Original Research Report

Prosthetics and Orthotics International

OPEN

# Impact of the COVID-19 restrictions on physical activity and quality of life in adults with lower limb amputation

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## Abstract

**Background:** This study investigated the impact of COVID-19 restrictions on ambulatory activity and health-related quality of life (HR-QoL) in people with a lower limb amputation (LLA) in Norway. We hypothesized that the restrictions would negatively affect HR-QoL and decrease prosthetic wear time and ambulatory activity in participants with already limited mobility.

**Methods:** Twenty individuals with LLA (age and time since amputation 56.2 ± 11.9 and 22.3 ± 20.1 years, respectively) participated. Ambulatory activity (stepwatch: prosthetic wear time; steps per day; minutes of low-intensity (1–15 steps $min^{-1}$), moderate-intensity (16–40 steps $min^{-1}$), and high-intensity ambulation (>40 steps $min^{-1}$)) and HR-QoL (EQ-5D-5L) data were collected prepandemic and 8–12 months later during pandemic restrictions. Semistructured interviews identified personal experiences of coping with restrictions.

**Results:** Prosthetic wear time decreased significantly (−1.0 ± 1.5 hours $day^{-1}$, $p < 0.05$). Steps per day (440 ± 1481), moderate-intensity and high-intensity ambulation (3.7 ± 23.4, and 4.8 ± 13.9 minutes $day^{-1}$, respectively), and EQ-5D-5L index (.02 ± .10) increased, whereas low-intensity ambulation decreased (−1.5 ± 16.1 minutes $day^{-1}$), all nonsignificant changes. Qualitative analysis identified three themes related to coping with restrictions: (1) personal situation, (2) a prosthetic user's perspective, and (3) mindset.

**Conclusions:** Increased time spent at home might explain the decreased prosthetic wear time. Contrary to the hypothesis, participants did not decrease their physical activity, and the declined low-intensity ambulation was offset by increased moderate-intensity and high-intensity ambulation. A positive mindset, intrinsic motivation, and health awareness may be important factors for maintaining ambulatory activity and HR-QoL in people with LLA.

**Keywords**

coronavirus, social distancing, limb loss, fitness tracker, prosthetic use

Date received: 28 May 2021; accepted 1 November 2021.



## Introduction

As a response to the COVID-19 pandemic, the Norwegian authorities introduced restrictions to the society in March 2020 to prevent the spread of the coronavirus. National recommendations and measures targeted social distancing, limiting traveling, canceling events and recreational activities, closing schools, fitness centers and hospitality industries, and mandated working from home. Hence, severe restrictions were imposed on individual mobility. Even without such restrictions, people with a lower limb amputation (LLA) experience challenges and limitations related to mobility in daily life.[1] The ability to walk with a prosthesis is an important determinant of quality of life because it involves independence and participation in the community.[2]

Since the beginning of the pandemic, international online surveys demonstrated that people adopted a more sedentary lifestyle during home confinement[3] and that decreased physical activity level was related to worsened overall well-being and increased anxiety levels.[4] Moreover, consistent inactivity and lower walking pace (i.e, an indicator of low cardiorespiratory fitness) are reported risk factors for developing severe COVID-19 and mortality.[5,6] People with LLA have a substantial lower physical activity level than able-bodied people,[7] and most do not meet the recommended daily step count for healthy adults.[8] Lower levels of prosthetic use and physical activity are associated with worsened walking capacity,[9] lower functional ability,[10] and an increased risk of developing cardiovascular diseases.[11] Hence, maintaining a sufficient physical activity level is highly important for community participation and overall health in this exposed population.

Daily step count is demonstrated to be significantly correlated with community participation (i.e number of steps in the community and number of community visits) in people with LLA with different levels of functional capacity,[12] indicating that community ambulation is an important contributor to overall ambulation. Considering that the COVID-19 restrictions impose new barriers to community activity, these findings indicate that ambulatory behavior may change in this population, but this has not been investigated previously.

