



Sedentary Behavior and Quality of Life in People with Psychotic Disorders from a Low Income Country: A Study from Uganda

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Abstract

The current study examined the impact of sedentary behaviour (SB) on quality of life (QoL) in people with psychotic disorders. Thirty-six Ugandan women (mean age = 33.9 ± 8.0 years) and 23 men (37.4 ± 11.8 years) with a DSM 5 diagnosis of psychosis completed the World Health Organization Quality of Life—Brief version and Simple Physical Activity Questionnaire (SIMPAQ). Medication use, physical co-morbidities, weight, height, blood pressure and smoking habits were recorded. Multiple regression analyses were undertaken. Variability in SIMPAQ sedentary and walking scores explained 56% of the variability in psychological QoL, while variability in SIMPAQ walking explained 46% of the variability in physical QoL. Health care professionals should not only consider increasing physical activity but also reducing SB to improve QoL in their patients.

Keywords Physical activity · Exercise · Sedentary · Psychosis · Quality of life

Introduction

According to the World Health Organization global burden of disease study, psychotic disorders rank within the top 20 causes of disability among all medical conditions (Whiteford et al. 2013). Of particular concern is the 14.5-year lower life expectancy in people with psychotic disorders compared to

the general population. This gap in life expectancy in comparison to the general population is greater in Africa where it may be as high as 27 years (Hjorthøj et al. 2017). Although the underlying causes of the increased risk for premature mortality are multi-factorial, it is well established that a higher risk for cardio-metabolic disease plays a major role (Correll et al. 2017; Vancampfort et al. 2015a, b, c, d, 2016). This cardio-metabolic risk is increasing in both high and low income countries (Lozano et al. 2012). Cardio-metabolic comorbidity is increased in people with psychotic disorders, with psychotropic medication use (Correll et al. 2015) and unhealthy lifestyle behaviours (Soundy et al. 2013; Stubbs et al. 2016a, c; Vancampfort et al. 2017a) being key modifiable factors. Unsurprisingly, the recurrence of psychotic symptoms following cessation of antipsychotic medication is extremely high (up to 90%—Zipursky et al. 2014), and the high prevalence of somatic co-morbidities (Stubbs et al. 2016b) has a major impact on the physical and psychological quality of life (QoL) of people living with psychotic disorders. QoL is an important patient-rated outcome and is a measure of the impact an illness has upon the functional health status as perceived by the patients themselves (Saarni et al. 2010). It is an important target of interventions aiming to achieve functional recovery. Identifying determinants of QoL in people with psychotic disorders therefore is of

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both clinical and public health relevance, as it may help to improve the focus of multidisciplinary treatments. Previous research in people with schizophrenia from a high-income country (Vancampfort et al. 2011, 2015a) demonstrated that lack of physical activity and reduced aerobic fitness impaired a person's QoL. This finding is also important for low income countries where the opportunities for physical activity are usually limited during admission to a treatment facility (Vancampfort et al. 2017b). To date, it is unknown whether sedentary behavior (independent of physical activity) is associated with the QoL of a person with psychosis. Sedentary behavior can be defined as an energy expenditure ≤ 1.5 metabolic equivalents of task, while in a sitting or reclining posture during waking hours (Cart 2012). People with psychotic disorders are known to be more sedentary than the general population (Stubbs et al. 2016c) and sedentary behavior is associated with increased cardio-metabolic risks independent of physical activity (Stubbs et al. 2015). It is currently unknown whether physical activity levels and sedentary behavior contribute to the QoL of people with psychotic disorders in low-income countries. Such information is of high clinical relevance as QoL determinants may differ in low-income settings compared with those in high-income countries. For example, the risk of cardio-metabolic diseases may differ due to limited availability of second-generation antipsychotics, many of which are known to significantly increase the risk of metabolic abnormalities (Vancampfort et al. 2013). On the other hand, it is plausible that due to the strong focus on pharmacotherapy and symptom reduction (Mugisha et al. 2017b) and the high patient to staff ratios, health care professionals may not fully appreciate the importance of considering the QoL of people with psychotic disorders (Mugisha et al. 2017a). Only a very small amount of funding (median of 0.62% of the health budget) is allocated to mental health care in Sub-Saharan Africa (World Health Organization 2011). As a result, mental health care services are poorly resourced and typically very few inpatient facilities are available in the larger urban cities. The few that are available in rural areas are almost non-functional due to limited staff and infrastructure (Mugisha et al. 2017a). Treatment rates for people with mental health disorders remain low, with over 90% not receiving formal treatment (Mugisha et al. 2011). A recent study evaluating mental health policies in Sub-Saharan Africa (Vancampfort et al. 2017a, b) demonstrated that, although physical activity and sedentary behavior are increasingly acknowledged as important in the management of people with psychotic disorders, this has not yet translated into service delivery. Finding associations between physical activity participation, sedentary behavior and QoL in people with psychotic disorders in a low-income country could provide the impetus for future research and policy changes (Mugisha et al. 2017a). Furthermore, the lack of available data from low-income countries highlights the

