European Journal of Adapted Physical Activity, 7(2), 24 – 31

A CONTRIBUTION TO DESIGNING EFFECTIVE AND ENJOYABLE PHYSICAL ACTIVITY PROGRAMS FOR INDIVIDUALS WITH SCHIZOPHRENIA

Eluana Gomes*
Research Centre in Physical Activity, Health and Leisure (CIAFEL), Faculty of Sport, University of Porto, Portugal
Tânia Bastos
Centre of Research, Education, Innovation and Intervention in Sport (CIDI2D), Faculty of Sport, University of Porto, Portugal
Research Center in Sports Sciences, Health Sciences and Human Development, CIDESD, University Institute of Maia, ISMAI, Portugal
Michel Probst
Faculty of Kinesiology and Rehabilitation Sciences, Research Group for Adapted Physical Activity and Psychomotor Rehabilitation, Catholic University of Leuven, Belgium
José Carlos Ribeiro
Research Centre in Physical Activity, Health and Leisure (CIAFEL), Faculty of Sport, University of Porto, Portugal
Gustavo Silva
Research Centre in Physical Activity, Health and Leisure (CIAFEL), Faculty of Sport, University of Porto, Portugal
Rui Corredeira
Research Centre in Physical Activity, Health and Leisure (CIAFEL), Faculty of Sport, University of Porto, Portugal

*Corresponding author: Eluana Gomes: Faculdade de Desporto da Universidade do Porto, Rua Dr. Plácido Costa, nº91, 4200-450 Porto, Portugal • Tel: +351967719880 • Fax: +351225500689 • Email: aeluana@yahoo.com.br

Schizophrenia is one of the most debilitating diseases among psychiatric disorders. Additionally, these individuals present high mortality rates and sedentary lifestyles. Physical activity is an important factor for reducing morbidity and mortality among individuals with schizophrenia. However, to develop motivational strategies to increase the participation of individuals with schizophrenia in physical activity is necessary. The goal of this pilot study was to determine which type of physical activity (walking, dancing and small-sided games) is the most enjoyable and effective for individuals with schizophrenia. Nine outpatients with schizophrenia (men = 5 and women = 4; M = 37.0 yrs., SD = 7.10 yrs.). Different types of physical activity sessions (walking, dancing and small-sided games) were performed. The three sessions occurred during one week with a-one day interval between each session. The duration of each session was of approximately 60 minutes. The walking session consisted in: stretching, walking and breathing exercises. The dance session consisted of: stretching exercises, choreographed dance, free dance, and breathing exercises. The small-sided games session consisted of: stretching exercises, small-sided games (2_v2, 3_v3, 4_v4), basic skills, abdominal exercises and, breathing exercises. Physical activity levels, heart rate and type of PA preferred were assessed. The walking sessions were the most effective (72% of the estimated HRmax). Most of the participants (n = 7) chose the small-sided games session as the most enjoyable. Physical activity programs specifically designed for individuals with schizophrenia should offer both small-sided games and walking. An increase of the sessions' duration (i.e., to over 60 minutes) can also be suggested in order to increase the time spent in vigorous physical activity.

Key word: Schizophrenia, outpatients, enjoyment, PA levels, heart rate

INTRODUCTION

Individuals with schizophrenia present high mortality rates and sedentary lifestyles (Roick et al., 2007), as well as comorbidities such as Diabetes Mellitus, Hypertension, respiratory diseases and Obesity (Correll, Frederickson, Kane, & Manu, 2006). Additionally, there is scientific evidence that the second-generation of antipsychotic drugs produce side effects, including increased body mass and hyperlipidemia (Ösby, Correia, Brandt, Ekbom, & Sparén, 2000). These factors reflect a decrease in the quality of life of individuals with schizophrenia (Allison, Mackell, & McDonnell, 2003).

