

Fluctuations in Physical Activity over the Course of the COVID-19 Pandemic

Direct Original Research

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Open Access



Published: November 3, 2024



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Research Directs in Health Sciences: 2024, Volume 4 (Issue 1): 10

ISSN: 2768-492X

Abstract

Introduction: Several studies have indicated that physical activity (PA) declined during the restrictions associated with the onset of the COVID-19 pandemic. However, research comparing PA before the pandemic and during the pandemic-related restrictions to a more recent period when pandemic-related restrictions ended is limited. The purpose of this study was to compare PA across three timepoints: prior to the start of the pandemic (T1), the initial six-months of the pandemic (T2), and 18 – 24 months after the onset of the pandemic (T3).

Methods: University students (N = 149, n = 80 female) who owned an Apple iPhone reported PA (average steps/day) using the Health app at three timepoints: T1 (9/2019-3/2020), T2 (3/2020-8/2020), and T3 (9/2021-3/2022).

Results: A one-way repeated measures ANOVA demonstrated a significant main effect ($F = 11.4, p < 0.001$) for changes in average daily steps across timepoints. Steps were significantly lower ($p \leq 0.004$) during T2 (5045 ± 2423 steps/day) when compared to T1 (5674 ± 2856 steps/day) and T3 (6010 ± 2616 steps/day). No significant differences ($p = 0.11$) were found between T1 and T3.

Conclusions: During the initial six months of the pandemic participants reduced steps by 11%, which supports previous research. Subsequently, current evidence supports a novel recovery in steps in the six months prior to data collection as PA returned to baseline values. Future research is warranted to determine if other negative behaviors that may have been adopted during the pandemic have since abated.

Key Words: Behavior, steps, objective PA

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Introduction

Restrictions such as the closure of facilities and social distancing protocols during the COVID-19 pandemic may have negatively affected health behaviors since the onset of the pandemic in March 2020¹. While research published during the first few months of the pandemic suggested that exercise may be beneficial in reducing the severity of COVID-19², multiple studies have suggested that the pandemic promoted an increase in sedentary behavior and decreased physical activity³⁻⁵.

Specifically, there is evidence of increased sitting and decreases in total vigorous physical activity^{6,7} as well as an overall decrease in objectively measured daily steps⁸. A significant decline in steps from pre-pandemic (January 1, 2019) to the first year of the pandemic (November 2021) was reported with additional evidence suggesting that this decrease continued into the second year of the pandemic (2022)⁹. This same study noted a partial return to pre-pandemic levels or ‘recovery’ in steps from May to November 2021; however, steps were still 10% below average steps per day pre-pandemic (January 1 – December 31, 2019)⁹.

This potential ‘recovery’ of physical activity has not been examined thoroughly in all populations and, to the best of our knowledge, has yet to be examined after all major restrictions were lifted in the United States. Further, the limited

research that has attempted to examine a potential ‘recovery’ in physical activity relative to pre-pandemic levels is equivocal. The purpose of this study was to objectively assess physical activity (daily steps) at three time-points: 1) six months before the onset of the pandemic, 2) the first six months of the pandemic, and 3) 18 – 24 months after the onset of the pandemic in a sample of college students. This population is of interest as most universities cancelled face-to-face classes, closed all fitness facilities, and sent most students home at the height of the pandemic^{10,11}. We hypothesized that physical activity levels would decrease the first six months of the pandemic when compared to pre-pandemic physical activity levels and that physical activity would return to baseline values 18 – 24 months after the onset of the pandemic when most pandemic-related restrictions and closures were ended.

Scientific Methods

Participants

Participants (N=149, n= 80 female) included college-aged individuals (21.0 ± 1.7 years old) who owned an Apple iPhone (Cupertino, California, Apple Inc.) at a large public university in the Midwestern United States. This study received Institutional Review Board approval and all participants provided informed consent prior to data collection. A consent statement was included as the first page of the survey. Initiating the survey was considered providing consent.

Protocol

Data were collected in May 2022. Participants completed a single data collection session in which they reported steps using the Health application located within their iPhones. The Health application is a validated objective assessment of physical activity data¹². Participants were instructed to open the Health application on their device and select the ‘6M’ (six months) option under steps, which averages all step data in six-month intervals. Participants average steps 18 – 24 months after the onset of the pandemic (December 2021 – May 2022) were recorded. Participants were then instructed to adjust the six-month date range in the Health application to match the dates of September 15, 2019 – March 15, 2020 in order to collect steps data pre-pandemic. Finally, participants were instructed to adjust the date range in the Health application to match the dates of March 15, 2020 – August 15, 2020 in order to collect data from the first six months of the pandemic when restrictions were commonplace. We chose March 15, 2020 as the start date for pandemic-related restrictions as this is when the university mandated that face-to-face classes were cancelled and all campus recreational facilities were closed.

