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Promoting More Physical Activity and Less Sedentary Behaviour During the COVID-19 Situation – SportStudisMoveYou (SSMY): A Randomized Controlled Trial

EMPIRICAL PAPER

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ABSTRACT

Objective: To determine the effect of an innovative, online-based intervention, addressing the possible decline of physical activity (PA) and increase of sedentary behavior (SB) during COVID-19 stay at home restrictions in Switzerland.

Methods: This study investigated the effect of a two-week, social cognitive theory-based, online-video moderate to vigorous (MV)PA or SB intervention on MVPA and SB behaviour and intention via a 3 group by 2 time point parallel randomized controlled trial during the COVID-19 pandemic. Adults (≥18 yo) were recruited over the internet between April 10th and April 19th 2020 (n = 129; 75.2% female; mean age = 29.0 [SD 11.8] years). Both intervention groups received five videos targeting either SB for the SB group or MVPA for the MVPA group and were compared to an attention control group (fruit and vegetable consumption). It was hypothesized that MVPA time and intention would increase for the MVPA group and the SB group would outperform control on SB behaviour and intention indicators.

Results: No significant interactions were found for the MVPA group (n = 41) versus control (n = 40). Only one significant interaction was measured for the SB group (n = 48; intention of active breaks F = (2,114) = 5.84, p = 0.004, η_p^2 = 0.09). Although mostly non-significant and small effects, the MVPA group showed results pointing in the hypothesized direction on all PA indicators and the SB on all SB indicators, respectively.

Conclusion: Considering this study's limitations (e.g. small intervention dose), video-based online PA and SB interventions seem promising and feasible. This approach is appropriate for COVID-19 and other stay at home situations.

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INTRODUCTION

Moderate-to-vigorous physical activity (MVPA) has positive effects on cardiorespiratory fitness, musculoskeletal fitness, cognition, weight management, diabetes mellitus, some cancers, obesity, bone as well as joint diseases, and depression (2018 Physical Activity Guidelines Advisory Committee, 2018; Warburton et al., 2006). However, over the past few decades sedentary behaviour (SB) has increased due to technological advances, societal influences and environmental attributes. SB has been linked to health risks such as type 2 diabetes, metabolic syndrome, cancer, and all-cause and cardiovascular disease mortality (Mansoubi et al., 2014).

Despite the MVPA benefits, in Switzerland, 24% of adults do not meet the guidelines of 150 minutes of MVPA or 75 minutes of vigorous PA per week (Swiss Federal Statistical Office, 2019), whereas 27.5% globally do not meet these WHO guidelines (Guthold et al., 2018). In terms of SB in Switzerland, 48% self-report sitting >6 h/day and the longer the SB phases are the less PA breaks are made (Swiss Federal Statistical Office, 2019). Similarly, in Europe on average >5 h/day is spent sitting (Bennie et al., 2013).

The sudden stay at home (also referred to lockdown or quarantine) status declared in several countries after the spread of COVID-19 caused an acute lifestyle change for many (Ferreira et al., 2020) potentially impacting PA and SB. Despite social – or more appropriately physical – distancing in many countries, the population should be encouraged to maintain daily PA (Ferreira et al., 2020; Jiménez-Pavón et al., 2020) as the stay at home situation may lead to more SB through working from a home office or increasing leisure screen time. This likely leads to increased body weight/obesity, cardiovascular problems, high blood pressure or even psychosocial disorders. Furthermore, PA positively influences immunity (Ferreira et al., 2020). Thus, a physically active lifestyle and reducing SB especially during the stay at home period is an important approach to decrease susceptibility of COVID-19 infections and to counteract possible consequences of the crisis (Ferreira et al., 2020).

Is COVID-19 actually making the world more sedentary? With parks, gyms, exercise outlets, stores and (fitness) businesses being closed, the PA opportunities are restricted (WHO, March 27, 2020). The ability for people to leave their home to engage in PA is limited (Hall et al., 2020). With amateur and competitive races and competitions canceled all over the world due to COVID-19, the motivation to train or to move decreases especially for participants/athletes (Lidbury, March 17, 2020). Non-athletes may also feel demotivated as athletic role models are less present in the media. PA motivation may also be negatively affected as it is difficult or impossible to meet with workout groups, sport teams or friends. Furthermore, with national school closures on March 18th, 2020, in 107 countries (Viner et al., 2020), parents are required to juggle the responsibilities of childcare, teaching, caretaking of grandparents, and working simultaneously, and may have less time for their own preferences and hobbies, including PA. Additionally, mental health challenges emerge during stay at home times since physical distancing is necessary to slow down the contagion but hinders social interactions crucial for mental well-being (Bansal et al., 2020). The current restrictions are of uncertain duration, therefore daytime stress, anxiety and depression levels may also increase (Altena et al., 2020). PA improves mental health in general and can reduce the risk of depression (WHO, March 27, 2020). But with the stay at home, it may be more challenging to engage in or even start a PA program.

