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Assessing validity of retrospective recall of physical activity in individuals with psychosis-like experiences

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ABSTRACT

Psychosis-like experiences are present in the general population and may indicate risk for more severe forms of psychosis. They are associated with cognitive impairments, potentially impacting ability to accurately complete certain self-report measures. This study investigated whether the presence of psychosis-like experiences was associated with impairments in retrospective reports of physical activity, a measure salient to this population, by comparing post-study questionnaire data on activity level with reports of activity contemporaneously collected through ecological momentary assessment (EMA). Participants ($n = 39$) were 18–25 years of age and recruited via stratified sampling to maximize representation of a full psychosis-like experience spectrum. Mobile questionnaires were sent six times a day for one week, and included questions probing amount and intensity of activity. Upon completion of the EMA week, participants completed a retrospective recall of the past week's activity. High levels of psychosis-like experiences were associated with poorer recall for past sedentary behavior as evidenced by the moderating effect of psychosis-like experiences on the relation between retrospective and in vivo measured sedentary activity (interaction effect: $b = -0.26$, $t(1) = -2.04$, $p = 0.05$, $f^2 = 0.08$). Findings call into question the validity of retrospective self-reporting of activity level for those experiencing psychosis-like experiences.

1. Introduction

Transient experiences of psychosis that manifest at subclinical levels are sometimes referred to as psychosis-like experiences, taking the form of attenuated hallucinations or delusions. Research investigating the etiological underpinnings of psychosis has uncovered commonalities between individuals with psychosis-like experiences and those with psychosis, including shared risk factors across demographic, social, biological, and psychopathological domains (van Os et al., 2009), indicating that further examination of psychosis-like experiences may help promote understanding of the psychosis spectrum. Though some individuals with psychosis-like experiences may develop symptoms over time that meet threshold for a psychotic disorder, many will remain at a subclinical level. Yet, even at subclinical levels, those with psychosis-like experiences often show clinically relevant functional impairments similar in nature, but less severe than those with a formal psychotic disorder (Kelleher et al., 2014; Yung et al., 2005). People

with psychosis-like experiences often experience clinical distress that leads to high rates of help-seeking behavior (DeVylder et al., 2014), and suicidal behavior (DeVylder et al., 2015; Kelleher et al., 2013; Koyanagi and Stickley, 2015). Psychosis-like experiences are far more common than formally diagnosed psychotic disorders (8% vs. 3%; van Os et al., 2009; Perälä et al., 2007) facilitating the study of the psychosis spectrum in an accessible population.

Deficits in executive functioning and memory are present across the psychosis-spectrum (Elvevag and Goldberg, 2000; Fryer et al., 2013; Fusar-Poli et al., 2012; Karlsgodt et al., 2010), including in those with psychosis-like experiences (Barber et al., 2018; Sheffield et al., 2016). These impairments may impact processes vital to accurate and effective research and clinical efforts, such as the validity of retrospective self-report questionnaires (Cain et al., 2009; Fisher et al., 2011). Further, individuals with psychosis-like experiences experience symptoms related to conceptual disorganization (Brandizzi et al., 2014), a variable known to impact memory (Pelletier et al., 2005) and thus retrospective

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recall.

Relative to retrospective methods, use of daily diary and experience sampling has been suggested as a method to get a more accurate account of past behavior among people with cognitive or memory deficits (Cain et al., 2009). Ecological Momentary Assessment (EMA), a form of daily diary assessment, involves mobile monitoring of daily experiences through a real-time, real-world measurement strategy (Shiffman et al., 2008). EMA has the potential to not only provide accurate self-report information among people with possibly compromised retrospective reporting abilities, it can also be used to establish the magnitude of gaps in accuracy between actual behavior and retrospective self-report. Despite suggestions to increase use of EMA in samples experiencing psychosis-like experiences (Cain et al., 2009), there remains a dearth of research to adapt such methodology.

Physical activity measurement is one area within psychosis-like experiences research where retrospective biases may impact accurate reporting. High rates of sedentary behavior are pervasive among individuals on the more severe end of the psychosis spectrum, and are associated with numerous negative health sequelae (Vancampfort et al., 2012). Despite this salience for people on the psychosis continuum, physical activity has historically been assessed via self-reported retrospective recall, which may be sensitive to bias due to memory and recall errors (Lewis et al., 2017). EMA is a validated method for physical activity data collection that can capture and probe levels of physical activity during, or shortly after, their occurrence (Marszalek et al., 2014). As this technique minimizes recall limitations, it can aid a better understanding of possible discrepancies in recall accuracy for those with psychosis-like experiences.

