

Improving practices of mental health professionals in recommending more physical activity and less sedentary behaviour to their clients: an intervention trial

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Abstract

Background:

We hypothesised that mental health professionals would be more likely to promote more physical activity (PA) and less sedentary behaviour (SB) among their clients, if they themselves are more physically active. In this context, we investigated the effects of engaging mental health professionals in an intervention to increase PA and reduce SB on their attitudes towards and practices in recommending more PA and less SB to their clients.

Methods:

We used a mixed-methods study design comprising of a four-week pre-post intervention trial and focus group discussions. The study was conducted with 17 mental health professionals (mean \pm standard deviation of age = 37.9 \pm 9.8 years) employed in two Orygen headspace centres in Melbourne, Australia. The intervention consisted of a group session where the participants received consultations and an information booklet on how to increase their PA and reduce SB, followed by goal setting and weekly reminders. Baseline and follow-up data were collected using a modified Exercise in Mental Health Illness Questionnaire and GENEActiv accelerometers. Two focus group discussions were conducted after the intervention.

Results:

There was no significant change in physical activity and sedentary behaviour among mental health professionals, but the intervention had a positive effect on their attitudes towards recommending more PA and less SB among their clients. The mental health professionals who increased their own physical activity during the intervention (compared to those who did not) significantly increased the frequency of recommending more physical activity ($p=0.009$) and less sedentary behaviour ($p=0.005$) to their clients. In focus group discussions, participants stated that the intervention made them feel more confident in consulting with their clients about PA and SB, but that its effectiveness could be further improved by introducing more reminders/follow-up calls.

Conclusion:

These results show that a relatively simple, low-cost intervention, consisting of group counselling, goal setting and positive feedback, may improve mental health professionals' attitudes towards and practices in recommending more PA and less SB to their clients.

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Introduction

People with mental illness have an increased risk of chronic diseases and shorter life expectancy compared to the general population [1-3]. Pooled estimates of 148 studies found mortality rates were two to three times higher in people with severe mental illness [4]. Interventions for increasing physical activity might not only reduce the risk of chronic diseases, but also improve outcomes of treatment and management of severe mental health illness [5]. In their updated guidelines for treatment and management of psychosis and schizophrenia in adults, the National Institute for Health and Care Excellence in the United Kingdom encouraged mental health professionals to recommend a combined healthy eating and physical activity program to their clients with psychosis or schizophrenia, especially to those taking antipsychotics [6]. A similar recommendation has been made by the Royal Australian and New Zealand College of Psychiatrists in their guidelines for the management of schizophrenia and related disorders [7].

Health professionals have been regarded as role models in the promotion of healthy lifestyle. It has been found that clinicians were more likely to prescribe physical activity to their clients, if they themselves engaged in regular physical activity (8). The evidence, however, suggests that most health care professionals do not achieve a sufficient level of physical activity [8]. This may, therefore, be an avenue for indirect promotion of physical activity among patients in mental health settings.

The potential role of mental health professionals' in physical activity promotion is further bolstered by their regular contacts with clients and their skills in applying behaviour change techniques [9, 10]. The integration of physical activity counselling as an essential component of mental health services depends on mental health

professionals' attitudes towards physical activity and culture within mental health clinics [11]. It can be hypothesised based on previous studies that helping mental health professionals to formulate a physical activity plan and increase their own physical activity would improve their attitude towards recommending physical activity to their clients [8, 12, 13]. We, therefore, investigated the effects of engaging mental health professionals in an intervention to increase physical activity and reduce sedentary behaviour on their attitudes towards and practices in recommending more physical activity and less sedentary behaviour to their clients. To inform the future studies, it is important to investigate the reasons why an intervention was effective or ineffective and to find out what could improve its effectiveness. Therefore, we also used qualitative research methods to explore: (1) what motivated mental health professionals to participate in the intervention; (2) perceived effects of the intervention on participants' own physical activity and sedentary behaviour; (3) perceived effects of the intervention on the practices of mental health professionals in recommending more physical activity and less sedentary behaviour to their clients; and (4) what the participants think would have improved the intervention.

Methods:

Rationale and Study design

We used a mixed-methods study design comprising of a four-week pre-post intervention trial and focus group discussions. The study was conducted in two Orygen, The National Centre of Excellence in Youth Mental Health, headspace centres (Glenroy and Sunshine) in Melbourne, Australia from September to October 2019. The headspace centres provide various mental health services to young people

aged 12 to 25 years, including psychological and psychiatric assessment and treatment, counselling, primary health care and substance-use services [14]. The study overview is presented in Supplementary figure 1. Ethics approval was granted by the Victoria University Human Ethics Research Committee, Melbourne, Australia. The study was conducted in accordance with the Consolidated Standards of Reporting Trials (CONSORT) [15]. Orygen, provided general oversight of safety and adverse events during the course of the trial.

Participants

We recruited 17 mental health professionals that satisfied the following eligibility criteria: aged 18–65 years; ambulatory; non-pregnant; free of a pre-existing musculoskeletal disorder; and engaged in clinical practice. This study sample was large enough to achieve a statistical power of 80% in a one-way repeated measures analysis of variance (ANOVA) with two repeated measurements, probability of type I error of <0.05 , correlation between the measurements of 0.80, and the expected effect of at least medium size ($f > 0.25$) according to Cohen [16].