However, there are also many opportunities to practice more PA and less SB during stay at home times. As there is no commute to work or school during stay at home, there may be more time for PA. Home-based PA workouts are easily accessible on the internet, which may also lead to less SB. The time at home may also make us realize that we may need social interactions as relatedness is thought to be a basic human need (Deci & Ryan, 2008). For some, there is more time to spend with family and loved ones, introspect, or do family activities during the stay at home being able to focus on activities that they did not have time for before (e.g., gardening, family hikes) which could result in more PA and less SB. Previous research has shown the feasibility of video-based interventions to promote PA and highlighted that videos should be of short duration (Vandelanotte & Mummery, 2011).

To motivate individuals to be active, application of theory is recommended (Downs et al., 2013). The social cognitive theory (SCT) is one of the most useful theories to understand behaviour and is based on variables that influence intention and behaviour (Beauchamp et al., 2019). High self-efficacy, positive outcome expectations, perceived social support and beneficial environmental variables increase the likelihood of being active (Lippke & Wiedemann, 2007; Wilcox et al., 2003; Wilhelm & Büsch, 2006). The majority of PA research using the theory focused on the determinants and effects of efficacy beliefs (Feltz et al., 2008). SCT interventions have been successful in promoting PA in minorities (Joseph et al., 2017), cancer survivors and caregivers (Stacey et al., 2016), adults that had a stroke (Bailey, 2020), and among other populations.

Even though there are >400 documented ongoing COVID-19 studies worldwide, to-date no PA and/or SB interventions could be identified (WHO, 2020). Data from Garmin users shows that the global pandemic decreased the average of daily steps, as well as more specific activities like skiing (Garmin, April 9, 2020). Fitbit (March 23, 2020) compared their own users' (n > 30 million) established baseline step count during the

week of March 22, 2019 with the same week during the COVID-19 year. A significant decline in average step count in almost all studied countries was documented. The most dramatic change was observed for European countries with declines of step counts ranging from 7%–38% (Fitbit, March 23, 2020). However, a more in-depth study showed that people who did PA two to three times a week before COVID-19 were more likely to be active and those who were irregularly physically active were moving even less during the COVID-19 stay at home (Brand, April 15, 2020). A recent study assessing PA in U.S. adults during the first month of COVID-19 found a significant reduction of vigorous intensity (37% decrease), moderate intensity (47% decrease) PA and walking intensity (33% decrease) in early vs. pre COVID-19 period (Dunton et al., 2020). Overall these findings indicate a negative impact of COVID-19 on PA.

To address the possible decline of PA and increase of SB during the stay at home of COVID-19, this study explored the effect of a brief, SCT-based, online (YouTube), MVPA and SB intervention on MVPA and SB behaviour and intention during the COVID-19 pandemic. It was hypothesized that 1) the MVPA intervention group would outperform the attention control group on MVPA behaviour and MVPA intention, and 2) the SB intervention group would outperform the attention control group on SB behaviour and SB intention indicators.

METHODS

DESIGN/PROCEDURES

The SportStudisMoveYou study was a 3 (group) by 2 (time point) parallel randomized controlled trial (RCT). Participants had to be at least 18 years old and provided informed consent prior to completing the online pre-survey. At the end of the pre-survey session participants were randomly assigned via a computer algorithm with allocation ratio of one third to one of two intervention groups (moderate-to-vigorous physical activity or sedentary behaviour and screen time) or an attention control group (fruit and vegetable). At that time they were given a link to a YouTube channel containing five videos specific to their assigned group. The videos were open access on YouTube, however watching the videos of the other intervention groups (contamination) would have needed participants to put in extra effort. The intervention lasted over a two-week time period, during the COVID-19 stay at home time. Pre-surveys were collected between April 10th 2020 and April 19th 2020. After one week, a reminder email was sent to the participants containing the link to the five intervention group specific videos again. After two weeks, participants were emailed a link to complete the post-survey, which could be filled out until May 6th 2020. Procedures were approved by the University of DBPR IRB, and the reporting followed the CONSORT Guidelines for RCT's (Schulz et al., 2010).

RECRUITMENT/SAMPLE

The main strategy in order to recruit participants for the study relied on the distribution of a short promotion video (1 min 35s). The promotion video's goal was to arouse interest in the project and get people to register for it. To obtain a broad sample and increase reach, the spoken language was English with German and French subtitles. In the recruitment phase, the video was shared during 9 days through three main promotion strategies. First, media and influencers – DBPR, UNIK Sports, and Aniya Seki (Swiss Boxing Champion) – shared the promotion video via their social media channels and newsletters. Also, utilizing a customizable text template, as many of the authors' personal contacts as possible were contacted through WhatsApp, E-Mail or personal social networks. Additionally, a project specific Facebook and Instagram page was created where the promotion video as well as the link to join the project was featured. Lastly, the video was posted on at least 28 different Facebook pages receiving over 2500 views. Upon clicking on the link in the description of the promotion video, participants were directly forwarded to the pre-survey.

