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ARTICLE

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Predictors of improvement in personal recovery and activity engagement among mental health service users following a group-based sensory modulation intervention

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ABSTRACT

Background: Mental health service users often have sensory processing difficulties affecting activity engagement and personal recovery. Since interventions targeting this area are scarce, a group-based sensory modulation intervention was developed. To determine in which settings and for whom this intervention has clinical value, this study aimed to investigate whether sociodemographic and clinical baseline characteristics were associated with improvement in personal recovery and activity engagement.

Methods: This study included participants from the intervention group ($N=107$) of a trial (reg.nr: NCT06432114) evaluating an 11-week group-based sensory modulation intervention in mental health outpatient units. Data were collected at baseline, post-intervention, and at 6-month follow-up. Analysis included descriptive statistics and baseline-adjusted multiple linear regression models.

Results: Results showed that the absence of a psychosis diagnosis was associated with a higher mean score of personal recovery at post-intervention ($p=0.003$), but not at 6-months follow-up ($p=0.826$). There were no significant associations between the predictors and activity engagement.

Conclusion: Most predictors in the models were not significantly associated with improvement across any of the outcomes. This suggests that improvement in personal recovery and activity engagement, following the intervention, was accessible to the diverse group of mental health service users, independent of their baseline characteristics.

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Background

Sensory processing is essential for the experience of being human, allowing the perception of internal states, one's body and the surrounding environmental context [1]. A growing body of research shows that people who live with mental illness have sensory processing difficulties hampering engagement in activities in everyday life [2–4]. To address these difficulties, interventions focusing on sensory processing (sensory modulation interventions) are being developed and evaluated in mental health settings. Sensory modulation interventions focus on the use of sensory processing theory and strategies to increase awareness of bodily sensations and enhance control of emotional and physiological arousal, enabling service users to engage in everyday activities in an optimal way [5,6]. Several reviews of outcomes of sensory modulation interventions showed positive results in both inpatient and outpatient settings, although research on effectiveness is scarce [7–10].

The concept of personal recovery focuses on subjective aspects of the recovery process, including increased well-being, empowerment and quality of life [11]. This contrasts

with the traditional clinical perspective of recovery, which focuses on symptom relief [12,13]. This view of personal recovery has its origin in mental health service users' lived experiences and their perspectives on what is important in their own process of finding meaning in everyday life, even while experiencing continuing psychiatric symptoms. Conceptually, recovery consists of both intrapersonal aspects, such as empowerment, hope, personal confidence and purpose, and interpersonal aspects, such as relating and connecting to other persons [11]. These factors have been captured in the personal recovery framework, 'CHIME' (Connectedness, Hope, Optimism, Identity, Meaning and Empowerment), which was developed from mental health service users' published accounts of recovery [14–16]. The construct of CHIME is further related to the aim and outcomes of sensory approaches and sensory modulation interventions in clinical mental health settings [17]. In mental health inpatient settings, research indicates that sensory modulation interventions help mental health service users feel calmer, stabilising arousal, increasing management of psychiatric symptoms and to generally feel more in control

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of their environment [7,8]. These sensory modulation outcomes are closely associated to the personal recovery process, as they support a sense of safety, agency and empowerment [11,14,15]. Furthermore, the interpersonal factors of recovery, which includes connecting with others [11], have been reported as an important aspect in group-based sensory modulation interventions. Group based interventions provide opportunities for feelings of self-acceptance and belonging *via* sharing experiences in a safe space, increased understanding of sensory needs, and validation of sensory challenges [18,19]. However, quantitative research focusing on relationships between sensory processing and personal recovery processes for mental health service users is unfortunately limited [20], especially in mental health outpatient settings.

Activity engagement refers to the process of participation in everyday activities in a way that the person finds meaningful. The experience and level of engagement are shaped by a dynamic interaction between the person, the activity and the physical and social environment [21,22]. Engagement in everyday activities is important for mental health and is closely related to the recovery process for mental health service users [23–25]. Research on sensory processing in relation to activity engagement is limited. However, an earlier cross-sectional study within the current research project found that activity engagement was positively associated with a sensory processing pattern (sensation seeking), which is also usually related to positive health-related outcomes [26]. An experiential study reported that sensory processing strongly influences engagement in activities of everyday life [27] and difficulties related to sensory input were experienced as hindering activity engagement [28]. Moreover, research on sensory modulation interventions has shown positive results related to engagement in activities within inpatient settings [7,8,29], and outpatient settings [9,18,30]. Lastly, the construct of sensory modulation interventions [5] overlaps with the theoretical concept of activity engagement, as they both focus on person-environment interactions as being crucial to everyday functioning and the experience of meaning and recovery in everyday life [24].

