Characterizing the Affective Responses to an Acute Bout of Moderate-Intensity Exercise in People with Schizophrenia

by

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A thesis submitted in conformity with the requirements for the degree of Master of Science in Exercise Science

Department of Exercise Sciences

University of Toronto

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Abstract
This study characterized the basic affective – feelings of pleasure and arousal – responses to exercise using the Circumplex Model of Affect within the schizophrenia population. Affect during exercise was also examined as a correlate of future physical activity (PA) participation. A randomized, repeated measures, crossover design compared affect before, during, after, and 10 minutes after a bout of moderate-intensity exercise on a treadmill versus passive sitting. Twenty-one participants enrolled in the study; 17 were included in the final analyses. A 2(task) x 4(time) within-participant repeated measures ANOVA revealed a significant main effect for time, $F(3,45)=6.38, p=.001$, for pleasure. No other significant differences emerged. Contrary to hypotheses, exercise did not significantly alter affect, and affect during exercise was unrelated to PA participation. Future research should examine the relationship between acute affective responses to different intensities of exercise, and why affect during exercise is unrelated to PA participation in this population.
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1 Introduction

1.1 Schizophrenia and Comorbidity

Schizophrenia is a severe and chronic form of mental illness, characterized primarily by the presence of psychosis, specifically hallucinations, delusions, or disorganized speech (American Psychiatric Association, 2013). The presentation of schizophrenia is, however, largely heterogeneous. Different individuals may display a wide variety of symptoms characterized as both positive (symptoms that are an addition or an excessive distortion of typical or healthy functioning, e.g., hallucinations, delusions, and bizarre behaviour) and negative (deficits or loss of functioning, e.g., affective flattening, amotivation, and anhedonia). Cognitive deficits (such as impaired memory, attention, and reasoning) may also occur in 75%-85% of the patient population (Reichenberg et al., 2006), and are considered distinct from deficits in the negative symptoms category.

Although severe, schizophrenia is relatively uncommon. The most recent epidemiological reviews concluded that the median worldwide lifetime prevalence of schizophrenia is 0.4%, and the median lifetime morbidity rate is 0.72% (McGrath, Saha, Chant, & Welham, 2008; Saha, Chant, Welham, & McGrath, 2005). Incidence and onset tends to be different in males when compared to females. Males are about 1.4 times as likely to develop schizophrenia as females (McGrath et al., 2008; Saha et al., 2005). Schizophrenia tends to onset during late adolescence and early adulthood, though males tend to experience a slightly earlier onset than females (Castle, Wessely, & Murray,
1993; McGrath et al., 2008). Despite being a relatively small proportion of the population, management of schizophrenia carries with it a significant societal burden due to disability caused by both psychological impairment and physical comorbidity.

A recent review suggests that individuals with schizophrenia have a 10-25 year reduced life expectancy compared to the general population, and, while suicide is still a major contributor, this increased mortality is due primarily to natural causes such as physical illness (Laursen, Munk-Olsen, & Vestergaard, 2012). In particular, individuals with schizophrenia tend to have high rates of cardiovascular disease (CVD; Carney, Jones, & Woolson, 2006; Newcomer & Hennekens, 2007; Tandon, Keshavan, & Nasrallah, 2008), which accounts for 12%-46% of all-cause mortality within the population (Bushe, Taylor, & Haukka, 2010), compared to about 20% in the general Canadian adult population (Health Canada, 2012). Much like in the general population, the causes of CVD in patients with schizophrenia are varied and complex. However, it appears that unhealthy lifestyle factors and metabolic side effects of antipsychotic medication are likely major contributors to increased risk of CVD in this population.

With regards to lifestyle behaviours, individuals with schizophrenia are more likely to smoke (Kelly et al., 2011), consume less healthful diets (McCreadie et al., 1998; Ryan, Collins, & Thakore, 2003; Strassnig, Brar, & Ganguli, 2003), and tend to be less physically active (Cohn, Prud’homme, Streiner, Kameh, & Remington, 2004; Daumit et al., 2005; Lindamer et al., 2008; Yamamoto et al., 2011) than the general adult population. This tendency towards an unhealthy lifestyle is compounded by weight gain associated with the commencement of antipsychotic treatment (Allison et al., 1999; Homel, Casey, & Allison, 2002; Meyer et al., 2008). Recent evidence suggests that
medications that are considered to be of low metabolic risk may instead have a delayed pattern of weight gain compared to other antipsychotics (Correll et al., 2009; Pérez-Iglesias et al., 2008). The exact cause of this phenomenon is not well understood though several possible biological mechanisms have been posited, such as antagonism of histamine and dopamine receptors, leading to increased appetite, and changes in weight homeostasis as a result of hyperprolactinemia or drug-induced leptin resistance (see: Jin, Meyer, Mudaliar, & Jeste, 2008; Reynolds & Kirk, 2010). As a result of both unhealthy lifestyle and medication side effects, individuals with schizophrenia are not only at greater risk of CVD, but also diabetes and obesity. Specifically, individuals with schizophrenia have a 1.6-2.5 times greater odds of having diabetes (Bresee, Majumdar, Patten, & Johnson, 2010; Carney et al., 2006; Dixon et al., 2000) and are 1.5-4 times more likely to be obese (Carney et al., 2006; Coodin, 2001; Gurpegui et al., 2012; Silverstone, Smith, & Goodall, 1988) than the general population.

Obesity has additional implications for individuals living with schizophrenia. In particular, central obesity has been shown to be associated with decreased quality of life within the schizophrenia population (Faulkner, Cohn, Remington, & Irving, 2007b). Moreover, distress over weight gain is a contributor to medication non-compliance in people with schizophrenia (Weiden, Mackell, & McDonnell, 2004). Thus, developing non-pharmacological strategies to mitigate weight gain will likely increase quality of life and simultaneously reduce the risk of CVD, diabetes, and all-cause mortality within this population.
Chapter 2

2 Literature Review

2.1 Why physical activity?

Physical activity (PA) may provide multiple health benefits for persons with schizophrenia, such as reducing excess weight, improving glycemic control, and reducing the risk of CVD while simultaneously improving psychological well-being. Several systematic reviews of randomized controlled trials have demonstrated that non-pharmacological interventions for managing weight – including PA – in individuals who have schizophrenia (Faulkner, Cohn, & Remington, 2007a) or who are using antipsychotics (Caemmerer, Correll, & Maayan, 2012) are plausible and modestly efficacious. In addition to the physical health benefits of PA, systematic reviews of randomized control trials reveal small but significant improvements in the mental health of patients with schizophrenia who participate in the assigned PA intervention (Faulkner & Duncan, 2012; Gorczynski & Faulkner, 2010), suggesting that regular PA can not only help prevent and manage physical co-morbidities, but also may improve psychological symptoms. Despite these health benefits, physical inactivity remains highly prevalent within this population. Therefore, determining more effective ways to promote PA for people with schizophrenia is warranted.