MEASURES

Online questionnaire forms (*limesurvey.org*) were used for both pre-test and post-test measurements. Demographics (sex, age, education, and country) were collected at pre-intervention only. The other measures were collected at pre- and post-intervention. In the post-test survey participants were asked how many videos they have watched in context of this study, in order to check intervention delivery/dose.

MVPA

As the intervention targeted MVPA, the moderate and vigorous questions of the International Physical Activity Questionnaire (IPAQ) (Craig et al., 2003) were used. The IPAQ is designed for 15 to 65 years old and asks about behaviour of the last seven days. The IPAQ has documented reliability and validity (Lee et al., 2011). Vigorous PA is classified as activities that take hard physical effort and make you breathe much harder than normal activities such as heavy lifting, aerobics or fast cycling. Moderate PA is classified as activities that make you breathe a bit harder than normal and demand a moderate physical effort such as comfortable cycling, tennis doubles and carrying light things. Additionally, participants were asked if they intend to engage in regular MVPA.

SB

Questions from the last 7-d SB questionnaire (Wijndaele et al., 2014) were selected specific to our study purposes. Screen time (not for school or work purposes), as well as the interruption of longer periods of sitting by changing

to standing or active breaks, were surveyed. An active break was defined as a short movement activity lasting longer than 30 seconds (stretching, knee bends, some walking). Additionally, the intention to reduce screen time and the intention to interrupt longer sitting times with active breaks was assessed.

INTERVENTION

The study team was being educated about theories of behavior change when COVID-19 began in Europe. The team spontaneously decided that an intervention should be put together to motivate people to be active and decrease their SB. Different theories were reviewed with respect to effectiveness and generalizability. Upon reaching a theory consensus, the scripts were developed and translated into videos by the team. According to the assigned group, SSMY participants were provided with five videos that aimed to change their health behaviour. The videos followed the same concept and were based on the SCT (Bandura, 1977). Each intervention included one basic motivational video and four videos with specific strategies for behaviour change. The videos used behavior change techniques derived from the SCT such as including self-efficacy building instruction, positive reinforcement, goal setting as well as brief discussion of outcome expectations and pros and cons of the addressed health behaviours. The videos were tailored to be appropriate for stay at home situations like during the current COVID-19 restrictions throughout most of Europe. All intervention videos can be accessed by the weblink listed in the next paragraph. The purpose of the basic video was to motivate the people to change their behaviour, highlight the benefits and set a goal via the following four SCT-related aspects: self-efficacy, outcome expectations, pros and cons, and goal setting. The four videos with the specific ideas and strategies for behaviour change focused on starting with easy tasks progressing to harder tasks towards the last video – this mapped on to ¾ of the sources of self-efficacy including mastery experiences, verbal persuasion, and vicarious experiences. The text spoken by a computer generated male voice was in English with German and French subtitles. The actors in the videos were 3 male and one female sports science master students. The videos were filmed in a common apartment. The basic motivational video lasted about 1 min 45 s and the four specific behaviour change strategy videos lasted around one minute each. Therefore, when watching all the videos at once, the intervention lasted for around 6 minutes.

The two intervention groups and the attention control group are described below and the videos are at: *https://www.youtube.com/channel/UC9wvza0GKHIxitSY6jOOjUQ*

- MVPA (intervention group 1): This intervention's goal was to motivate people to include 10–20 minutes of additional MVPA in their daily routine. The four specific ideas for behaviour change videos provided the participants with exercises that can be easily implemented at home without any equipment. Each video contained four exercises, one of which focuses on cardiovascular and three exercises targeting large muscle groups, namely the lower body (i.e. legs), the back as well as the front part of the upper body (chest, shoulders, triceps). Body weight exercises were presented which should further stress the core muscles. Furthermore, people were given exercises with different levels of difficulty using objects (e.g. backpack with extra weight, bottles etc.) that are likely to be found at home. The motivational process was supported by setting easy goals and promoting self-efficacy aspects in each of the four videos.

- SB (intervention group 2): This intervention's goal was to sit or lay an hour less per day and spend half an hour less per day in front of a screen. In the first behaviour change strategy video participants were motivated to try standing more while working on the computer with an improvised standing desk by placing a chair on a desk/table and putting the computer on the chair. The second video was dedicated to the goal of reducing the daily screen time by sticking post-it note reminders on their screens like TV, PC, etc. The third behaviour change strategy video was about taking short preferred active breaks like stretching, doing 20 squats or walking up and down the hallway. In the last video viewers were confronted with the challenge of learning how to juggle as juggling is conceptualized as an active and enjoyable active break.

