Finnish Late Adolescents' Physical Activity During COVID-19 Spring 2020 Lockdown

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Abstract

Background

Physical activity (PA) is recognised as one of the leading and effective strategies to prevent non-communicable diseases that boosts the immune system to fight against diseases. Closures of schools, sport clubs and facilities because of COVID-19 reduced the opportunities to participate in PA. We aimed to examine physical activity levels of late adolescents, the contexts to be physical active and its changes during the spring 2020 lockdown.

Methods

A nationally represented sample of late adolescents in general upper secondary school (n=2408, females = 64%, mean age = 17.2y, SD=0.63) completed online surveys on PA between March and May 2020. Multinominal logistic regression analyses were performed to identify correlates with PA, and decision tree analyses to ascertain the perceived changes on PA during lockdown based on sport club aspirations and levels of PA.

Results

Among the late adolescents, the distribution of PA frequency was 23% (0-2 days/week), 35% (3-4 days/week), 30% (5-6 days/week) and 12% (7 days/week), and differences between males and females were not statistically significant. Participation in PA both indoor and outdoor were 50 times more likely to report daily PA (OR=54.28, CI=15.16-194.37). A quarter of late adolescents not part of a sports club yet their PA levels increased. Although sport club members generally perceived they did less PA during lockdown, over a third of sport club members with competitive aspirations reported daily PA.

Conclusions

Overall, late adolescents reported their PA levels decreased during lockdown. Findings from this study continue to demonstrate factors associated with PA in the context of the COVID-19 lockdown.

Background

Physical inactivity is detrimental to the short- and long-term health of adolescents. There is evidence that increased physical activity (PA) boosts the immune system to fight infections and viruses (1), as well as prevention of leading non-communicable diseases (2). Despite these known advantages, adolescents struggle to maintain a physically active lifestyle and PA levels drop as age increases (3). Late adolescents (15–20 years old), is a phase where academic results are taken more seriously (4) and competitive sports make participation more exclusive (5). More barriers to being physical active appear during late adolescents, as individuals experience physical, psychological and social changes (6) and try out thrill seeking activities as part of the transition from child to adulthood (7).

Much of the independence was taken away from adolescents when the COVID-19 restrictions closed down schools, sport practices and social events, known as lockdown. During lockdown, much of the time late adolescents spent was indoors and PA levels reduced (8). Yet, a proportion of late adolescents had positive experiences during lockdown with increased freedom to carry out studies or PA in their own time (9). Despite the challenges maintain PA levels was possible during the spring lockdown (10). There was also a shift in the time of day for when PA occurred as the commute to schools no longer existed (11).

On the 13th of March, the Finnish government declared the use of the Emergency Powers Act, whereby public spaces such as libraries, swimming halls and other public sports facilities were shut down until further notice (12). Public gatherings were limited to maximum of 10 people, hence the majority of sports clubs and associations seized to function. Schools adapted to distanced learning on the 18th of March (13). There was a gradual dismantling of these restrictions from the 14th of May, including the possibility for late adolescents to return to school and participation in outdoor sport practices (14).

In Finland, the majority of students, particularly females, aged 16 to 19 attend general upper secondary education (15). General upper secondary education normally lasts three years, prepares for students in higher education and studies are organized in 6-week blocks. The structured physical education (PE) lesson is dependent on the curriculum and is typically two blocks during the three years. Although PE is not the only source for overall physical activity, it can be successful in promoting PA levels among individuals who do not typically have PA related leisure time activities (16). During lockdown, the change of environment for PE was challenging for many. Physical educators experienced difficulties in remote teaching PE (17), and for example in Norway, almost a quarter of PE teachers reported their subject had a lower priority during lockdown (9). Teachers had little time to prepare for online classes, and most have little or no experience in their preparation for teaching PE remotely (18) which may have limited the common positive effect of PE on PA. Similarly, sport clubs are common settings for PA and were shut down. Sport coaches and their athletes with access to technology, such as wearables, were able to continue with training during lockdown (19). Yet, the use of PA trackers among adolescents was approximately 45% for apps, 15% for sport watches and 9% for heart rate monitors (20), leading to the majority of late adolescents to may have struggled to stay connected with coaches and peers.