The current study assessed the possible impact of psychosis-like experiences on retrospective reporting by examining the relation between in vivo responses gathered using real-time EMA techniques, and those gathered after the fact from retrospective self-report. Physical activity was selected as a variable of interest given its sensitivity to recall bias, and its importance to possible psychosis-like experience interventions. We hypothesized that overall there would be relatively low correlation coefficients between in vivo and retrospective reports of all levels of physical activity (vigorous, moderate, light, and sedentary). Regarding the impact of psychosis-like experiences, we hypothesized that individuals with more severe psychosis-like experiences would show greater limits to activity recall, and further, that the presence of psychosis-like experiences would most impact memory of less strenuous activity (i.e., light activity and sedentary behavior) as more arduous activity presents with less barriers to recollection (Shephard, 2003).

2. Methods

2.1. Participants

Participants ($N = 47$) were current University of Maryland, Baltimore County (UMBC) students, between the ages of 18–25 years. To be considered for participation, participants must have had a smartphone compatible with the SurveySignal program (the main data collection software), and must not have had a disability preventing normal walking or physical activity, as it can be reasonably assumed that an inability to engage in physical activity could alter the outcome of the physical activity measure. Students were recruited from a previously conducted large-scale screening study ($N = 546$) that collected self-reported ratings of psychosis-like experiences. Individuals were excluded from the final analysis sample ($N = 39$) due to missing or incomplete data for EMA measures ($n = 3$) or retrospective report ($n = 5$). Remuneration for study participation included extra credit and financial compensation. The study was approved by the UMBC institutional review board.

2.2. Procedure

2.2.1. Recruitment and screening

This study took place within the YouthFIRST lab at UMBC. Screening and recruitment were completed in two separate phases. Screening was initially employed to gather baseline data on level of self-reported psychosis-like experiences, as measured by the Prime Screen (Miller et al., 2004). A stratified random sampling approach was used for EMA phase sampling to ensure maximum variability in regard to psychosis-like experiences. Four separate sampling strata were formed based on frequency distributions of psychosis-like experiences within the initial screening sample, with four equal sized quartiles created based on Prime symptom scores. Upper and lower score boundaries for each quartile were used to determine data-driven symptom boundaries for each of the current studies four recruitment strata, and a minimum of 10 participants were recruited from each quartile to participate in the EMA portion.

Participants for the initial screen were recruited from an online UMBC student research volunteer pool. Interested participants completed a self-report battery including the Prime Screen ($N = 546$). Recruitment for EMA began after recruitment was complete for the screen, following determination of psychosis-like experiences distribution within the screening sample. For EMA data to be considered complete and valid, the participant must have completed at least one-third of their daily questionnaires (Myin-Germeys et al., 2001).

2.2.2. . Screening procedure

Interested participants enrolled via an online participant pool.

Eligible students received web-based study description and informed consent before progressing to the online questionnaire battery (<10 min). The battery included basic demographics, self and family psychiatric history, and level of psychosis-like experiences (Prime Screen).

2.2.3. EMA procedure

At baseline, participants came in person and reviewed study procedures, signed informed consent, and registered their personal smartphone with SurveySignal online software (Hoffman and Patel, 2015). Participants also completed an updated Prime Screen self-report.

Mobile questionnaires were sent six times-a-day at a random minute within a pre-determined 2-h time frame (beginning at 7:30 a.m. and ending at 10:30 p.m.) using SurveySignal (Hoffman and Patel, 2015), an online application that uses the mobile device's own text messaging as a signaling mechanism. The participant had 20 min from arrival of text link to complete and submit the questionnaire before the link was deactivated and the questionnaire was considered missing, thus constraining each questionnaire window to 30 min, and increasing time-response validity (Mehl and Conner, 2012). This process continued for 7-days allowing for a comprehensive assessment of one complete week. Upon completion of the EMA week, participants returned in person and completed the International Physical Activity questionnaire (IPAQ-S).

