities in non-metropolitan regions many have impacted their health and wellbeing.

In terms of sport and physical activity status during COVID-19 lockdown, older adults who participated in diverse settings, in both club sport and informal sport and physical activity, had significantly better general health and physical health than those who participated solely in one of these settings or the other, with club-only participants reporting the poorest general health and physical health. The same pattern was observed for measures of general wellbeing and resilience. Also, regarding modes of participation, those participating in both team and individual activities reported better general wellbeing than those who participated solely in either team or individual activities. From a Self-Determination theory perspective, this could reflect how a combination of team and individual sport involvement optimally satisfy human psychological needs of control, competence and relatedness (Deci & Ryan, 2008). For example, an individual may possess several opportunities to remain socially connected if they are involved in a team sport environment. They may also benefit from demonstrating autonomy through having a wider range of sport and physical activity choices that can be sought out during the pandemic. By additionally engaging in individual-only sport and physical activity, the same individual may be able to satisfy their needs to feel competent through task choice and design (e.g. electing to go for a hard, fast run, or a slow leisurely walk). In this way, involvement in team and individual sport may have led to better general wellbeing compared to those who participated solely in either team or individual sports because they were more readily able to satisfy their basic psychological needs.

The pattern was slightly different for general and physical health, with the worst health reported by those who participated solely in team activities, and similar better response profiles for those who participated solely in individual activities or in both individual and team activities. Individual sports can be more readily adapted, modified and maintained in non-traditional settings compared to team-based sports. This has implications for how team sports develop resources and support for members to engage with during the next unexpected event. It seems that more diversity in activity status is associated with improved health and wellbeing and that may also be related to social support or social nature of participation. Particularly important for older adults' activity status is the social support (Lindsay Smith et al., 2017). Social support to be physically active for older adults helps them to be

physically active, especially when that support comes from family members (Lindsay Smith et al., 2017). Therefore, sports organisations need to consider how to support participation for older adults, especially those without immediate support from their families.

Regarding changes compared to pre-COVID-19, those who participated only in informal settings generally had the most positive profiles of health changes, while club-only participants had the most negative profiles of health change. It may be that sports club-only participants rely on sport more than others for their mental health and wellbeing (Elliott et al., 2021). The comparison was clearest and strongest for general health, weaker for physical health, and more complex for mental health, where the informal-only group exhibited the greatest variability, with the highest reported proportions of both better and worse health. These results may be a consequence of inability to engage in club-based sports during COVID-19 restrictions, while participation in informal activities such as walking or cycling was still possible.

On the other hand team-only respondents reported the most positive profile of health changes and the highest life satisfaction during COVID-19, which may be related to better social connectedness and sense of community through teammates and other club personnel providing a buffer effect on their wellbeing (Eime et al., 2013; Lindsay Smith et al., 2017). There are perceptions that team-based sports with large membership of players and volunteers have the access, infrastructure and literacy to remain connected during the pandemic using social media and online events to sustain connectedness (Elliott et al., 2021). It is plausible that sports with smaller membership, often characterised by individual and informal sports, experienced more barriers to remain connected with its membership by virtue of capacity. Such a perspective might encourage team-only and individual-only to share resources, ideas and platforms in order to keep older Australian adults in sport and physical activity as a strategy to support general, physical and mental health.

This study has limitations. It is based on data from a convenience sample, predominantly of Australian sports participants recruited with the assistance of NSOs and SSOs, in May and June 2020. The primary sample was supplemented by recruitment through social media, which resulted in an additional smaller sample of participants in only informal sport or other physical activity settings, and

an even smaller sample of physically inactive people. Consequently, the sample is subject to both known and unknown sources of bias, and caution must be exercised in generalising the results. Even within the primary club sport sample, the geographical coverage was uneven, depending on the strength of the relationships between the research team and the SSOs in the various states, and the capacities and priorities of different SSOs in the context of the unfolding COVID-19 situation. Nevertheless, on the other side of the ledger, the sample obtained was extremely large, and because respondents provided information about the multiple sports and other physical activities that they engaged in, there was comprehensive representation of the sporting codes and other types of recreational physical activity that are participated in by older adults in Australia.