Before the commencement of the study, information sessions about the study were held for headspace centre managers. These managers then sent an invitation email to the clinicians who were working in their centres to take part in the study. The clinicians who expressed their interest to participate in the study received detailed information including: the aims of the research; the methods used and what would be expected from them as participants; any risks associated with the study participation; a statement that they are free to choose if they want to participate or not in the study and that they can withdraw from the study at any time without any negative

consequences to them; and information about methods of dissemination of research results. All participants signed a consent form prior to their enrolment in the study.

Intervention

This intervention study is primarily grounded in the Theory of Planned Behaviour (TPB) [17]. According to the TPB, an individual's intention to spend time in physical activity is a key determinant of their physical activity. The proximal determinants of this intention are attitudes, subjective norms, and perceived behavioural control. Attitudes towards physical activity and sedentary behaviour represent, for example, what an individual thinks of benefits or harms of being physically active or sedentary, and how important these are. Subjective norms reflects an individual's perception of social support to engage in physical activity and sedentary behaviour. Perceived behavioural control for physical activity and sedentary behaviour is an individual's perception of the extent to which they have control over their engagement and time spent in these behaviours. Our intervention addressed all three groups of proximal determinants of physical activity and sedentary behaviour. The intervention aimed to make a positive change in attitudes towards physical activity and sedentary behaviour via group counselling. To affect participants' subjective norms, discussion in a group email was encouraged for the participants to exchange their thoughts on physical activity and sedentary behaviour, and they received positive feedback from the researchers. To influence their perceived behavioural control, participants were encouraged to set their goals at the beginning of the intervention and received reminder texts/calls during the intervention.

The intervention consisted of a group meeting and weekly reminders/consultation sessions. At the beginning of the intervention, a group meeting was held to discuss

the benefits of increasing physical activity and reducing sedentary behaviour, and to present to participants various strategies that can be adopted to achieve this. A professionally printed information booklet containing 24 such strategies was provided to the participants. The participants were also referred to an online version of the booklet. At the meeting, the participants set their individual goals and designed their weekly plan to achieve their desired levels of physical activity and reduce sedentary behaviour. This was followed by weekly reminder emails/text messages and telephone calls, with the aim to find out whether the participant followed their physical activity plan, identify any difficulties in achieving the set goals, and assisting participants in creating a plan and selecting strategies to overcoming such barriers in the following week.

Information booklet

Several meetings of the research team were held while designing the information booklet. A thorough review of academic and grey literature was conducted to identify possible strategies for sitting less and moving more in the domains of leisure, home, work, and transport. The research team discussed about the strategies and made a selection based on their simplicity, feasibility in the context of mental health professionals, and appropriateness for different groups according to age, ethnicity and adiposity status. The selected strategies were low cost and reasonably easy to incorporate into daily life. Within the booklet, each of the 24 selected strategies was briefly described in lay language. Visual elements of the booklet were selected in collaboration with a professional graphic designer. In addition to the elements included in the print version of the booklet, the online version also included links to websites

where participants could find more information about some of the strategies (Supplementary file 1).

Focus groups

At the end of the intervention, participants were invited to participate in 45- to 60-minute focus group interviews. Ten participants agreed to participate. To encourage verbal interactions, two focus group sessions were organised, each including five participants. The focus group moderator used a set of predetermined questions to collect data. The focus group questions can be found in the Supplementary file 1. Participants were asked to share their views on a range of topics related to their motives for participating in the study, experiences with the intervention, changes in their attitudes towards and practices in recommending more physical activity and less sedentary behaviour to their clients, and how the intervention could be further improved.

The focus discussion was audio-recorded. Additionally, written notes were also taken to supplement the recordings. Participants were notified that the discussion will be audio-recorded and transcribed verbatim by the researcher and that their personal identity would remain confidential. The transcript and notes were coded and later analysed using thematic analysis. The coding was done using NVivo software.

Outcomes

Attitudes towards and practices in recommending more physical activity and less sedentary behaviour to clients were assessed using a modified version of the Exercise

in Mental Illness Questionnaire - Health Professional version [18]. The section of the questionnaire on general beliefs asked participants to express their agreement with six statements (e.g. "Physical activity is valuable for patients hospitalised with a mental illness in the same manner as for outpatients") on a 5-level Likert-type response scale. It also asked participants to rank 11 treatment strategies, including increasing physical activity and reducing sedentary behaviour, according to their importance in the care of people with mental illness. The section on perceived barriers for recommending physical activity to people with mental illness asked participants to express their agreement with 11 statements (e.g. "I do not know how to recommend physical activity to people with a mental illness") on a 5-level Likert-type response scale. The section on practices included the following two items: "Do you recommend physical activity to people with a mental illness?"; and "Do you recommend reducing sedentary behaviour (time spent sitting/screen time) to people with a mental illness?", with the following response options: "Never"; "Occasionally"; "Most of the time"; and "Always". A previous study found the questionnaire has good measurement properties [18]. In the modified version of the questionnaire used in our study, we replaced the term "exercise" with "physical activity", to capture a whole range of physical activity types that mental health professionals can recommend to their clients. Unlike the original questionnaire, the modified version used in this study included two items about sedentary behaviour counselling. The questionnaire also included questions on: gender; age; marital status; number of years of employment in mental health profession; in which country they completed their highest educational degree; how is their headspace role funded ("employed by headspace [salaried staff]" or "private provider"); whether they currently work in a clinical role at another service in addition to headspace; whether they

consider the headspace role as their main job; and whether they have undergone formal training in recommending physical activity.