2.3. Materials and measures

2.3.1. The Prime Screen

The Prime Screen is a 12-item self-report measure designed to evaluate presence and severity of attenuated positive symptoms of psychosis within the past year (Miller et al., 2004). Participants are asked to report the severity of symptoms using a 7-point Likert-type format. A screener total psychosis-like experience score can be obtained by summing all responses, resulting in scores ranging from 0–72. The Prime Screen has demonstrated strong test-retest properties and is acceptable for use in undergraduate populations (Kline et al., 2012; Kline et al., 2015).

2.3.2. International Physical Activity Questionnaire—short form

The International Physical Activity Questionnaire—Short Form (IPAQ-S), is a self-report measure used to assess physical activity by gathering information across a comprehensive set of domains (Committee, 2005). It quantifies activities as either sedentary, light/walking, moderate, or vigorous. The measure informs participants to consider sedentary behavior as any time spent sitting or laying. Light activity is categorized as time spent walking at work and at home, walking to travel, or any other walking or light activity done for recreation, sport, exercise, or leisure. Moderate activity is categorized as any activity that takes moderate physical effort and makes you breathe somewhat harder than normal, such as carrying light loads or biking at a moderate pace. Vigorous activity is categorized as all activities that take hard physical effort and make you breathe much harder than normal such as heavy lifting, digging, aerobics, or fast biking/jogging. The IPAQ-S gathers information on minutes spent engaging in each of these activities over the past 7 days. A continuous total physical activity variable can be calculated by summing weighted subdomain means (Committee, 2005). The IPAQ-S has been shown to be both a valid and reliable measure of physical activity in numerous populations and has acceptable validity and reliability (Dinger et al., 2006; Poppel et al., 2010). The current study used the IPAQ-S at baseline and during the EMA phase. Minor modification to the IPAQ-S language was required when asked during EMA as the original IPAQ-S is intended to gather retrospective data. Specifically, participants were asked to reflect on time spent engaging in each form of physical activity "since the last questionnaire," rather than over the past 7 days. Retrospective activity level data were collected as total activity minutes per day; weekly activity totals were calculated by multiplying daily minute totals by 7. In vivo activity level was measured as total activity minutes per signal period. To allow for comparison of in vivo and retrospective activity values, weekly minute totals for EMA activity levels were calculated by multiplying the mean signal value by 42 (6 signals per day × 7 days a week).

2.3.3. Mobile EMA questionnaire

EMA questionnaires were created and formatted through Qualtrics mobile questionnaires, using previously validated visuals (Granholm et al., 2008). Each momentary questionnaire contained a battery of questions (roughly 2–3 min in length), including an adapted IPAQ-S. As the IPAQ-S was originally created to collect retrospective data, language was modified to specify the participant should be considering activities "since the last questionnaire." Modifications were also made to the scale of response, as an ordinal scale was introduced in place of continuous minutes, such that participants were asked to choose amount of time spent from one of six categories ranging from less than 10 min to more than 2 h. Though this is the first use of IPAQ-S in an EMA study to our knowledge, similar physical activity measures have been validated for mobile data collection (Marszaek et al., 2014).

2.4. Analyses

2.4.1. Missing data

Questionnaires were sent six times a day for seven days. Survey response rate was 82.51%, with only 6.7% ($n = 3$) of participants completing less than 75% of their questionnaires.

2.4.2. Statistical analyses

All analyses were conducted using SPSS version 25.0. A Kolmogorov-Smirnov test was used to examine normality, with retrospective vigorous ($D(39) = 0.20$, $p < .05$), moderate ($D(39) = 0.25$, $p < 0.05$), and light ($D(39) = 0.28$, $p < 0.05$) activity distributions indicated to be non-normal (Table 1; Curran et al., 1996). Square root transformation was used to correct for nonnormality. Bivariate correlations were run to examine the relation between retrospective and in vivo activity level report. Total activity levels were compared using

Table 1
Descriptive statistics for analysis sample and activity level.