## Conclusions

In conclusion those older adults active in a range of settings and modes had improved health and wellbeing. Perhaps those who were more active pre-COVID-19 had greater motivation and/or support to continue being active during COVID-19 restrictions. Social support is very important for people to become and remain physically active, and especially for older adults. Further, social support impacts the health and wellbeing of active adults. It is recommended that sport and community groups encourage diversity of activities for older adults and ensure social support mechanisms to maximise participation and health outcomes. The nature of diversifying activities and sporting opportunities must be engineered in a way that meets the needs of older Australian adults who seek informal, formal, individual and team sports and can be maintained in diverse settings (e.g. at home and at the local club) if long-term engagement in sport and physical activity are to be sustained. It is recommended that future research continue to measure participation and the range of health outcomes associated with participation and see how the return to sport post-COVD-19 can impact our health and wellbeing.

## AUTHOR'S NOTE

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*Conflict of interests*

The Author(s) declare(s) that there is no conflict of interest.

*Availability of data and materials*

The corresponding author can be contacted with regards to access to the study data.

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Table 1. Self-assessment of current health: by respondent characteristics

| Health assessments | Characteristics | p-value[1] |
|---|---|---|
| | Gender | |

| | Male | | Female | | |
|---|---|---|---|---|---|
| | N | % | N | % | |
| General health | | | | | .006 |
| Poor or fair | 130 | 11.0 | 57 | 8.8 | |
| Good | 438 | 36.9 | 203 | 31.3 | |
| Very good or excellent | 619 | 52.1 | 388 | 59.9 | |
| Total | 1187 | 100.0 | 648 | 100.0 | |
| Physical health | | | | | .329 |
| Poor or fair | 197 | 16.6 | 123 | 19.0 | |
| Good | 804 | 67.8 | 433 | 67.0 | |
| Very good or excellent | 185 | 15.6 | 90 | 13.9 | |
| Total | 1186 | 100.0 | 646 | 100.0 | |
| Mental health | | | | | .213 |
| Poor or fair | 181 | 15.4 | 90 | 14.0 | |
| Good | 481 | 40.9 | 245 | 38.0 | |
| Very good or excellent | 514 | 43.7 | 309 | 48.0 | |
| Total | 1176 | 100.0 | 644 | 100.0 | |
| | Region | | | | |
| | Metropolitan | | Non-metropolitan | | |
| | N | % | N | % | |
| General health | | | | | .070 |
| Poor or fair | 97 | 8.8 | 89 | 12.1 | |
| Good | 387 | 35.1 | 256 | 34.7 | |
| Very good or excellent | 618 | 56.1 | 393 | 53.3 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Total | 1102 | 100.0 | 738 | 100.0 | | | |
| | | | | | | | |
| Physical health | | | | | | | .929 |
| Poor or fair | 191 | 17.4 | 129 | 17.5 | | | |
| Good | 745 | 67.8 | 495 | 67.1 | | | |
| Very good or excellent | 163 | 14.8 | 114 | 15.4 | | | |
| Total | 1099 | 100.0 | 738 | 100.0 | | | |
| | | | | | | | |
| Mental health | | | | | | | .022 |
| Poor or fair | 144 | 13.2 | 127 | 17.3 | | | |
| Good | 430 | 39.4 | 297 | 40.5 | | | |
| Very good or excellent | 517 | 47.4 | 310 | 42.2 | | | |
| Total | 1091 | 100.0 | 734 | 100.0 | | | |