gap between where most research is done and where the largest public health impacts of physical inactivity, sedentary behaviour (SB) and low QoL will be in the future (Sallis et al. 2016).

The specific aim of the present study was to investigate whether physical activity participation and SB in people with psychotic disorders contributed to a person's QoL in a low-income country (using Uganda as a case study), while adjusting for previously established contributing factors such as age, gender, body mass index and antipsychotic medication use.

Methods

Participants and Protocol

Over a 3-month period, in- and outpatients with a DSM 5 diagnosis (American Psychiatric Association 2013) who had a clinical diagnosis of a psychotic disorder were invited to participate. Eligible diagnoses included schizophrenia, schizoaffective disorder, bipolar disorder, depression with psychotic features and delusional disorders, as diagnosed by the treating psychiatrist of the Butabika National Referral Psychiatric Hospital, (Kampala, Uganda),. Butabika Hospital is the National Referral and Teaching Hospital in Uganda with around 700 in- and outpatients, closely linked with community centers in Kampala and Mukono. Study respondents were included if they had at least a partial reduction in psychotic symptoms and were able to concentrate during the interview as determined by the treating psychiatrist. Since severe substance abuse might impair daily physical activity behavior, participants were excluded if they had a co-morbid DSM 5 diagnosis of substance abuse during the previous 6 months. Somatic exclusion criteria included self-reported evidence of significant cardiovascular, neuromuscular and endocrine disorders, which might prevent normal physical activity participation. Patients were asked to assess their QoL and physical activity and sedentary levels (interviewer-administered questionnaires in a local language, Luganda). The study procedure was approved by the Scientific and Ethical Committee of Mengo Hospital, Kampala, Uganda and the Butabika Hospital Research Committee, Kampala, Uganda. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. All participants gave their informed written consent. In case participants were not able to read or write, fingerprints were taken and a related witness signed the informed consent document.

World Health Organization Quality of Life-Brief Version (WHO QoL-BREF) (Skevington et al. 2004)

The WHO QoL-BREF is a 26-item questionnaire comprising 24 questions and 2 items that measure overall QoL and general health. Participants express how much they have experienced the items in the preceding 2 weeks on a 5-point Likert scale ranging from 1 (not at all) to 5 (completely). The 24 items are summarized in four domains namely: physical (7 items), psychological (6 items), social (3 items), and environmental (8 items) QoL. Question 1 and 2 plus the domain scores were calculated and transformed using WHO QoL-BREF SPSS syntax file. The transformed scores are presented on a scale of 0–100. A higher score indicates a better QoL.

Simple Physical Activity Questionnaire (SIMPAQ) (Rosenbaum and Ward 2016)

The SIMPAQ is a 5-item clinical tool to assess physical activity among populations at high risk for sedentary behavior. It uses an interview format to estimate time spent in bed (min/day), time spent sedentary during waking hours (min/day), time spent napping (min/day), time spent walking (min/day), time spent in structured exercise (min/day), and time spent in incidental or non-structured physical activity (min/day) during the past week.