Physical activity (PA) is an important factor for reducing morbidity and mortality among individuals with schizophrenia (Allison, et al., 2003; Beebe et al., 2005). It helps to control lipid profile (Marzolini, Jensen, & Melville, 2009) and reduce body mass (Beebe, et al., 2005). Furthermore, some studies have stated that PA improves cognitive function (Pajonk et al., 2010), self-esteem (Vancampfort, De Hert, et al., 2011), as well as improving positive (e.g., hallucinations or delusions) and negative symptoms (e.g., apathy, lack of ability to engage in and keep up planned activities) of the disease (Bernard & Ninot, 2012). These factors have a positive impact on the overall quality of life of this population (Faulkner & Sparkes, 1999).

The literature highlights the importance of PA programs in individuals with schizophrenia (De Hert et al., 2011) and different methodological approaches have been developed in order to design the most suitable PA intervention plan (Faulkner & Biddle, 1999). Some authors have developed PA programs focused on walking exercises (Beebe, et al., 2005; McDevitt, 2005), yoga (Behere et al., 2011; Duraiswamy, Thirthalli, Nagendra, & Gangadhar, 2007) and general aerobic exercises (i.e., dance, cycling, aerobic training, abdominal, seated arm ergometer, step-machine, and mini-trampoline) (Acil, Dogan, & Dogan, 2008; Daumit et al., 2011; Dodd, Duffy, Stewart, Impey, & Taylor, 2011; Fogarty, Happell, & Pinikahana, 2004; Marzolini, et al., 2009; Pelletier, Nguyen, Bradley, Johnsen, & McKay, 2005).

Any assessment of PA should ideally measure all of the four dimensions of PA (frequency, duration, intensity and type of activity) (Armstrong & Welsman, 2006). A detailed analysis of two dimensions (frequency and intensity) of PA programs designed for individuals with schizophrenia also shows different methodological approaches. The frequency of the programs ranged between 2-5 days per week (Acil, et al., 2008; Duraiswamy, et al., 2007; Pajonk, et al., 2010) whereas the intensity of the exercises range between 60% - 80% of the heart rate reserve (Marzolini, et al., 2009) and 65 – 75% of the maximum heart rate (Dodd, et al., 2011). Due to this heterogeneous context it is difficult to identify an optimal PA dose or intervention strategy for individuals with schizophrenia (Vancampfort et al., 2009). The recommendation for the public in general is of 30 minutes a day of moderate-intensity aerobic (endurance) PA for five days/week or vigorous-intensity aerobic PA for at least 20 min for three days/week to improve health (American College of Sports Medicine, 2000).

Regarding attendance in PA programs studies have reported an average of 13% to 35% dropout (McDevitt, 2005; Menza et al., 2004; Poulin et al., 2007; Skrinar, Huxley, Hutchinson, Menninger, & Glew, 2005). Specifically, in the study of Archie, Wilson, Osborne, Hobbs, and McNiven (2003) a dropout rate of 90% was reached after a 6-month period of free access to a public fitness facility. The lack of PA programs and facilities, the lack of ongoing support and transportation, the costs of the programs and the perceived negative outcomes of the general population participants are some of the barriers to the practice of PA that has been pointed out in literature (Wilcox et al., 2006). For individuals with mental illness in particular, the lack of intrinsic motivation and enjoyment seems to be related to the high dropout rates in PA program (Choi & Medalia, 2010; Hodgson, McCulloch, & Fox, 2011). The side effects of the medication, the mental illness itself, the social stigma together with the lack of motivational leadership by mental service professionals are some of the barriers that justify the lack of motivation in PA programs (McDevitt, Snyder, Miller, & Wilbur, 2006; Mitchell, Malone, & Doebbeling, 2009).

Faulkner and Biddle (1999) stated that the lack of adherence to PA programs occurs in any population and that effective strategies to increase the participation of individuals with schizophrenia in PA are necessary. For

example, the professional support throughout the programs and the implementation of motivational strategies can help trouble-shoot the adherence to the PA program (Archie, et al., 2003; Beebe & Smith, 2010; Bernard & Ninot, 2012).