Based on the behaviour epidemiological framework for studying physical activity and COVID-19 (21), the aim of the study is the identify factors associated with PA. Given that three main environment for adolescents to be physically active during lockdown; home, remote schooling and remote sport clubs, the purpose of this study was describe the levels of PA during lockdown, how remote physical education (PE), sport club activities and self-
organised PA were correlated with PA among Finnish late teenagers who attended general upper secondary school, and how perceived changes in PA were associated with behaviour during lockdown.

Methods

Study Design

The Finnish Late Adolescents Physical Activity (LAPA) study is a national monitoring physical activity study of late teenagers. It is the extension to the Finnish School-age Physical Activity (F-SPA) study that included 7, 9, 11, 13, and 15-year olds to late adolescents aged between 16–19 years old. The design of the sampling and administration F-SPA and LAPA were similar. In short, the sampling strategy was based on national representative sample through probability proportion to size, where clusters were set at macro regions of Finland, notably Metropolitan, South, Central and North. A complex sample design included the allocation of survey responses from general upper secondary schools as well as vocational colleges. The planned data collection phase in spring 2020 commenced on the 9th March. As the emergency powers act came into force on the 17th March 2020, with schools closed on the 18th March, the research team rapidly updated the items in the LAPA study and included items that focused on relationships between PA behaviour and COVID-19 in the LAPA-C19 study. Data from the LAPA-C19 study were collected between 6th April – 5th June 2020. The LAPA study has a split sample design, so that traditional monitoring would continue with the original LAPA study in both Finnish (LAPA) and Swedish (LAPA-S) including the collection of week-long accelerometer data. Data from late adolescents in general upper secondary school who completed LAPA-C19, LAPA, and LAPA-S were combined for the purpose of this study (Fig. 1). Contact with late adolescents in vocational colleges were an administrative challenge and for that reason, data from vocational colleagues were removed from the data analyses to avoid biasing the sample. Furthermore, accelerometer data was removed from the data set leaving representative general upper secondary school data in this study.

All surveys were completed anonymously and voluntarily through an online survey. In Finland, late adolescents over the age of 16 have the legal right to consent for themselves to take part in the study. Permission was obtained by all participants in this study. LAPA study was approved by the University of Jyväskylä research ethics committee.

Survey items

Background variables

Age was calculated from respondents input of their day, month and year of birth in relation to the date of survey completion. Age categories were created based on the nearest whole year for 16y, 17y, 18y olds. Disabilities were calculated through the self-reported version of the child functioning module of the Washington group on disability studies (22). There are 11 items with a four-point scale on core functions for adolescents namely, seeing, hearing, speaking, walking, concentrating, learning, self-care, remembering, change of routines, getting friends, controlling own behaviour. A first past the post system for difficulties at the level of ‘a lot of difficulty’ was used to determine rate of disabilities (23). Items in relation to social economic status were determined by two items on parent's highest level of education and the family finance level. Place of residence was a single item, those who live in a city was coded as urban, and those who live outside of the city were coded as rural.

Physical activity variables

A definition of physical activity intensity was included at the beginning of the survey, followed by a single item measure the number of days in the past week where the individual had participated in at least 60 minutes of moderate to vigorous physical activity (MVPA). This item has been used extensively for national monitoring purposes (24) with good validity against accelerometers (25) and acceptable test-retest reliability (26). The days were grouped into 0–2 days, 3–4 days, 5–6 days, and 7 days, as 4 categories have meaningful interpretations (27) as well as providing more insight into the ‘every move counts’ connection from the updated WHO PA guidelines (28). An additional definition of vigorous intensity PA followed and a single question on the number days in a usual week the individual does VPA. This variable dichotomised into less than 3 days and more than 3 days as part of the PA guidelines for strengthen exercises (28).

Frequency of 21 physical activities carried out during a week was based on a frequency scale from Never to daily. Items were selected from Finnish expert group and included; muscular fitness training, body care (i.e. stretching/yoga), indoor aerobic, dance, gymnastics, hula hoops, cycling, skating or scootering, jogging, walking or Nordic walking, hiking, orienteering, geocatching, frisbee golf, stair running, walking the dog, skiing or ice skating, nature-based exercises, indoor e-games, outdoor e-games, and other. Respondents who reported ‘other’, wrote in an open-ended response box to describe what was the activity they did during lockdown. These items were cross-checked with the 21 items to identify extra activities that were not on the 21 activities already listed. This resulted in four more activities, ball sports, martial arts, horse riding and golf. Items responses of never, less than weekly or weekly as 0, more frequently or daily as 1. The activities were then grouped into no PA, indoor only, outdoor only, and both indoor and outdoor PA.