Anthropometric Assessments

Body weight and height were assessed in order to calculate the body mass index. Body weight was measured in light clothing to the nearest 0.1 kg using a SECA beam balance scale, and height to the nearest 0.1 cm using a wall-mounted stadiometer. Waist circumference (WC) was measured to nearest 1 cm at the level of the umbilicus and at the end of expiration with the participant upright and his/her hands by the side. Blood pressure was recorded twice in the sitting position after a 5-min rest with an Omron M6 (HEM-7001-E) (Omron® Healthcare Europe). The average of both measures was used for analysis.

Medication Use

Antipsychotic dose was recorded and converted into a daily chlorpromazine equivalent dosage (Gardner et al. 2010). Mean dosages of specific mood stabilisers and antidepressants were reported when they were used by at least ten participants.

Smoking

Participants were asked whether they smoked or not, and if so, how many cigarettes they smoked per day on average.

Physical Co-morbidity

The presence of an ICD-10 (WHO 1993) physical co-morbidity was obtained from patients' medical records.

Data Analysis

All data were tested for normality using the Shapiro–Wilks test and found to be normally distributed. As a first step, Pearson correlation coefficients were calculated to estimate the strength of association between mental and physical HRQoL, and single variables of interest. All significant correlates were included in a linear multiple regression analysis in order to assess the total variance in physical, psychological, social and environmental QoL explained by all predictor variables. To assess whether the associations with QoL outcomes differed by gender or age, the terms representing interactions between each clinical measure and gender, and each clinical measure and age were added to the main effects regression equation. Differences between inpatients and outpatients in SIMPAQ scores were assessed with unpaired t-tests. The significance level was set at $P < 0.05$. Statistical analyses were performed using the statistical package SPSS version 24.0 (SPSS Inc., Chicago, IL).

Results

Participants

Out of 63 patients with psychosis, 59 (42 inpatients and 17 outpatients) met the inclusion criteria. None declined to participate or dropped-out. Three patients had a co-morbid DSM 5 diagnosis of substance abuse while one patient was excluded due to medical reasons preventing normal physical activity participation in the previous week. The final sample consisted of 36 women (mean age = 33.9 ± 8.0 years; body mass index, $BMI = 27.0 \pm 6.8$ kg/m², $WC = 93.9 \pm 18.6$) and 23 men (mean age = 37.4 ± 11.8 years; $BMI = 24.6 \pm 5.7$ kg/m², $WC = 89.8 \pm 14.3$). The mean systolic and diastolic blood pressure was 123/82 mmHg for women and 127/80 mmHg for men. Eight participants (13.5%) smoked a mean of 2.6 ± 0.8 cigarettes per day. Mean daily equivalent dosage of chlorpromazine ($n = 55$) was 279.6 ± 169.8 mg/day. Fifteen patients were treated with carbamazepine, five with lithium carbonate, five with valproic acid, three with fluoxetine and two with imipramine. Medical records indicated that 7 (11.9%) patients were diagnosed with HIV/

AIDS. No other physical co-morbidities were recorded. There were no significant differences in SIMPAQ sedentary (705.6 ± 140.8 min/day vs. 669.4 ± 110.1 min/day, $P=0.35$), SIMPAQ walking (21.1 ± 18.6 min/day vs. 22.9 ± 19.1 min/day, $P=0.74$), SIMPAQ structured exercise (2.5 ± 7.7 min/day vs. 2.7 ± 8.2 min/day, $P=0.94$) and SIMPAQ incidental or non-structured physical activity (59.4 ± 62.6 min/day vs. 74.1 ± 56.1 min/day, $P=0.40$) scores between inpatients and outpatients. The mean and standard deviations of demographic, SIMPAQ and WHO QoL-BREF scores for the entire sample are presented in Table 1.