Despite the multitude of benefits that are associated with engaging in regular PA for the schizophrenia population, strategies to promote regular PA participation have been under-examined. Promoting the uptake of, and adherence to, regular PA in the general population is a significant challenge. This challenge is further compounded in the
schizophrenia population due to the symptoms and complications of the disorder. While positive symptoms tend to be well controlled by antipsychotic medication, negative symptoms such as avolition (lack of motivation) and anhedonia (an inability to experience pleasure to normally pleasurable stimuli) are more difficult to manage (Tandon et al., 2008). Unsurprisingly, the presence of negative symptoms has been consistently associated with less PA participation (Vancampfort, Knapen, et al., 2011b); see also: (Van Citters et al., 2010; Vancampfort, Knapen, et al., 2011b; Vancampfort, Probst, et al., 2011c; Wichniak et al., 2011; Yamamoto et al., 2011). Thus, even in clinically stable patients, amotivation may still be prominent and may present as a barrier to well-being and PA behaviour change for individuals with schizophrenia.

In addition to the aforementioned concerns associated with amotivation, cognitive deficits may also add a level of complexity to PA behaviour change within the schizophrenia population. Many current health behaviour models use cognitive factors (e.g., self-efficacy, planning, attitudes, or knowledge of the risks of disease and potential benefits of engaging in the behaviour) to predict the target behaviour. A recent systematic review identified greater knowledge of PA benefits and CVD risk, higher self-efficacy, greater intentions to engage in PA, and better physical self-perceptions as recurrent psychological correlates of PA in people with schizophrenia (Vancampfort, Knapen, et al., 2011b). Although these cognitive factors apparently contribute to PA behaviour engagement, interventions seeking to modify these cognitive correlates (such as educational sessions, goal-setting, planning, or motivational interviewing) may not be fully understood or remembered by a majority of the schizophrenia population. Given the cognitive impairment commonly seen in schizophrenia, other psychological factors that
do not require higher-level cognitive processes – such as enjoyment – may also relate to PA participation in persons with schizophrenia. Thus, identifying additional psychological correlates of PA is warranted for improving overall health promotion endeavors within the schizophrenia population.

2.2 The Circumplex Model of Affect

One growing area of research that may be informative for improving both the understanding of the mental health benefits of PA and the development of PA interventions for people with schizophrenia is the study of affective responses to PA (Ekkekakis, Parfitt, & Petruzzello, 2011). Affective responses are defined as the conscious psychological feelings an individual experiences (Oxford English Dictionary, n.d.). Understanding the relationship between affective responses and acute exercise may provide insight into the mental health benefits of regular PA for persons with schizophrenia since short bouts of exercise may be one way of regulating daily affect (Craft, 2013). Furthermore, Ekkekakis and colleagues (Ekkekakis et al., 2011; Ekkekakis & Petruzzello, 1999) suggest that individuals who find a single bout of moderate-intensity exercise more pleasurable will be more likely to engage in PA on a regular basis. Ekkekakis and Petruzzello (2000) advocate that, among the various constructs of affect, basic (core) affect – the most fundamental and reflexive experiences of pleasure and arousal elicited by a stimulus – may be of particular value for predicting future PA behaviour. This is differentiated from emotions and moods, which are conceptualized as specific extensions built upon basic affective responses (Ekkekakis, 2013; Ekkekakis & Petruzzello, 2000). Both emotions and moods are affective constructs, but as opposed to
basic affect they require cognitive evaluations of either a specific stimuli’s relevance to immediate goals or well-being in the case of emotions, or are the result of evaluations of the self in relation to others, the environment, and life goals (i.e. whether things are going generally well or poorly) in the case of moods (Ekkekakis, 2013; Ekkekakis & Petruzzello, 2000). Within this framework, basic affect subsumes the experiences of emotions and moods and is irreducible, thus capturing all changes in affect experienced as a result of PA. Furthermore, from a theoretical perspective, basic affect represents the most fundamental and immediate psychological response resulting from the physical experience of exercise (Ekkekakis & Petruzzello, 2000; 2002). As such, the measurement of basic affective responses to PA should represent how much an individual finds PA pleasurable at a fundamental level, without being influenced by disordered thought processes. Furthermore, while people with schizophrenia often demonstrate blunted affect expression, they still perceive and report affect (Alpert, Rosenberg, Pouget, & Shaw, 2000; Berenbaum & Oltmanns, 1992). Thus, self-reported basic affect may prove to be a valuable predictor of PA engagement in individuals with schizophrenia, and prospective testing may help identify an additional psychological predictor of PA within this population.

In a four part series on the measurement of affect within the exercise psychology field, Ekkekakis and Petruzzello (2000; 2001a; 2001b; 2002) reviewed the current knowledge of the structure of affect, and assessed the status of measuring affective responses to PA. The authors concluded that future affect research should be driven with the following considerations in mind: 1) basic affect should be the focus of assessment, 2) a dimensional approach is optimal for measuring basic affective responses to exercise,
3) using exercise-specific affect measures are unjustified, and 4) a deductive approach, based on a theorized structure of affect be used. Based on these four caveats, the authors suggest the use of the Circumplex Model of Affect (Russell, 1980) see Figure 1) as an optimal solution, given that its two orthogonal dimensions, *valence* and *activation*, have the capacity to describe most forms of basic affect in a parsimonious manner, congruent to the theorized structure of basic affect. Within the Circumplex Model of Affect, valence refers to the continuum of pleasure or displeasure experienced at a given moment, while activation refers to the perception of arousal or alertness. Although several dimensional models of affect exist (for examples see Thayer, 1989; Watson, Clark, & Tellegen, 1988), many fundamentally represent 45° rotations of this Circumplex Model of Affect (Ekkekakis & Petruzzello, 2002; see Figure 2), which are alternative dimensions that explain the same Euclidean space, and are thus compatible with each other.
Figure 1. Circumplex Model of Affect. Adjectival exemplars of affective states in grey placed around the circumplex are approximations of corresponding valence and activation levels based on data presented in Ekkekakis (2013, p. 58)
**Figure 2.** Rotated variants of the Circumplex Model of Affect. Adapted from Ekkekakis & Petruzzello (2002). Dashed grey lines represent 45° rotational variants of the affective circumplex depicted in Figure 2. Dashed axes are labeled using Thayer's (1989) Tense and Energetic Arousal dimensions, as well as Watson, Clark, & Tellegen’s (1988) Positive and Negative Activation dimensions.
2.2.1 Using the Circumplex Model of Affect to Assess Acute Exercise Responses

A systematic review of affective responses to acute bouts of exercise concluded that the valence component of affective responses vary considerably based on the intensity of the exercise, where ventilatory threshold or lactate threshold is an important landmark of change (Ekkekakis et al., 2011). This effect of intensity is referred to as the dual-mode theory (Ekkekakis, 2003; 2009a; 2009b; Ekkekakis et al., 2011). In general, changes in affect during light-intensity exercise (below the ventilatory/lactate threshold) tend to be homogeneously positively valenced; changes measured during vigorous-intensity exercise (above the ventilatory/lactate threshold), on the other hand, tend to be homogenously negatively valenced (Ekkekakis et al., 2011). Moderate-intensity exercise (around the ventilatory/lactate threshold) is, however, a unique case.