Thus, the first step when designing intervention programs it to determine whether PA interventions are feasible in terms of their acceptability (Beebe & Smith, 2010). Similarly, Vancampfort et al. (2009) stated that further studies should assess what types of exercises or techniques would best fit with the patient's preference and which are the most enjoyable for the patients. Therefore, the goal of this pilot study was to determine which type of PA (i.e., walking, dancing and small-sided games) is more enjoyable and effective (i.e., minimal target heart rate and PA levels) for individuals with schizophrenia.

METHOD

Participants

Nine individuals with schizophrenia (men = 5 and women = 4; M = 37.0 yrs., SD = 7.10 yrs.) participated in this study. All participants: i) were outpatients; ii) had to have an antipsychotic treatment in the previous 2 years; iii) had a medical certificate stating that the participant could safely take part in PA, and that they had no other known medical conditions (i.e., proliferative diabetic retinopathy, musculo-skeletal, severe chronic obstructive pulmonary disease, and peripheral vascular disease) that could likely put them at risk. Participants engaged in any PA program in the 6 months prior to the beginning of this study were excluded. Mean daily equivalent dosage of chlorpromazine (Gardner, Murphy, O'Donnell, Centorrino, & Baldessarini, 2010) of the participants were 606.3 ± 388.5 mg/day. Seven participants used typical antipsychotics and two participants used atypical antipsychotics. These participants also used antianxiety (n = 7), antidepressants (n = 8) and antiepileptic medication (n = 2). The participants' characteristics are presented in Table 1. This study was carried out following the Declaration of Helsinki guidelines for human research. The Faculty Ethics Committee (CEFADE 24.2013) approved this study.

Table1. Weight, BMI and waist and hip circumference of the participants (n = 9)

Caracteristics	Mean ± SD	Range
Weight (Kg)	77.18 ± 12.49	65.00 – 99.30
Male	76.68 ± 8.26	65.00 – 92.20
Female	77.82 ± 16.27	65.00 – 99.30
BMI (Kg/m^2)	27. 49 ± 5.05	21.00 – 37.00
Male	25.91 ± 3.91	21.00 – 30.00
Female	29.48 ± 6.18	22.00 – 37.00
Waist circumference (cm)	96.41 ±13.80	72.00 – 117.00
Male	93.80 ± 15.10	72.00 – 106.00
Female	99.87 ± 13.35	87.00 – 117.00
Hip circumference (cm)	105.91 ± 11.50	95.00 – 131.00
Male	101.00 ± 5.24	95.00 – 107.00
Female	112.05 ± 15.03	98.00 - 131.00

BMI = body mass index

Experimental protocol

The participants were exposed to three types of PA sessions, namely: i) walking, ii) dancing and, iii) small-sided games. The PA sessions took place in the sports facilities of a Sport Faculty for one week. The sessions occurred with one day interval and the duration of each session was of approximately 60 minutes.

Regarding the type of exercises suggested the walking session consisted in: stretching, walking and breathing exercises. The dance session consisted of: stretching exercises, choreographed dance, free dance, and breathing exercises. Finally, the small-sided games

session consisted of: stretching exercises, small-sided games (2_v2, 3_v3, 4_v4) of handball and soccer as well as basic skills (shooting, passing, dribbling), abdominal exercises and, breathing exercises.

Measurements

Anthropometric measurements

Height and weight were measured before testing, with participants wearing shorts and t-shirts only. Height was measured using a Holtain stadiometer (Holtain Ltd., Crymmych, UK) and recorded in centimeters to the nearest millimeter. Weight was measured to the nearest 0.1 kg with a Seca weight scale. Body mass index (BMI) was calculated by the ratio between weight and squared height (kg.m-2). Waist circumference was measured at the level of the umbilicus and hip circumference was measured at the largest circumference of the hips.

Physical activity levels

Participants wore the Actigraph GTX3 accelerometer (Manufacturing Technology, Fort Walton Beach, FL) to measure PA levels during the three PA sessions. All participants agreed to wear the device over their right hip by using an adjustable nylon belt. Verbal instructions for caring for and placing the monitor were given to participants.