A separate item was used to measure the extent of change in PA as a result of the emergency measures. The response option was a five-point scale from Much less to Much more with the midpoint (3) as the same. There has not been time to validate the measure, although similarly worded items have been used in a variety of published COVID-19 related papers (29).

Physical education

Students were asked if they received physical education instruction during lockdown through remote methods. If they reported yes, the respondents were asked their level of agreement (1 completely agree – 4 completely disagree) on whether they completed all the PE tasks during the day. Students who
reported ‘completely agree’ were grouped as ‘high task’, all others were grouped as ‘low task’, and students without any remote PE were coded as ‘no remote PE’ as the reference category.

**Sport clubs**

Three groups were created based on the combination of two items, 1. Membership of sport clubs before lockdown, and 2) Level of competitive aspiration. Aspirations for competitive sports for youth and adults were combined into a group called competitive member. Responses of membership but no competitive aspiration were grouped into recreational member and the final and reference group were the responses of no sport club member.

**Statistical Analyses**

Chi-square test of independence on the proportions for the background variables were carried out to confirm analyses for pooled data from the survey types (LAPA-C19, LAPA, LAPA-S) as well as segmentation analysis (SES and physical education) that could be generalised for the rest of the sample. When proportions of MVPA did not differ between the extra responses from LAPA-C19 with the rest of the sample (p > .05), the combined data were consisted sufficiently general for the items on PE and SES. Multinominal logistic analyses of the background variables and correlates were performed to identify the associations with different proportions of MVPA categories (3–4 days, 5–6 days and 7 days) to the reference category of 0–2 days.

A decision tree analyses approach through Chi-square Automatic Interaction Detector (CHAID) analysis was used for testing the probability of 0–2 days, 3–4 days, 5–6 days or 7 days of MVPA based on involvement in sport clubs, competitive aspiration and perceptions of change to MVPA. CHAID analysis can determine the probability of each possible node for different frequencies of MVPA.

To estimate the correlates of change in PA, univariate analysis of variance was conducted where change of MVPA was the independent variable and gender, age, disability, place of living, SES, PE, types of activity, frequency of MVPA, VPA and sport club aspirations as dependent variables. IBM SPSS 27.0 with 2-tailed tests and 95% confidence intervals was used for all analyses.

**Results**

Most students in Table 1 were female (64%) with the mean age of 17.2y (SD = 0.63). Under a quarter (23%) of adolescents were inactive (0–2 days), over a third reported 3–4 days (35%), reported 5–6 days (30%), and one in ten were physically active daily (12%). Almost a half of the students did not have remote PE (43%), a quarter had remote PE but did not always do the tasks (23%), and a third always did the PE tasks (34%). Over a half (54%) adolescent reported they did over three days a week of vigorous exercise or were not members of organised sports (56%), with over a quarter (26%) doing recreational organised sports and less than one in five (18%) had competitive aspirations in organised sports. Over a third reported they did less (39%) or did more (39%) PA during the lockdown, the remainder (23%) reported the same.

Physical activity behaviour during lockdown

Half of the late adolescents (52%) reported taking part in both in- and outdoors physical activities at least a few times a week and a quarter (26%) reported their activities were only outdoors ones. One in ten reported only indoor (11%) or no physical activities (12%) during lockdown. Walking, muscle strengthening activities, body conditioning (i.e. yoga), running, taking dog for a walk or cycling were common activities during lockdown. Statistically significantly more females reported walking, body conditioning, walking the dog, dancing, gymnastics, hiking and doing hula hoops than males. More males reported to do cycling, frisbee golf, skating or scootering, or mobile physical activity games outsides than females (Supplementary Table 1).