| | Sport and physical activity settings | | | | | | |
|---|---|---|---|---|---|---|---|
| | Club only | | Informal only | | Club and informal | | |
| | N | % | N | % | N | % | |
| General health | | | | | | | <.001 |
| Poor or fair | 75 | 15.9 | 6 | 9.7 | 106 | 8.1 | |
| Good | 207 | 43.9 | 22 | 35.5 | 415 | 31.7 | |
| Very good or excellent | 190 | 40.3 | 34 | 54.8 | 788 | 60.2 | |
| Total | 472 | 100.0 | 62 | 100.0 | 1309 | 100.0 | |
| | | | | | | | |
| Physical health | | | | | | | .024 |
| Poor or fair | 102 | 21.7 | 9 | 14.8 | 210 | 16.1 | |
| Good | 311 | 66.0 | 39 | 63.9 | 892 | 68.2 | |
| Very good or excellent | 58 | 12.3 | 13 | 21.3 | 206 | 15.7 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Total | 471 | 100.0 | 61 | 100.0 | 1308 | 100.0 | |
| Mental health | | | | | | | <.001 |
| Poor or fair | 108 | 23.1 | 12 | 19.4 | 152 | 11.7 | |
| Good | 204 | 43.7 | 20 | 32.3 | 504 | 38.8 | |
| Very good or excellent | 155 | 33.2 | 30 | 48.4 | 643 | 49.5 | |
| Total | 467 | 100.0 | 62 | 100.0 | 1299 | 100.0 | |

| | Sport and physical activity modes | | | | | | |
|---|---|---|---|---|---|---|---|
| | Team only | | Individual only | | Team and individual | | |
| | N | % | N | % | N | % | |
| General health | | | | | | | <.001 |
| Poor or fair | 43 | 14.6 | 72 | 10.3 | 72 | 8.4 | |
| Good | 134 | 45.6 | 215 | 30.9 | 295 | 34.6 | |
| Very good or excellent | 117 | 39.8 | 409 | 58.8 | 486 | 57.0 | |
| Total | 294 | 100.0 | 696 | 100.0 | 853 | 100.0 | |
| Physical health | | | | | | | .128 |
| Poor or fair | 58 | 19.7 | 136 | 19.6 | 127 | 14.9 | |
| Good | 194 | 66.0 | 456 | 65.7 | 592 | 69.5 | |
| Very good or excellent | 42 | 14.3 | 102 | 14.7 | 133 | 15.6 | |
| Total | 294 | 100.0 | 694 | 100.0 | 852 | 100.0 | |
| Mental health | | | | | | | <.001 |
| Poor or fair | 64 | 22.0 | 100 | 14.5 | 108 | 12.8 | |
| Good | 132 | 45.4 | 249 | 36.0 | 347 | 41.1 | |
| Very good or excellent | 95 | 32.6 | 343 | 49.6 | 390 | 46.2 | |

25

| | | | | | | |
|---|---|---|---|---|---|---|
| Total | 291 | 100.0 | 692 | 100.0 | 845 | 100.0 |

[1] Chi-square test of independence

Table 2. Self-assessment of current health compared to one year ago: by respondent characteristics

| Health assessments | Characteristics | | | | p-value[1] |
|---|---|---|---|---|---|
| | Gender | | | | |
| | Male | | Female | | |
| | N | % | N | % | |
| General health | | | | | .032 |
| Worse or much worse | 229 | 19.4 | 158 | 24.6 | |
| About the same | 758 | 64.1 | 389 | 60.5 | |
| Better or much better | 196 | 16.6 | 96 | 14.9 | |
| Total | 1183 | 100.0 | 643 | 100.0 | |
| Physical health | | | | | .157 |
| Worse or much worse | 135 | 11.4 | 79 | 12.3 | |
| About the same | 334 | 28.2 | 205 | 31.9 | |
| Better or much better | 716 | 60.4 | 359 | 55.8 | |
| Total | 1185 | 100.0 | 643 | 100.0 | |
| Mental health | | | | | .009 |
| Worse or much worse | 218 | 18.4 | 156 | 24.1 | |
| About the same | 863 | 72.8 | 446 | 68.9 | |
| Better or much better | 105 | 8.9 | 45 | 7.0 | |
| Total | 1186 | 100.0 | 647 | 100.0 | |
| | Region | | | | |
| | Metropolitan | | Non-metropolitan | | |
| | N | % | N | % | |
| General health | | | | | .990 |
| Worse or much worse | 231 | 21.1 | 156 | 21.2 | |
| About the same | 688 | 62.8 | 462 | 62.9 | |
| Better or much better | 177 | 16.1 | 117 | 15.9 | |