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**Associate Editor**: Cheryl Metcalf



DOI: 10.1097/PXR.0000000000000078

The aim of this study was to investigate the impact of the COVID-19 restrictions on ambulatory activity and health-related quality of life (HR-QoL) in people with LLA, using quantitative and qualitative methods. The level of ambulatory activity was measured with a step monitoring device for 7 days before the start of the COVID-19 pandemic in 2019 and during the COVID-19 pandemic 1 year later. Semistructured interviews were performed to identify how individuals experienced the impact of the restrictions on their daily life. Integration of quantitative and qualitative data was used to achieve a deeper understanding of the individual experiences and to identify potential psychosocial factors that might have influenced the level of ambulatory activity. It is hypothesized that the restrictions negatively affect HR-QoL and have a decreasing effect on prosthetic wear time and ambulatory activity in people with LLA.

## Methods

### Study design

This study was a follow-up, cohort study. The initial data collection was performed before the start of the COVID-19 pandemic and included measurements on ambulatory activity using a Step Activity Monitor (SAM) and self-reported HR-QoL (5Q-5D-5L).[13] Follow-up data collection and interviews were performed 8 to 12 months later (Figure 1).

### Participants

Twenty-two participants who were recruited as participants to a larger research project on mobility in the daily lives of people with LLA were invited to volunteer for the current study. Twenty-one persons responded to be willing to participate. The inclusion criteria were age between 18 and 75 years; a transtibial, transfemoral or knee-disarticulation amputation; minimum of 1 year since amputation; 6 months of experience with a prosthesis; and the ability to walk 500 m without a walking aid. The research project was approved by the Regional Committees for Medical and Health Research Ethics in Norway and the Norwegian Centre for Research Data. All participants signed an informed consent document before data collection.

### Quantitative methodology

The following demographic and clinical data were collected: sex, age, level and etiology of amputation, number of years since amputation, occupation, and use of a walking aid and/or wheelchair. Ambulatory activity was measured over 7 consecutive days with the SAM (Modus Health) attached to the prosthetic limb at the ankle level and calibrated according to the manufacturer's instructions. It is an accurate and reliable monitor for analyzing slow, irregular, or impaired gait in people with LLA.[14] The SAM reports the number of steps taken with the prosthetic limb in 10-sec intervals and multiplying by two provides the total number of steps. The outcome measures used in this study were the number of steps, hours of prosthetic wear time, and minutes of ambulation at the following intensities: low (1–15 steps $min^{-1}$), moderate (16–40 steps $min^{-1}$), and high (>40 steps $min^{-1}$). Participants were asked to keep a logbook to describe their main activities, pain episodes or other health-related issues, use of a walking aid, and weather condition for each day with the SAM. Measurements were considered valid when the SAM monitored the ambulation of at least five full days including logbook descriptions. HR-QoL was measured with the questionnaire EQ-5D-5L (EuroQol, The Netherlands).[13,15]

### Qualitative methodology

Semistructured interviews were conducted in the Norwegian language over telephone directly after the follow-up quantitative data measurements. Guiding questions aimed to identify personal experiences of coping with restrictions and covered the following topics: (1) personal situation (i.e, living alone or with partner/children, occupation, and being in a risk group for COVID-19), (2) mobility (i.e, daily prosthetic use, regular means of transportation, use of walking aid, and seasonal impact on activities), (3) activities (i.e, participation in social, recreational, and leisure time activities), (4) psychosocial aspects (i.e, the support of a social network and the experience of isolation), and (5) other needs (i.e, the need for and access to prosthetic services and use of digital solutions). For each discussed topic, participants were asked to describe whether changes had occurred since the outbreak of the COVID-19 pandemic. In addition, information from logbooks was used to ask more specific questions about activities during data collection. Interviews were audio recorded using the Dictaphone app (Nettskjema-diktafon, UiO, Norway) and transcribed verbatim in NVivo 13 (QSR International, Australia).[16]

### Quantitative analysis

MATLAB software (R2019a, Mathworks) was used to calculate outcome measures on ambulatory activity using custom algorithms. Data sheets were manually labeled for the first and last step taken each day to extract prosthetic wear time. Because the SAM cannot distinguish walking from cycling movement, information from the logbooks was used to identify and remove cycling activity from the data sheets. Statistical analysis was performed in SPSS Statistics version 27.0 for Windows 10 (IBM).[17] All variables were tested for normality using the Shapiro–Wilk test. To identify a difference between observations, a paired samples *t*-test and a Wilcoxon signed-rank test were applied for variables with normal and nonnormal distribution, respectively. Data are presented as means ± SD, and the significance level was set at $p < 0.05$.