Associations of WHO QoL-BREF Scores with SIMPAQ and Demographic Data

Univariate Pearson correlations between SIMPAQ and demographic variables and WHO QoL-BREF scores were calculated. The SIMPAQ sedentary score was negatively correlated and the SIMPAQ walking score positively correlated with the physical and psychological QoL domains. The SIMPAQ incidental physical activity score correlated positively with the physical QoL factor only. No other significant correlates were found. R and P-values are presented in Table 1. Next, we explored differences in WHO QoL-BREF scores between in- and outpatients, those with and without HIV/AIDS and smokers versus non-smokers. Except for a significantly higher social QoL (45.3 ± 22.4 vs. 24.3 ± 20.0 , $P=0.022$) in non-smokers versus smokers, no significant differences were found. The data are presented in online-only supplementary files.

Following the univariate analyses, the variables that significantly correlated with the physical and psychological QoL domains were included in the regression analyses. To

assess whether the associations differed by sex or age, interactions were added to the main effects regression equation. There were no significant age or sex interactions.

As shown in Table 2, the SIMPAQ sedentary, walking and incidental physical activity scores significantly predicted psychological QoL independently, but when all variables were included in the same regression model, only SIMPAQ sedentary and SIMPAQ walking remained significant ($P < 0.05$) predictors. The final model explained 56% of the variability in psychological QoL.

The SIMPAQ sedentary and walking scores significantly predicted the psychological QoL independently, but when both variables were included in the same regression model, only SIMPAQ walking remained a significant ($P < 0.05$) predictor. The final model explained 46% of the variability in physical QoL (Table 3).

Discussion

To the best of our knowledge the current study is the first to demonstrate that in people with psychotic disorders from a low income country (a) higher levels of SB are associated with lower physical and psychological QoL, and (b) less time spent walking is associated with lower physical and psychological QoL. In contrast to findings from studies in people with psychotic disorders living in high-income countries (Vancampfort et al. 2011, 2015a), a higher BMI and WC, smoking and older age were not related to lower QoL. The reason that smoking behaviour was not associated with QoL scores might be reflect the fact that only a limited number of people (13.5%) smoked a low number of cigarettes per day (mean = 2.6 ± 0.8). Why higher BMI and

Table 1 Associations of WHO-QoL BREF scores with demographic and SIMPAQ data in Ugandan in-and outpatients with psychotic disorders (n=59)

	Mean \pm SD	Physical QoL (53.9 \pm 16.3)		Psychological QoL (57.8 \pm 20.1)		Social QoL (42.8 \pm 23.0)		Environmental QoL (55.9 \pm 17.9)	
		r	P	r	P	r	P	r	P
Age (years)	35.3 \pm 9.7	-0.07	0.59	-0.11	0.41	0.03	0.84	-0.25	0.06
BMI	26.1 \pm 6.5	0.04	0.78	0.15	0.25	0.24	0.07	0.17	0.20
Waist (cm)	92.3 \pm 17.0	0.09	0.51	0.22	0.09	0.14	0.29	0.10	0.45
AP dose (mg/day) (n = 55)	279.6 \pm 169.8	0.01	0.94	-0.01	0.94	-0.008	0.95	-0.01	0.92
SIMPAQ sedentary (min/day)	695.2 \pm 132.8	-0.39	0.002*	-0.31	0.02*	-0.24	0.06	-0.16	0.22
SIMPAQ walking (min/day)	21.6 \pm 18.6	0.45	<0.001*	0.38	0.003*	0.22	0.09	0.23	0.07
SIMPAQ exercise (min/day)	2.6 \pm 8.0	0.25	0.05	0.21	0.11	0.09	0.50	0.09	0.51
SIMPAQ incidental PA (min/day)	63.6 \pm 60.7	0.29	0.02*	0.25	0.06	0.24	0.06	-0.04	0.73

WHO QoL BREF World Health Organisation Quality of Life-Brief version, BMI body mass index, AP antipsychotic medication, SIMPAQ Simple Physical Activity Questionnaire, PA physical activity