During moderate-intensity exercise, the dual-mode theory posits that substantial individual variability occurs, with some people reporting increased (more positive) valence during exercise, while others report decreased (more negative) valence (Ekkekakis, 2009a; 2009b). This variability is often hidden as “error” when using common parametric statistical methods, which rely on calculating mean scores (Ekkekakis & Petruzzello, 1999; Van Landuyt, Ekkekakis, Hall, & Petruzzello, 2000), but can be detected through graphing individual data points such as in a Q-Q plot or reported in terms of the proportion of participants experiencing increases or decreases in valence during exercise. Recent studies reporting the proportions of participants experiencing increases and decreases in valence during moderate-intensity exercise tend to show about equal numbers of participants experiencing pleasant and unpleasant
changes in affect (Ekkekakis, Hall, & Petruzzello, 2005; Rose & Parfitt, 2007; Schneider, Dunn, & Cooper, 2009; Van Landuyt et al., 2000; Williams et al., 2008). Ekkekakis and colleagues (2011; 1999) note that roughly half of people drop out of an exercise program during the first 6 months, and hypothesize that this may be related to this individual variability in affect experienced during moderate-intensity exercise, as equal numbers of people seem to experience increases and decreases in valence during moderate-intensity exercise. Thus, the individual variability in affective responses during moderate-intensity exercise may be predictive of future PA participation, as those who find a single bout of moderate-intensity exercise unpleasant are less likely to engage in PA on a regular basis. Therefore, the pleasure and displeasure (i.e., valence) experienced during exercise is highly dependent on intensity, and at moderate-intensity the effect of exercise on affect varies from person to person.

2.2.2 Typical Affective Responses During and Post-Exercise

The myth of an all-encompassing “feel-good” effect of exercise may be in part due to the use of pre-post study designs, which do not assess affect during exercise (Ekkekakis & Petruzzello, 1999), as well as the period of assessment post-exercise when affect is measured. A meta-analysis examining the changes in positively activated affect (i.e., the affective dimensions corresponding to the positively valenced high activation quadrant of the Circumplex Model of Affect; see high energetic arousal or positive activation in Figure 2) as a result of exercise provides three main findings to the pattern of affective responses during a single (or acute) bout of exercise (Reed & Ones, 2006). First, exercise has an overall increasing effect on positively activated affect. Second,
exercise intensity moderated this effect, where light-intensity exercise had a greater effect (Cohen’s $d = 0.57$) than either moderate- ($d = 0.35$) or vigorous- ($d=0.31$) intensity exercise, which were both comparable. Third, the effects of exercise on affect dissipate over time such that a longer time period between completing a bout of exercise and administering an affect measurement results in smaller changes in positively activated affect compared to affect before engaging in exercise, with effect sizes ranging from $d=0.61$ (0-2 minutes post-exercise) to $d =0.10$ ($\geq 40$ minutes post-exercise (Reed & Ones, 2006). As this meta-analysis was focused on positively activated affect, which is a combination of high activation and positive valence, it is difficult to partial out the individual effects of exercise on valence and activation post-exercise. In general though, valence tends to stay positive post-exercise compared to pre-exercise, while activation tends to increase during exercise and decrease steadily post-exercise, with participants reporting more tranquil-like affect post-exercise. The resultant vector is a shift towards the pleasant-low activation quadrant post-exercise (see Figure 3). Unlike the intensity-dependent affect changes noted during exercise, this shift tends to occur regardless of the exercise intensity (Ekkekakis et al., 2011; Ekkekakis & Petruzzello, 1999).
Figure 3. Expected changes in affect post-exercise relative to baseline.
2.2.3 Common Instruments to Assess Affect During and Post-Exercise

The transient nature of basic affect requires measurement tools that not only align with the target constructs (i.e., valence and activation) and theorized structure of affect, but also tools that are appropriate for detecting changes in the time frame specified. Single item instruments provide a rapid assessment of affect at very specific time points, and are easy to respond to in a demanding task such as an acute bout of moderate-intensity exercise. Single-item measures are also likely to be less fatiguing to participants than multi-item measures when repeated throughout a short time period (Ekkekakis & Petruzzello, 2002). Consideration for participant fatigue is especially important as it may alter participant responses. Multi-item measures, on the other hand, may be more reliable than single-item measures, although they require more time to complete. In a recent review of affect responses to exercise (Ekkekakis et al., 2011), the most commonly used measure of affect was the Feeling Scale (FS; Hardy & Rejeski, 1989), which is a single item measure of valence. When measured, a commonly used assessment of activation is the Felt Arousal Scale (FAS; Svebak & Murgatroyd, 1985). Typically, the studies that measure affect during a bout of exercise use the FS and FAS. Meanwhile, the Activation Deactivation Adjective Checklist (Thayer, 1986) was the most commonly used multi-item measure of affect, while the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) and the Physical Activity Affect Scale (PAAS; Lox, Jackson, Tuholski, Wasley, & Treasure, 2000) were less frequently used Circumplex Model of Affect measures. However, unlike the FS and FAS combination, the Activation Deactivation Adjective Checklist, PANAS, and PAAS are congruous with the rotated
variant of the Circumplex Model of Affect (Ekkekakis & Petruzzello, 2002). Therefore, responses obtained by the Activation Deactivation Adjective Checklist, PANAS, and PAAS should be largely comparable to responses from the FS and FAS, albeit using slightly different dimensions to explain basic affect. Other common measures of affect, which do not conform to the Circumplex Model of Affect include the multi-item Subjective Exercise Experiences Scale (SEES; McAuley & Courneya, 1994) – which consists of three subscales named Positive Well-Being, Psychological Distress, and Fatigue – and the state scale of the State-Trait Anxiety Inventory (STAI; Spielberger, 1983), which is a common multi-item self-report measure of anxiety, and is at least somewhat related to the tense arousal dimension of the Circumplex Model of Affect.

2.2.4 Typical Exercise Protocols Used to Assess Affect

In addition to the wide range of instruments used to assess affect, the protocols used within the 30 studies included in Ekkekakis and colleagues’ (2011) review varied considerably with respect to mode and intensity. In terms of mode, stationary cycling or walking/running on a treadmill were the most commonly used, both of which have been strictly conducted in a laboratory setting. Meanwhile, the intensity of the exercise session has been assessed either through measures of percentage of maximal capacity (% maximum heart rate, heart rate reserve, or VO2max) or metabolic markers of intensity (i.e., ventilatory threshold, lactate threshold or the onset of blood lactate). Overall, the participants included within the studies examined have been somewhat of a homogenous sample (in terms of health status), and have ranged in age from 12.5 years to 68 years, with an equal proportion of males and females. The average sample size across the
studies was 34 participants, with the participants being generally healthy, except for two of the studies where the effects of exercise on affect was examined in people who were overweight or obese (Ekkekakis & Lind, 2005; Ekkekakis, Lind, & Vazou, 2009). None of the remaining studies included in Ekkekakis and colleagues’ review have examined affective response to exercise in populations with other physical and/or mental health conditions, therefore further illustrating the need for conducting research in the area of acute exercise and affective responses within the schizophrenia population.