Physical activity was assessed by a GENEActiv Original accelerometer (Activinsights Ltd, Cambridgeshire, United Kingdom) worn on the dominant wrist continuously for 5-7 days in the week before the intervention and in the week after the intervention. These waterproof tri-axial accelerometers record accelerations and decelerations at a sampling frequency of 10-100Hz. For the purpose of this study, the sampling frequency was set at 80Hz. The accelerometer can be worn during sleep and waking time, which allows for 24-hour continuous monitoring of movement and non-movement behaviours. The data obtained for 10 or more hours a day during waking hours on at least 4 days was considered to be valid [19]. The GENEActiv data were analysed using the GENEActiv PC software version 3.2 and the associated Microsoft Excel macros [20]. This study used the cut-points for GENEActiv accelerometers proposed by Esliger et al. [21], to classify activities into: sedentary behaviour (<217 counts/min) and physical activity (≥ 217 counts/min) The remaining time was categorised as bedtime (included sleep and other bed time), using the algorithms provided in Excel Macros provided by the manufacturer. Prior to statistical analysis, the time-use components were re-scaled proportionally to add up to 24 hours. A relatively high validity has been found for GENEActiv accelerometer data as assessed against indirect calorimetry [21].

Statistical analyses

Statistical analyses were conducted using the *robCompositions* package [22] in R Statistical Software (R Foundation for Statistical Computing, Vienna, Austria) and IBM

Statistical Package for the Social Sciences (SPSS) software, version 23 (SPSS Inc., an IBM Company, Chicago, IL, USA). Baseline characteristics of the study participants are presented as means \pm standard deviations (SD) or percentages. The amounts of time spent in physical activity, sedentary behaviour and bedtime are parts of a time-use composition. They were, therefore, analysed using compositional data analysis, as recommended in previous methodological papers [23-25]. We calculated compositional means and variation matrix for the time-use compositions at baseline and follow-up. In the next step, the amounts of time participants spent in physical activity, sedentary behaviour and bedtime at baseline and follow-up, were expressed as two specific isometric log ratios (*ilrs*) called pivot coordinates that explain the whole variance of the raw time-use composition. To test the overall effect of the intervention on the time-use composition, we used a two-way repeated measures multivariate analysis of variance (MANOVA) on the two *ilrs*. These procedures are explained in more detail in previous papers [25-29]. Furthermore, to assess the changes in beliefs, perceived barriers, and practices from baseline to follow up in the overall sample, we used a set of one-way repeated measures ANOVAs. This was followed by a set of two-way repeated measures ANOVAs, to test the difference in changes in beliefs, perceived barriers and practices between participants who increased their physical activity and reduced sedentary behaviour compared to those who did not.

Results

Sample characteristics

The mean age of participants was 37.9 years and were working in the mental health profession for 7.8 years on average (Table 1). Most of the participants were female

(76.5%), married/de facto (76.5%), and salaried staff (82.3%) and they completed their highest qualification in Australia (82.3%).

Quantitative findings

At baseline, the participants spent on average around 546 minutes/day in sedentary behaviour (570 minutes/day at follow up) and 338 minutes/day in physical activity (327 minutes/day at follow up) (Table 2). . Variability of time-use components is presented in Supplementary table 1. Repeated measures MANOVA found no significant difference ($p=0.513$) between the baseline and follow-up time-use compositions.

In regard to general beliefs about recommending physical activity to clients, for the overall sample there was a significant decrease from baseline to follow-up in the agreement with the statement “People with a mental illness who are recommended physical activity will not adhere to it” (Supplementary table 2). In regard to perceived barriers for recommending physical activity to clients, there was a significant decrease in participants’ agreement with the following statements: “People with mental illness won’t adhere to a physical activity program” and “My workload is already too excessive for recommending physical activity”. We found no significant changes in the remaining general beliefs and perceived barriers of mental health professionals for recommending physical activity to their clients. We also found no significant changes from baseline to follow-up in how mental health professionals ranked the value of physical activity and sedentary behaviour in comparison with other forms of treatment for mental illness, including medication, social support, electroconvulsive therapy, bright light therapy, family therapy, social skills training, cognitive behavioural therapy, vocational rehabilitation, and hospitalisation (Supplementary table 2).

The participants who increased their own physical activity during the intervention (compared to those who did not) significantly increased the frequency of recommending more physical activity and less sedentary behaviour to their clients (Table 3). However, we found no significant differences between the two groups in the effects of the intervention on their general beliefs about and perceived barriers for recommending physical activity to their clients.

Qualitative findings

When asked about what motivated them to participate in the trial, participants reported that the intervention provided them an opportunity to engage in a healthy behaviour as a team, with encouragement from their colleagues. They stated, for example:

“It’s like professional development stuff. People identify something that might be helpful and say like let’s all do this.”

“We got that encouragement to push, I mean you know you can talk it for a while. But it may not actually happen, so that was kind of ‘Oh! We are all in it now’.”

Some participants stated they were also motivated to participate because their experiences during the trial would help them in their work with their clients.

“Thinking this might be good stuff to pass onto our clients was probably a big motivator for actually turning up as well.”

Participants stated that their physical activity increased during the intervention. They reported trying different strategies to increase physical activity and reduce sedentary behaviour, such as setting up a sit-stand desk and organising walking meetings. A

participant stated that he was more physically active during the intervention, even though he did not engage in the activities he initially planned to do.