*Significant when $P < 0.05$

Table 2 Physical related quality of life regressed on SIMPAQ sedentary, walking and incidental physical activity

	b	SE	Beta	P	R ²
SIMPAQ sedentary					
Duration (min/day)	−0.05	0.02	−0.40	0.003*	0.39
Gender (male = 1)	1.84	4.29	0.06	0.67	
Age (years)	−0.03	0.21	−0.02	0.89	
Constant	88.61	12.32		<0.001*	
SIMPAQ walking					
Duration (min/day)	0.40	0.10	0.46	<0.001*	0.46
Gender (male = 1)	−2.96	4.04	−0.09	0.47	
Age (years)	−0.10	0.20	−0.06	0.63	
Constant	49.8	7.65		<0.001*	
SIMPAQ incidental PA					
Duration (min/day)	0.09	0.04	0.34	0.02*	0.31
Gender (male = 1)	4.09	4.87	0.12	0.41	
Age (years)	−0.07	0.22	−0.04	0.74	
Constant	49.0	8.78		<0.001*	
All together					
SIMPAQ sedentary (min/day)	−0.04	0.02	−0.30	0.02*	0.56
SIMPAQ walking (min/day)	0.33	0.11	0.38	0.003*	
SIMPAQ incidental PA (min/day)	0.02	0.04	0.06	0.67	
Gender (male = 1)	0.66	4.5	0.02	0.88	
Age (years)	−0.03	0.20	−0.02	0.86	
Constant	72.51	13.63		<0.001*	

b unstandardised regression coefficient, *beta* standardised regression coefficient, *SE* standard error, *BMI* body mass index, *SIMPAQ* Simple Physical Activity Questionnaire, *PA* physical activity

*Significant when $P < 0.05$

Table 3 Psychological related quality of life regressed on SIMPAQ sedentary, walking and incidental physical activity

	b	SE	Beta	P	R ²
SIMPAQ sedentary					
Duration (min/day)	−0.05	0.02	−0.31	0.02*	0.32
Gender (male = 1)	1.73	5.44	0.04	0.75	
Age (years)	−0.14	0.27	−0.07	0.60	
Constant	94.8	15.7		<0.001*	
SIMPAQ walking					
Duration (min/day)	0.42	0.13	0.39	0.003*	0.41
Gender (male = 1)	−3.02	5.14	−0.07	0.56	
Age (years)	−0.20	0.26	−0.10	0.43	
Constant	57.01	9.71		<0.001*	
All together					
SIMPAQ sedentary (min/day)	−0.04	0.02	−0.24	0.06	0.46
SIMPAQ walking (min/day)	0.37	0.13	0.35	0.007*	
Gender (male = 1)	−0.52	5.19	−0.01	0.92	
Age (years)	−0.15	0.25	−0.07	0.56	
Constant	80.6	15.6		<0.001*	

b unstandardised regression coefficient, *beta* standardised regression coefficient, *SE* standard error, *BMI* body mass index, *SIMPAQ* Simple Physical Activity Questionnaire, *PA* physical activity

*Significant when $P < 0.05$

WC and older age were not significantly associated with lower QoL warrants further investigation. It might be that in contrast with older patients with metabolic abnormalities living in rural areas, older patients living in urban areas may have better access to medical services for these conditions.

Previous meta-analyses (Dauwan et al. 2016; Rosenbaum et al. 2014) demonstrated that physical activity interventions improve the psychological and physical QoL of people with psychosis. Our data indicated that reducing sedentary time might also be associated with better QoL in this population. Longitudinal and interventional research are needed before any firm conclusions can be drawn. The current findings suggest that future research should explore whether reducing SB, i.e. time spent lying down or prolonged sitting, might improve QoL levels or prevent further deterioration. Future research could also explore the impact of assisting patients to limit their sitting time during the day and the use of motorized transport on QoL levels in people with psychosis, e.g. by walking short distance. However, this requires deliberate efforts to influence the current attitudes of health workers and patients to the risks of physical inactivity. This might also require additional job training (continuous medical education; CME) since most staff in the hospital lack training about the

importance of reducing SB and increasing physical activity levels. In addition to reducing overall sedentary time by increasing physical activity levels, future research should also explore the effect on QoL of interrupting sedentary time by increasing sporadic movements. In practice, this may be achieved by advising people to disrupt prolonged periods of sitting or by increasing movements while sitting (Vancampfort et al. 2015c, d). Related to this, qualitative research is needed to understand the attitudes of mental health care workers and patients to the role of increasing physical activity and reducing SB in the management of psychosis and the contextual factors that might promote or hinder such efforts.