Higher SES was associated with increasing MVPA, but not age and gender (Table 2). Participants in both indoor and outdoor activities during lockdown were over 50 times more likely to report daily MVPA than students who reported no activities and 0–2 days of MVPA (OR = 54.28, CI = 15.16-194.37). The association strength of MVPA decreased with outdoor or indoor activities respectively. There were positive associations between students with competitive aspirations or doing at least 3 days of VPA with increasing days of MVPA compared with 0–2 days and non-participation in organised sport or less than 3 days of VPA. Students who reported high PE tasks were more likely to have taken part in 3–4 days (OR = 1.61, CI = 1.12–2.32) or 5–6 days (OR = 1.84, CI = 1.22–2.78) of MVPA but not daily MVPA compared with 0–2 days and to those not having remote PE.
|                      | Total | LAPA-C19 | LAPA  | LAPA-S | p    |
|----------------------|-------|----------|-------|--------|------|
| **Gender**           |       |          |       |        |      |
| Total                | 2408  | 1678     | 363   | 367    | 0.065|
| Female (%)           | 63.9  | 65.4     | 60.1  | 60.8   |      |
| Male (%)             | 36.1  | 34.6     | 39.9  | 39.2   |      |
| **Age Categories**   |       |          |       |        |      |
| Total                | 100.0 | 100.0    | 100.0 | 100.0  | 0.001|
| 16y (%)              | 9.3   | 9.5      | 11.6  | 6.3    |      |
| 17y (%)              | 54.1  | 55.3     | 53.7  | 49.0   |      |
| 18y (%)              | 36.5  | 35.2     | 34.7  | 44.7   |      |
| **Disabilities**     |       |          |       |        |      |
| Total                | 2408  | 1678     | 363   | 367    | 0.129|
| Without Disabilities (%) | 84.9 | 83.7     | 86.5  | 88.6   |      |
| With Disabilities (%) |       |          |       |        |      |
| Sensory (%)          | 2.7   | 2.8      | 3.3   | 1.4    | 0.212|
| Physical (%)         | 0.4   | 0.4      | 0.3   | 0.5    | 0.852|
| Cognitive (%)        | 7.3   | 7.7      | 6.6   | 5.7    | 0.349|
| Behavioural (%)      | 9.1   | 10.1     | 5.8   | 7.6    | 0.021|
| **Urbanicity**       |       |          |       |        |      |
| Total                | 2402  | 1672     | 363   | 367    | < .001|
| Rural (%)            | 31.9  | 31.0     | 21.5  | 46.0   |      |
| Urban (%)            | 68.1  | 69.0     | 78.5  | 54.0   |      |
| **Change in PA**     |       |          |       |        |      |
| Total                | 2305  | 1652     | 302   | 351    | .356 |
| Less (%)             | 38.6  | 37.7     | 39.4  | 41.9   |      |
| Same (%)             | 22.5  | 22.6     | 24.8  | 19.7   |      |
| More (%)             | 39.0  | 39.6     | 35.8  | 38.5   |      |
| **Family Finance 2** |       |          |       |        |      |
| Total                | 1672  | 1672     | n/a   |        |      |
| Bad or very bad (%)  | 5.0   | 5.0      |       |        |      |
| Average (%)          | 23.8  | 23.8     |       |        |      |
| Good (%)             | 51.3  | 51.3     |       |        |      |
| Very good (%)        | 19.9  | 19.9     |       |        |      |
| **Remote PE**        |       |          |       |        |      |
| Total                | 1676  | 1676     | n/a   |        |      |
| No remote PE (%)     | 43.1  | 43.1     |       |        |      |
| Low tasks remote PE (%) | 23.2 | 23.2     |       |        |      |
| High task remote PE (%) | 33.7 | 33.7     |       |        |      |

LAPA, Late Adolescents Physical Activity, C19; COVID-19 version, S; Swedish version. *Only in LAPA-C19 survey.
## Table 2
Descriptive Multinomial Regression of MVPA from 0–2 days MVPA (as reference)