When transferring knowledge from research to implementation in real clinical settings, it is also important to explore elements that are not directly related to effectiveness but still have clinical relevance. Sociodemographic aspects, such as education, could affect the personal recovery process. Lower education levels have for example, unexpectedly been shown to be related to higher scores in perceived recovery for people with severe mental illness [31]. Ageing with severe mental illness has been experienced as affecting activities in everyday life in terms of changed activity patterns [32]. However, recent research including people with severe mental illness showed that quality of life was similar across ages, but older people tended to have higher levels of personal recovery [33]. Additionally, women, compared with men and non-binary mental health service users, have been reported to experience modestly greater sensory processing difficulties [26].

Consequently, investigating how different sociodemographic and clinical baseline characteristics may predict outcomes following an intervention can be important for

providing optimal care for a target group. A few studies have investigated this with mental health service users. For example, an occupational therapy intervention in mental health outpatient settings [34] showed that most sociodemographic variables were not strongly associated with outcomes of engagement in activities, implying that the intervention fitted a wide variety of mental health service users. Another intervention study, including individuals with first-episode psychosis, who participated in a psychosocial intervention, investigated whether sociodemographic factors predicted the outcomes of symptoms and function. It showed that higher education level predicted fewer symptoms, worse social functioning earlier in life (adolescence) predicted worse levels of psychotic symptoms, and age was a moderator for better improvement in psychopathology [35].

Although some studies have examined predictors of outcomes in occupational therapy interventions in mental health, this line of research remains limited. To our knowledge, no studies have explored predictors of outcomes following participation in a sensory modulation intervention in mental health outpatient settings [9]. In addition, sensory modulation interventions are still relatively new in Sweden and remain unfamiliar to many mental health service users and mental health staff. The close relationship between personal recovery and activity engagement further highlights the importance of investigating whether sociodemographic and clinical baseline characteristics are associated with follow-up outcomes after participation in a sensory modulation intervention. Accordingly, this study aimed to increase knowledge about whether sociodemographic and clinical baseline characteristics were associated with improvement in personal recovery and activity engagement after participation in a group-based sensory modulation intervention.

Method

Study design

This study included mental health service users who were allocated to the intervention group and who had gone through an 11-week group-based sensory modulation intervention in mental health outpatient units in southern Sweden. A selection of sociodemographic (gender, age, education) and clinical (diagnosis, sensory processing difficulties) baseline characteristics were chosen to explore associations with improvement in personal recovery (Questionnaire about the Process of Recovery - QPR) [11,36] and activity engagement (Profiles of Occupational Engagement among people with Severe mental illness - POES) [21,22] among mental health service users who received the group-based sensory modulation intervention. Increased information about differences and similarities in outcome scores among subgroups of mental health service users could contribute to knowledge about intervention fit and potential needs for adaptations to suit the diverse population of mental health service users. This study follows an RCT project (REG.nr NCT06432114) evaluating the effect of a group-based sensory modulation intervention compared to treatment as usual (TAU) for adult mental health service users. The RCT evaluated the effect on reduced

anxiety (primary outcome) and several clinical and recovery-related outcomes (secondary outcomes).

Ethical considerations

The study received ethical approval from the local Research Ethics Committee (Dnr 2017/43). Before enrolment in the larger RCT (REG.nr NCT06432114), mental health service users were provided with oral information about the project and informed that participation was voluntary, confidential and that they could withdraw at any time from the project without providing a reason and without consequences for their regular treatment. They also received and signed a written consent form.

Research setting

This study included mental health service users from 18 different sensory modulation intervention groups in 16 mental health outpatient units (12 non-psychotic diagnosis units and 4 psychosis units). The outpatient units were located in 3 different regional psychiatry organisations in southern Sweden, including both urban/rural and different socioeconomic areas, and were further situated in areas with both relatively high and low proportions of immigrants.