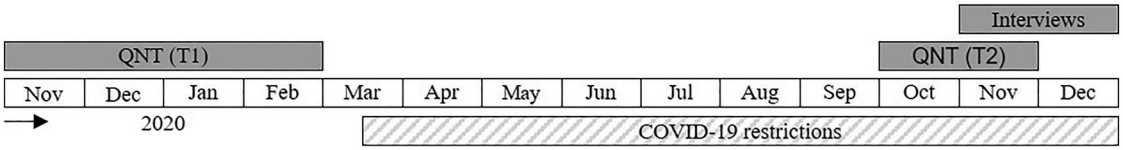


**Figure 1.** Study timeline. QNT, quantitative data collection; T1, time of initial data collection; T2, time of follow-up data collection.

**Table 1.** Demographic and clinical data (n = 20).

| ID | Sex | Age (yrs) | Time since amputation (yrs) | Level of amputation | Etiology | Occupation | Walking aid |
|---|---|---|---|---|---|---|---|
| P1 | F | 63 | 58 | KD | Trauma | Employed | NA |
| P2 | M | 39 | 7 | TTA | Trauma | Employed | Crutches |
| P3 | M | 65 | 8 | TFA | Arthrofibrosis | Unemployed | Wheelchair, sticks |
| P4 | M | 48 | 15 | TTA | Trauma | Employed | Crutches |
| P5 | M | 48 | 24 | TFA | Cancer | Student | Crutches |
| P6 | M | 60 | 7 | TTA | Trauma | Employed | Sticks |
| P7 | M | 49 | 47 | KD | Congenital | Employed | NA |
| P8 | M | 63 | 11 | TTA | Trauma | Retired | Sticks |
| P9 | F | 62 | 7 | TTA | Surgery error | Retired | NA |
| P10 | M | 67 | 5 | TTA | Diabetes | Retired | Wheelchair, sticks |
| P11 | M | 68 | 15 | TFA | Infection | Employed | Sticks |
| P12 | M | 70 | 53 | TTA | Trauma | Retired | Crutches |
| P13 | M | 45 | 27 | TTA | Cancer | Employed | NA |
| P14 | M | 55 | 6 | TFA | Trauma | Employed | Sticks |
| P15 | M | 46 | 16 | TFA | Trauma | Employed | Wheelchair, sticks |
| P16 | M | 64 | 11 | Bilateral TTA | Diabetes | Retired | NA |
| P17 | F | 70 | 70 | TTA | Congenital | Retired | Wheelchair |
| P18 | M | 60 | 40 | TTA | Trauma | Employed | NA |
| P19 | M | 24 | 12 | TTA | Cancer | Employed | NA |
| P20 | F | 58 | 7 | TTA | Cancer | Unemployed | Crutches |
| Mean ± SD | | 56.2 ± 11.9 | 22.3 ± 20.1 | | | | |

*Abbreviations: KD, knee disarticulation; TTA, transtibial amputation, TFA, transfemoral amputation, NA, not applicable*

### Qualitative analysis

Two coders analyzed the narratives independently. The first coder generated initial codes deductively based on a model from Batten et al.[1] and predetermined variables related to the guiding questions.[18] The coding allowed for adjustment of initial codes and addition of new codes to the coding framework. The second coder was instructed to familiarize themselves with the narratives before initiating the coding process by use of the coding framework. The two sets of coded narratives were merged for calculation of the interrater reliability using Cohen kappa. Debriefing meetings were conducted for discussions on the coding process and thematic analysis, using a phenomenological approach. Quotations used in this study were translated independently by the two coders and compared to reconcile and synthesize translated quotations.