	Mean/Frequency	SD/% of sample
Age	20.22	1.59
Gender (female)	22	56%
Race		
Asian	15	38%
Black/African-American	9	23%
White/Caucasian	11	28%
Multiracial	3	8%
Other	1	3%
Ethnicity (Hispanic)	1	3%
Drug use (current)	8	21%

	Mean (SD)	Skewness	Kurtosis
Prime sum score	11.77 (11.32)	1.01	0.57
Retrospective report			
Vigorous activity	157.82 (185.58)	2.36	8.25
Moderate activity	202.82 (304.21)	2.72	8.48
Light activity	436.03 (597.69)	3.55	15.36
Sedentary activity	391.15 (185.81)	0.46	0.90
Total activity	3512.73 (3039.25)	1.76	3.69
In vivo report			
Vigorous activity	78.85 (98.29)	1.40	1.20
Moderate activity	87.82 (110.49)	1.29	1.37
Light activity	448.72 (280.14)	1.49	3.42
Sedentary activity	2184.23 (700.19)	0.43	−0.52
Total activity	2799.62 (743.56)	0.42	−0.42

Note: For all statistics, $N = 39$.

paired sample t-tests to evaluate magnitude and direction of differences in activity level estimation. The primary hypotheses were tested running moderated multiple regressions (Aiken et al., 1991) to examine the potential moderating effect of psychosis-like experiences on the association between retrospective and real time self-reports of activity, per level. Age, gender, and drug use were included as covariates given their potential impacts on recall of physical activity (Becker et al., 2014; Ferrari et al., 2007; Prince et al., 2008). For interpretational ease, mean EMA score, age, and psychosis-like experiences levels were centered. These centered scores, the cross product between EMA score and psychosis-like experiences level, and the control variables were entered into a linear regression predicting retrospective report scores. Square root values were used for retrospective values that were non-normally distributed.

3. Results

Demographic characteristics and descriptive statistics for the analysis sample can be found in Table 1. No significant relations were found between psychosis-like experiences and age (r_P [$N = 39$] $= −0.05$, $p = .75$), race ($F[4, 34] = 1.51$, $p = .22$), gender (t [37] $= 0.48$, $p = .63$), or drug use ($t[8.05] = −1.15$, $p = .28$).

3.1. In vivo versus retrospective recall of physical activity

A correlation matrix of retrospective and in vivo activity measures is presented in Table 2. Retrospective report was significantly correlated with in vivo report for vigorous ($r_P[N = 39] = 0.59$, $p < 0.01$), light ($r_P[N = 39] = 0.35$, $p < 0.05$), and sedentary activities ($r_P[N = 39] = 0.49$, $p < 0.01$). Moderate activity levels were not significantly correlated ($r_P[N = 39] = 0.26$, $p = 0.11$). To determine whether activity levels were on average over- or underestimated in retrospective report, we compared weekly activity level totals for retrospective and in vivo measures using paired sample t-tests. On average participants overestimated activity level on the retrospective measure for vigorous ($t(38) = −3.16$, $p = .003$, $d = 0.40$) and moderate (t (38) $= −2.45$, $p = .02$, $d = 0.48$) activity, but underestimated activity for light ($t(38) = 2.38$, $p = .02$, $d = 0.44$) and sedentary (t

Table 2
Correlations among activity level variables.

	1.	2.	3.	4.	5.	6.	7.
Retrospective report							
1. Vigorous activity							
2. Moderate activity	.26						
3. Light activity	−0.16	.42**					
4. Sedentary activity	−0.26	.15	−0.08				
In vivo report							
5. Vigorous activity	**.59****	.04	−0.10	−0.06			
6. Moderate activity	.24	**.26**	.11	−0.10	.13		
7. Light activity	−0.39*	.11	**.35***	.20	−0.29	.23	
8. Sedentary activity	−0.18	.31	.05	**.49****	−0.26	.07	.22

*$p < .05$; ** $p < .01$; *** $p < .001$.
For all analyses, square root values of retrospective activity for vigorous, moderate, and light activity levels were used due to non-normal distributions for these variables.
Sedentary activity was reverse coded for ease of interpretability.

(38) = 22.84, $p < .001$, $d = 4.31$) reports (Fig. 1). In other words, for vigorous and moderate activity, participants were more likely to endorse higher levels of activity on their self-report questionnaires relative to their EMA reporting. The opposite pattern was true for light and sedentary behavior.

3.2. Impact of PLEs on relation between in vivo and retrospective recall

The moderating effect of psychosis-like experiences on the relation between retrospective and in vivo activity report was estimated in four (one for each level of activity) moderated multiple regressions, controlling for gender, age, and drug use. Overall models were significant for vigorous (F [6, 32] = 3.74, $p < .05$) and sedentary activity (F [6, 32] = 3.05, $p < .05$), but did not reach statistical significance for moderate or light activity (all $ps > 0.05$).