- Fruit and vegetable consumption (attention control group): To provide the same attention but not influence, MVPA, or SB, the content focused on fruit and vegetable consumption. Specifically, the goals pursued in the attention control intervention were to motivate the participants to try to eat enough fruits and vegetables. The four behaviour change strategy videos contained solutions in the form of simple and quickly prepared recipes, in which the participants do not need to have special skills or ingredients. In the first behaviour change strategy video it was recommended to include fruits already in their breakfast by adding them to the cereals or as an alternative to mix up fruits in a fruit smoothie. In the second behaviour change strategy video an oven-based vegetable lunch recipe was provided. The third video focused on healthy snacks, sweet and juicy fruit salad, and healthy chips. The fourth video showed the preparation of a vegetable soup for dinner.

STATISTICAL ANALYSES

A 2 (time-point) by 3 (intervention group) repeated measures analysis of variance (ANOVA) was calculated for each of the study variables using a Bonferroni corrected significance level of $p < .007$ with Tukey HSD follow-up tests. The average missing data per variable was relatively low at 3.49% (SD = 1.74%), therefore, pairwise deletion was used in the analyses. The analyses were also replicated with a mean substitution for missing data resulting in the same conclusions (results not shown). Dropouts, participants not filling out the post-survey received by email, were excluded from the intervention efficacy analysis. However, an analysis between dropouts and study completers was performed in order to check whether demographics and baseline measures differed between them. Self-reported intervention delivery/dose was analyzed using descriptive statistics.

RESULTS

Participant flow is provided in ***Figure 1***. Participants (n = 129) were 75.2% female; mean age = 29.0 [SD = 11.8] years old, mean years of education = 12.2 [SD = 2.1] years; 55.8% students; 96% chose German for the survey language; and 88.4% were from Switzerland. Pre-test variable descriptives and demographics by intervention group are presented in ***Table 1***. All pre-test group comparisons were non-significantly different ($p > .05$). Skewness and kurtosis indicated that study variables were normally distributed, thus these variables were not transformed. Analysis between study dropouts and completers showed no significant pre-test differences for the demographic or study variables ($p > .05$).

Self-reported intervention delivery/dose did not differ between the three groups ($p > .05$). The MVPA group watched an average of 4.41 (SD = 2.34) videos, while the SB group reported to have seen 5.35 (SD = 3.12) and the attention control reported an average of 4.83 (SD = 2.63) videos watched. Nearly half of all participants (45%, n = 58) reported that they had watched five videos, and 21 (13.2%) participants reported to have watched more than 5 videos, in context of this study. A small number of participants (11.6%, n = 15) reported that they had watched two or less videos in context of this study.