Finally, future research should also explore potential mechanisms contributing to the association between reductions in SB and improvements in QoL. One of the mechanisms that should be explored in more detail is a reduced risk for physical co-morbidities in people who are less sedentary. In addition, SB has deleterious effects on a person's mood and increases the risk for developing depressive symptoms. For example, a 1-week sedentary behavior-inducing intervention found that depression scores significantly increased and life satisfaction and mood scores reduced in otherwise active adults during the sedentary week, but normalized again within 1 week (Edwards and Loprinzi 2016, 2017).

The current findings should be considered in light of some methodological limitations. First, due to the cross-sectional nature of the study, it was not possible to establish a causal relationship. Second, we did not include a rigorous assessment of psychotic symptoms, and relied on assessments made by psychiatrists in patient records. Previous research (Chou et al. 2014) demonstrated that the presence of psychiatric symptoms has a profound impact on the QoL of a person with psychosis. Third, the reliance on self-reported physical activity, a method that is prone to both systematic and random errors, is a limitation (Soundy et al. 2014). Future studies should incorporate more objective assessment methods, for example, pedometers or accelerometers (Vanhees et al. 2005). Fourth, the different recall periods between the questionnaires used might have affected the magnitude of any associations. While the SIMPAQ (Rosenbaum and Ward 2016) assesses physical activity during the previous week, the WHO QoL-BREF assesses the HRQOL during the preceding weeks.

Nevertheless, although with limitations, the current study shows that in a low resource setting, SB may contribute to a lower QoL in people with psychosis. The current data highlights the importance of a multidisciplinary approach to improve the QoL in people with psychosis by facilitating physical activity participation and reducing SB.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Informed Consent All participants gave their informed written consent. In case participants were not able to read or write, fingerprints were taken and a related witness signed the informed consent document.

Research Involving Human Participants and/or Animals The study procedure was approved by the Scientific and Ethical Committee of Mengo Hospital, Kampala, Uganda and the Butabika Hospital Research Committee, Kampala, Uganda. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

References

- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5)*. Washington, DC: American Psychiatric Association.
- Cart, L. R. S. M. (2012). Letter to the editor: Standardized use of the terms “sedentary” and “sedentary behaviours”. *Applied Physiology Nutrition and Metabolism*, 37(3), 540.
- Chou, C.-Y., Ma, M.-C., & Yang, T.-T. (2014). Determinants of subjective health-related quality of life (HRQoL) for patients with schizophrenia. *Schizophrenia Research*, 154(1), 83–88.
- Correll, C., Detraux, J., De Lepeleire, J., & De Hert, M. (2015). Effects of antipsychotics, antidepressants and mood stabilizers on risk for physical diseases in people with schizophrenia, depression and bipolar disorder. *World Psychiatry*, 14(2), 119–136.
- Correll, C. U., Solmi, M., Veronese, N., Bortolato, B., Rosson, S., Santonastaso, P., et al. (2017). Prevalence, incidence and mortality from cardiovascular disease in patients with pooled and specific severe mental illness: A large-scale meta-analysis of 3,211,768 patients and 113,383,368 controls. *World Psychiatry*, 16(2), 163–180.
- Dauwan, M., Begemann, M. J., Heringa, S. M., & Sommer, I. E. (2016). Exercise improves clinical symptoms, quality of life, global functioning, and depression in schizophrenia: A systematic review and meta-analysis. *Schizophrenia Bulletin*, 42(3), 588–599.
- Edwards, M. K., & Loprinzi, P. D. (2016). *Effects of a sedentary behavior-inducing randomized controlled intervention on depression and mood profile in active young adults*. Paper presented at the Mayo Clinic proceedings.
- Edwards, M. K., & Loprinzi, P. D. (2017). Experimentally increasing sedentary behavior results in decreased life satisfaction. *Health Promotion Perspectives*, 7(2), 88.
- Gardner, D. M., Murphy, A. L., O'Donnell, H., Centorrino, F., & Baldessarini, R. J. (2010). International consensus study of antipsychotic dosing. *American Journal of Psychiatry*, 167, 686–693.
- Hjorthøj, C., Stürup, A. E., McGrath, J. J., & Nordentoft, M. (2017). Years of potential life lost and life expectancy in schizophrenia: A systematic review and meta-analysis. *The Lancet Psychiatry*, 4, 295–301.
- Lozano, R., Naghavi, M., Foreman, K., Lim, S., Shibuya, K., Aboyans, V., et al. (2012). Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: A systematic analysis for the Global Burden of Disease Study 2010. *The Lancet*, 380(9859), 2095–2128.