Participants

The participants included 107 mental health service users who had been allocated to the intervention group in the RCT (REG.nr NCT06432114). The inclusion criteria were adulthood (≥ 18 years) and having a severe mental illness for at least two years impairing community functioning, in accordance with the two-dimensional definition by Ruggeri et al. [37]. In addition, service users had at least one self-reported psychiatric diagnosis and clinically assessed moderate to severe anxiety. The exclusion criteria were insufficient ability to understand the Swedish language, treatment primarily for substance use, having an intellectual disability or dementia, or being acutely ill (somatically or mentally).

Intervention

Sensory awareness program (SAP)

The description of the intervention in the current study was created according to The Template for Intervention Description and Replication (TIDieR) [38]. Built on sensory modulation theory, the Sensory Awareness Program (SAP) was developed and adapted from the original manualized group-based Sensory Connection Program (SCP) [39].

The SAP supports mental health service users in identifying everyday sensory triggers, understanding their own sensory profile, and applying sensory strategies during difficult situations to reduce anxiety, increase engagement in everyday activities and facilitate their personal recovery process.

The SAP includes psychoeducation on sensory systems and sensory processing, specifically in relation to managing

anxiety and emotional regulation. Furthermore, the service users receive information and exercises for managing physiological arousal through sensory strategies and tools, both during group sessions and between sessions in the home environment. The SAP also applies individual goal setting for the service users during the program. Examples of strategies include using headphones to reduce distress caused by auditory stimuli, using a weighted blanket to ease anxiety through deep-pressure input, or engaging in physical exercise to increase alertness through proprioceptive stimulation.

In the present study, the manualised SAP program was delivered face-to-face in mental health outpatient units for 11 weeks. The SAP started with one individual session focusing on the completion of a sensory profile [40] with the service user, followed by 10 weeks of 1.5 to 2 h group sessions each week. Each group consisted of a maximum of 8 mental health service users.

The course leaders across all groups were one occupational therapist and a co-therapist of varying disciplines (i.e. nurse, psychologist, or social worker). Prior to the start of the program, all staff went through a two-day education on sensory modulation theory and the specific SAP program, delivered by the research team. The course leaders and co-therapists used a detailed instruction manual throughout the intervention, while the service users used a participant manual and worksheets.

Data collection

Data collection was mainly digital through the data collection system REDCap [41]. A minority of the mental health service users preferred to do the data collection in-person (paper-based) and had meetings with a research assistant to fill in the questionnaires. The paper-based data were then transferred into the digital system. The collected data included standardised questionnaires focused on the process of recovery and activity engagement, as well as sociodemographic and other clinical baseline information, as outlined below.

Questionnaires

Sociodemographic and clinical baseline characteristics

Sociodemographic and clinical baseline characteristics are potentially valuable when clinicians plan and adapt interventions in mental health outpatient units. In the larger RCT (REG.nr NCT06432114), which the current study follows, a questionnaire with sociodemographic and clinical baseline characteristics was designed and used during data collection.

A selection of sociodemographic and clinical baseline characteristics was included to explore their associations with outcome scores of personal recovery and activity engagement among mental health service users immediately post-intervention and at 6-month follow-up. The selection included gender, age, education, and diagnosis, in terms of either having a non-psychotic diagnosis (ex. depression, anxiety syndrome, bipolar disorder, PTSD etc) or a psychosis diagnosis and 'presence of sensory input (smells, sights, touch or movements) causing strong discomfort in everyday life,

Table 1. Characteristics of participants.

Characteristics	N (%)
Gender: women/men/non-binary (<i>n</i> = 105)	77/25/3 (73/24/3)
Age: mean/min/max (<i>n</i> = 104)	43/22/78
Education (<i>n</i> = 107)	
Not completed primary school	3 (3)
Completed primary school	11 (10)
Completed highschool	53 (50)
Completed university	40 (37)
Self-reported main psychiatric diagnosis (<i>n</i> = 107)	
Psychosis	18 (17)
Non-psychotic diagnosis	89 (83)
Are there any sensory input (smells, sights, touch or movements) in your everyday life that can trigger strong discomfort, such as fear, flashbacks and/or feelings of unreality? yes/no (<i>n</i> = 106)	81/25 (76/24)
Born in Sweden – yes/no (<i>n</i> = 107)	97/10 (91/9)
Present working/work-training/studying – yes/no (<i>n</i> = 107)	46/61 (43/57)
Years since first contact in psychiatry mean/min/max (<i>n</i> = 106)	17/0/52
Experience of trauma – yes/no (<i>n</i> = 107)	92/15 (86/14)
Type of trauma experience (<i>n</i> = 107)	
Life threatening illness or accident – yes/no (<i>n</i> = 107)	25/82 (24/76)
Present when someone else has been killed or injured – yes/no (<i>n</i> = 107)	23/84 (22/78)
Death of a close relative – yes/no (<i>n</i> = 107)	49/58 (46/54)
Physical or psychological violence – yes/no (<i>n</i> = 107)	62/45 (58/42)

such as fear, flashbacks and/or feelings of unreality'. Further sociodemographic characteristics and details within the sample are presented in Table 1.