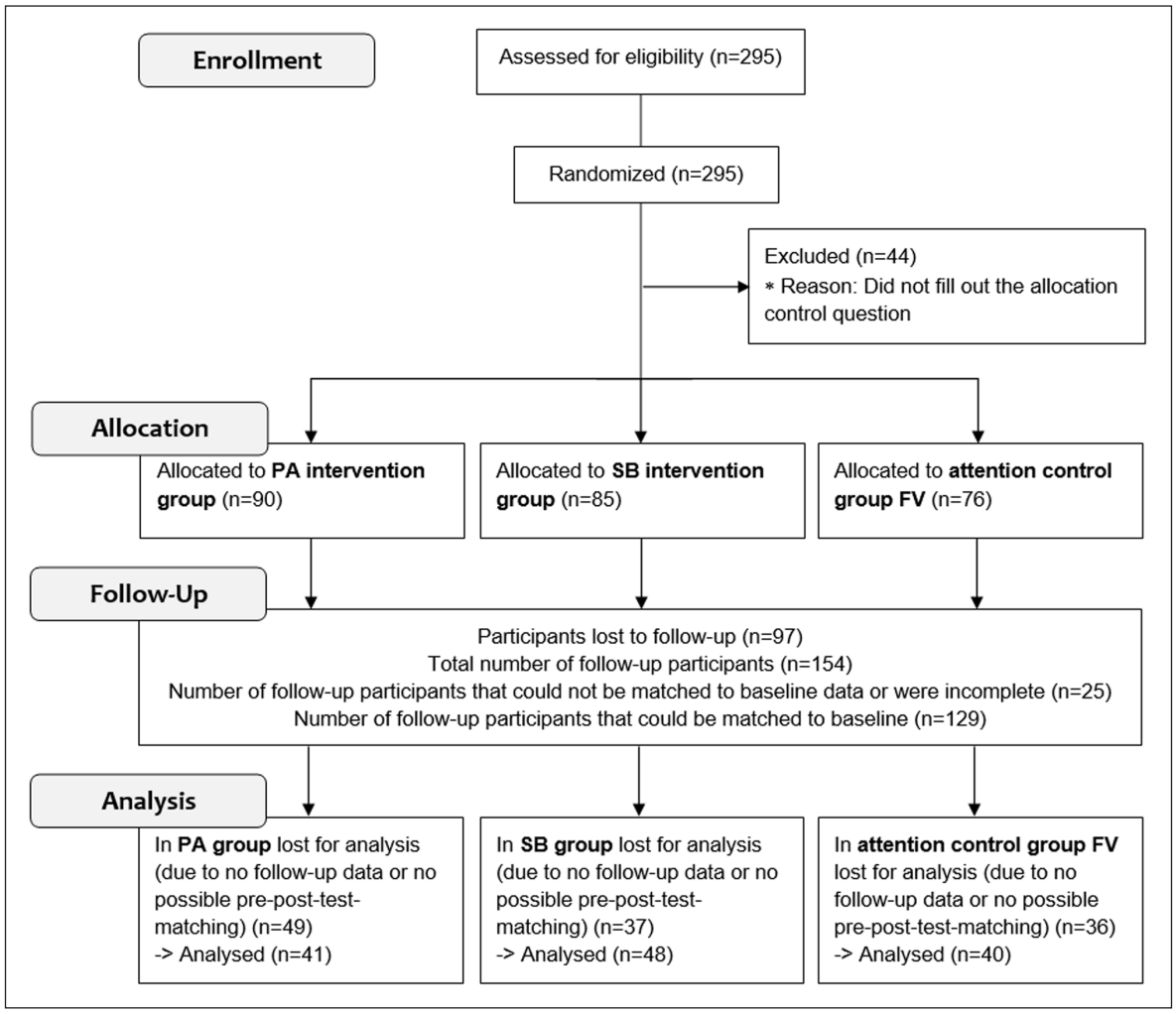

Figure 1 CONSORT participant flow diagram.

MVPA (HYPOTHESIS 1)

Repeated measures ANOVA results revealed a non-significant time by group interaction for MVPA F = (2,114) = 0.39, p = 0.68, η_p^2 = 0.01 (see ***Figure 2a***), and for intention for MVPA F = (2,117) = 0.53, p = 0.59, η_p^2 = 0.01 (see ***Figure 2b***).

SB (HYPOTHESIS 2)

Repeated measures ANOVA results revealed a non-significant time by group interaction for leisure screen time (ST) F = (2,122) = 0.57, p = 0.57, η_p^2 = 0.01 (see ***Figure 3a***), for the quantity of active breaks (AB) F = (2,119) = 1.41, p = 0.25, η_p^2 = 0.02 (see ***Figure 3b***), and for quantity of standing time F = (2,116) = 2.17, p = 0.12, η_p^2 = 0.04 (see ***Figure 3c***). A significant time by group interaction was found for the intention of active breaks F = (2,114) = 5.84, p = 0.004, η_p^2 = 0.09 (see ***Figure 3d***). Intention of taking active breaks increased for the SB group, remained the same for the PA group, and decreased for the attention control group as hypothesized; however, Tukey's HSD post-hoc tests revealed no significant differences between any of the groups. Repeated measures ANOVA results revealed a non-significant time by group interaction for the intention of screen time reduction F = (2,120) = 1.52, p = 0.22, η_p^2 = 0.03 (see ***Figure 3e***).

Summarizing the results, a significant time by group interaction could be found for the intention of active breaks. All other results were in the hypothesized direction, but not significant.

GROUP		MVPA [MIN PER WEEK]	INTENTION TO INCREASE PA [1–5]	LEISURE SCREEN TIME [MIN PER DAY]	QUANTITY OF ACTIVE BREAKS [TIMES PER HOUR]	QUANTITY OF CHANGING TO STANDING [TIMES PER HOUR]	INTENTION TO DO ACTIVE BREAKS [1–5]	INTENTION TO REDUCE SCREEN TIME [1–5]	AGE	YEARS IN SCHOOL	%F
PA	M	346.7	4.0	121.6	1.4	1.2	3.7	3.7	30.9	11.7	85.4
	SD	*245.5*	*0.9*	*68.1*	*0.8*	*0.8*	*0.8*	*0.9*	*12.7*	*2.1*	
SB	M	345.1	3.9	160.4	1.2	0.9	3.7	3.8	26.7	12.3	72.9
	SD	*231.7*	*0.9*	*120.9*	*0.7*	*0.8*	*0.8*	*0.9*	*10.0*	*2.1*	
Ctrl (FV)	M	417.4	3.6	135.0	1.3	0.8	4.1	3.4	30.0	12.7	67.5
	SD	*308.9*	*0.9*	*83.6*	*0.8*	*0.8*	*0.7*	*1.1*	*12.7*	*1.9*	
Total	M	369.0	3.8	139.8	1.3	1.0	3.9	3.7	29.1	12.2	75.2
	SD	*262.8*	*0.9*	*95.4*	*0.7*	*0.8*	*0.8*	*1.0*	*11.8*	*2.1*	

Table 1 Pre-test variable descriptives and demographics.