| | | | | | |
|---|---|---|---|---|---|
| Total | 1096 | 100.0 | 735 | 100.0 | |
| Physical health | | | | | .293 |
| Worse or much worse | 118 | 10.8 | 97 | 13.2 | |
| About the same | 328 | 30.0 | 212 | 28.8 | |
| Better or much better | 649 | 59.3 | 428 | 58.1 | |
| Total | 1095 | 100.0 | 737 | 100.0 | |
| Mental health | | | | | .834 |
| Worse or much worse | 222 | 20.2 | 153 | 20.7 | |
| About the same | 784 | 71.3 | 529 | 71.6 | |
| Better or much better | 93 | 8.5 | 57 | 7.7 | |
| Total | 1099 | 100.0 | 739 | 100.0 | |

| | Sport and physical activity settings | | | | | | |
|---|---|---|---|---|---|---|---|
| | Club only | | Informal only | | Club and informal | | |
| | N | % | N | % | N | % | |
| General health | | | | | | | .046 |
| Worse or much worse | 114 | 24.3 | 9 | 14.8 | 265 | 20.3 | |
| About the same | 295 | 62.8 | 37 | 60.7 | 820 | 62.9 | |
| Better or much better | 61 | 13.0 | 15 | 24.6 | 218 | 16.7 | |
| Total | 470 | 100.0 | 61 | 100.0 | 1303 | 100.0 | |
| Physical health | | | | | | | .051 |
| Worse or much worse | 69 | 14.7 | 8 | 12.9 | 138 | 10.6 | |
| About the same | 150 | 31.9 | 17 | 27.4 | 374 | 28.7 | |
| Better or much better | 251 | 53.4 | 37 | 59.7 | 791 | 60.7 | |
| Total | 470 | 100.0 | 62 | 100.0 | 1303 | 100.0 | |
| Mental health | | | | | | | .012 |
| Worse or much worse | 87 | 18.4 | 14 | 22.6 | 274 | 21.0 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| About the same | 349 | 73.8 | 36 | 58.1 | 930 | 71.2 | |
| Better or much better | 37 | 7.8 | 12 | 19.4 | 102 | 7.8 | |
| Total | 473 | 100.0 | 62 | 100.0 | 1306 | 100.0 | |

| | Sport and physical activity modes | | | | | | |
|---|---|---|---|---|---|---|---|
| | Team only | | Individual only | | Team and individual | | |
| | N | % | N | % | N | % | |
| General health | | | | | | | .253 |
| Worse or much worse | 67 | 22.9 | 160 | 23.1 | 161 | 19.0 | |
| About the same | 185 | 63.1 | 421 | 60.8 | 546 | 64.3 | |
| Better or much better | 41 | 14.0 | 111 | 16.0 | 142 | 16.7 | |
| Total | 293 | 100.0 | 692 | 100.0 | 849 | 100.0 | |
| Physical health | | | | | | | .200 |
| Worse or much worse | 38 | 12.9 | 94 | 13.6 | 83 | 9.8 | |
| About the same | 87 | 29.6 | 200 | 28.9 | 254 | 29.9 | |
| Better or much better | 169 | 57.5 | 397 | 57.5 | 513 | 60.4 | |
| Total | 294 | 100.0 | 691 | 100.0 | 850 | 100.0 | |
| Mental health | | | | | | | .002 |
| Worse or much worse | 45 | 15.3 | 174 | 25.0 | 156 | 18.4 | |
| About the same | 220 | 74.6 | 470 | 67.5 | 625 | 73.5 | |
| Better or much better | 30 | 10.2 | 52 | 7.5 | 69 | 8.1 | |
| Total | 295 | 100.0 | 696 | 100.0 | 850 | 100.0 | |