Personal recovery

Questionnaire about the process of recovery (QPR). QPR is a self-report questionnaire and measures the individual's process of personal recovery [11,42]. It is closely related to the framework of CHIME [14–16]. The original QPR has 22 items across two subscales (intrapersonal, 17 items; interpersonal, 5 items), rated on a 5-point Likert scale (0–4), with higher scores indicating a higher level of personal recovery. Example items address connectedness, sense of control, and self-worth [11]. The 22-item version showed good psychometric properties during development; however, subsequent testing supported the intrapersonal subscale (internal consistency, reliability and construct validity), but not the interpersonal subscale. The one-factor 15-item version demonstrated more robust psychometric properties [42]. In the current study, we used the Swedish QPR (QPR-Swe) [36], a one-factor 16-item version adapted from the original 22-item scale. It corresponds to the international 15-item version but additionally includes item 13, which addresses access to support that facilitates independent living, since this item demonstrated adequate psychometric properties in the Swedish validation study [36]. The sum score ranges from 0 to 64 [36].

Activity engagement

Profiles of occupational engagement among people with severe mental illness (POES). The instrument POES was developed based on service users' time use diaries and is used to measure activity engagement, reflecting the dynamic interplay between personal, environmental, and activity aspects [21]. The questionnaire is divided into two parts; the first part includes a time use diary over the service users' last 24h, divided into four columns and one-hour intervals. The first addresses time, while the other three reflect activities

performed (activity domain), where and with whom they were with (environmental domain), and the experience of the activity in terms of perceptions and feelings (personal domain). The second part involves the participants reflecting on the diary content and rate on a scale with 9 items, resulting in the person's level of activity engagement (from low to high). The rating consists of a 4-point Likert scale; from 1, strongly disagree to 4, strongly agree and the items include information about for example: meaningfulness, variation in everyday life and balance between activities. The sum score of the scale is from 9 to 36, where a higher score indicates a higher level of activity engagement. POES has been shown to have internal construct validity and reliability [21,22,43].

Data analysis

All data were exported from the REDCap system [41] and analysed using SPSS version 31. Normality for continuous variables was checked using histograms. Categorical variables were investigated using frequencies, cross-tabulations, and Fisher's exact test [44]. Pearson correlations were performed between continuous variables. Missing data were analysed by comparing complete versus incomplete cases (missing at least one timepoint), and no significant baseline differences were found. There was no imputation on the entire dataset for missing time points. Item-level missing data was handled using calculated mean value imputation where participants had filled in at least 90% of the items in a questionnaire. In the current study, this means that mean imputation was only done in the outcome of personal recovery (QPR), since in activity engagement (POES), the missing data in participants with missing items were higher than 10% and hence, were not imputed. A multiple linear regression model for each outcome variable and for each time point (post-intervention and 6-month follow-up) was performed. We adjusted for baseline values in all regression models by using baseline as a covariate. Assumptions for regression models were checked, using the variance inflation factor (VIF) to check for multicollinearity between independent variables, residuals were checked for normality, homoscedasticity and outliers using plots and the Durbin-Watson test for autocorrelations. The significance level in the analysis was $p < 0.05$ two-tailed [44].

Non-binary service users were excluded in the primary regression models, due to statistical issues, since there were very few (3 persons) in the sample. However, a sensitivity analysis was performed on this group, to check if there was any difference.

Results

Sociodemographic information, clinical baseline characteristics and descriptive statistics

Most of the mental health service users in the sample reported experiences of trauma and sensory input causing strong discomfort in everyday life, and a majority of the sample were women. Approximately one-fifth of the sample had a psychosis diagnosis. Educational attainment was relatively high, with 37% having completed university education (Table 1).