### Integration of data

Integration of quantitative and qualitative data was performed at the interpretation and reporting level through joint displays as described by Fetters et al.[19] Individual quantitative outcome measures (% change between time of initial data collection and time of follow-up data collection for the following variables: steps per day, prosthetic wear time, and minutes of high-intensity ambulation) were structured in a table and sorted in a descending order according to change in steps per day. Next, the narrative for each participant was integrated into the joint display and investigated for quotations that could facilitate the interpretation of the quantitative data. Exemplar quotations were then added to the table in a separate column (Table 3). The two coders performed an iterative process of discussions to formulate a subjective interpretation of the psychological mechanisms behind the physical behavior of ambulatory activity and prosthetic wear time. Next, the subjective interpretations of each participant's results were compared and analyzed to identify additional factors that might have influenced the physical activity level before and during the restrictions.

## Results

### Participants

Twenty-one participants with LLA volunteered for this study. One participant did not meet the criterion of the minimum of five full days with SAM measurements; hence, data from twenty participants were used for the analysis (80% men; 12 transtibial amputation (TTA), 5 transfemoral amputation, 2 knee disarticulation, and 1 bilateral TTA; 9 traumatic, 4 cancer, 2 diabetes, and 5 other) (Table 1). All participants used their prostheses daily. Four participants reported occasional use of a wheelchair in their homes to relieve pressure on the stump or because of pain. Crutches and/or walking sticks were used outside the home for walking longer distances, on off-road terrain, or during pain episodes.

### Quantitative results

After removing seven days of incomplete SAM measurements, a total of 273 days were used for further analysis. Nineteen reported

**Table 2.** Data from Step Activity Monitor (SAM) and EQ-5D-5L (n = 20).

| | T1 | T2 | ΔT2–T1 | *p* value |
|---|---|---|---|---|
| | Mean ± SD | Mean ± SD | Mean ± SD | |
| Prosthetic wear time (hours day$^{-1}$) | 15.1 ± 1.5 | 14.1 ± 2.0 | −1.0 ± 1.5 | 0.001[a] |
| Steps per day | 5297 ± 2299 | 5736 ± 2533 | 440 ± 1481 | 0.200 |
| Ambulation intensity (min day$^{-1}$) | | | | |
| Low (1–15 steps min$^{-1}$) | 82.2 ± 24.4 | 80.7 ± 26.0 | −1.5 ± 16.1 | 0.681 |
| Moderate (16–40 steps min$^{-1}$) | 80.0 ± 24.3 | 83.7 ± 31.0 | 3.7 ± 23.4 | 0.490 |
| High (>40 steps min$^{-1}$) | 38.9 ± 22.5 | 43.7 ± 24.9 | 4.8 ± 13.9 | 0.139 |
| EQ-5D-5L index | .80 ± .10 | .82 ± .16 | .02 ± .10 | 0.311 |

*T1, time of initial data collection (prepandemic); T2, time of follow-up data collection (during pandemic)*
[a]*Significance <0.05.*

cycling sessions were removed from the data sheets. Prosthetic wear time decreased significantly by approximately seven hours per week ($p = 0.001$), whereas participants on average performed around 50 minutes of additional ambulatory activity of moderate and high intensities per week ($p = 0.490$ and $p = 0.139$, respectively) (Table 2). Individual results demonstrate a large range in steps per day (−41.3 to 52.4%), prosthetic wear time (−36.1 to 6.5%), low-intensity ambulation (−47.5 to 40.6%), moderate-intensity ambulation (−40.8 to 51.6%), and high-intensity ambulation (−54.9 to 81.0%) (Figure 2).

### Qualitative results

The interrater reliability demonstrated a moderate agreement (Cohen kappa = 0.64) between the two coders. Team-based discussions revealed that the coders prioritized the narratives somewhat differently, which influenced the coding decisions. It was probably due to overlapping in the essence of codes rather than disagreement in interpretation. The coders agreed that quotations often could be covered by multiple codes; hence, recoding was unnecessary. In fact, the existing overlap in codes facilitated the grouping of codes toward development of themes. Three themes were identified that illustrated the individual experience of coping with COVID-19 restrictions: (1) personal situation, (2) a prosthetic user's perspective, and (3) mindset.