The mentioned device has been proved to be valid for quantifying activity levels in laboratory and field settings (Trost, McIver, & Pate, 2005). Accelerometer data was recorded in 5-seconds sampling periods (epochs). The standard software ActiLife version 6.0 (Actigraph, Florida) was used to reduce the raw activity data from the accelerometers into daily PA. Wear time validation was carried out according to definitions from Troiano et al. (2008) and time period records of at least 60 consecutive minutes of zero counts were excluded from analysis and regarded as non-wear. To determine the time spent of PA different intensities, the following counts intervals (counts/min) were considered: 0 - 99 for sedentary physical activity (SEDPA), 100 - 2019 for light physical activity (LIGPA), 2020 - 5998 for moderate physical activity (MODPA) and ≥ 5999 for vigorous physical activity (VIGPA).

Heart rate

To assess the heart rate response during the PA sessions, the participants used heart rate monitors (Polar TEAM Pro, Polar Electro Inc., Port Washington, NY). The intensity of the sessions was described as a percentage of the estimated maximal heart rate, calculated as 220-age (Fox, Naughton, & Haskell, 1971).

Logbook

The training logbook was used by the researchers to record any behavioral problems observed (e.g., refusing to participate in the activities, showing agitation during the session), as well as the comments of the patients throughout the sessions.

Type of PA preferred by the participants

At the end of the three sessions the participants were asked which one they had enjoyed the most. The question was: "From the three physical activity sessions that you performed, which one did you enjoy the most?"

Statistical analysis

Descriptive statistics are presented as Mean (M) ± standard deviation (SD). Differences between the sessions (walking, dancing and small-sided games) were assessed using the Kruskal-Wallis Test. All analyses were computed with SPSS (Version 20.0) with the significance level set at 0.05.

RESULTS

PA Levels

The average PA levels of the participants are presented in Table 2. Across the three sessions of PA, the average of minutes of moderate to vigorous physical activity (MVPA) was significantly different between the dancing and walking sessions ($p < 0.001$) and between small-sided games and the walking session ($p < 0.001$). No difference was found between the average of MVPA for dancing and the small-sided games session ($p = 0.104$).

Heart rate

The average of the heart rate response of the participants during the three types of sessions ranged from 50% to 80% of their estimated maximum heart rate (HRmax).

Table 2. Means (M), standard deviations (SD), Kruskal-Wallis values and *p* values regarding the level of physical activity of the participants during the sessions

	Dancing (1)	Walking (2)	Small-sided games (3)	
	M ± SD	**M ± SD**	**M ± SD**	**Kruskal-Wallis**
Sedentary (min/session)	1.00 ± 1.22	0,78 ± 1.09	8.89 ± 3.72	x^2KW(2) = 13.212; $p < 0.001$ 1<3; 2 < 3
Light (min/session)	39.55 ± 14.52	1.88 ± 1.05	26.55 ± 6.97	x^2KW(2) = 19.490; $p = 0.001$ 1 > 2; 2 < 3; 1>3
Moderate (min/session)	13.11 ± 10.53	37.11 ± 15.49	16.89 ± 3.65	x^2KW(2) = 11.171 ; $p < 0.001$ 1 < 2; 2 > 3
Vigorous (min/session)	2.33 ± 4.63	17.00 ± 15.38	5.66 ± 4.74	x^2KW(2) = 8.708 ; $p = 0.004$ 1 < 2; 2 > 3
MVPA (min/session)	15.44 ± 14.57	54.11 ± 1.45	22.55 ± 4.95	x^2KW(2) = 18.627; $p < 0.001$ 1 < 2; 2 > 3

MVPA = moderate to vigorous physical activity

The average HR responses of the participants recorded in dancing sessions was approximately of 60% of the estimated HRmax (60 ± 6,30%), 72% of the estimated HRmax in the walking session (72 ± 6,67%) and 65% of the estimated HRmax in the small-sided games session (65 ± 8,45%).