Details of descriptive statistics, including means, standard deviations (SD), medians, and ranges (min/max) for continuous variables, are presented in Table 2. Cross-tabulation analyses using Fisher's exact test showed that sensory input causing strong discomfort, was more frequently reported by women ($n=63/76$, 83%) than by men ($n=15/25$, 60%, Fisher's exact test, two-sided $p=0.027$) and by mental health service users with a non-psychotic diagnosis ($n=72/88$, 82%) than by those with a psychosis diagnosis ($n=9/18$, 50%, Fisher's exact test, two-sided $p=0.012$). No other statistically significant associations were identified in the exploratory analyses of the categorical variables. Correlation analyses of continuous variables, showed that all outcome variables were significantly correlated across measurement points, including baseline, post-intervention, and 6-month follow-up, but not significantly correlated to age.

Multiple linear regression analysis

Associations between predictors and personal recovery

In the models with personal recovery as the outcome, when adjusted for baseline, having a non-psychotic diagnosis rather

than a psychosis diagnosis was a significant predictor ($p=0.003$) for higher mean scores of personal recovery immediately post-intervention (model 1). However, the confidence interval was wide ($-9.94 - -2.06$). At the 6-month follow-up (model 2), none of the predictors were significant. The adjusted r^2 value in model 1 was 0.81 and 0.59 in model 2, meaning that most of the variance in the outcome immediately post-intervention and at 6-month follow-up could be explained by the baseline value, though in a long-term perspective, the baseline value of personal recovery contributed less to the outcome value of personal recovery. Results of regression models 1–4 are presented in Table 3.

An unexpected difference was observed between the models at post-intervention and at the 6-month follow-up, prompting further descriptive analysis. This analysis revealed that service users with a psychosis diagnosis had a lower mean in personal recovery scores at post-intervention compared to their baseline value. However, descriptively, mean personal recovery scores at the 6-month follow-up were higher than baseline in both the group of service users with a psychosis diagnosis and those with a non-psychotic diagnosis. The overall difference in absolute values from baseline to 6-month follow-up was found to be small between these two groups. These findings are illustrated in Figure 1.

Associations between predictors and activity engagement

In models with activity engagement as the outcome, no predictors were significantly associated with higher mean scores in activity engagement, after adjustment for baseline, either immediately postintervention (model 3) or at the 6-month follow-up (model 4). Adjusted r^2 in both models were mainly related to the baseline value, 0.59 in model 3 and 0.64 in model 4, meaning that the baseline value explained most of the variance in activity engagement. However, the baseline

Table 2. Descriptive statistics of continuous variables.

Variable	N	Mean (SD)	Median (Min/max)
Age	104	43.45 (13.44)	41 (22/78)
Personal recovery (QPR)	101	34.18 (12.12)	34.13 (2/64)
Baseline			
Personal recovery (QPR)	71	35.85 (12.69)	38 (2/64)
Post-intervention			
Personal recovery (QPR)	51	37.56 (13.32)	39 (7/64)
6-month follow-up			
Activity engagement (POES)	101	22.24 (5.73)	22 (9/36)
Baseline			
Activity engagement (POES)	69	22.80 (6.34)	23 (9/36)
Post-intervention			
Activity engagement (POES)	52	23.88 (6.71)	24 (9/36)
6-month follow-up			

Table 3. Multiple linear regression models [1–4].

Dependent variables	Independent variables	β	β 95% CI	p
Model 1	Gender (reference: men)	−1.898	−5.188–1.3933	0.253
Personal recovery (QPR)	Age	0.082	−0.028–0.191	0.140
Post intervention	Education (reference: non-university)	−1.916	−4.765–0.934	0.184
Adjusted R square: 0.814	Diagnosis (reference: non-psychotic)	−5.999	−9.943–−2.056	0.003**
	Sensory input discomfort (reference: yes)	3.393	−0.167–6.952	0.061
	QPR baseline	0.985	0.867–1.104	<0.001***
Model 2	Gender (reference: men)	−1.284	−7.391–4.824	0.674
Personal recovery (QPR)	Age	0.060	−0.143–0.263	0.555
6-month follow-up	Education (reference: non-university)	2.429	−2.859–7.717	0.359
Adjusted R square: 0.585	Diagnosis (reference: non-psychotic)	−0.804	−8.123–6.514	0.826
	Sensory input discomfort (reference: yes)	3.118	−3.489–9.724	0.346
	QPR baseline	0.850	0.630–1.071	<0.001***
Model 3	Gender (reference: men)	−1.024	−3.465–1.418	0.405
Activity engagement (POES)	Age	0.029	−0.054–0.112	0.489
Post intervention	Education (reference: non-university)	1.444	−0.739–3.626	0.191
Adjusted R square: 0.587	Diagnosis (reference: non-psychotic)	1.027	−1.983–4.038	0.497
	Sensory input discomfort (reference: yes)	−0.203	−2.908–2.501	0.881
	POES baseline	0.814	0.621–1.008	<0.001***
Model 4	Gender (reference: men)	−0.912	−3.709–1.885	0.514
Activity engagement (POES)	Age	0.031	−0.064–0.126	0.518
Adjusted R square: 0.636	Education (reference: non-university)	1.264	−1.236–3.765	0.314
	Diagnosis (reference: non-psychotic)	1.455	−1.994–4.905	0.400
	Sensory input discomfort (reference: yes)	2.081	−1.017–5.180	0.183
	POES baseline	0.852	0.630–1.073	<0.001***