2.3 Affective Responses to Acute Exercise in Persons with Mental Illness

Given that exercise may be beneficial for the physical and mental health of people with schizophrenia, studying the affective response to exercise in this population may provide insight into the psychological mechanisms that may lead to better overall health. Exercise may help regulate affect by serving as a suitable outlet for reducing psychological stress and anxiety, which might otherwise lead to worsening of symptoms (Van Winkel, Stefanis, & Myin-Germeys, 2008). Thus, shifts towards more positively valenced affect may serve a dual purpose of improving affective symptoms and ameliorating stress to prevent relapse of psychosis. Despite this, since Ekkekakis and colleagues’ review (Ekkekakis et al., 2011), only two studies (Arbour-Nicitopoulos, Faulkner, Hsin, & Selby, 2011; Vancampfort, De Hert, et al., 2011a) have investigated the acute responses to exercise in people with severe mental illness, with only one of these studies using a sample consisting solely of people with schizophrenia and schizophrenia-like illness (i.e. schizoaffective disorder, schizotypal personality disorder,
or schizophreniform disorder). The following two sections provide a detailed overview of these two studies.

2.3.1 Study 1: Vancampfort et al., 2011

Vancampfort et al. (2011a) conducted a pilot study of 40 individuals with schizophrenia or schizoaffective disorder using a pre-post crossover design to examine changes in affect post-exercise. Participants were required to complete three sessions (30 minutes of yoga, 20 minutes of cycling, and 20 minutes of sitting quietly reading) at a self-selected pace, on three separate occasions in a randomly assigned order. In order to assess the acute effects of exercise (either yoga or cycling) on anxiety, psychological distress, and well-being, participants completed the STAI, and the Psychological Distress and Positive Well-being subscales of the SEES, respectively. A within-participant, repeated measures ANOVA revealed a significant main effect for time for all three affect variables. Scheffe’s post-hoc test revealed significant ($p<0.01$) improvements in anxiety, psychological distress, and well-being, after either form of exercise compared to the control condition. However, no differences emerged between the yoga and cycling conditions. Large effect sizes (calculated using Cohen’s $d$) were found, which ranged from 0.83 for psychological distress to 0.87 for state anxiety in the yoga condition, and from 0.82 for psychological distress to 1.01 for state anxiety in the cycling condition. Together, these results suggest that either 20 minutes of cycling at a self-selected pace or 30 minutes of yoga can reduce anxiety and distress, while improving well-being in people with schizophrenia.
The above findings are promising for improving the understanding of the mechanisms behind the therapeutic benefits of an acute bout of exercise for persons with schizophrenia. However, the dimensions of stress, anxiety, and well-being may not adequately capture the full range of affective responses to an acute bout of exercise. The STAI is conceptualized as a measure of emotion rather than basic affect, and is scored as a single unidimensional scale (Spielberger, 1983). Although conceptually related to the dimension of tense arousal, this measure has been criticized as containing items that are affective (e.g., “I feel pleasant”), cognitive (e.g., “I am presently worried over possible misfortunes”), and physiological (e.g., “I feel strained”) in nature, and therefore, potentially unsuitable as a unidimensional measure of basic affect given the multiple domains (Ekkekakis, 2013).

The SEES is conceptualized as an exercise-specific affect instrument, and therefore, may not be an appropriate measure for assessing affect within non-exercise control conditions (Ekkekakis & Petruzzello, 2001b). Additionally, previous validation work involving the SEES has shown both the Positive Well-Being and Fatigue subscales to correlate moderately with the Psychological Distress subscale ($r_s = -.52$ and $.38$, respectively; (McAuley & Courneya, 1994). This finding suggests that the dimensions of the SEES are not orthogonal, despite being developed with the intention of orthogonality, nor are they polar opposites. Therefore, the SEES does not comprise a true circumplex and may be severely limited in its ability to describe variance in affective states (for an in-depth critique of the SEES see: Ekkekakis & Petruzzello, 2001b). Therefore, while this study demonstrates the positive effects an acute bout of exercise can have on anxiety and well-being among individuals with schizophrenia, it does not adequately address basic
affect from a theory-based approach. As mentioned before, targeting basic affect, rather than specific emotional states, provides a comprehensive assessment of all changes in affect experienced as a result of PA, based on the theorized structure of affect.

Additionally, Vancampfort et al. (2011a) did not investigate feeling states during exercise. Measuring affect during exercise, and not just before and after, may provide valuable information, as the dual-mode theory predicts considerable variation between participants during moderate-intensity exercise. Measuring affect during exercise allows for the testing of the dual-mode theory. Furthermore, the intensity of both the yoga and cycling sessions was unclear. Participants received heart rate feedback while cycling at a self-selected pace, but the authors failed to report this data. Not assessing or reporting intensity, either through physiological markers or self-report, makes it difficult to translate these findings into recommendations. Thus, using a broader assessment of affect, such as valence and activation of the Circumplex Model of Affect, clearly quantifying exercise intensity, and assessing affect during (as well as before and after) an acute bout of exercise is a novel and informative endeavor to perform with people with schizophrenia.

2.3.2 Study 2: Arbour-Nicitopoulos et al., 2011

Another recent pilot study has, however, used the Circumplex Model of Affect to examine affective responses, before, during, and after an acute bout of exercise among 14 people with serious mental illness undergoing nicotine replacement therapy (as the primary outcome was reductions in smoking cravings), of which only three participants self-reported schizophrenia or schizoaffective disorder (Arbour-Nicitopoulos et al.,
This study followed a randomized crossover design where participants sat passively for 10 minutes in the control condition or walked briskly for 10 minutes on a treadmill in the exercise condition. Participants reported valence and activation using the FS and the FAS; (Svebak & Murgatroyd, 1985), respectively, at five time points (i.e., pre-condition, 5 minutes mid-condition, and 0-, 10-, and 20-minutes post-condition). The intensity of each task was assessed objectively using heart rate and subjectively with the Borg Ratings of Perceived Exertion (Borg RPE; Borg, 1998). However, heart rate was not reported as a function of personal capacity (i.e. % maximum heart rate or % heart rate reserve), nor was there a target heart rate for participants to achieve during the brisk walk (rather participants were told to walk at a self-selected pace). Given the age range of participants (35-72 years), this may have lead to significant variation in actual physical exertion. Nevertheless, the 10-minute brisk walking induced a significantly higher mean heart rate and Borg RPE score than the sitting condition. Mean Borg RPE during the exercise condition was 9.99, with a range of 6-13.6, suggesting that although some participants had reached moderate-intensity thresholds (ratings from 12-14; Borg, 1998), participants generally perceived the PA as light-intensity. Despite the small sample size, analysis of covariance (controlling for pre-task affect) revealed a significant time x condition interaction for valence ($p < .05$, partial $\eta^2 = .19$). While there was no significant difference between the two conditions at any given time point, participants tended to report higher valence scores in the brisk walking condition than in the sitting condition. Running the same analysis for activation revealed a significant main effect for time ($p < .03$, partial $\eta^2 = .21$), with participants reporting significantly greater activation immediately post-exercise compared to 20 minutes post-exercise, after controlling for
baseline activation. Overall, this study demonstrated a trend for increases in activation and valence when participants engaged in brisk walking versus passive sitting. Having a pre-set, objectively measured intensity level for the exercise condition may help to clarify these results, by reducing variation in the stimulus. Furthermore, using a sample comprised solely of people with a single diagnosis category (i.e. schizophrenia-like illness) will likely improve the specificity of the results.