| REF 0–2day | 3–4 days | 5–6 days | 7 days |
|------------|----------|----------|--------|
|            | OR       | LCI      | UCI    | p     | OR       | LCI      | UCI    | p     | OR       | LCI      | UCI    | p     |
| **Gender** |          |          |        |       |          |          |        |       |          |          |        |       |
| Female     | 1.00     |          |        |       | 1.00     |          |        |       | 1.00     |          |        |       |
| Male       | 0.857    | 0.632    | 1.163  | 0.322 | 0.970    | 0.678    | 1.387  | 0.866 | 0.912    | 0.579    | 1.438  | 0.692 |
| Age        | 0.973    | 0.765    | 1.236  | 0.820 | 1.184    | 0.895    | 1.566  | 0.236 | 0.914    | 0.641    | 1.304  | 0.622 |
| SES        | 1.287    | 1.068    | 1.553  | 0.008 | 1.273    | 1.021    | 1.587  | 0.032 | 1.586    | 1.193    | 2.106  | 0.001 |
| **Disabilities** | | | | | | | | | | | | |
| Without    | 1.00     |          |        |       | 1.00     |          |        |       | 1.00     |          |        |       |
| With       | 0.722    | 0.499    | 1.044  | 0.083 | 0.627    | 0.395    | 0.996  | 0.048 | 0.685    | 0.371    | 1.264  | 0.226 |
| **Residence** | | | | | | | | | | | | |
| Rural      | 1.00     |          |        |       | 1.00     |          |        |       | 1.00     |          |        |       |
| Urban      | 1.225    | 0.901    | 1.667  | 0.196 | 1.471    | 1.022    | 2.118  | 0.038 | 0.923    | 0.589    | 1.445  | 0.725 |
| **Remote PE** | | | | | | | | | | | | |
| Without    | 1.00     |          |        |       | 1.00     |          |        |       | 1.00     |          |        |       |
| Low Task   | 0.787    | 0.554    | 1.116  | 0.179 | 0.572    | 0.371    | 0.882  | 0.012 | 0.352    | 0.193    | 0.643  | 0.001 |
| High Task  | 1.608    | 1.117    | 2.314  | 0.011 | 1.837    | 1.219    | 2.769  | 0.004 | 1.277    | 0.773    | 2.107  | 0.339 |
| **VPA**    |          |          |        |       |          |          |        |       |          |          |        |       |
| < 3/week   | 1.00     |          |        |       | 1.00     |          |        |       | 1.00     |          |        |       |
| =>3/week   | 2.292    | 1.620    | 3.243  | <.001 | 13.863   | 9.378    | 20.493 | <.001 | 36.373   | 18.824   | 70.283 | <.001 |
| **Organised Sport** | | | | | | | | | | | | |
| None       | 1.00     |          |        |       | 1.00     |          |        |       | 1.00     |          |        |       |
| Recreation | 1.313    | 0.940    | 1.835  | 0.111 | 1.179    | 0.793    | 1.751  | 0.416 | 1.250    | 0.737    | 2.118  | 0.407 |
| Competitive| 3.210    | 1.698    | 6.070  | <.001 | 7.115    | 3.686    | 13.733 | <.001 | 14.451   | 7.057    | 29.594 | 0.000 |
| **Activities** | | | | | | | | | | | | |
| None       | 1.00     |          |        |       | 1.00     |          |        |       | 1.00     |          |        |       |
| Indoor     | 4.502    | 2.624    | 7.726  | <.001 | 4.891    | 2.196    | 10.890 | <.001 | 6.181    | 1.481    | 25.793 | 0.012 |
| Outdoor    | 6.555    | 4.171    | 10.301 | <.001 | 13.957   | 6.820    | 28.562 | <.001 | 27.323   | 7.316    | 102.041| <.001 |
| In- & Outdoor | 10.356 | 6.549    | 16.376 | <.001 | 27.652   | 13.766   | 55.544 | <.001 | 54.277   | 15.157   | 194.373| <.001 |

SES – social economic status; PE – physical education; VPA – vigorous intensity physical activity; OR – Odds ratio; LCI – Lower 95% confidence interval, UCI – Upper 95% confidence interval