[1] Chi-square test of independence

Table 3. Measures of wellbeing[1]: by four respondent characteristics

| Measure | Characteristics | | | | | | | | | p-value[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| | N | Mean | SD | N | Mean | SD | N | Mean | SD | |
| | Gender | | | | | | | | | |
| | Male | | | Female | | | | | | |
| General wellbeing | 1105 | 3.85 | 0.555 | 596 | 3.80 | 0.60 | | | | .068 |
| Resilience | 1135 | 3.85 | 0.579 | 625 | 3.81 | 0.59 | | | | .291 |
| Life satisfaction | 1162 | 7.62 | 1.580 | 632 | 7.35 | 1.88 | | | | .001 |
| | Region | | | | | | | | | |
| | Metropolitan | | | Non-metropolitan | | | | | | |
| General wellbeing | 1023 | 3.85 | 0.571 | 682 | 3.82 | 0.57 | | | | .285 |
| Resilience | 1060 | 3.84 | 0.584 | 703 | 3.83 | 0.58 | | | | .590 |
| Life satisfaction | 1077 | 7.52 | 1.667 | 720 | 7.54 | 1.73 | | | | .861 |
| | Sport and physical activity settings | | | | | | | | | |
| | Club only | | | Informal only | | | Club and informal | | | |
| General wellbeing | 432 | 3.73 | 0.614 | 59 | 3.72 | 0.61 | 1217 | 3.87 | 0.55 | <.001 |
| Resilience | 451 | 3.78 | 0.612 | 59 | 3.77 | 0.53 | 1256 | 3.86 | 0.57 | .031 |
| Life satisfaction | 459 | 7.41 | 1.902 | 60 | 7.32 | 1.67 | 1281 | 7.58 | 1.61 | .109 |
| | Sport and physical activity modes | | | | | | | | | |
| | Team only | | | Individual only | | | Team and individual | | | |
| General wellbeing | 269 | 3.78 | 0.582 | 656 | 3.80 | 0.61 | 783 | 3.88 | 0.53 | .009 |
| Resilience | 281 | 3.77 | 0.586 | 672 | 3.83 | 0.60 | 813 | 3.86 | 0.57 | .087 |
| Life satisfaction | 287 | 7.69 | 1.689 | 684 | 7.30 | 1.88 | 829 | 7.67 | 1.50 | <.001 |

[1] General wellbeing: 14 items, scale 1-5. Resilience: 4 items, scale 1-5. Life satisfaction: 1 item, scale 1-10

[2] Independent samples t-test (2 groups) F-test (3 groups)

**Journal of Aging and Physical Activity**
**Manuscript ID JAPA.2022-0046**
**The impact of COVID-19 restrictions on perceived health and wellbeing of active Australian older adults**

| **Comments to Author:** | **Author response** |
|---|---|
| | |
| **Associate Editor** | |
| Thank you for your submission. Please carefully review and respond to the reviewer comments. Particularly clearly link your study aims/hypotheses to the specified analyses and their interpretation. | See our responses to the comments of Reviewer 1. |
| **Reviewer 1** | |
| The manuscript is well-written and provides valuable insight into the health and well-being of older adults during the COVID-19 pandemic based on gender, region, and participation in various settings and modes of physical activity. My questions, suggestions, and concerns are below. | Thank you. No response required |
| *Introduction* | |
| • Page 5 (lines 21 – 24): Can you provide a more specific purpose for your study?<br>You say that you are seeking "to determine the association between perceived health and wellbeing of older adults and the impact of COVID-19 related restrictions on different modes and settings of participation in sport and physical activity, together with genders, age groups, and regions."<br>From reading your manuscript, it seems like you have two different aims.<br>From my understanding, it looks like you want to determine the association between ratings of general health, physical health, mental health, and well-being with gender, regions, and modes/settings of physical activity in older adults during the pandemic.<br><br>For the second aim, it looks like you are looking at the impact of COVID-19 on perceived changes in health based on gender, region, and mode/setting of physical activity. Is this accurate?<br><br>There does not seem to be an analysis based on age groups as mentioned in your purpose and your analysis does not seem to address how the COVID-19 impacted different modes and settings of participation in sport and physical activity. Therefore, I would suggest to rewrite your purpose and make sure that the purpose is clear and that the analysis plan and reporting of the results align with the purpose of your study. | Done (P5 L22-26)<br><br>Agreed<br>Agreed<br><br>Agreed<br><br>Done (P5 L22-26) |
| • Please include a hypothesis | There are many implicit hypotheses, regarding the association between each health measure and each demographic and sport participation characteristic. Having now made these details clearer (see purpose |