Statistical Analysis

A one-way repeated measures ANOVA was used to analyze potential changes in average daily steps across three timepoints: 1) six-months pre-pandemic (pre-pandemic), 2) initial six months of the pandemic (first six-months), 3) 18 – 24 months after the onset of the pandemic. Post-hoc paired samples t-tests were utilized to further assess a significant main effect of time. SPSS version 27 was used. A priori alpha of $p \leq 0.05$ was considered statistically significant.

Results

The ANOVA demonstrated a significant main effect of time for changes in steps per day ($F = 11.4, p = 0.000017$), Figure 1). Participants accumulated significantly ($t = 2.962, p = 0.004$) fewer steps during the first six-months of the pandemic (5045 ± 2423 steps/day) relative to the pre-pandemic time point (5674 ± 2856 steps/day). However, there was a significant increase ($t = 5.035, p = 0.0000014$) in physical activity from the first six months of the pandemic to 18 – 24 months after the onset of the pandemic (i.e., post-pandemic) time point (6010 ± 2616 steps/day). There was no significant difference ($t = 1.630, p = 0.105$) from pre-pandemic steps/day to the post-pandemic time point.

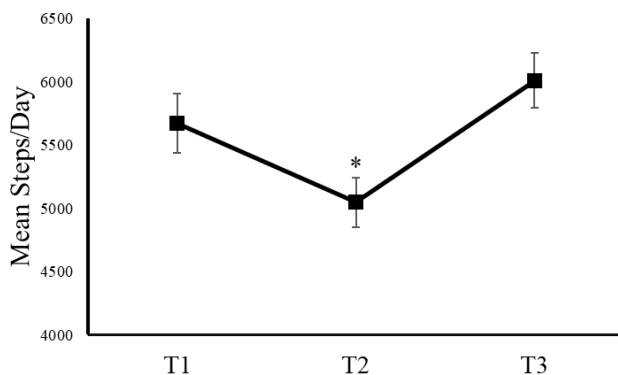


Figure 1. Changes in average daily steps across three time points: six months before the onset of the pandemic (T1), the initial six months of the pandemic (T2), and 18 – 24 months after the onset of the pandemic (T3). *Significantly less ($p \leq 0.004$) than T1 and T3.

Discussion

Presently we provide objective evidence that physical activity decreased by 11% from pre-pandemic to the first six months of the pandemic, which supports prior findings that identified similar reductions in physical activity, specifically in a college-aged population⁵⁻⁷. Utilizing this population allowed us to define specific timepoints where all included individuals experienced similar pandemic-related restrictions (e.g., closure of campus and recreational facilities) that may not have been reflected in other populations. These restrictions likely changed the day-to-day lives of students significantly, allowing us to examine how the pandemic directly impacted physical activity behaviors. Additionally, we provide novel evidence that physical activity, following this initial decrease, increased back to pre-pandemic levels at the time data was collected approximately two years after the start of the pandemic. This would indicate that despite a period of decreased physical activity during the initial six months of the pandemic, individuals may have returned to prior physical activity behavior now that pandemic-related restrictions and closures were ended. Not only is this rebounding effect of physical activity behavior important itself, but it provides initial evidence that the potentially negative behavioral impact of the pandemic may have since returned to normal. Perhaps some of the other documented negative impacts of the pandemic such as increased sedentary behavior⁵, increased alcohol consumption¹³, and worsening mental health^{14,15} may similarly return to pre-pandemic levels. Future research is warranted to determine if these other negative pandemic-era outcomes have since normalized as we move further into post-pandemic life.

This research study only included university students who own an iPhone. Therefore, our ability to generalize beyond a population inclusive of college-aged individuals with an iPhone is limited. It is possible that this specific population experienced changes in physical activity behaviors due to the return of in-person courses (i.e., walking to classes) which may not be representative of the general adult population. Further, while the health app is a valid assessment of physical activity and a useful tool in assessing past behavior¹², the phone has to be with the person when they are active to assess steps. It is possible some physical activity data was missed due to the individual not having the phone on their person during a given bout of physical activity.

Conclusions

Compared to pre-pandemic levels, physical activity declined by 11% at the onset of the pandemic. However, by May 2022, participants daily average steps had returned to pre-pandemic levels. This may indicate that the pandemic-era decreases in physical activity did not become habitual in this sample of university students. This creates the possibility that other adverse health behaviors (e.g., increased sitting and alcohol consumption) and outcomes (e.g., poorer mental health) that were reported as a consequence of the pandemic may not be habitual and can return to baseline. Future research is needed to examine if other negatively impacted behaviors and outcomes have persisted or abated now that pandemic-related restrictions have been lifted.

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