In sum, several studies have examined the mental health benefits of a chronic PA program for people with schizophrenia (see: Faulkner & Duncan, 2012; Gorczynski & Faulkner, 2010), yet the acute effects of exercise on psychological factors within the schizophrenia population have been under-examined. As this line of investigation is still nascent, using a model capable of describing a wide variety of affective responses – such as the Circumplex Model of Affect – is therefore warranted. Furthermore, given that affective responses during exercise vary based on intensity (Ekkekakis et al., 2011), specific, objective, and measurable intensity targets that participants must reach during exercise need to be defined a priori. Conducting research that meets these criteria may provide insight into the mechanisms behind the beneficial effects of PA on mental health specific to people with schizophrenia.

2.4 Relationship between Acute Affective Responses to Exercise and Regular PA Participation

Ekkekakis and colleagues (2011, 2014) suggest that people may be hedonically motivated to engage in regular PA. Specifically how pleasant or unpleasant an individual feels during a session of moderate-intensity exercise – as this is where the dual-mode
theory predicts individual differences in valence to occur – may be predictive of whether individuals continue to engage in future PA. Therefore, assessing affective responses during an acute bout of moderate-intensity exercise using the Circumplex Model of Affect as a theoretical framework may provide a highly parsimonious and pragmatic predictor of PA behaviour in the schizophrenia population. If affective responses during exercise are predictive of future PA participation, this may improve the success of endeavors to promote PA among people with schizophrenia and other severe mental illnesses.

Currently, three studies (Kwan & Bryan, 2010; Schneider et al., 2009; Williams et al., 2008) have investigated the relationship between regular PA participation and affective responses measured during an acute bout of exercise. Table 1 provides a summary of these studies. Overall, the FS was used in two of the studies, while the Physical Activity Affect Scale (PAAS; Lox et al., 2000) was used in only one of the studies, which contains four unipolar scales: positive affect, negative affect, tranquility, and fatigue. Positive affect and fatigue represent the high and low activation ends of the Energetic Arousal dimension of the Circumplex Model of Affect (see Figure 2) respectively, while negative affect and tranquility represent high and low activation along the tense arousal dimension (Figure 2), respectively. Interestingly, neither of the two studies that used the FS employed a measure of the activation dimension. As predicted by the dual-mode theory (Ekkekakis, 2009a; 2009b; Ekkekakis et al., 2005), considerable variations in affective responses during an acute bout of moderate-intensity exercise were observed, whereas an acute bout of vigorous-intensity exercise induced mostly negatively valenced affect during exercise. Post-exercise affect was also largely positively valenced
for moderate-intensity exercise. In all three studies, affective responses during moderate-intensity exercise predicted or significantly improved explained variance for regular PA behaviour. Together, these findings are consistent with Ekkekakis and colleagues’ (2011) hypothesis that individual differences in affective responses during moderate-intensity exercise may influence whether people engage in regular PA.

Given the recency of this line of research, and the dearth of research investigating affective responses to acute bouts of exercise in people with mental illness, it is not surprising that researchers have yet to investigate the relationship between affective changes to an acute bout of moderate-intensity exercise and PA participation in the schizophrenia population. Yet, due to the affective symptoms and cognitive deficits that are associated with severe mental illness, this may be one of the most salient predictors of PA behaviour for these populations. Two of the three studies listed in Table 1 used healthy participants. Kwan and Bryan (2010) specifically excluded participants with diabetes or psychiatric illnesses or who smoked, while Schneider et al. (2009) excluded anyone with depression (albeit because participants were recruited from a larger study where this was a requirement), and participants had a healthy mean body mass index. Only Williams et al. (2008) used a sample of participants who were specifically recruited to be inactive. Study participants had an average body mass index in the overweight range, but otherwise were considered to be healthy. In this study, a large significant correlation was shown between valence during moderate-intensity exercise and PA participation at 6- ($r = .50$) and 12-month ($r = .47$) follow-up. These studies provide some indication that affect during moderate-intensity exercise may also be predictive of PA behaviour in persons with schizophrenia.
Currently, an opportunity exists to not only characterize affective responses to exercise in people with schizophrenia, but also to test the relationship between affective response to an acute bout of moderate-intensity exercise and PA participation in a prospective, objective manner. Only two studies (Kwan & Bryan, 2010; Williams et al., 2008) have used a prospective design to predict future self-reported PA levels, while one study (Schneider et al., 2009) has used an objective measure of PA behaviour (i.e., accelerometry), albeit the behavior was assessed prior to testing the affective responses to an acute bout of moderate-intensity exercise. Furthermore, only one of the studies (Kwan & Bryan, 2010) has used a measure capable of assessing the activation dimension of the Circumplex Model of Affect. It is unclear as to whether feelings of activation during exercise would also influence decisions to engage in regular PA. It is possible that activation may increase the variance explained by valence alone, though valence remains the most relevant construct to Ekkekakis and colleagues’ (Ekkekakis et al., 2011; Ekkekakis & Dafermos, 2012) theory of hedonic motivation for engaging in PA. Thus, a prospective study that objectively measures PA behaviour in people with schizophrenia not only has the potential to increase the generalizability of this relationship, but may also strengthen the overall evidence for affect during moderate-intensity exercise as a determinant of PA participation.

Currently, very few studies have investigated basic affect responses to an acute bout of exercise in persons with severe mental illness – only one of which has used a theory-based approach. Given this gap in the affect literature, the primary objective of the current thesis is to characterize the affective response to an acute bout of moderate-intensity exercise in persons with schizophrenia. In light of recent research suggesting a
relationship between affective responses to moderate-intensity exercise and regular PA participation (Kwan & Bryan, 2010; Schneider et al., 2009; Williams et al., 2008), an investigation of these affective responses simultaneously provides an opportunity to identify a potentially novel determinant of PA in the schizophrenia population.
Table 1. Summary of studies using affective response to an acute bout of exercise as a predictor of physical activity behaviour.

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Acute PA task</th>
<th>Affect Measures</th>
<th>PA Measures</th>
<th>Results</th>
</tr>
</thead>
</table>
| (Williams et al., 2008)   | 37 inactive (<90min of PA/week) adults (29 F); MAge = 43.92 years (SD .8.63) MBMI = 28.28 kg/m² (SD 5.9); 31 returned at 6 &12 months | At baseline: Balke treadmill protocol – increasing grade every 2 min until 85% MHR ≥64% MHR used to define when MPA is reached during task | FS assessed pre-task & every 2 min during task | 7 day Physical Activity Recall assessed at baseline, 6 and 12 months | Changes in Affect: Compared to pre-task FS, moderate-intensity exercise improved affect in 27% of participants, decreased affect in 30%, no change in 43%  
Relationship to PA Participation  
FS during first minute at moderate-intensity exercise correlated to PA at 6-month (r = .50, p<.01), and 12-month (r = .47, p<.01) follow-up, but not at baseline. Relationship between FS during exercise and PA at 6 months significant when controlling for baseline FS score (β=.51, p=.01), and PA at 12 months (β=.39, p=.04) when also controlling for PA at 6 months. |
| (Schneider et al., 2009)  | 192 adolescents (87 F); MAge = 14.78 years (SD .45); 124 included in analysis | During 2nd and 3rd visit: 30 min cycle ergometer at either moderate- (below pre-determined VT) or vigorous- (above VT) intensity in random order | FS assessed pre- and post-task & every 10 min during task | Accelerometers worn for 7 days after 1st visit | Moderate-Intensity Exercise task  
Compared to pre-task: 56% of participants experienced a decline in FS; 22% experienced no change, and 22% experienced improvement; changes in FS during exercise task compared to baseline related to minutes of MVPA ($R^2=.21$), minutes of MPA ($R^2=.21$), and meeting daily PA guidelines ($R^2=.16$).  
Vigorous-Intensity Exercise task |
Compared to pre-task: 85% experienced a decline in FS; 6% experienced no change, and 9% experienced improvement; FS response to exercise task not related to PA behaviour.