Session preferred by the participants

After the three PA sessions, the participants were invited to choose which session had been the most enjoyable. Seven participants choose the small-sided games session and two the dancing session. None of the participant choose the walking session as being their favorite.

DISCUSSION

The lack of scientific consensus about the optimal PA dose or intervention strategies for individuals with schizophrenia (Archie, et al., 2003; Vancampfort, et al., 2009) makes it necessary to carry out research in this field. Therefore, the goal of this pilot study was to determine which type of PA (walking, dancing and small-sided games) is the most enjoyable and effective (i.e., minimal target heart rate and PA levels) for individuals with schizophrenia.

For adults, it is recommended to perform PA in 55%/65%-90% of HRmax to promote health benefits of enhancing muscular fitness (i.e., the functional parameters of muscle strength, endurance, and power) (American College of Sports Medicine, 2000; U.S. Department of Health and Human Services, 2008). Thus, the average of heart rate responses recorded in the three sessions was in accordance with the recommendations. The average of estimated HRmax in the walking session was higher than that of dancing and small-sided games sessions.

Regarding the PA levels for adults, moderate-intensity aerobic activity for a minimum of 30 minutes per day (at least 5 days per week) or vigorous-intensity of aerobic activity for a minimum of 20 minutes per day (at least 3 days per week) is recommended to improve and maintain health (Haskell et al., 2007). In this study, more than 30 minutes sessions of MVPA were achieved only in the walking session. Possibly, these differences occur because the walking exercises were performed continuously. In this context, it is important to emphasize that several studies have successfully developed PA programs with more than 60 minutes of the exercises per sessions (Marzolini, et al., 2009; Pelletier, et al., 2005). Consequently, further studies implementing small-sided games and dancing exercises should increase the duration of the PA sessions in order to increase the participants' opportunities to achieve more MVPA during the sessions.

The analysis of the enjoyment in the PA sessions showed that most of the participants (n = 7) considered the small-sided games session the most enjoyable. The participants reported that these activities were a good opportunity to learn new movements in a dynamic way and associated the activities performed to good PA experiences experienced in their childhood/teenage years. Moreover, the participants highlighted the importance of being engaged in a team sport to have the opportunity to play with their friends. Acknowledging that patients with schizophrenia commonly experience difficulties in volition, mutual communication and everyday social interactions (Waters, Rock, Dragovic, & Jablensky,

2011), this type of activity can help develop social skills needed in situations on the daily living.

None of the participants choose the walking session as their favorite. The participants reported that walking was a monotonous activity (i.e., to perform the same exercise for a long time) which they can easily do by themselves (e.g., during the summer) without supervision. Finally, the dancing session was considered a fun and innovative activity. For most of the participants (n = 6) it was the first time they had experienced this specific activity. However, participants also mentioned that the basic steps were too complex for them. Bonsaksen, Fung, and Tsang (2011) argued the importance of implementing a diversity of activities according to personal preferences to achieve a higher level of participation among individuals with severe mental illness. Moreover, different studies analyzing the relationship between adherence and enjoyment in PA program with general population found a significant correlation between sport identity and commitment, enjoyment and time spent in PA (Curry & Weaner, 1987), and motivation and regular participation in PA (Kilpatrick, Hebert, & Jacobsen, 2002).

PERSPECTIVE

Overall, the present study shows that the small-sided games were enjoyable although the walking was the most effective. It is believed that the findings of the present study can have a positive impact in the adherence of individuals with schizophrenia to PA programs. According to our data, it is possible to suggest that further research should propose PA programs based on small-sided games mixed with walking exercises and increase the duration of the sessions (i.e., over 60 minutes), in order to increase the time spent in vigorous PA and offer an enjoyable and effective practice.