### Sport Club participation

A quarter of late adolescents (25%) were not members of sport clubs, yet perceived their PA increased during lockdown. Days of MVPA were strongly associated with participation in sport clubs as well as perceived changes in PA during lockdown. Based on the CHAID analysis (Fig. 2), students who perceived to do less PA during lockdown and were not involved in sport clubs (Node 4) were 47% likely to report 0–2 days of MVPA. Similarly, late adolescents who perceived their PA was less during lockdown and were recreational club members (Node 7), perceived the same PA during lockdown as normal and were not in organised sports (Node 5), or perceived their PA levels increased during lockdown and were not in sport clubs (Node 6) were 47%, 35%, and 42% likely to report 3–4 days of MVPA, respectively. Students with competitive aspirations, irrespective of perceptions of doing less (Node 9) (40%), the same (Node 10) (57%) or more PA (Node 11) (42%) were most likely to report 5–6 days of MVPA. Similarly, recreation aspirations and perceptions of doing the same or more PA during lockdown (Node 8) (40%) were most likely to report 5–6 days of MVPA and had similar distributions in frequency of MVPA.
Late adolescents generally reported to have done less PA during the spring 2020 lockdown (mean = 2.71, CI = 2.59–2.83). Males reported their PA levels had reduced more compared to females (2.59 vs 2.83, p < .001). In addition, late adolescents who lived in urban places reported their PA levels reduced compared to peers in who live rural places (2.64 vs 2.78, p = 0.02). Late adolescent without remote PE were, on average, reporting their PA levels reduced than students who did the tasks from remote PE (2.64 v 2.81, p = 0.03). Without participation in any form of PA (2.32), there was perceptions of doing less PA than doing indoor activities (2.81, p < .001), outdoor activities (2.70, p = 0.001), or both indoor and outdoor activities (3.00, p < .001). Late-teens who reported 0–2 days of MVPA felt their PA levels decreased the most (mean = 2.14, CI = 1.99–2.30), followed by 3–4 days (mean = 2.62, CI = 2.48–2.76). Late adolescents who reported daily MVPA felt their PA levels increased during the spring 2020 lockdown (mean = 3.18, CI = 2.98–3.38). The opposite pattern was observed among late adolescents who were not in organised sports, with perceptions of increased PA levels (mean = 3.12, CI = 2.99–3.25), whereas recreational sport club members perceived PA levels reduced (mean = 2.65, CI = 2.50–2.80) as well as members with competitive aspirations (mean = 2.36, CI = 2.20–2.52). These declines were statistically significant (F = 54.04, p < .001) and between each level through least significant difference tests (p < .001). In Fig. 3, the forest plot represents the mean values with 95% confidence intervals for changes in PA during lockdown for demographic and physical activity behavioural characteristics. The vertical line represents no change. Mean values to the left represent less PA and values to the right of the line represent more PA during lockdown.

**Discussion**

This study examined the associations of PA with the at home school, remote sport club activities and self-organised PA contexts available to adolescents during the first wave lockdown during Spring 2020 in Finland. We described the correlates between PA and individual characteristics, PE, sport clubs and leisure time activities during lockdown, before examining the associations with perceived changes in PA during lockdown. In our sample, increased SES, vigorous PA at least three times a week, competitive aspirations and in indoor or outdoor activities during lockdown were associated with increased levels of PA. Furthermore, a third of late adolescents reported their PA levels were lower than before lockdown and the findings are consistent with previous reports that a large proportion of adolescents reported a reduction in PA (29). Surprising a similar proportion reported they increased their levels of PA during lockdown, which is more than the prevalence reported in earlier studies (8).

In the current study, only 12% of the late adolescents took part in daily MVPA, which is similar to the rates in 2017 for the same age cohorts (30). Despite closures of sport facilities, increased SES was associated with increasing MVPA. Based on the capability, opportunity, motivation and behaviour (COM-B) model and PA, Hankonen and colleagues (31) reported higher SES was associated with self-monitoring, action planning, and greater material resources explaining the possible reasons for being physically active among late adolescents with high SES. Complementary to these results, there were also very strong associations with increases in MVPA with regular VPA, organised sport with competitive aspirations and leisure time PA. These correlates have been reported in previous studies (19), although the extent of the effect were larger in our study. These findings would suggest an increasing gap between individuals who are physically active or not in late adolescents as reported globally (29).

During the spring 2020 lockdown, schools in Finland were closed (13). We found positive associations between high PE task and participating between 3–4 and 5–6 days a week, but not daily MVPA. For some late adolescents, PE may support physically active lifestyles or it may have encouraged PA (16). PE contributes to overall PA, but on its own is not enough to support daily MVPA (32). It might be an extra school task that does not contribute to much more than an exercise (33). This latter reason could be one reason for the negative association for low PE task and 5–6 days of MVPA and may have been exacerbated through remote teaching (34). PE teachers encountered technological barriers in the remote teaching space (35), as well as faced a new paradigm to include the family and community into the PE lesson (36).