- Mugisha, J., Abdulmalik, J., Hanlon, C., Petersen, I., Lund, C., Upadhaya, N., et al. (2017a). Health systems context (s) for integrating mental health into primary health care in six Emerald countries: A situation analysis. *International Journal of Mental Health Systems*, 11, 7.
- Mugisha, J., Hert, M. D., Stubbs, B., Basangwa, D., & Vancampfort, D. (2017b). Physical health policies and metabolic screening in mental health care systems of sub-Saharan African countries: A systematic review. *International Journal of Mental Health Systems*, 11, 31.
- Mugisha, J., Hjelmeland, H., Kinyanda, E., & Knizek, B. L. (2011). Distancing: A traditional mechanism of dealing with suicide among the Baganda, Uganda. *Transcultural Psychiatry*, 48(5), 624–642.
- Rosenbaum, S., Tiedemann, A., Sherrington, C., Curtis, J., & Ward, P. B. (2014). Physical activity interventions for people with mental illness: A systematic review and meta-analysis. *Journal of Clinical Psychiatry*, 75(9), 964–974.
- Rosenbaum, S., & Ward, P. B. (2016). The simple physical activity questionnaire. *The Lancet Psychiatry*, 3(1), 1.
- Saarni, S. I., Viertiö, S., Perälä, J., Koskinen, S., Lönnqvist, J., & Suvisaari, J. (2010). Quality of life of people with schizophrenia, bipolar disorder and other psychotic disorders. *The British Journal of Psychiatry*, 197(5), 386–394.
- Sallis, J. F., Bull, F., Guthold, R., Heath, G. W., Inoue, S., Kelly, P., et al. (2016). Progress in physical activity over the Olympic quadrennium. *The Lancet*, 388(10051), 1325–1336.
- Skevington, S. M., Lotfy, M., & O'Connell, K. A. (2004). The World Health Organization's WHOQOL-BREF quality of life assessment: Psychometric properties and results of the international field trial. A report from the WHOQOL group. *Quality of Life Research*, 13(2), 299–310.
- Soundy, A., Roskell, C., Stubbs, B., & Vancampfort, D. (2014). Selection, use and psychometric properties of physical activity measures to assess individuals with severe mental illness: A narrative synthesis. *Archives of Psychiatric Nursing*, 28(2), 135–151.
- Soundy, A., Wampers, M., Probst, M., De Hert, M., Stubbs, B., & Vancampfort, D. (2013). Physical activity and sedentary behaviour in outpatients with schizophrenia: A systematic review and meta-analysis. *International Journal of Therapy and Rehabilitation*, 20(12), 588–596.
- Stubbs, B., Firth, J., Berry, A., Schuch, F. B., Rosenbaum, S., Gaughran, F., et al. (2016a). How much physical activity do people with schizophrenia engage in? A systematic review, comparative meta-analysis and meta-regression. *Schizophrenia Research*, 176, 431–440.
- Stubbs, B., Gardner-Sood, P., Smith, S., Ismail, K., Greenwood, K., Farmer, R., et al. (2015). Sedentary behaviour is associated with elevated C-reactive protein levels in people with psychosis. *Schizophrenia Research*, 168(1), 461–464.
- Stubbs, B., Koyanagi, A., Veronese, N., Vancampfort, D., Solmi, M., Gaughran, F., et al. (2016b). Physical multimorbidity and psychosis: Comprehensive cross sectional analysis including 242,952 people across 48 low-and middle-income countries. *BMC Medicine*, 14(1), 189.
- Stubbs, B., Williams, J., Gaughran, F., & Craig, T. (2016c). How sedentary are people with psychosis? A systematic review and meta-analysis. *Schizophrenia Research*, 171(1–3), 103–910.