Note: MVPA – moderate-to-vigorous physical activity; SB – sedentary behaviour; Ctrl (FV) – attention control (fruit & vegetable); %F – % Female.

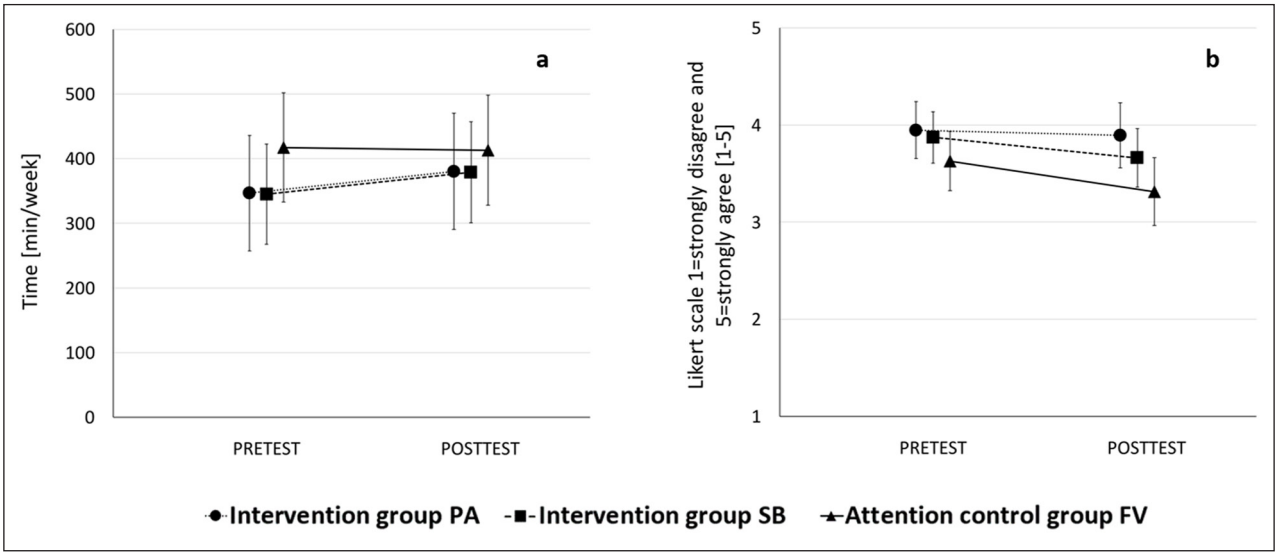

Figure 2 Pre- and post-test means and 95%-Confidence Intervals of the PA variables. a Weekly MVPA time by intervention group. b MVPA Intention. Note that means and CIs are shifted left/right in order to make it more visible.