Although the overall model for vigorous activity was significant, the interaction term between in vivo activity and psychosis-like experiences was found to be non-significant ($b = 0.01$, $p = .78$), and was thus not further explored. For sedentary activity, results suggested the presence of a linear interaction between in vivo activity report and psychosis-like experiences levels (Table 3). Although the interaction between sedentary in vivo activity report and psychosis-like experiences did not achieve statistical significance at traditional levels ($p = .05$), we elected to probe this interaction given the low power and small effect size typically seen in higher order terms (e.g., interactions; Aiken et al., 1991). To explore the interaction, the simple effects of in vivo activity on retrospective report were estimated at three levels of psychosis-like

Table 3
Moderated binary logistic regression predicting retrospective sedentary activity.

| Predictors	b (SE)	t	p	f^2
Gender	27.16 (55.76)	0.49	.63	.005
Drug use	−54.60 (66.98)	−0.82	.42	.01
Age	16.45 (17.74)	0.93	.36	.02
In vivo activity	4.17 (1.44)	2.90	.01	.17
PLE Level	0.17 (2.57)	0.07	.95	.00
PLE x In vivo activity	−0.26 (0.13)	−2.04	.05	.08

Age, in vivo activity report, and PLE level are mean centered for ease of interpretation.

experiences. Psychosis-like experiences were centered at approximately 0, 12, and 23 to reflect the effect of in vivo activity on retrospective report at low ($\sim$ Mean $_{PLE}$ – SD$_{PLE}$), middle ($\sim$ Mean $_{PLE}$), and high ($\sim$ Mean $_{PLE}$ + SD$_{PLE}$) psychosis-like experience level. In vivo sedentary activity was strongly related to retrospective report at lower ($b = 7.15$, $t(1) = 3.76$, $p = .001$, $f^2 = 0.28$) and mean psychosis-like experiences levels ($b = 4.17$, $t(1) = 2.90$, $p < 0.05$, $f^2 = 0.17$), however, the relation was non-significant at one SD above mean psychosis-like experiences level ($b = 1.19$, $t(1) = 0.54$, $p = 0.59$, $f^2 = 0.01$). Visual representation of in vivo and retrospective activity scores by psychosis-like experiences level indicate that on average participants who endorsed higher levels of psychosis-like experiences showed more discrepant activity reports of sedentary activity as compared to participants with lower self-reported psychosis-like experiences (Fig. 2).

4. Discussion

Previous studies have examined the retrospective recall abilities of individuals with schizophrenia (Ben-Zeev et al., 2012; Blum et al., 2015) and other serious mental illnesses (Ben-Zeev et al., 2009; Solhan et al., 2009); however, to our knowledge, this is the first study comparing results collecting data using retrospective and in vivo report methods from participants along the subclinical range of the psychosis spectrum. In a sample with varying levels of psychosis-like experiences, results indicate that individuals with high levels of psychosis-like experiences demonstrated poorer recall for past sedentary behavior, a construct closely aligned to both mental and physical health (Reiner et al., 2013), in comparison to those with low levels of psychosis-like experiences.