Taking into consideration that individuals with schizophrenia reveal lack of motivation to engage in PA programs (Vancampfort, Probst, et al., 2011), it is crucial to understand which type of physical activity will increase the enjoyment in this specific group. Consequently, these findings will help researchers and practitioners to design successful PA intervention programs that may contribute to reduce risk of health problems common in individuals with schizophrenia.

However, the findings of the present study need to be interpreted with caution due to some methodological limitations. The small sample size limits the conclusions and, therefore, future studies should increase the sample size and match gender in order to analyze the differences in the participants' preferences (male vs. female). It would be interesting to analyze the participants' previous PA experiences in order to assess the possible influence on the PA session preference. Future studies should also assess the PA preferences through a ranking or a scale. Finally, further research should take in consideration the possible influence of the adapted physical education teacher's personality in the participants' PA preference.

Acknowledgements

We would like to acknowledge the contribution of Associação Nova Aurora de Reabilitação Psicossocial (ANARP) for this study. We are also grateful to the reviewer for his/her comments on an earlier version of the manuscript. E. Gomes is supported by CAPES Foundation, Ministry of Education of Brazil, Brasília - DF, Brazil. The Research Centre on Physical Activity Health and Leisure (CIAFEL) is supported by UID/DTP/00617/2013.

Conflict of interest

The author declares that there is no conflict of interest.

REFERENCES

Acil, A. A., Dogan, S., & Dogan, O. (2008). The effects of physical exercises to mental state and quality of life in patients with schizophrenia. *Journal of Psychiatric and Mental Health Nursing, 15*(10), 808-815.

Allison, D. B., Mackell, J. A., & McDonnell, D. D. (2003). The impact of weight gain on quality of life among persons with schizophrenia. *Psychiatric Services, 54*(4), 565-567.

American College of Sports Medicine. (2000). *ACSM's guidelines for exercise testing and prescription* (8 ed.). Baltimore: Lippincott Williams & Wilkins.

Archie, S., Wilson, J. H., Osborne, S., Hobbs, H., & McNiven, J. (2003). Pilot Study: Access to Fitness Facility and Exercise Levels in Olanzapine-Treated Patients. *Canadian Journal of Psychiatry-Revue Canadienne De Psychiatrie, 48*(9), 628-632.

Armstrong, N., & Welsman, J. R. (2006). The Physical Activity Patterns of European Youth with Reference to Methods of Assessment. *Sports Medicine, 36*(12), 1067-1086.

Beebe, L. H., & Smith, K. (2010). Informed consent to research in persons with schizophrenia spectrum disorders. *Nursing Ethics, 17*(4), 425-434.

Beebe, L. H., Tian, L., Morris, N., Goodwin, A., Allen, S. S., & Kuldau, J. (2005). Effects of exercise on mental and physical health parameters of persons with schizophrenia. *Issues in Mental Health Nursing, 26*(6), 661-676.

Behere, R. V., Arasappa, R., Jagannathan, A., Varambally, S., Venkatasubramanian, G., Thirthalli, J., et al. (2011). Effect of yoga therapy on facial emotion recognition deficits, symptoms and functioning in patients with schizophrenia. *Acta Psychiatrica Scandinavica, 123*(2), 147-153.

Bernard, P., & Ninot, G. (2012). Bénéfices des activités physiques adaptées dans la prise en charge de la schizophrénie : revue systématique de la littérature. *L'Encéphale, 38*(4), 280-287.

Bonsaksen, T., Fung, K. M. T., & Tsang, H. W. H. (2011). Participation in physical activity among inpatients with severe mental illness: a pilot study. *International Journal of Therapy & Rehabilitation, 18*(2), 91-99.

Choi, J., & Medalia, A. (2010). Intrinsic motivation and learning in a schizophrenia spectrum sample. *Schizophrenia Research, 118*(1-3), 12-19.

Correll, C. U., Frederickson, A. M., Kane, J. M., & Manu, P. (2006). Metabolic syndrome and the risk of coronary heart disease in 367 patients treated with second-generation antipsychotic drugs. *Journal of Clinical Psychiatry, 67*(4), 575-583.