### Personal situation

To what extent the different restrictions affected a participant's life was dependent on their personal situation. A major factor was the status of occupation because most participants who had a job were forced to work from their homes. Not commuting to and from work and the smaller working space of a home office were mentioned as reasons for decreased ambulation during working hours. Other challenges were maintaining a healthy work–life balance, not having informal conversations with colleagues, and lacking ergonomic office furniture suited for long periods of sitting. A positive aspect was saving time by not commuting, which for instance was used with the children. Another reason for the increased spare time was canceled organizational and recreational activities or other activities that involved social gatherings. Most participants had a partner, children, and/or relatives living nearby or in the same household, which was mentioned as an important factor for coping with social distancing. Other factors such as owning a car, a dog, and a private cabin influenced to what degree the participants went out of their homes.

### A prosthetic user's perspective

Participants explained their reduced prosthetic wear time as a consequence of the increased time spent at home. Trust in prosthetic functioning, terrain, and seasonal conditions were important factors for the ability to be physically active outdoors. A few participants experienced challenges with walking outdoors, particularly during the winter season, and used indoor activities or physiotherapy classes to be physically active. However, when these facilities closed because of the restrictions, participants lost their access to physical activity and their contact with peers. Not meeting peers through fitness classes, sports teams, or activities organized by the user organization for people with LLA was experienced as a significant loss.

### Mindset

A positive outlook and acceptance of the authorities' guidelines were requisites for coping with the restrictions. Participants were not particularly anxious about the situation but expressed their awareness of being in the risk group for COVID-19 themselves, people around them, and/or other persons with LLA because of higher age or underlying diseases. Limited social contact was experienced as the most considerable burden, and although digital contact was acceptable, it was not experienced as a proper replacement to actual physical contact. Important aspects of adapting to a new situation were being flexible and creative, such as finding alternatives for canceled activities.

### Integration of data

Discussions on the interpretation of the integrated quantitative and qualitative data for each participant revealed that intrinsic motivation, creativity, and awareness of the importance of physical activity were factors that appeared in persons who maintained or increased their physical activity level. Participants with decreased activity levels appeared to be more dependent on external stimuli, such as participation in sports teams/fitness groups, and were less motivated to exercise alone. Four exemplar participants are presented in Table 3, including data of change in steps per day, prosthetic wear time, minutes of high-intensity

**Table 3.** Exemplar participants with quantitative measures of difference (%) between prepandemic and during the COVID-19 pandemic for the variables steps per day, prosthetic wear time, and high-intensity ambulation value indicates an increase during the pandemic, quotations from semistructured interviews and subjective interpretation from the integration of data.