“Some of us had the experience of going out for walking meetings. Let’s check this work outside.”

“I was doing things that were different from my plan, but still I did a lot more activity.”

When inquired whether participating in the intervention resulted in any change in their physical activity counselling practices during the period, participants stated that the intervention made them feel more confident in discussing with their clients about various strategies to increase physical activity and reduce sedentary behaviour. They also stated they were more likely to recommend incidental physical activity (e.g. taking stairs instead of escalator) to their clients, as it is easier to implement and adhere to, compared with other types of physical activity. Typical statements on this issue were as follows:

“I talked about it a little bit more with some of my clients. I shared with them some of those strategies that you gave us. I did not give them the brochure, but I gave them some ideas. It made me feel more confident, because now I could be quite specific about some of those ideas, whereas before it would have been more like ‘Try to do a bit more what you are comfortable doing’.”

“It could be incidental exercise. Maybe that’s the only stuff that I really stuck to. But I felt a little bit more motivated to use little tricks. Today I have got a water bottle, but I have been making effort to have just a glass of water on my desk,

just little things like that, so that I am forcing myself to get up or tricking myself in doing more incidental exercises. I enjoyed that stuff and I felt like that those are the things that I truly felt confident of sharing with my clients.”

The participants found the strategies that were presented to them in the intervention session were helpful and easy to implement. However, they felt there should have been more reminders/follow-up calls. They also said that reflecting upon how they were progressing during the intervention period would have been helpful to bring them back on track. When asked what would have improved their adherence to the strategies to increase physical activity and reduce sedentary behaviour, the participants stated, for example:

“For me it would be like having more around to do exercise and may be with the follow-up call and also sending through reminders what to do.”

“Maybe even have a time to be realistic and reflect how we all are going a couple of weeks in would have been enough to get us back on track.”

In relation to the same question, a participant shared her experience how a follow-up call was helpful in finding alternative ways to increase her physical activity, that is, other than those that were planned in Smart goals during the intervention period. She stated:

“I remember we had an email exchange, and I think at one point I was struggling to get a running routine happening and you said something like: “Have you tried park run?”. Then I looked it up and there was one in the area, but it made me think about alternative ways to be motivated and that problem-solving aspect was really nice and felt very supported.”

Discussion

We found that a relatively simple intervention, consisting of group counselling, goal setting and positive feedback, may improve attitudes of mental health professionals towards recommending more physical activity and less sedentary behaviour to their clients. The effects of the intervention on physical activity and sedentary behaviour of mental health professionals remains unclear. Nevertheless, the mental health professionals who increased their own physical activity during the intervention, significantly increased the frequency of recommending more physical activity and less sedentary behaviour to their clients. This finding supports the hypothesis that, by promoting physical activity among mental health professional, we can indirectly improve their practices in recommending more physical activity and less sedentary behaviour among their clients. More follow-up calls and other reminders were identified by the participants as a possible strategy to further improve the effectiveness of the intervention.

Previous studies provided mixed evidence on the effectiveness of lifestyle interventions among health professionals. A systematic review that assessed the effects of physical activity interventions among nurses found that six out of nine studies reported significant increases in physical activity or energy expenditure [30]. Only one study included in the review found a significant reduction in sitting time [31]. In the current study, the average amounts of time spent in physical activity and sedentary behaviour before and after the intervention remained about the same. Nevertheless, physical activity increased more than 10 minutes a day among 47% of participants and sedentary behaviour decreased by more than 30 minutes a day among 29% of participants. It might be that some interventions are effective only among a specific group of mental health professionals. This should be elucidated in future studies using

larger samples that would allow for exploring possible moderator effects. From the participant feedback provided in the focus group sessions, it seems that the effectiveness of the intervention could be improved by introducing additional reminders and follow-up calls. Given that the frequency of follow-up calls was once a week, when designing and evaluating future interventions, the researcher should consider implementing two or more follow-up calls per week. In addition, text messages and emails might be a feasible way to remind mental health professionals more frequently to adhere to their chosen strategies. Furthermore, participants also mentioned that encouragement from their colleagues was an important factor for them to engage in the intervention. Motivating intervention participants to provide positive feedback to each other during the intervention may also be a way to achieve greater effectiveness. Strategies involving greater social support warrant further study.

Health professionals generally have positive attitudes towards their role as promoters of a healthy lifestyle to their clients [32-34]. Nevertheless, various barriers have been reported for lifestyle counselling by health professionals, such as lack of confidence in their counselling skills [35], lack of time [36], and little interest from patients on increasing their physical activity level [35, 36]. In our study, however, we found that mental health professionals generally did not agree with the commonly reported barriers in the literature. This might be because mental health professionals are routinely trained in behaviour change counselling [37, 38] and generally have positive attitudes towards it [12, 39-41]. Although there was no significant overall change in physical activity and sedentary behaviour among mental health professionals, our intervention had a positive effect on their attitudes towards recommending more physical activity and less sedentary behaviour among their clients. From the participant feedback received in the focus group sessions, it seems their attitudes were

improved through increasing knowledge about and confidence to recommend physical activity. We found that those who increased their physical activity during the intervention started recommending physical activity and less sedentary behaviour more often to their clients.