| | |
|---|---|
| | above) we do not think the inclusion of a list of individual hypotheses would add any further information. |
| *Methods* | |
| • Page 6 (lines 10 - 11): How was consent obtained (i.e. written, e-consent, verbal, etc)? | Text clarified (P6 L9-12) |
| • Page 6: Other than adults 60 years and older, was there any other inclusion criteria? What about exclusion criteria? | Exclusion of a small number of inactive respondents (P8 L20-23) |
| • Page 8 (lines 3 – 7): What was the 14-time battery? What type of tool was it? Can you explain more about the specific tool? The reference mentioned here looks like it is a tool developed for children. Is there a rationale for using it in this study with an older adult population? | This was a tool purpose-built by the research team, much of the thematic content of which was derived or adapted from existing tools, mainly the SF-36, (9 items) for which the reference was included, which was cited elsewhere in the manuscript, but inadvertently omitted at this point. This has now been added. The reference we included pertained to only two of the items. Three items were developed by the research team to address negative feelings likely to be exacerbated by COVID-19. We have amended the text accordingly. (P8 L6-9)<br><br>We acknowledge that two items were derived from a child-related source. However, the concepts involved (feelings of loneliness and loss of sleep due to worry) are not specific to children. Furthermore, while the present manuscript pertains to older adults, the age range of the survey was 13 years and above. While the survey had separate child (adolescent) and adult branches for some demographic items and items about relationships, social capital and community engagement, the health and wellbeing questions, including this 14-item question, were judged by the research team to be appropriate across the full age range.<br><br>In light of the amendments to the text, we do not believe it is necessary to include the full text of each item.<br><br>However, FYI the items were:<br><br>…in the past two weeks…<br>How often …<br><br>Did you feel full of life<br>Have you been a very nervous person<br>Have you felt so down in the dumps that nothing could cheer you up<br>Have you felt calm and peaceful<br>Did you have a lot of energy<br>Have you felt downhearted and depressed<br>Did you feel worn out<br>Have you felt happy and cheerful |

| | |
|---|---|
| | Did you feel tired<br>Have you felt fearful about the future<br>Have you felt optimistic about the future<br>Have you felt lonely<br>Have you felt a loss of your independence<br>Did you lose sleep due to worry |
| • Page 8 (lines 8 – 10): What specific 4-item tool was used? Please provide more explanation of the tool that was used. | Again, this was a tool purpose-built by the research team, Three items were selected from the brief resilience scale (BRS) (citation included in the manuscript) and a fourth item regarding challenges, regarded by the research team as appropriate wording for sport-focused respondents. The text has been amended. (P8 L12-15)<br><br>FYI, the items were:<br>I tend to bounce back quickly after hard times<br>I have a hard time making it through stressful events<br>I feel confident about meeting challenges<br>It does not take me long to get over setbacks in my life |
| *Results* | |
| • Page 9 (Lines 22 - 24): You say that those in non-metropolitan regions were significantly more likely to report poor or fair physical health and those living in metropolitan cities were significantly more likely to report higher rates of good/excellent physical health ($p = 0.022$). When looking at Table 1, it looks like there was no difference in physical health between those living in metropolitan and non-metropolitan cities ($p = 0.929$). From the table, it looks like mental health was significantly different at $p = 0.022$ as opposed to physical health. Could you please check the data clarify this in the written results and results in the table? | Thank you for picking this up. The text and the p-values reported in the text are correct. The discrepancies were due to earlier incorrect drafts of Tables 1 and 2 being inadvertently inserted into the submitted manuscript. The correct Tables 1 and 2 have now been inserted. |
| • Page 10 (lines 1 – 5): You say that the p value for both general health and physical health was <0.001, but Table 1 shows that the p value for physical health is 0.024. The text says that mental health was not significant, but Table 1 says that it is significant ($p<0.001$). Could you please check the data clarify this in the written results and results in the table? | As above |
| • Page 10 (lines 6 – 10): Same as mentioned above. The results do not seem to match the table. You say in the text that those participating in individual-only activities had significantly higher reported general health and physical health (both $p<0.001$) that team only and both team and individual activities, but Table 1 shows no significance for physical health ($p = 0.128$). Your table shows significant differences for mental health, but in the text, you say there is no significant differences. Could you please check the data clarify this in the written results and results in the table? | As above |