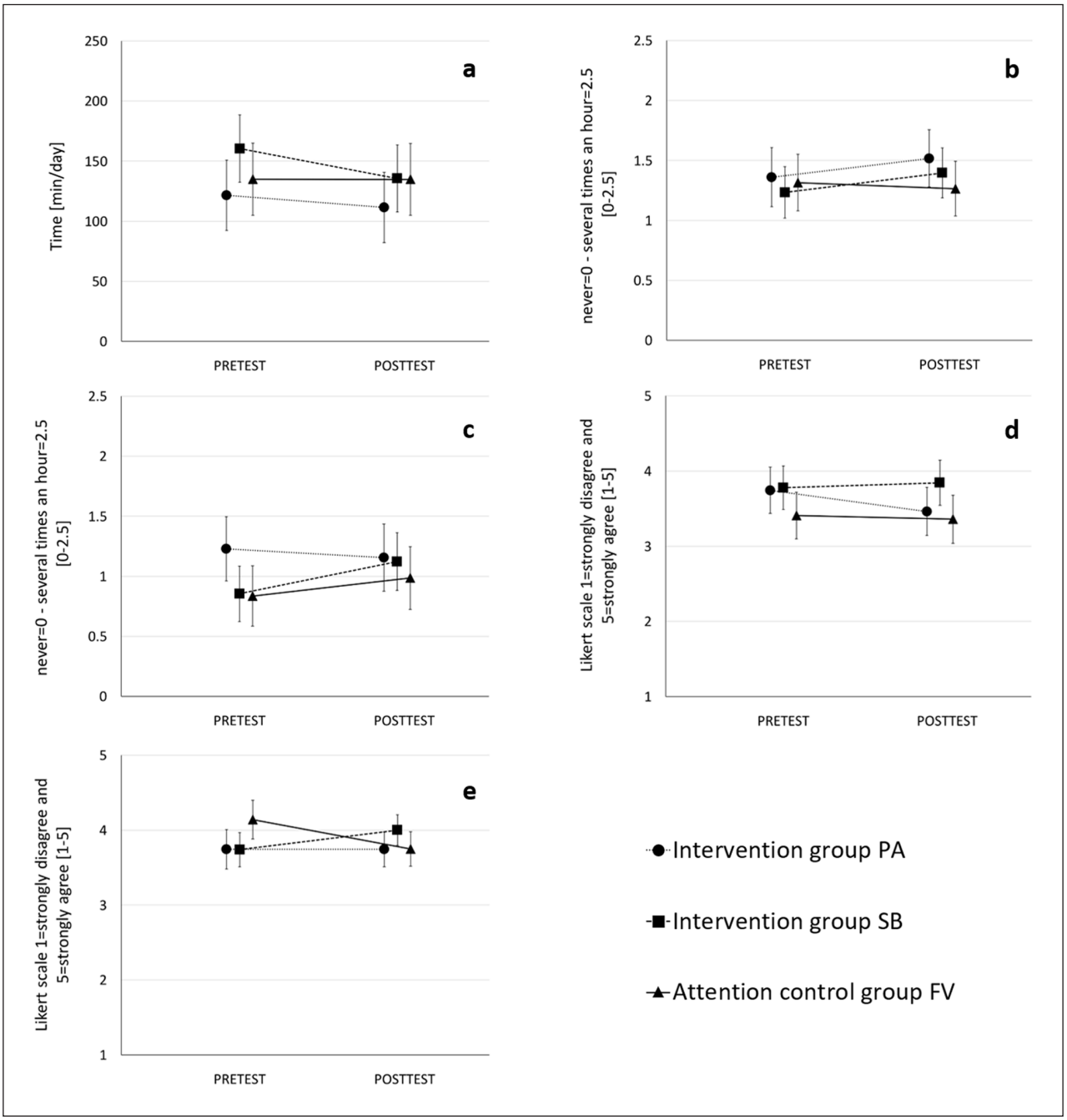

Figure 3 Pre- and posttest means and 95%-Confidence Intervals of the SB variables. a Minutes of leisure screen time per day. b Quantity of active breaks. c Quantity of standing time. d Intention of screen time reduction. e Intention to do active breaks ($p < .05$). Note that means and CIs are shifted left/right in order to make it more visible.

DISCUSSION

This project investigated whether a theory-based YouTube video intervention influenced MVPA and SB during the COVID-19 stay at home situation. In both the MVPA and SB intervention the respective targeted behaviour and intention variables seemed to be most positively affected. Within the targeted MVPA intervention group, the results of MVPA and MVPA intention results had the highest increase or the smallest decrease. However, interactions on MVPA variables were statistically non-significant. The same direction of the results could be observed for the SB intervention, with the intention of active breaks being the only significant effect. Again, these effects were statistically small and mostly non-significant. Therefore, the results of the intervention could be considered as possibly non-effective. Potential explanations for lack of an effect could be the sample size, limited intervention in terms of number of videos and duration per video, limited interaction of participants with the intervention videos, relying on only one online intervention channel (YouTube), and potential intervention contamination (although participants only received the link to their intervention specific videos, they could have found the other videos through a google search).

Nevertheless, since all of the findings observed were in the same hypothesized positive direction for the PA intervention and the SB intervention, the consistency and direction of the overall non-significant results could also be interpreted as a positive signal in hypothesized direction. Practically, the PA intervention was associated with a non-significant increase of >30 minutes/week (>4 minutes/day) of MVPA and the SB intervention with a non-significant decrease of >140 minutes/week (>20 minutes/day) of screen time. Importantly, the attention control group in each case performed worse on the targeted variables compared to the targeted intervention group. Considering the short intervention duration (2 weeks), the relatively small sample size, the small intervention dose (around 6 min of videos), and only using one intervention modality (videos), the study shows that online-based interventions using videos as an intervention modality could be a feasible and promising approach for promoting more PA and less SB during stay at home situations. Previous studies have also pointed out the feasibility of video-based physical activity interventions (Vandelanotte & Mummery, 2011).