(Kwan & Bryan, 2010) 129 adults (67 F); Mage =22.4 years (SD 4.15); 127 analyzed 30 min treadmill task at moderate-intensity (65% predetermined VO₂max) PAAS (4 subscales positive affect, negative affect, fatigue, tranquility) assessed pre-task, at 5-, 10-, & 20-min during task, immediately before task completion, 15- & 30-min post-task 7 day Physical Activity Recall assessed 3 months after acute exercise task; frequency of voluntary PA analyzed Exercise intentions measured with 4-items

### Changes in Affect

**In-task:** positive affect increased over time ($\beta$ = 0.52, $p$<.01); decrease over time in negative affect ($\beta$ = -0.12, $p$<.01), tranquility ($\beta$ = -0.62, $p$<.01), & fatigue ($\beta$ = -0.39, $p$<.01)

**Post-task:** positive affect ($\beta$ = 0.73, $p$<.01) & tranquility ($\beta$ = 0.63, $p$<.01) increased 15-min post-task; negative affect ($\beta$ = -0.13, $p$<.01) & fatigue ($\beta$ = -0.21, $p$<.01) decreased

### Relationship to PA Participation

Changes in positive affect in-task positively related to PA frequency ($\beta$ = 0.62, partial $\eta^2$ = .03, $p$<.05), negative relationship between fatigue and PA frequency ($\beta$ = -0.85, partial $\eta^2$ = .06, $p$<.01), no significant relationship with negative affect or tranquility. Positive affect and fatigue mediated relationship between intentions and PA.

PA = Physical Activity; FS = Feeling Scale; MHR = Max Heart Rate; MPA = Moderate intensity PA; VPA = Vigorous intensity PA; VT = Ventilatory Threshold; PAAS = Physical Activity Affect Scale
2.5 Objectives and Hypotheses

The primary objectives of this thesis are to: 1) characterize the affective response to an acute bout of moderate-intensity exercise versus passive sitting using the Circumplex Model of Affect as a theoretical framework and 2) determine whether individual differences in affective responses to an acute bout of moderate-intensity exercise are predictive of objectively-measured PA behaviour. Compared to sitting, it is hypothesized that participants will experience higher levels of valence and activation during and after exercise. Based on the dual-mode theory (Ekkekakis, 2003; 2009a; 2009b), it is hypothesized that valence responses during an acute bout of moderate-intensity exercise will show considerable inter-individual variability, with a mean change toward positively valenced affect compared to baseline. Meanwhile, activation will increase throughout the bout of moderate-intensity exercise compared to baseline. Furthermore, consistent with previous research (Arbour-Nicitopoulos et al, 2011; see also Ekkekakis et al., 2011), affective responses after exercise will be primarily positively valenced with activation decreasing over time. Similar to recent findings examining the relationship between affect during exercise and MVPA behaviour (Kwan & Bryan, 2010; Schneider et al., 2009; Williams et al., 2008), the variations in affective responses during an acute bout of moderate-intensity exercise will be predictive of accelerometer-determined MVPA levels, such that a more positive change in valence during exercise will be associated with greater MVPA behaviour.
Chapter 3

3 Methodology, Analyses, and Research Implications

3.1 Parent Study

The current study took place within the context of a larger prospective study examining the determinants of PA participation among people with schizophrenia. Specifically, the parent study is testing the predictive validity of a questionnaire specifically designed to measure PA determinants in the schizophrenia population using the Health Action Process Approach (HAPA) model; see Schwarzer, 2008). This parent study aims to recruit 130 participants, and is still ongoing. Figure 4 outlines the protocol and measures used in the parent study. During the screening for the parent study, prospective participants were asked of their interest in participating in the current study. If they expressed interest, the Physical Activity Readiness Questionnaire (PAR-Q; Canadian Society for Exercise Physiology, 2000) was administered to determine eligibility. Participants were ineligible if they said “yes” to any of the items on the PAR-Q, and were unable to receive permission to engage in PA from a physician; however, taking medication for blood pressure was deemed acceptable so long as their most recent blood pressure reading was below 140/90. The current study occurred on non-consecutive days between Time 2 and 3 (inclusive) of the parent study (see Figure 4). All participants who agreed to be in the current study were expected to continue through the parent study as described above without any other alterations.

The parent study provided a captive audience of people with schizophrenia, and data on sample characteristics that may influence outcomes such as symptom severity, apathy, and baseline PA levels. It also provided the opportunity to objectively measure PA participation
prospectively using accelerometers. All relevant measures are described herein, however Table 2 summarizes which measures were assessed as part of the parent study and which are unique to the current study. The parent study was approved by the Centre for Addiction and Mental Health Research Ethics Board (REB), and received a secondary review by the University of Toronto REB as is standard for the University of Toronto. The University of Toronto REB, with acknowledgement that data from the parent study would be used, approved the present study.

3.2 Study Design

The study consisted of a randomized crossover design. Participants completed both an exercise task and a passive sitting task on non-consecutive days during the 3rd week of the parent study, between the 2nd and 3rd visit (see Figure 4), in random order. With the intention of generating relatively equal numbers of participants starting with either task, a card from a stack of 34 cards (one for each intended recruit) was drawn, that had been shuffled by someone independent of the study, and kept in an opaque envelope. Seventeen of the cards were marked on one side to start with the exercise task, while the remaining 17 were marked to start with the sitting task, but were otherwise indistinguishable. Participants were unaware of the process of selection, and were blinded as to which task they had been assigned to until the first session was underway. The experimenter drew the allocation card on the day of the participant’s first visit for the current study, to minimize experimenter bias. Participants received $15 for participating in the first session, and $20 for participating in the second session to promote study completion.
3.3 Participants