| | |
|---|---|
| • Page 10 (lines 6 – 7): You say that those with individual only activities had significantly higher reported general health compared to team-only or those participating in both team and individual activities. Your Table shows significance. The percentages for individual only and for both team + individual are pretty close to each other so is the individual only category higher than the other two categories or just the team only category? | As above |
| • Page 10 (lines 12 – 19): Similar to above, the p values are different in the text compared to the table. | As above |
| • Page 11 (line 15): Your p value is different in the test (p = 0.002) compared to the table (p = 0.001) • Page 11 (line 21): The values in the text do not match the values in the table for general wellbeing (mean in text: 3.88, mean in table: 3.87) and resilience (mean in text: 3.88, mean in table: 3.86) | As above |
| *Discussion* | |
| • You start out your discussion saying that the study investigated the impact of COVID-19 restrictions on perceived health and wellbeing of active Australian older adults.<br>I would expand on this and say that you compared general health, physical health, and mental health during COVID-19 based on gender, residential location, and activity modes and settings. Make this match your updated purpose. | Done. (P12 L8-10) |
| • Page 13 (lines 4 - 6): You mention differences may be due to vaccination rates in different regions. Considering you said in the methods that the survey was conducted during May and June of 2020, COVID-19 vaccines wouldn't have been available at that time. I would suggest to remove this sentence or revise it. | Thank you for picking this up. We have removed this sentence and replaced it by a reference to pre-existing underlying health differences. (P13 L15-18) |
| **Reviewer 2** | |
| Overall interesting research question. More discussion on the study data and outcome between physical fitness and mental wellbeing would be of interest. | We have added further discussion P12 L20-23, P13L204. |
| Would like to see more discussion on the 88 activities and which of those were most indicative of increased physical and mental well being: for example, adding a table with the most relevant correlations. | An analysis based on particular activities is beyond the scope of the present paper. This would not involve correlations, but rather a series of bivariate analyses of the association between health and wellbeing outcomes (categorical or quantitative) and participation (yes/no dichotomy) in each of a list of selected activities. In these analyses, participation in each activity would have a similar role to gender or region, resulting in tables similar to Table 1 and 2 for each selected activity. Furthermore, because most respondents engaged in more than one activity, such bivariate analyses would be of limited value, because they would not account for the complexity of the contributions of multiple |

| | |
|---|---|
| | activities and their potential interactions. For these reasons, in the present study we derived the composite 'settings' and 'modes' variables, which enabled a broad-brush examination of the associations between health and wellbeing and different types, and mixes of types, of activity. |
| Unsure that the author completely connected the relation between resilience factors and cognitive decline - may need additional discussion on this portion of the analysis. | Cognitive decline was mentioned briefly in the literature review in the Introduction section, but we did not investigate cognitive decline. Our investigation of mental health was based on self-reported perceptions of overall mental health. |
| Finally, the author states in the introduction that differences between men and women exist with respect to social isolation and impacts to mental health. Would like to see more discussion of these differences - data is included by sex in the tables but not analyzed/discussed. | We have added some discussion (P13 L1-4) |
| Author noted limitations to study and I agree that additional cohorts are indicated. Consider broadening geographical coverage and including three categories, rather than just two: urban, suburban and rural. I suspect that rural impact would be much greater, due to social isolation and lack of organized sports/services in those areas. | The metropolitan/non-metropolitan dichotomy used in this study is a well-established element of the Australian Standard Geographical Classification (ASGC) system much used in social research in Australia, including in sport and physical activity contexts. We acknowledge that other finer-grained divisions exist, such as a 5-class remoteness categorisation based on the Accessibility and Remoteness Index of Australia (ARIA+), but such breakdowns were beyond the scope of this study. |
| The author noted the broadband communication gap and telehealth impact, but there are additional elements that need to be considered, including resources for individual or organized physical activity in the three geographic areas. | Agree and we have added further text (P13 L15-18, L23-24) |
| Author might also consider t test study, analyzing data gathered in 2020, at the initial stages of the pandemic, and compare to physical activity and mental wellness now, two years later. | A follow-up survey was conducted mid-2021, after some sport had resumed. Longitudinal analysis is currently underway. |