| ID | Quantitative data | | Qualitative data | Integration of data |
|---|---|---|---|---|
| | Variable | ΔT2-T1 | Quotations | Subjective interpretation |
| P3 | Steps<br>PWT<br>High | +32.2%<br>−36.1%<br>+38.7% | "When I could not attend my regular activities, I checked the weather forecast and when the weather was good, I went for crosscountry skiing. Or in the summer, I went for a bike ride."<br>"Cycling has been a huge relief for me. It is a great pleasure, and then it is not the disability that counts."<br>"I miss the social contacts through my activities. I recognize how much I valued meeting these people." | This person is unemployed and has a different activity each day of the week, such as playing wheelchair volleyball and singing in a choir. Because all activities are canceled, he has much spare time. His motivation does not depend on the activities, and he is flexible and motivated to find other opportunities to be physically active. He spends much time outdoor and enjoys skiing or cycling, depending on the season. |
| P13 | Steps<br>PWT<br>High | +26.2%<br>−2.6%<br>+26.4% | "I have become more sedentary in the work situation, but I have actually exercised more in my spare time. I spend less time on transportation, fewer activities for the children, so I have more spare time."<br>"I motivate myself to exercise for my own good. To get out and feel better in my body"<br>"Something that is less pleasant, are the cancelled competitions I wanted to participate in." | This person is very active in different sports. His training sessions are mainly alone and outside, so he has never lost the access to exercise because of the restrictions. Although all future competitions are canceled, he keeps motivated to continue training. He has more free time because he has worked at home and uses this time to exercise even more often. |
| P5 | Steps<br>PWT<br>High | −11.0%<br>+1.3%<br>−27.7% | "To not have the discipline to get out, and have a place to meet people. It has been a bit uninspiring. But it was also comfortable to drop commuting and being stuck in traffic"<br>"Since you are so much at home, you do not get the natural amount of exercise with walking, as you do when moving from A to B."<br>"Paralympic sports and ice-sledge hockey have been shut down. I have started to go for walks and such, but there has not been any fitness training. | This person is very social and misses fellow students and his sports team members around him. Because his sport club is closed, and he has more spare time because of home schooling, he spends more time with his children by going for walks or playing games. The inability to perform training sessions together with his team, keeps him from maintaining fitness training. |
| P12 | Steps<br>PWT<br>High | −21.7%<br>−2.8%<br>−38.6% | "Since the pandemic, I have lost all forms of physical exercise that I am able to do, and that includes activities in a heated pool that has been closed."<br>"Now when I am at home, I do some stretching and lifting, just to keep my body in motion."<br>"There is no point in getting annoyed and upset. That's the way it is for most of us, whether we have legs or not." | This person suffers from pain and his exercise depends on special treatments in a heated swimming pool. Because the pool has been closed, he does some exercises at home, but this is not a sufficient replacement for him. Because this person has gone through many episodes of health problems and pain, he has learned how to put his worries into perspective and to stay positive. |

*Abbreviations: Steps, steps per day; PWT, prosthetic wear time; High, high-intensity ambulation*

ambulation, quotations, and the subjective interpretation from the two coders.

## Discussion

The study's aim was to investigate the impact of the COVID-19 restrictions on ambulatory activity and HR-QoL in people with LLA. In line with our hypothesis, quantitative findings demonstrated a significant decrease in prosthetic wear time during the pandemic compared with prepandemic. However, ambulatory activity in steps per day and minutes of moderate-intensity and high-intensity ambulation increased. In addition, HR-QoL slightly increased, but these results were not significant. This is in contrast to the reported decreased physical activity and quality of life in previous studies to the impact of the pandemic.[3,4]

Qualitative analysis identified three overlapping themes that illustrated the experienced impact of the restrictions on the individual's life: (1) personal situation, (2) a prosthetic user's perspective, and (3) mindset. Although the restrictions were similar for the entire population, the impact on the activity and participation domain on the individual level was multifactorial. Subthemes as having a job and household members were among essential factors determining to what extent participants experienced that the

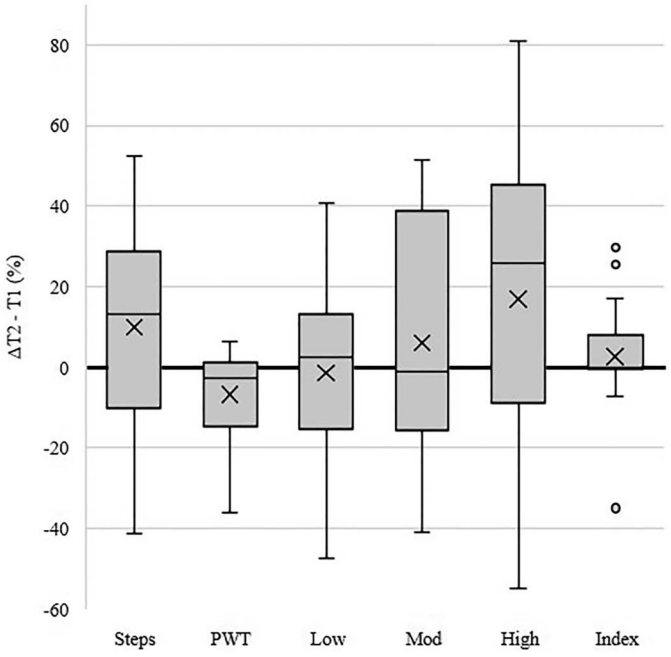


**Figure 2.** Difference (%) between T1 and T2 for variables. Steps; steps per day, PWT, prosthetic wear time; Low, low-intensity ambulation; Mod, moderate-intensity ambulation; High, high-intensity ambulation; Index, EQ-5D-5L index. Median and mean values are illustrated with a line and cross, respectively. Dots signify outliers. A positive value indicates an increase.