With a larger sample, more videos, also using other intervention channels, and an extended intervention time, the intervention effects possibly could be larger and significant. Relatedly, the current sample self-reported more than double the recommended levels of MVPA which means that maintaining, versus increasing, PA levels is of priority. Further, the potential reach of YouTube (and social media) is large and not limited by geography, so even a small effect size of 1% to 2% (similar to this project's results) can become meaningful considering the impact equation (impact = reach × efficacy) (Marcus et al., 2000). For example, in an 8 Million population (e.g., about the population of Switzerland) a 1% effect size would promote 80,000 people to a healthier lifestyle. These public health considerations are salient especially when attempting to influence population wide susceptibility of COVID-19 infection and resiliency.

Conclusions should be made with caution due to the study's limitations. First, although the intervention was provided in three languages (English, German and French) to reach more potential participants, only a few international participants were recruited (4% non-German speaking and 11.6% non-Swiss). Second, there was a rather short (~1 week) recruiting time. Given more recruiting time, more partners such as media institutions, social media channels and individuals could have been approached to disseminate the promotion video and increase participation. Third, a pilot testing of the intervention was not possible because of the complex COVID-19 situation which required a quick response. Due to space and time limitations, mediating variables (e.g., self-efficacy, outcome expectations) were not assessed thus no mediation analyses regarding effect mechanisms were possible. The use of self-report assessments may have introduced social desirability bias. Furthermore, the intervention videos were all limited in terms of number (5), duration (approx. 1 min) and reminder (once, after 7 days) limiting the overall intervention dose. Analyses of the self-reported intervention dose suggests that the majority of the participants watched the five videos at least once and a small number did not watch or only watched one or two of the videos. Some people (around 13%) reported to have watched more than 5 videos which could be interpreted in two ways. Either, some participants have watched some of the videos more than once or some participants searched for and watched the videos of the other intervention groups, reflecting a small possibility of contamination. Objective measures (e.g. Google Analytics) should be used for future research to assess the actual intervention dose. Attrition in this study with a dropout rate of nearly 50% was high. Having no physical or personal contact with study participants, probably resulting in less commitment, is seen as a major reason for the many dropouts. Lastly, some technical issues interfered with link distributions early in the intervention, decreasing the intervention duration for a few participants by a couple of days. The problem was solved by automating this step.

To-date MVPA and SB intervention studies during the COVID-19 times are rare. Based on the benefits of enhanced MVPA and decreased SB, this study provided some evidence of the effect of an online, home based YouTube intervention on MVPA and SB behaviour and intention.

PUBLIC HEALTH IMPLICATIONS

A physically active lifestyle is an important approach to decrease susceptibility and severity of COVID-19 infections (WHO, March 27, 2020) or to reduce possible negative consequences of stay at home situations on overall mental and physical health (Ferreira et al., 2020). The overall findings of the study show a small non-significant signal of a positive effect for the MVPA and SB interventions on intention and behaviour indicators. Online-based interventions offer great potential reach, not limited by geography or face-to-face contact, so even a small effect size can have a meaningful impact on public health. But further research is still needed and should focus on recruitment and individualized tailoring (e.g., on age, sex, fitness level, motives, goals, interests). Future research should be done not only using self-reported, but also objective measurements (e.g. accelerometers, Google Analytics). Most importantly, this study approach is not limited to COVID-19 but potentially applies to MVPA promotion and decreasing SB during other disease or natural disaster related stay at home situations or even daily life.

ADDITIONAL FILES

The additional files for this article can be found as follows:

- **Supplementary File 1.** CONSORT 2010 checklist of information to include when reporting a randomised trial. DOI: *https://doi.org/10.5334/hpb.25.s1*
- **Supplementary File 2.** The TIDieR (Template for Intervention Description and Replication) Checklist. DOI: *https://doi.org/10.5334/hpb.25.s2*
- **Supplementary File 3.** SPSS dataset, syntax and output for the SSMY Study. DOI: *https://doi.org/10.5334/hpb.25.s3*
- **Supplementary File 4.** Links to recruitment and intervention videos and questionnaires used for the SSMY study. DOI: *https://doi.org/10.5334/hpb.25.s4*

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COMPETING INTERESTS

The authors have no competing interests to declare.

AUTHOR CONTRIBUTIONS

A.M., B.C., F.W., J.K., S.S. and T.F. recruited the participants. A.Z., B.D., L.G., L.V., P.Z. and T.G. designed the Interventions. C.U., D.B., M.G., R.L. and X.B. developed the measurement method. N.A., J.W. and M.Z. oversaw and coordinated the three groups. The introduction was drafted by A.M., A.Z., L.V., M.Z., N.A., P.Z., S.S., T.G. and C.N.; Results were drafted by B.C., B.D., D.B., F.W., J.W., L.G., M.G., R.L., X.B., and C.N. Discussion was drafted by J.K., T.F., C.U., and C.N. C.N. was the PI and provided oversight of the entire study. The manuscript was reviewed and approved by all authors.

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