This intervention trial was subject to some limitations that need to be considered when interpreting our findings. Firstly, the study design did not include a 'true' control group, that is, a comparison group of mental health professionals that received no intervention. It may be, therefore, that some of the changes we observed in our study sample were not due to the intervention effects only. Second, the study only included only two mental health facilities. The participants that were recruited into this study might not be representative of all mental health professionals in Australia, which limits the generalizability of our findings. Third, although the study sample was large enough to ensure adequate statistical power in the main analysis (i.e. one-way repeated measures ANOVA), it did not allow us to further explore possible moderator effects of sociodemographic and lifestyle variables. Finally, we examined only short-term effects of the intervention, because the follow-up measurement was conducted immediately after the intervention. We, therefore, cannot draw conclusions about potential impact of the intervention on attitudes and practices of mental health professionals over a longer term.

Conclusion

Our findings suggest that a relatively simple, 4-week intervention, consisting of group counselling, goal setting and positive feedback, can improve attitudes and practices of mental health professionals in recommending more physical activity and less sedentary behaviour to their clients. It seems justified to further improve the

intervention based on participant feedback we received and scale it up to promote more physical activity and less sedentary behaviour in mental health settings. This area would benefit from randomised controlled trials evaluating long-term effects of interventions that combine indirect and direct strategies to improve attitudes and practise of mental health professionals for promoting healthy lifestyle.

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Table 1: Characteristics of respondents

Characteristics	Mean ± SD
Age	37.9 ± 9.8
Years in profession	7.8 ± 7
	Percentage of respondents
Female gender	76.5%
Married/de facto	76.5%
Completed highest degree in Australia	82.3%
Salaried staff	82.3%
Currently works in a clinical role at another service	47%
Considers the role in headspace as the main job	76.5%
Undergone formal training in recommending physical activity	35.3%

Table 2: Time-use composition at baseline and follow-up

Part	Baseline		Follow-up	
	<i>Compositional mean in proportions</i>	<i>Compositional mean in hours/day</i>	<i>Compositional mean in proportions</i>	<i>Compositional mean in hours/day</i>
Sedentary behaviour	0.38	9.10	0.40	9.49
Physical activity	0.23	5.64	0.23	5.45
Bedtime	0.39	9.27	0.38	9.06

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Table 3: Changes in general beliefs, perceived barriers and practices among mental health professionals who increased their physical activity or reduced sedentary behaviour during the intervention and among those who did not

	Increased physical activity					Reduced sedentary behaviour				
	No; mean (SD)		Yes; mean (SD)		p^*	No; mean (SD)		Yes; mean (SD)		p^*
	Pre [†]	Post [‡]	Pre [†]	Post [‡]		Pre [†]	Post [‡]	Pre [†]	Post [‡]	
Beliefs										
People with a mental illness know that physical activity is good for their physical health	3.33 (1.23)	3.89 (0.93)	3.63 (0.52)	3.63 (1.06)	0.289	3.11 (0.93)	3.44 (0.88)	3.88 (0.84)	4.13 (0.99)	0.876
People with a mental illness know that physical activity is good for their mental health	2.89 (0.93)	3.00 (0.87)	3.38 (0.74)	2.75 (0.70)	0.094	3.00 (0.87)	2.89 (0.60)	3.25 (0.87)	2.88 (0.99)	0.565
People with a mental illness do not engage in physical activity, because they don't think they can	3.56 (0.73)	3.67 (0.50)	3.00 (1.06)	3.38 (0.74)	0.488	3.33 (0.70)	3.44 (0.73)	3.25 (1.17)	3.63 (0.52)	0.488
Physical activity is valuable for patients <i>hospitalised</i> with a mental illness in the same manner as for outpatients	4.00 (0.50)	4.22 (0.44)	4.38 (0.52)	4.13 (0.64)	0.115	4.00 (0.50)	4.22 (0.67)	4.38 (0.52)	4.13 (0.35)	0.115
The physical and mental health benefits of physical activity for people with a mental illness are not long lasting	2.33 (0.87)	2.11 (0.60)	2.13 (0.84)	2.25 (0.70)	0.550	2.22 (0.97)	2.22 (0.83)	2.25 (0.7)	2.13 (0.35)	0.830
People with a mental illness who are recommended physical activity will not adhere to it	3.11 (0.78)	2.56 (0.73)	2.87 (0.84)	2.50 (0.76)	0.657	2.78 (0.67)	2.33 (0.50)	3.25 (0.89)	2.75 (0.89)	0.892
How do you rank increasing physical activity compared to other forms of treatment?	3.44 (1.67)	3.11 (1.54)	3.38 (1.30)	4.38 (1.92)	0.154	3.67 (1.87)	3.89 (2.15)	3.13 (0.84)	3.50 (1.41)	0.874
How do you rank reducing sedentary behaviour compared to other forms of treatment?	6.33 (1.73)	5.44 (1.88)	5.00 (2.07)	6.38 (1.92)	0.060	5.22 (1.79)	5.78 (2.22)	6.25 (2.12)	6.00 (1.60)	0.526
Perceived barriers										
Their mental health makes it impossible for them to participate in physical activity	1.67 (0.70)	1.33 (0.50)	2.13 (0.99)	2.00 (1.06)	0.464	1.67 (0.87)	1.67 (0.7)	2.13 (0.84)	1.63 (1.06)	0.065
I'm concerned physical activity might make their condition worse	1.56 (0.73)	1.78 (0.97)	1.38 (0.52)	1.63 (0.52)	0.948	1.44 (0.53)	1.89 (0.93)	1.50 (0.76)	1.50 (0.54)	0.285
I am not interested in recommending physical activity for people with a mental illness	1.33 (0.50)	1.33 (0.70)	1.5 (0.54)	1.25 (0.46)	0.409	1.22 (0.44)	1.22 (0.44)	1.63 (0.52)	1.38 (0.74)	0.409
I don't believe physical activity will help people with a mental illness	1.33 (0.50)	1.22 (0.44)	1.38 (0.52)	1.25 (0.46)	0.955	1.22 (0.44)	1.22 (0.44)	1.50 (0.540)	1.25 (0.46)	0.304
Their physical health makes it impossible for them to participate in physical activity	1.56 (0.53)	1.67 (0.70)	2.13 (0.99)	2.00 (0.76)	0.619	1.56 (0.53)	1.67 (0.7)	2.13 (0.99)	2.00 (0.76)	0.619
I'm concerned they might get injured while engaging in physical activity	1.56 (0.73)	1.44 (0.73)	1.88 (0.84)	1.63 (0.74)	0.736	1.44 (0.73)	1.33 (0.7)	2.00 (0.76)	1.75 (0.70)	0.736