Participants showed better recall of their previous week's vigorous activity levels, minimal recall of light activity and sedentary behavior, and poor recall for moderate activity. It is likely that vigorous activity
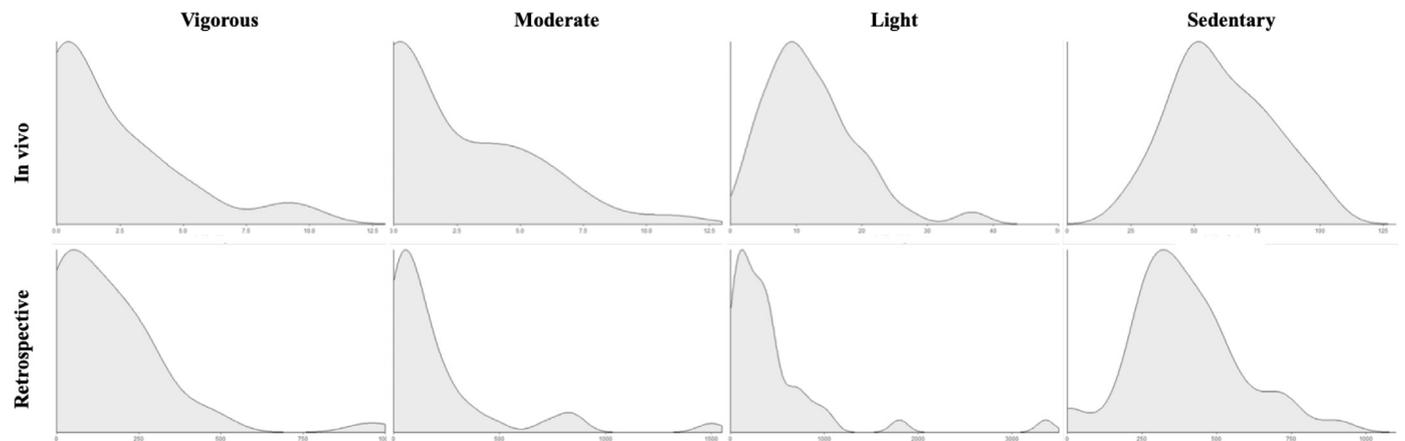
Fig. 1. Distribution of in vivo and retrospective activity level values.
Distributions of all activity level values in the sample for in vivo (top row) and retrospective (bottom row) reporting methods. Activity values were significantly correlated for vigorous, light, and sedentary activity. Retrospective vigorous, moderate, and light activity values were non-normally distributed.
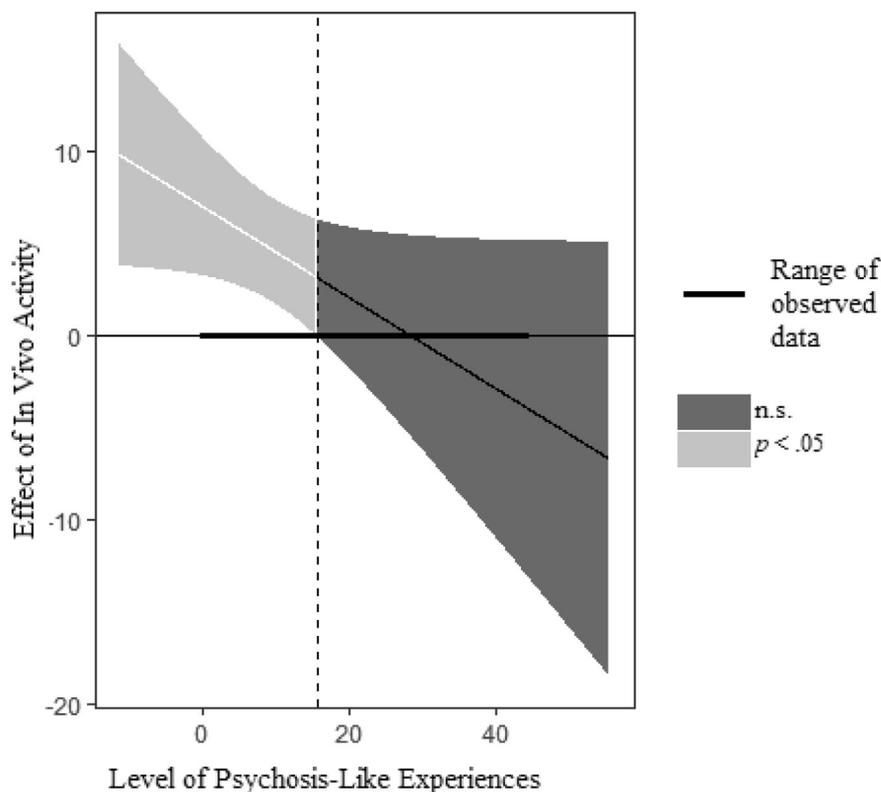
Fig. 2. Effect of PLEs on relation between retrospective and in vivo sedentary activity.
The relation between retrospective and in vivo sedentary activity report was moderated by PLE level. Individuals with greater reported PLE levels (as indicated in this figure by the darker shaded area on the right segment) showed larger discrepancies between in vivo and retrospective activity report. Activity values were calculated as weekly total activity minutes for retrospective report, and mean activity level minutes per signal for in vivo report.

showed highest agreement between data collection methods due to the intense or emotional nature of the exercise, given the known stronger recall for more effortful forms of activity (Shephard, 2003). Other than for vigorous activity, correlation coefficients were small and indicated relatively poor agreement for previous week's physical activity. Such main effect findings are similar to previous studies examining the validity of retrospective self-report for physical activity (Prince et al., 2008), as historically, retrospective self-report of physical activity is known to be imprecise (Ferrari et al., 2007), although none of these prior studies tested for interactions by mental health conditions or experiences such as psychosis-like experiences.