As a result of closure of schools, sport clubs, and fitness centres, levels of PA reduced, yet PA opportunities were based on individual activities in compliance with physical distancing measures (8, 14). The lockdown measures were common around the globe and has been reported to reduce the amount of PA by half among adolescents (29). In our Finnish sample, the most frequently reported outdoor activity was walking. This was an opportunity for late adolescents to meet a friend outside in a safe place. Finns have easy access to nature to go for walks (37) and the outdoor activities were more positively associated with increased levels of PA than indoor activities. Almost half the respondents reported doing muscle strengthening exercises and a third with body conditioning activities at least a few times a week. These activities may have been done unsupervised or through the support of on-demand coaching or fitness sessions. During the lockdown period, one of the largest fitness chains in Finland offered a schedule of free on demand fitness sessions and this may have been one way for the late adolescents to have done more PA during lockdown. Further studies are needed to investigate the mechanisms of influencers, remote coaching, its effectiveness and uptake.

The results from the decision tree analyses confirms the widening of gap between physically active and inactive based on competitive aspiration in sports. In relation to the spring 2020 lockdown, late adolescents with competitive aspirations may have had more possibilities to remote and on-demand training with coaches willing to find ways to keep their athletes in condition (38). For late adolescents not part of sport clubs, independent exercises such as walking, exercise classes and dance were more common among females than males. The activities were easy to organise activities and maybe more attractive for females to do than males who see sports as the main ways to take part in PA (39). As the opportunities for sport were reduced from the lockdown, it is common for males to turn to online gaming for leisure time activities, and this type of behaviour is associated with lower physical activity levels (40).
This study has some limitations for the readers to consider. The instruments reported were self-report and there might be some bias. The instruments used were originally taken from previously validated measures for these participants. Due to the rapid changes from the COVID-19 pandemic, the question about perceived change has not been tested for psychometric properties, as with many other studies that have used the similar measure. The data is cross-sectional; therefore, no casual assumptions can be made. The late adolescents included in this study were from high school, and may not represent all late adolescents as 40% attend vocational schools (41), although it has been challenging to recruit vocational school adolescents due to their placement and low levels of in-person contact with their teachers to administer a classroom based survey like this LAPA study.

Conclusions

Physical activity levels among late adolescents is seldom reported from national representative samples. The differences in PA between Finnish males and females was non-existent, yet commonly reported correlates of MVPA were with social economic status, vigorous physical activity, sport club and leisure time activities. In the context of COVID-19, this paper highlights the changes in PA and how there were differences depending on preferred types of activities as well as involvement in sport clubs. As reported in Dwyer and colleagues (10), training during lockdown needs to continue to maintain the health benefits from regular PA. Regular accumulation of at least 60 minutes were most commonly reported to be between 3-4 days a week. Furthermore, late adolescents with competitive sport aspirations perceived their levels of PA decreased, although remained the most physically active group.

Declarations

Ethics approval and consent to participate

This study was approved by the University of Jyväskylä Research Ethics committee and participants gave informed consent to participation to the study. All methods were carried out in accordance with the relevant guidelines and regulations.

Consent for publication

Participants were informed of the research data could be used for publication and prior to commencing the survey provided their own consent to the terms of the study.

Availability of data and materials

The dataset supporting the conclusions of this article is available upon request with the last author of the manuscript.

Competing interests

The authors have no competing interests as defined by BMC, or other interests that might be perceived to influence the results and/or discussion reported in this paper.

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Authors’ contributions

All authors wrote the main manuscript text, KN carried out the data analysis, prepared figures and tables. All Authors reviewed the manuscript.

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**Figures**
Figure 1
Sample population flow chart for analyses. Late Adolescents Physical Activity (LAPA), COVID-19 (C19), Swedish version (S).

Figure 2
Flow chart of organised sport, changes in PA during spring 2020 lockdown and MVPA levels
Figure 3
Changes in physical activity among Finnish Adolescents during lockdown

Supplementary Files
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- SupplementaryTable.docx