People with a mental illness won't adhere to a physical activity program	2.22 (1.09)	1.78 (0.97)	2.63 (1.30)	2.00 (0.76)	0.707	1.67 (0.87)	1.44 (0.53)	3.25 (0.87)	2.38 (0.92)	0.161
My workload is already too excessive to include recommending physical activity to people with a mental illness	2.11 (1.05)	1.89 (0.78)	2.38 (1.12)	1.50 (0.76)	0.128	1.89 (1.05)	1.67 (0.87)	2.63 (1.06)	1.75 (0.70)	0.128
Recommending physical activity to people with a mental illness is not part of my job	1.56 (0.53)	1.56 (0.73)	1.38 (0.52)	1.38 (0.74)	1.000	1.33 (0.50)	1.44 (0.730)	1.63 (0.52)	1.50 (0.76)	0.445
I do not know how to recommend physical activity to people with a mental illness	2.11 (1.27)	2 (1.0)	2.50 (1.41)	2.00 (1.07)	0.362	1.56 (1.00)	1.44 (0.53)	3.13 (1.13)	2.63 (1.06)	0.362
Prescription of physical activity to people with mental illness is best delivered by an exercise professional such as an exercise physiologist	2.78 (0.97)	2.56 (1.13)	2.75 (1.58)	2.38 (1.4)	0.661	2.11 (0.93)	1.89 (0.930)	3.5 (1.20)	3.13 (1.25)	0.661
Practice										
Do you recommend physical activity to people with a mental illness?	3.44 (0.53)	2.89 (0.78)	3.00 (0.93)	3.38 (0.52)	0.009	3.44 (0.73)	3.33 (0.70)	3.00 (0.76)	2.87 (0.64)	0.972
Do you recommend reducing sedentary behaviour (time spent sitting/screen time) to people with a mental illness?	3.00 (1.00)	2.67 (1.00)	2.50 (0.93)	3.00 (0.93)	0.005	3.33 (0.70)	3.22 (0.83)	2.13 (0.84)	2.38 (0.92)	0.273

* p -value for the interaction between the group (No/Yes) and time (B/F) according to a two-way repeated measures univariate analysis of variance (ANOVA)

† Pre-intervention (i.e. at baseline)

‡ Post-intervention (i.e. at follow-up)

Supplementary table 1: Variation matrix*

	Sedentary behaviour	Physical activity	Bedtime
Sedentary behaviour	-	0.136	0.068
Physical activity	0.165	-	0.121
Bedtime	0.596	0.119	-

*Pre-intervention and post-intervention values are presented below and above the main diagonal, respectively

Supplementary table 2: Overall changes in general beliefs, perceived barriers and practices of mental health professionals from baseline to follow-up

	Pre-intervention		Post-intervention		<i>p</i> *
	Mean	SD	Mean	SD	
Beliefs					
People with a mental illness know that physical activity is good for their physical health	3.47	0.94	3.76	0.97	0.26
People with a mental illness know that physical activity is good for their mental health	3.12	0.86	2.88	0.78	0.30
People with a mental illness do not engage in physical activity, because they don't think they can	3.29	0.92	3.53	0.62	0.22
Physical activity is valuable for patients <i>hospitalised</i> with a mental illness in the same manner as for outpatients	4.18	0.53	4.18	0.53	1.00
The physical and mental health benefits of physical activity for people with a mental illness are not long lasting	2.24	0.83	2.18	0.64	0.84
People with a mental illness who are recommended physical activity will not adhere to it	3.00	0.79	2.53	0.72	0.03
How do you rank increasing physical activity compared to other forms of treatment?	3.41	1.46	3.71	1.79	0.53
How do you rank reducing sedentary behaviour compared to other forms of treatment?	5.71	1.96	5.88	1.90	0.78
Perceived barriers					
Their mental health makes it impossible for them to participate in physical activity	1.88	0.86	1.65	0.86	0.10
I'm concerned physical activity might make their condition worse	1.47	0.62	1.71	0.77	0.26
I am not interested in recommending physical activity for people with a mental illness	1.41	0.51	1.29	0.59	0.43