* $p \leq 0.05$.

** $p \leq 0.01$.

*** $p \leq 0.001$.

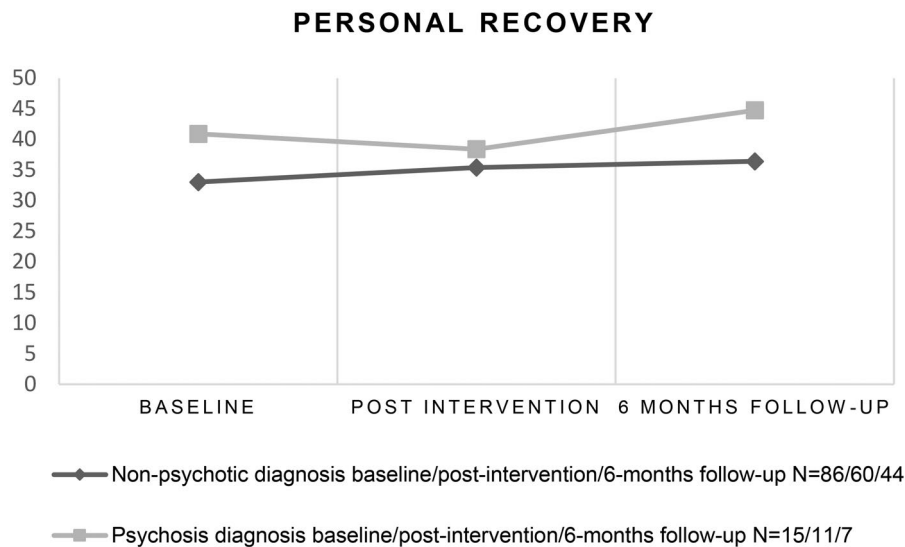


Figure 1. Descriptive absolute values at all timepoints based on diagnosis in the outcome of personal recovery.

value of activity engagement was less associated with the outcome than baseline in the models with personal recovery as the outcome.

Assumptions checked for showed normally distributed residuals in all models and no autocorrelation problems, since all Durbin-Watson values were close to 2.0. There was no problem with multicollinearity between independent variables, with all VIF scores between 1.04 and 1.28.

The sensitivity analyses, including the gender variable with three categories, showed small, negligible differences and therefore yielded the same conclusions as the primary regression models.

Discussion

This study contributed to new knowledge that sociodemographic and clinical baseline characteristics were generally not associated with improvement in personal recovery or activity engagement for mental health service users following a group-based sensory modulation intervention. This can be seen as a positive finding, as it suggests that opportunities for improvement are accessible to a diverse group of mental health service users, largely independent of their sociodemographic and clinical characteristics at baseline. It further means that the intervention seems to fit in a variety of mental health outpatient settings, including different types of mental health outpatient units and could support a more recovery-oriented clinical approach in general. These results are further aligned with earlier research on group-based occupational therapy interventions for mental health service users, which also found that sociodemographic and clinical baseline variables were not associated with improvement in activity engagement and several other activity-related outcomes [34].