- Vancampfort, D., Correll, C. U., Galling, B., Probst, M., De Hert, M., Ward, P. B., et al. (2016). Diabetes mellitus in people with schizophrenia, bipolar disorder and major depressive disorder: A systematic review and large scale meta-analysis. *World Psychiatry*, 15(2), 166–174.
- Vancampfort, D., Firth, D., Schuch, F., Rosenbaum, S., Mugisha, J., Hallgren, M., et al. (2017a). Sedentary behavior and physical activity levels in people with schizophrenia, bipolar disorder and major depressive disorder: A global systematic review and meta-analysis. *World Psychiatry*, 16(3), 308–315.
- Vancampfort, D., Guelinckx, H., Probst, M., Stubbs, B., Rosenbaum, S., Ward, P. B., et al. (2015a). Health-related quality of life and aerobic fitness in people with schizophrenia. *International Journal of Mental Health Nursing*, 24(5), 394–402.
- Vancampfort, D., Probst, M., Scheewe, T., Maurissen, K., Sweers, K., Knapen, J., et al. (2011). Lack of physical activity during leisure time contributes to an impaired health related quality of life in patients with schizophrenia. *Schizophrenia Research*, 129(2), 122–127.
- Vancampfort, D., Stubbs, B., De Hert, M., du Plessis, C., Gbiri, C. A. O., Kibet, J., et al. (2017b). A systematic review of physical activity policy recommendations and interventions for people with mental health problems in sub-Saharan African countries. *Pan African Medical Journal*, 26(104).
- Vancampfort, D., Stubbs, B., Mitchell, A. J., De Hert, M., Wampers, M., Ward, P. B., et al. (2015b). 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*, 14(3), 339–347.
- Vancampfort, D., Stubbs, B., Ward, P., Teasdale, S., & Rosenbaum, S. (2015c). Integrating physical activity as medicine in the care of people with severe mental illness. *Australian and New Zealand Journal of Psychiatry*, 49(8), 681–682.
- Vancampfort, D., Stubbs, B., Ward, P. B., Teasdale, S., & Rosenbaum, S. (2015d). Why moving more should be promoted for severe mental illness. *The Lancet Psychiatry*, 2(4), 295.
- Vancampfort, D., Wampers, M., Mitchell, A., Correll, C., Herdt, A., Probst, M., et al. (2013). A meta-analysis of cardio-metabolic abnormalities in drug naive, first-episode and multi-episode patients with schizophrenia versus general population controls. *World Psychiatry*, 12(3), 240–250.
- Vanhees, L., Lefevre, J., Philippaerts, R., Martens, M., Huygens, W., Troosters, T., et al. (2005). How to assess physical activity? How to assess physical fitness? *European Journal of Cardiovascular Prevention & Rehabilitation*, 12(2), 102–114.
- Whiteford, H. A., Degenhardt, L., Rehm, J., Baxter, A. J., Ferrari, A. J., Erskine, H. E., et al. (2013). Global burden of disease attributable to mental and substance use disorders: Findings from the Global Burden of Disease Study 2010. *The Lancet*, 382(9904), 1575–1586.
- World Health Organization. (1993). *The ICD-10 classification of mental and behavioural disorders: Diagnostic criteria for research*. Geneva: World Health Organization.
- World Health Organization. (2011). *Mental health atlas 2011*. Geneva: World Health Organization.
- Zipursky, R. B., Menezes, N. M., & Streiner, D. L. (2014). Risk of symptom recurrence with medication discontinuation in first-episode psychosis: A systematic review. *Schizophrenia Research*, 152(2), 408–414.

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