I don't believe physical activity will help people with a mental illness	1.35	0.49	1.24	0.44	0.33
Their physical health makes it impossible for them to participate in physical activity	1.82	0.81	1.82	0.73	1.00
I'm concerned they might get injured while engaging in physical activity	1.71	0.77	1.53	0.72	0.38
People with a mental illness won't adhere to a physical activity program	2.41	1.18	1.88	0.86	0.03
My workload is already too excessive to include recommending physical activity to people with a mental illness	2.24	1.09	1.71	0.77	0.02
Recommending physical activity to people with a mental illness is not part of my job	1.47	0.51	1.47	0.72	1.00
I do not know how to recommend physical activity to people with a mental illness	2.29	1.31	2.00	1.00	0.17
Prescription of physical activity to people with mental illness is best delivered by an exercise professional such as an exercise physiologist	2.76	1.25	2.47	1.23	0.10
Practice					
Do you recommend physical activity to people with a mental illness?	3.24	0.75	3.12	0.70	0.54
Do you recommend reducing sedentary behaviour (time spent sitting/screen time) to people with a mental illness?	2.76	0.97	2.82	0.95	0.72

* p -value for the difference between baseline and follow-up from a one-way repeated measures univariate analysis of variance (ANOVA)

Supplementary figure 1: Study timeline

Pre-int. week	Int. week 1	Int. weeks 2-4	Post-int. week 1	Post-int. week 2
<ul style="list-style-type: none">• Invitation to participate in the study• Recruitment of participants• At the beginning of the week, participants fill EMIQ questionnaire• Participants wear accelerometers for 7 days	<ul style="list-style-type: none">• Participants fill the remaining questionnaires• Group counseling on physical activity and sedentary behaviour	<ul style="list-style-type: none">• Reminder phone call (once a week)	<ul style="list-style-type: none">• Participants wear accelerometers for 7 days	<ul style="list-style-type: none">• At the beginning of the week, participants fill all questionnaires

References

1. Ribe AR, Laursen TM, Sandbaek A, Charles M, Nordentoft M, Vestergaard M. Long-term mortality of persons with severe mental illness and diabetes: a population-based cohort study in Denmark. *Psychol Med* 2014; **44**:3097-3107.
2. Gardner-Sood P, Lally J, Smith S, Atakan Z, Ismail K, Greenwood KE, *et al.* Cardiovascular risk factors and metabolic syndrome in people with established psychotic illnesses: baseline data from the IMPaCT randomized controlled trial. *Psychol Med* 2015; **45**:2619-2629.
3. Vancampfort D, Stubbs B, Mitchell AJ, De Hert M, Wampers M, Ward PB, *et al.* Risk of metabolic syndrome and its components in people with schizophrenia and related psychotic disorders, bipolar disorder and major depressive disorder: a systematic review and meta-analysis. *World Psychiatry* 2015; **14**:339-347.
4. Walker ER, McGee RE, Druss BG. Mortality in mental disorders and global disease burden implications: a systematic review and meta-analysis. *JAMA Psychiatry* 2015; **72**:334-341.
5. Bailey AP, Hetrick SE, Rosenbaum S, Purcell R, Parker AG. Treating depression with physical activity in adolescents and young adults: A systematic review and meta-analysis of randomised controlled trials. *Unpublished* 2017.
6. National Institute for Health and Care Excellence. Psychosis and schizophrenia in adults: Treatment and management. NICE clinical guideline 178. London: National Institute for Health and Care Excellence. 2014.
7. Galletly C, Castle D, Dark F, Humberstone V, Jablensky A, Killackey E, *et al.* Royal Australian and New Zealand College of Psychiatrists clinical practice guidelines for the management of schizophrenia and related disorders. *Aust N Z J Psychiatry* 2016; **50**:410-472.
8. Jinks AM, Lawson V, Daniels R. A survey of the health needs of hospital staff: implications for health care managers. *J Nurs Manag* 2003; **11**:343-350.
9. Happell B, Platania-Phung C, Scott D. Survey of Australian mental health nurses on physical activity promotion. *International Journal of Mental Health Promotion* 2013; **15**:148-161.
10. Happell B, Platania-Phung C, Scott D. Placing physical activity in mental health care: a leadership role for mental health nurses. *Int J Ment Health Nurs* 2011; **20**:310-318.
11. Rosenbaum S, Watkins A, Ward PB, Pearce D, Fitzpatrick K, Curtis J, *et al.* Psychiatry HeAL thyself! *Aust N Z J Psychiatry* 2016; **50**:600.
12. Howard L, Gamble C. Supporting mental health nurses to address the physical health needs of people with serious mental illness in acute inpatient care settings. *J Psychiatr Ment Health Nurs* 2011; **18**:105-112.
13. Terry J, Cutter J. Does education improve mental health practitioners' confidence in meeting the physical health needs of mental health service users? A mixed methods pilot study. *Issues Ment Health Nurs* 2013; **34**:249-255.
14. Rickwood DJ, Telford NR, Mazzer KR, Parker AG, Tanti CJ, McGorry PD. The services provided to young people through the headspace centres across Australia. *Med J Aust* 2015; **202**:533-536.
15. Schulz KF, Altman DG, Moher D, Group C. CONSORT 2010 statement: updated guidelines for reporting parallel group randomised trials. *BMJ* 2010; **340**:c332.
16. Cohen J. A power primer. *Psychol Bull* 1992; **112**:155-159.
17. Ajzen I. The theory of planned behavior. *Organizational Behavior and Human Decision Processes* 1991; **50**:179-211.
18. Stanton R, Happell B, Reaburn P. The development of a questionnaire to investigate the views of health professionals regarding exercise for the treatment of mental illness. *Mental Health and Physical Activity* 2014; **7**:177-182.
19. Pedisic Z, Bauman A. Accelerometer-based measures in physical activity surveillance: current practices and issues. *Br J Sports Med* 2015; **49**:219-223.
20. GeneActiv instructions manual version 1.4. Available from: https://49wvycy00mv416l561vrj345-wpengine.netdna-ssl.com/wp-content/uploads/2019/06/geneactiv_instruction_manual_v14pdf 2019.