Curry, T. J., & Weaner, J. S. (1987). Sport Identity Salience, Commitment, and the Involvement of Self in Role: Measurement Issues. *Sociology of Sport Journal, 4*(3), 280-288.

Daumit, G. L., Dalcin, A. T., Jerome, G. J., Young, D. R., Charleston, J., Crum, R. M., et al. (2011). A behavioral weight-loss intervention for persons with serious mental illness in psychiatric rehabilitation centers. *International Journal of Obesity 35*(8), 1114-1123.

De Hert, M., Vancampfort, D., Correll, C. U., Mercken, V., Peuskens, J., Sweers, K., et al. (2011). Guidelines for screening and monitoring of cardiometabolic risk in schizophrenia: systematic evaluation. *British Journal of Psychiatry, 199*, 99-105.

Dodd, K. J., Duffy, S., Stewart, J. A., Impey, J., & Taylor, N. (2011). A small group aerobic exercise programme that reduces body weight is feasible in adults with severe chronic schizophrenia: a pilot study. *Disability and Rehabilitation, 33*(13-14), 1222-1229.

Duraiswamy, G., Thirthalli, J., Nagendra, H. R., & Gangadhar, B. N. (2007). Yoga therapy as an add-on treatment in the management of patients with schizophrenia - a randomized controlled trial. *Acta Psychiatrica Scandinavica, 116*(3), 226-232.

Faulkner, G., & Biddle, S. (1999). Exercise as an adjunct treatment for schizophrenia: A review of the literature. *Journal of Mental Health, 8*(5), 441-457.

Faulkner, G., & Sparkes, A. (1999). Exercise as therapy for schizophrenia: an ethnographic study. *Journal of Sport & Exercise Psychology, 21*(1), 52-69.

Fogarty, M., Happell, B., & Pinikahana, J. (2004). The benefits of an exercise program for people with schizophrenia: A pilot study. *Psychiatric Rehabilitation Journal, 28*(2), 173-176.

Fox, S. M., Naughton, J. P., & Haskell, W. L. (1971). Physical activity and the prevention of coronary heart disease. *Annals Of Clinical Research, 3*(6), 404-432.

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. *American Journal of Psychiatry, 167*(6), 686-693.

Haskell, W. L., Lee, I. M., Pate, R. R., Powell, K. E., Blair, S. N., Franklin, B. A., et al. (2007). Physical activity and public health: Updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Medicine and Science in Sports and Exercise, 39*(8), 1423-1434.

Hodgson, M. H., McCulloch, H. P., & Fox, K. R. (2011). The experiences of people with severe and enduring mental illness engaged in a physical activity programme integrated into the mental health service. *Mental Health and Physical Activity, 4*(1), 23-29.

Kilpatrick, M., Hebert, E., & Jacobsen, D. (2002). Physical activity motivation: a practitioner's guide to self-determination theory. *JOPERD: The Journal of Physical Education, Recreation & Dance, 73*(4), 36-41.

Marzolini, S., Jensen, B., & Melville, P. (2009). Feasibility and effects of a group-based resistance and aerobic exercise program for individuals with severe schizophrenia: A multidisciplinary approach. *Mental Health and Physical Activity, 2*(1), 29-36.

McDevitt, J. (2005). A Walking Program for Outpatients in Psychiatric Rehabilitation: Pilot Study. *Biological Research For Nursing, 7*(2), 87-97.

McDevitt, J., Snyder, M., Miller, A., & Wilbur, J. (2006). Perceptions of Barriers and Benefits to Physical Activity Among Outpatients in Psychiatric Rehabilitation. *Journal of Nursing Scholarship, 38*(1), 50-55.

Menza, M., Vreeland, B., Minsky, S., Gara, M., Radler, D. R., & Sakowitz, M. (2004). Managing Atypical antipsychotic-associated weight gain: 12-month data on a multimodal weight control program. *Journal of Clinical Psychiatry, 65*(4), 471-477.