In further probing the discrepancies between in vivo and retrospective reports, there was a significant overestimation based on retrospective reporting of amount of activity completed for vigorous and moderate activity, and underestimation regarding light activity and sedentary behavior. The largest difference was found when comparing reports for sedentary behavior, with a Cohen's d effect size of over 4.0, indicating individuals on average drastically underestimated the amount of time spent completing sedentary activities on their retrospective report relative to EMA. Although we did not assess for the mechanisms behind these patterns, it is possible that social desirability played a role in biased retrospective reporting of physical activity (Adams et al., 2005).

Results suggest that psychosis-like experiences significantly impact the recall for participants' past week's sedentary behavior such that those with high levels of psychosis-like experiences had poorer recollection than those with low levels of psychosis-like experiences. No other studies to date have specifically examined the recall of physical activity for individuals along the psychosis spectrum; however, a comprehensive review on physical activity within individuals diagnosed with schizophrenia noted significant inconsistencies in self-reported physical activity data, and hypothesized poor recall may be impacting such findings (Vancampfort et al., 2012). Previous studies also suggest concerns with retrospective recall on self-reported measures of other constructs by those with schizophrenia (Ben-Zeev et al., 2012; Blum et al., 2015). In this study, sedentary activity may be

especially affected given the long length of time individuals spend being sedentary, making it more difficult to estimate time-spent, especially among those with higher psychosis-like experiences. Results serve to highlight potential concerns with recall for those on the psychosis spectrum.

Sedentary activity, a known correlate of psychosis symptomatology, is increasingly targeted for clinical intervention. Results from intervention studies suggest that physical activity may represent an accessible intervention focus, one that positively impacts both mental and physical well-being (Dauwan et al., 2015; Firth et al., 2015; Firth et al., 2017; Kimhy et al., 2016; Vakhrusheva et al., 2016). Self-report questionnaires are frequently used in such studies to measure physical activity progress and outcomes (Dauwan et al., 2015; Firth et al., 2015). Our findings highlight the negative impact psychosis-like experiences may have on recall of sedentary behavior, call the validity of retrospective self-report questionnaires of sedentary behavior into question, and make a compelling case for the use of in vivo measurement such as EMA, or objective measures (accelerometry), when collecting activity data.

Generalizability of these findings may be limited due to the small n and the use of undergraduate participants. College students likely present at a lower severity level of psychosis-like experiences in comparison to the larger community, as students are generally higher-functioning than non-student peers. Our range, however, was purposefully inclusive as we used quartile sampling, and 18% of our sample crossed a Prime screen threshold suggesting a need for further clinical evaluation. Despite this convention, given this college sample, the upper end of the continuum on the Prime Screen may not fully represent the general population. Nonetheless, this distribution of psychosis-like experiences is within the range of other similar samples (Kline and Schiffman, 2014). Of note, results with college students may yield conservative effect size estimates underestimating findings relative to general population or clinical samples. Despite limitations as a sample, our stratified approach afforded us the opportunity to examine across a reasonable range of reported psychosis-like experiences, and college students represent an important sample as they are at peak age

for psychosis symptom development (Thompson et al., 2004). Additionally, although EMA methods capture experiences in the moment, reduce recall bias (Mehl and Conner, 2012), and are a previously validated method for collection of physical activity (Marszalek et al., 2014), they remain subjective accounts. Measurement of activity is known to be affected by individual perception, and thus all subjective methods will include measurement error. Objective measurement, such as through actigraphy monitors eliminate bias, though lack the ability to collect important contextual information when used in isolation.

5. Conclusion

Consistent with prior research among people with diagnosable psychosis, this study suggests that in a non-clinical sample of people with a range of psychosis-like experiences, those with higher levels of psychosis-like experiences had worse recall for their past week's sedentary activity than those with minimal psychosis-like experiences. Results serve to extend the questionable validity of retrospective self-reporting in certain domains to those on the less severe end of the psychosis spectrum.

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Conflicts of interest

Authors have no conflicts of interest.

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Supplementary materials

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