21. Esliger DW, Rowlands AV, Hurst TL, Catt M, Murray P, Eston RG. Validation of the GENE Accelerometer. *Med Sci Sports Exerc* 2011; **43**:1085-1093.
22. robCompositions: An R-package for Robust Statistical Analysis of Compositional Data. *Compositional Data Analysis*: 341-355.
23. Dumuid D, Stanford TE, Martin-Fernandez JA, Pedisic Z, Maher CA, Lewis LK, *et al.* Compositional data analysis for physical activity, sedentary time and sleep research. *Stat Methods Med Res* 2018; **27**:3726-3738.
24. Pedišić Z. Measurement issues and poor adjustments for physical activity and sleep undermine sedentary behaviour research—the focus should shift to the balance between sleep, sedentary behaviour, standing and activity. *Kinesiology* 2014; **46**:135-146.
25. Pedišić Ž, Dumuid D, Olds T. Integrating sleep, sedentary behaviour, and physical activity research in the emerging field of time-use epidemiology: definitions, concepts, statistical methods, theoretical framework, and future directions. *Kinesiology* 2017; **49**:252-269.
26. Chastin SF, Palarea-Albaladejo J, Dontje ML, Skelton DA. Combined Effects of Time Spent in Physical Activity, Sedentary Behaviors and Sleep on Obesity and Cardio-Metabolic Health Markers: A Novel Compositional Data Analysis Approach. *PLoS One* 2015; **10**:e0139984.
27. Dumuid D, Pedisic Z, Palarea-Albaladejo J, Martin-Fernandez JA, Hron K, Olds T. Compositional Data Analysis in Time-Use Epidemiology: What, Why, How. *Int J Environ Res Public Health* 2020; **17**.
28. Gupta N, Mathiassen SE, Mateu-Figueras G, Heiden M, Hallman DM, Jorgensen MB, *et al.* A comparison of standard and compositional data analysis in studies addressing group differences in sedentary behavior and physical activity. *Int J Behav Nutr Phys Act* 2018; **15**:53.
29. Matricciani L, Bin YS, Lallukka T, Kronholm E, Wake M, Paquet C, *et al.* Rethinking the sleep-health link. *Sleep Health* 2018; **4**:339-348.
30. Torquati L, Pavey T, Kolbe-Alexander T, Leveritt M. Promoting Diet and Physical Activity in Nurses. *Am J Health Promot* 2017; **31**:19-27.
31. Lavoie-Tremblay M, Sounan C, Trudel JG, Lavigne GL, Martin K, Lowensteyn I. Impact of a pedometer program on nurses working in a health-promoting hospital. *Health Care Manag (Frederick)* 2014; **33**:172-180.
32. Johansson H, Weinehall L, Emmelin M. "It depends on what you mean": a qualitative study of Swedish health professionals' views on health and health promotion. *BMC Health Serv Res* 2009; **9**:191.
33. Valente CM, Sobal J, Muncie HL, Jr., Levine DM, Antlitz AM. Health promotion: physicians' beliefs, attitudes, and practices. *Am J Prev Med* 1986; **2**:82-88.
34. Wechsler H, Levine S, Idelson RK, Schor EL, Coakley E. The physician's role in health promotion revisited—a survey of primary care practitioners. *N Engl J Med* 1996; **334**:996-998.
35. Orleans CT, George LK, Houpt JL, Brodie KH. Health promotion in primary care: a survey of U.S. family practitioners. *Prev Med* 1985; **14**:636-647.
36. Cornuz J, Ghali WA, Di Carlantonio D, Pecoud A, Paccaud F. Physicians' attitudes towards prevention: importance of intervention-specific barriers and physicians' health habits. *Fam Pract* 2000; **17**:535-540.
37. Royal College of Psychiatrists. Information Pack for the Psychotherapy Section of the Core and General Curriculum. Royal College of Psychiatrists; (<http://www.rcpsych.ac.uk/pdf/psychotherapy%20information%20Pack%20revised.pdf>).
38. The Royal Australian & New Zealand college of psychiatrists. Guide to psychotherapy training. <https://www.ranzcp.org/files/prefellowship/2012-fellowship-program/guide-for-psychotherapy-training.aspx>.
39. Bartlem K, Bowman J, Ross K, Freund M, Wye P, McElwaine K, *et al.* Mental health clinician attitudes to the provision of preventive care for chronic disease risk behaviours and association with care provision. *BMC Psychiatry* 2016; **16**:57.

40. Johnson JL, Malchy LA, Ratner PA, Hossain S, Procyshyn RM, Bottorff JL, *et al.* Community mental healthcare providers' attitudes and practices related to smoking cessation interventions for people living with severe mental illness. *Patient Educ Couns* 2009; **77**:289-295.
41. Robson D, Haddad M, Gray R, Gournay K. Mental health nursing and physical health care: a cross-sectional study of nurses' attitudes, practice, and perceived training needs for the physical health care of people with severe mental illness. *Int J Ment Health Nurs* 2013; **22**:409-417.

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