However, the predictor of having a non-psychotic diagnosis rather than a psychosis diagnosis was significant for personal recovery post-intervention, but not at 6-month follow-up. This may suggest that diagnosis is important for

rapid improvement in personal recovery. One potential explanation could be that mental health service users with a psychosis diagnosis are more likely to have cognitive difficulties and may need more time to process and learn new strategies [45–47]. An earlier similar study, which investigated predictors for symptom improvement after a psychosocial intervention for people with first-episode psychosis, found that higher education was a predictor for fewer symptoms and that age was a moderator for better improvement [35]. The difference between the results of the current study and those of Lasalvia et al. [35] might support a distinction between clinical and personal recovery as outcomes, although these two aspects of recovery are also closely interrelated [48]. However, it could also potentially add new knowledge of the differences of sensory modulation interventions with the embodied aspect included, compared to interventions not including embodiment, when studying diagnosis in relation to outcomes of personal recovery and activity engagement. However, the descriptive results presented in Figure 1 indicated that the difference in improvement in personal recovery scores in the long term can also partly be explained by the decreased mean for people with a psychosis diagnosis at post-intervention follow-up. This finding could potentially suggest that people with a psychosis diagnosis may have decreased mental well-being immediately after the intervention, but after 6 months, the benefit of the intervention potentially was accessed by these service users. However, a meta-analysis including 18 trials by Cuijpers et al. [49] investigated negative effects after psychotherapy interventions and found that the risk of negative effects was low, although the results in different studies included were not consistent, and the participants had a depression diagnosis, which may be different compared with the service users in this current study with a psychosis diagnosis.

In contrast to the outcomes of personal recovery, none of the predictors were associated with improvement in activity engagement. It is surprising, as commonly the outcomes of personal recovery and activity engagement align with each

other [23]. However, the results of this current study is aligned with earlier research on occupational therapy group interventions [34], where most sociodemographic predictors were not either related to improvement in activity engagement. This might imply that activity engagement may be less directly influenced by sociodemographic and clinical baseline characteristics but more dependent on environmental and activity factors, which were not captured in the present study.

Methodological considerations

Strengths

A main strength of this study was the diversity of the sample across geographical locations and service contexts. Service users were recruited from mental health outpatient units in three different regions, representing a mix of rural and urban areas, socioeconomic contexts, and locations with both higher and lower proportions of immigrants. Mental health service users in the sample also had a wide range of ages (22–78 years old). The number of mental health outpatient units was relatively large (16 units) and included different types of units (non-psychotic diagnoses units/psychosis units). Taken together, the overall strength of this study was that it covered a wide group of mental health service users, meaning that the results could be transferable to the real clinical setting in mental health outpatient units.

Limitations

This study also had several limitations. Firstly, the sample size was relatively small, especially in the 6-month follow-up models, which increased the uncertainty of the results and might have affected the generalisability [50]. However, to be able to compare the models, the decision was taken to include the same predictors in all models, meaning the 6-month models became as a result of this, less robust and should be interpreted with caution. The sample was not diverse in terms of gender, with the large majority being women, and most participants were born in Sweden. This made the results less generalisable for men, non-binary and mental health service users born in other countries. A relatively small proportion of the mental health service users in the sample had a psychosis diagnosis, which might also have affected the results and stability of the regression models. Furthermore, missing data might have affected the result by reducing the sample and its composition across time points. However, this problem is not exclusive to this current study and is aligned with research in general, including mental health service users [51].

Conclusion and clinical implications

The findings of this study indicate that improvement in personal recovery and activity engagement following a group-based sensory modulation intervention may be accessible to a diverse group of mental health service users, largely independent of their socio-demographic and clinical baseline

characteristics. From a clinical perspective, this suggests that the intervention may be broadly applicable and implemented across diverse mental health outpatient populations and support the progression towards a more recovery-oriented mental health care. Since this is the first study, to our knowledge, investigating sociodemographic and clinical baseline predictors following a group-based sensory modulation intervention, these findings should be interpreted with caution and be investigated in further international contexts.

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Author contributions

CRedit: **Klara Forsberg**: Conceptualization, Formal analysis, Methodology, Project administration, Writing – original draft; **Daniel Sutton**: Conceptualization, Methodology, Supervision, Writing – review & editing; **Sigrid Stjernswärd**: Conceptualization, Supervision, Writing – review & editing; **Ulrika Bejerholm**: Conceptualization, Supervision, Writing – review & editing; **Elisabeth Argentzell**: Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Writing – review & editing.

AI statement

M365 Co-pilot was used only for editing the language. The authors are fully responsible for the content in this manuscript. No AI tools were used in the study design, analysis, or interpretations.

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Data availability statement

The data can be available on reasonable request to the corresponding author but are restricted according to the decision by the ethical approval, Dnr nr; 2017/43.

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