restrictions affected their daily life. From the prosthetic user's perspective, good prosthetic functioning, season, and arranged activities were important for ambulatory activity. The mindset, with subthemes as a positive outlook and being flexible to changes, was necessary for coping with the situation and was similar to enablers for community walking reported by Batten et al.[1]

The integration of quantitative and qualitative data through joint displays extended our understanding of the large interindividual differences in quantitative findings. We observed a trend that participants who maintained or increased their physical activity level demonstrated a higher level of intrinsic motivation, creativity, and health awareness. Participants with a higher need for external stimuli, such as social support, were more likely to decrease their physical activity level. A wide range in community activity among high-functioning prosthetic users has previously been observed[20] and indicates that functional capacity and prosthetic functioning are not isolated contributors to physical performance. Dillon et al argue the complex interactions between physical and mental health components and underline mental well-being as an essential contributor to physical health.[21] Our findings contribute to this holistic view by demonstrating that a change in physical behavior is the outcome of both physical and mental aspects.

Most of our participants had a high physical activity level and met the recommended minimum of 5000 steps per day for people with disabilities.[8] The average EQ-5D-5L index of .90 and .92 at time of initial data collection and time of follow-up data collection, respectively, was far above the previously reported index of .54 among persons with transfemoral amputation and TTA 24 months after rehabilitation discharge.[22] Our participants had a high level of prosthetic mobility, physical activity, independence, and the ability to be active in the community, which are factors that are related to quality of life.[2,23] However, because causality cannot be determined, it remains unknown whether the high activity level of our participants prevented a decline in quality of life, or vice versa. Still, limited participation in social activities and not being able to physically meet peers was described by most participants as the most burdensome consequence of the pandemic. Studies show that support from people with similar health and life challenges is associated with a positive outlook, a synergistic relationship between motivation, positive emotions, and confidence.[24] Despite lacking scientific evidence on the effect of peer support on the physical functions and mental well-being of people with LLA, our findings shed new light on the importance of meeting peers in this population.

### Limitations

Several limitations should be taken into consideration when interpreting our findings. First, the study cohort was small and included experienced prosthetic users with mainly nonvascular (65% due to trauma/cancer) reasons of amputation, limiting our findings' generalizability. The impact of the restrictions might be worse for persons with LLA with a poor functional level and overall health, who generally experience increased isolation and dependency.[22] Second, ambulatory activity monitoring was restricted to a total of 14 days for each participant. The level of physical activity can fluctuate over time and is reported to decrease during the autumn and winter season.[7] However, according to the participants' logbook descriptions, seasonal conditions were similar during data collections for both years, and participants experienced no limitations in their activity related to seasonal conditions.

## Conclusions

The findings demonstrate a decreased prosthetic wear time during the restrictions compared with prepandemic but an increased level of ambulatory activity in steps per day and moderate-intensity and high-intensity ambulation. Integrating subjective data indicated that experienced prosthetic users occur to have high level of health awareness and intrinsic motivation for physical activity. Therefore, we suggest that providing information on the benefits of physical activity on prosthetic functioning and overall health might promote physical activity in this population. In addition, we highlight the importance of meeting peers and promoting user organizations to initiate creative solutions for social contacts, such as arranging digital meetings or small gatherings for persons with LLA who live alone.

### Funding

The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was financially supported by the Research Council of Norway and Oslo Metropolitan University/Faculty of Technology, Art, and Design/Faculty of Health Sciences. The funded Project is "Patient-Centric Engineering in Rehabilitation (PACER)" and project No. is 273599

## Declaration of conflicting interest

The authors disclosed no potential conflicts of interest with respect to the research, authorship, and or publication of this article.

## Acknowledgments

The authors thank all participants who volunteered in the study.

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## Supplemental Material

There is no supplemental material in this article.

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