To be eligible for the study, participants must have met the following inclusion criteria: 1) age 18-64 years (in line with Canadian Physical Activity Guidelines recommendations for adults; (Canadian Society for Exercise Physiology, 2011); 2) outpatients with schizophrenia or schizoaffective disorder; and 3) be deemed fit enough to engage in PA as assessed by the PAR-Q (Canadian Society for Exercise Physiology, 2000). Participants were deemed ineligible to participate if they had: (1) been hospitalized in the past 12 months for angina pectoris, myocardial infarction, or cardiac surgery of any kind; and/or (2) uncontrolled hypertension (defined as blood pressure > 140/90).
Figure 4. Parent study summary protocol and instruments. MINI = Mini International Neuropsychiatric Inventory, MacCAT = MacArthur Competency Assessment Tool, *Sections A, D, & L required for differential diagnosis of mood & psychotic disorders, Sections J & K to determine alcohol and drug abuse/dependence IPAQ = International Physical Activity Questionnaire, SF-12 = 12-item Short Form Health Survey, HAPA = Health Action Process Approach, BPRS = Brief Psychiatric Rating Scale, CGI = Clinical Global Impression
Table 2. Comparison of assessments between the parent study and the current study of affective responses. * indicates data from parent study used in current study

<table>
<thead>
<tr>
<th>Parent Study (HAPA validation)</th>
<th>Current Study (Affect &amp; Exercise)</th>
</tr>
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<tbody>
<tr>
<td>Competence Assessment Tool for Clinical Research (Study Specific)</td>
<td>Competence Assessment Tool for Clinical Research (Study Specific)</td>
</tr>
<tr>
<td>Demographics*</td>
<td>Affect: Feeling Scale; Felt Arousal Scale; Positive and Negative Affect Schedule</td>
</tr>
<tr>
<td>Diagnosis Confirmation*</td>
<td>Intensity: Heart Rate &amp; Borg RPE</td>
</tr>
<tr>
<td>Symptoms: Brief Psychiatric Rating Scale*; Clinical Global Impression*; Apathy Evaluation Scale*</td>
<td>Hedonic Capacity: Snaith-Hamilton Pleasure Scale, Calgary Depression Scale</td>
</tr>
<tr>
<td>Short Form Health Survey*</td>
<td>Physical Activity Readiness Questionnaire</td>
</tr>
<tr>
<td>Baseline Physical Activity: International Physical Activity Questionnaire*</td>
<td></td>
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<tr>
<td>Accelerometry*</td>
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<tr>
<td>HAPA Questionnaire</td>
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</tbody>
</table>
3.4 Required Sample Size

Sample size calculations were based on the two primary study objectives outlined in Section 2.5. In terms of objective 1, Arbour-Nicitopoulos et al.’s (2011) pilot study of 14 participants where affect was a secondary outcome in people with severe mental illness found a medium interaction effect on valence as measured by the FS \( (\text{partial } \eta^2 = 0.19; \) (Arbour-Nicitopoulos et al., 2011). Based on an alpha level of 0.05 and a beta level of 0.80, G*Power3 calculated a required sample size of 64 participants across two conditions for a between-within interaction assuming an effect size of partial \( \eta^2 = 0.19 \) (i.e., 32 per condition), using eight assessment periods (see Figure 5). Given the crossover design of the current study, 32 participants would be a sufficient sample size to detect this effect. However, to account for the 25% attrition rate reported in (Arbour-Nicitopoulos et al., 2011) study, the projected sample size for the current study was 40 participants. This sample size was deemed to be sufficient to detect significant interactions between time and task (Study Objective 1), while also meeting the minimally rigorous rule of thumb of 10 participants per predictor in a regression model (D. E. Miller & Kunce, 1973) that was required to examine the relationship between affect during moderate-intensity exercise and future MVPA behaviour (Study Objective 2).

3.5 Measures

3.5.1 Screening Assessments

**Diagnosis.** The Mini-International Neuropsychiatric Interview (MINI; Sheehan et al., 1998; Appendix A) is a brief structured clinical interview which can be used to confirm diagnosis in a variety of conditions that are included in the *Diagnostic and Statistical Manual of*
Mental Disorders 4th ed., text revision (American Psychiatric Association, 2000). Currently, there are no similar assessments that reflect the recent changes to diagnostic categories presented in the current DSM 5th edition (5th ed., DSM5; American Psychiatric Association, 2013). Sections J (diagnostic criteria for alcohol dependence & abuse) and K (diagnostic criteria for substance abuse) of the MINI were used over the phone during participant screening for the parent study to assess dependence and abuse of both alcohol and drugs over the last three months. Sections A (depression), D (mania), & L (psychosis) were administered at Time 1 of the parent study (see Figure 4) to confirm diagnosis when the participant is not being referred by their primary psychiatrist or the research registry. These sections require rater judgment for some items that should be made in person.

Physical Activity. The Physical Activity Readiness Questionnaire (PAR-Q; Canadian Society for Exercise Physiology, 2000; Appendix B) was administered over the phone as part of screening. Participants who answered “yes” to any question on the PAR-Q had the opportunity to consult with their doctor about participating in the study. Responses to the PAR-Q were reviewed in person prior to beginning the study.

Capacity to Consent. In order to confirm that participants were capable of making an informed decision to participate in the study, the MacArthur Competence Assessment Tool for Clinical Research (MacCAT-CR; Appelbaum & Grisso, 2001; Appendix C) was used to assess the decision making capabilities of each participant wishing to enroll in the current study. The MacCAT-CR is a rigorous and commonly used assessment of capacity and is considered a gold standard for this purpose (Naimark, Dunn, Haroun, & Morris, 2006). The MacCAT-CR is modified for each study it assesses.
3.5.2 Affective measures

Affect was assessed with the Feeling Scale (FS; Hardy & Rejeski, 1989; Appendix D) and the Felt Arousal Scale (FAS; Svebak & Murgatroyd, 1985; Appendix E) to measure the valence and activation dimensions, respectively. As previously discussed, the FS and FAS are single item Likert scales that are congruous with the Circumplex Model of Affect and are commonly used to measure affect changes during exercise. The FS asks participants to rate on an 11-point scale how well they feel, ranging from +5 (very good) to -5 (very bad), with 0 anchored as neutral. Meanwhile, the FAS asks respondents “to estimate how aroused you feel” and provides a description of what is meant by arousal (i.e. relaxed vs. excitement). The original format of the FAS is a 6-point scale, but has been modified to an 11-point scale to match the FS when the scales are used together (Arbour-Nicitopoulos et al., 2011), with the original anchors “low arousal” and “high arousal” anchored at -5 and +5. The 11-point version was therefore used in the current study. Neither scale has been validated with individuals who have schizophrenia, but both have been successfully used to measure affective responses to exercise in people with severe mental illness, including schizophrenia (Arbour-Nicitopoulos et al., 2011).