Mitchell, A. J., Malone, D., & Doebbeling, C. C. (2009). Quality of medical care for people

with and without comorbid mental illness and substance misuse: systematic review of comparative studies. *The British Journal Of Psychiatry: The Journal Of Mental Science, 194*(6), 491-499.

Ösby, U., Correia, N., Brandt, L., Ekbom, A., & Sparén, P. (2000). Mortality and causes of death in schizophrenia in Stockholm county, Sweden. *Schizophrenia research, 45*(1-2), 21-28.

Pajonk, F. G., Wobrock, T., Gruber, O., Scherk, H., Berner, D., Kaizl, I., et al. (2010). Hippocampal plasticity in response to exercise in schizophrenia. *Archives of General Psychiatry, 67*(2), 133-143.

Pelletier, J. R., Nguyen, W., Bradley, K., Johnsen, M., & McKay, C. (2005). A study of a structured exercise program with members of an iccd certified clubhouse: program design, benefits, and implications for feasibility. *Psychiatric Rehabilitation Journal, 29*(2), 89-96.

Poulin, M.-J., Chaput, J.-P., Simard, V., Vincent, P., Bernier, J., Gauthier, Y., et al. (2007). Management of antipsychotic-induced weight gain: prospective naturalistic study of the effectiveness of a supervised exercise programme. *Australian & New Zealand Journal of Psychiatry, 41*(12), 980-989.

Roick, C., Fritz-Wieacker, A., Matschinger, H., Heider, D., Schindler, J., Riedel-Heller, S., et al. (2007). Health habits of patients with schizophrenia. *Social psychiatry and psychiatric epidemiology, 42*(4), 268-276.

Skrinar, G. S., Huxley, N. A., Hutchinson, D. S., Menninger, E., & Glew, P. (2005). The role of a fitness intervention on people with serious psychiatric disabilities. *Psychiatric Rehabilitation Journal, 29*(2), 122-127.

Troiano, R. P., Berrigan, D., Dodd, K. W., Mâsse, L. C., Tilert, T., & McDowell, M. (2008). Physical activity in the United States measured by accelerometer. *Medicine & Science in Sports & Exercise, 40*(1), 181-188.

Trost, S. G., McIver, K. L., & Pate, R. R. (2005). Conducting accelerometer-based activity assessments in field-based research. *Medicine and Science in Sports and Exercise,, 37*(11), 531-543.

U.S. Department of Health and Human Services. (2008). *Physical Activity Guidelines for Americans* (Vol. 2014). Washington DC: U.S. Department of Health and Human Services.

Vancampfort, D., De Hert, M., Knapen, J., Maurissen, K., Raepsaet, J., Deckx, S., et al. (2011). Effects of progressive muscle relaxation on state anxiety and subjective well-being in people with schizophrenia: a randomized controlled trial. *Clinical Rehabilitation, 25*(6), 567-575.

Vancampfort, D., Knapen, J., De Hert, M., van Winkel, R., Deckx, S., Maurissen, K., et al. (2009). Cardiometabolic effects of physical activity interventions for people with schizophrenia. *Physical Therapy Reviews, 14*(6), 388-398.

Vancampfort, D., Probst, M., Sweers, K., Maurissen, K., Knapen, J., & De Hert, M. (2011). Relationships between obesity, functional exercise capacity, physical activity participation and physical self perception in people with schizophrenia. *Acta Psychiatrica Scandinavica*, 1–8.

Waters, F., Rock, D., Dragovic, M., & Jablensky, A. (2011). 'Social dysmetria' in first-episode psychosis patients. *Acta Psychiatrica Scandinavica, 123*(6), 475-484.

Wilcox, S., der Ananian, C., Abbott, J., Vrazel, J., Ramsey, C., & Sharpe, P. A. (2006). Perceived exercise barriers, enablers, and benefits among exercising and nonexercising adults with arthritis: results from a qualitative study. *Arthritis & Rheumatism: Arthritis Care & Research, 55*(4), 616-627.