Currently, the only affect measure that conforms to the Circumplex Model of Affect and which has been validated for use with patients who have schizophrenia (Kring & Neale, 1996; Kring, Kerr, Smith, & Neale, 1993) is the PANAS (Watson et al., 1988; Appendix F). The PANAS is comprised of two, 10-item unipolar scales, Positive Activation and Negative Activation, which correspond to high activation negative valence (e.g., ‘hostile’) and positive valence (e.g., ‘determined’), respectively; see Figure 2 for a visual representation of where Positive and Negative Activation map onto the Circumplex Model of Affect. The PANAS was used in the current study as a validation check for the FS and FAS.
3.5.3 Physical activity levels

**Self-report.** Baseline physical activity at Time 1 was measured in the parent study with the self-report short form version of the International Physical Activity Questionnaire (IPAQ-SF; “Downloadable questionnaires - International Physical Activity Questionnaire,” n.d.; Appendix N). Metabolic equivalents can be calculated from responses to the IPAQ-SF making it useful for comparing against other measures of PA. Furthermore, use of the IPAQ-SF with people who have schizophrenia has shown validity with accelerometry comparable to that of the general population (Faulkner, Cohn, & Remington, 2006). Baseline PA was used as a descriptor of the sample for the current study

**Accelerometry.** An ActiGraph GT3X+ accelerometer was worn by participants for seven days at the end of the parent study (i.e., Time 3-4 in Figure 4) to assess MVPA behaviour. Accelerometers, which are worn on the right hip of the participant, provide an objective measure of PA duration, frequency, and intensity by detecting changes in movement. Participants were instructed to wear the accelerometer from the time they woke up until the time they went to bed – except for instances where wearing the accelerometer may have resulted in damage, such as showering or swimming. As a way of maintaining adherence, a log sheet was provided, along with written wearing instructions, for participants to record when they put on and took off the accelerometer each day (see Appendix O). Participants were instructed to treat the days wearing the accelerometer as if they would any other day (i.e. they do not have to engage in a certain amount of PA). A $20 cash incentive was provided to participants who wore the accelerometers for more than 10 hours a day on three weekdays, and one weekend day (Troiano et al., 2008; Trost, McIver, & Pate, 2005).
3.5.4 Exercise Intensity

Percentage of calculated maximum heart rate was used as an objective measure of exercise intensity during the moderate-intensity exercise task. Heart rate (HR) was monitored continuously throughout both tasks using a chest strap Polar T31 HR monitor. Although Ekkekakis et al. (2011) recommend using a metabolic marker – such as ventilatory or lactate threshold – at least one study has used percentage maximum HR as a marker of intensity during graded exercise, and found the expected pattern of variability at moderate-intensity exercise and strong negatively valenced affect at vigorous-intensity exercise (Williams et al., 2008). Measures of personal capacity, such as percent maximum HR or HR reserve, were just as common as metabolic markers when measuring affect during exercise (Ekkekakis et al., 2011). Furthermore, using HR does not require pre-task testing, unlike ventilatory or lactate threshold, as the process of measuring these thresholds could alter affective responses if measured simultaneously. Notably, lactate testing, which requires regular blood sampling throughout exercise, may be perceived as somewhat invasive by participants; while ventilatory threshold requires ventilatory gas exchange to be measured, which may be uncomfortable for participants unfamiliar with the procedure. Measures of HR thus provide a non-invasive and simple objective measure of intensity, making it feasible to use with the sample of the current study. The Borg Rating of Perceived Exertion (Borg RPE; Borg, 1998; Appendix P), a gold standard measure of perceived exertion, was also used to assess participants’ perceptions of exercise intensity. The Borg RPE is a single scale ranging from 6 (no exertion at all) to 20 (maximal exertion). Values on the scale, when multiplied by 10, are designed to correspond approximately to respondents’ heart rate (Borg, 1998). A rating of 12-14 on the Borg scale corresponds approximately to moderate-intensity exercise (Hines, 1999).
3.5.5 Sample Descriptors

Symptom severity. The anchored version of the Brief Psychiatric Rating Scale (BPRS-A; Woerner, Mannuzza, & Kane, 1988; Appendix G), and the severity scale of the Clinical Global Impression scale (CGI-S; Guy, 1976; Appendix H) were used as brief assessments of symptom severity. Both measures are assessed by rater judgment. The BPRS-A relies on a series of probing questions with anchoring provided to denote severity of each symptom. The CGI-S is a single-item scale assessed by the rater based on general symptom severity relative to other individuals with schizophrenia-like illness. Both of these instruments were administered at Time 1 as part of the parent study.

Negative Symptoms. The Apathy Evaluation Scale (AES; Marin, Biedrzycki, & Firinciogullari, 1991; Appendix I) is an 18-item self-report questionnaire, which assesses amotivation – a core negative symptom of schizophrenia. The AES is a reliable questionnaire with good construct validity designed for use with psychiatric populations (Marin et al., 1991). The AES was administered in the parent study at Time 1 (see Figure 4). Symptomatic anhedonia, which is not assessed by the AES, and not included in the parent study, may also alter the capacity of individuals to experience pleasure, blunting the experience of affect. The Snaith-Hamilton Pleasure Scale (SHAPS; see Appendix J) was developed to measure anhedonia in psychiatric populations (Snaith et al., 1995). The SHAPS has been shown to be a psychometrically valid measure of hedonic capacity – the ability to experience pleasure (Leventhal, Chasson, Tapia, Miller, & Pettit, 2006). Similarly, the Calgary Depression Scale for Schizophrenia (CDSS; Appendix K), a valid and reliable tool for measuring depression in people with schizophrenia (D. Addington, Addington, & Schissel, 1990; D. Addington, Addington,
Maticka-Tyndale, & Joyce, 1992), was used to assess current levels of depression. All three scales of negative symptoms compliment the BPRS and CGI as sample descriptors.

**Demographics.** A demographics questionnaire administered in the parent study at Time 1 was used to compile data on personal information (e.g. age, ethnicity, employment status) to accurately describe the sample. A list of psychiatric and physical health medications, as well as smoking and history of mental health were also collected (see Appendix L). Mental and physical health status were assessed in the parent study using the 12-item Short Form Health Survey (SF-12; Resnick & Nahm, 2001; Ware, Kosinski, & Keller, 1996; Appendix M). The SF-12 provides composite scores of both mental and physical well-being based on established norms. Together, these items characterized the sample’s socio-demographic characteristics and quality of life.

### 3.6 Procedures

#### 3.6.1 Screening

Upon initial contact via the parent study, participants were screened over the phone by the student investigator (M. Duncan) to determine if they met the study inclusion criteria. The PAR-Q was administered at this time. If the PAR-Q determined that the participant required medical permission to engage in exercise, they were offered the opportunity to enroll once they had consulted a physician.

#### 3.6.2 Pre-Test Procedures

During the first visit, each participant completed the SHAPS and was evaluated by the experimenter on the CDSS. The experimenter subsequently administered the PANAS, and then familiarized participants with the FS, FAS, and Borg RPE to ensure that the scales were
understood properly in-task, and participants would not have to read the scale instructions during the testing sessions. Responses to the FS and FAS at this time were recorded to compare with responses on the PANAS. Prior to beginning either of the two tasks (described below), participants were fitted with a HR monitor.

3.6.3 Exercise Task

The exercise task consisted of a 2-minute warm-up period, followed by 10 minutes of walking, with the goal of eliciting a target HR corresponding to moderate-intensity during this time period, and then a 2-minute cool-down (see Figure 5). Moderate-intensity for the current study was defined as 64%-76% of the calculated maximum HR for each participant (American College of Sports Medicine, 2010). To ensure participants remained within this target HR range, the experimenter adjusted the speed of the treadmill throughout the 10-minute moderate-intensity walking period. Prior to commencement, participants were reminded by the experimenter that they must reach a certain HR for the task to be valid – which was based on their personal capacity – and that the speed of the treadmill would be adjusted in order to achieve that HR. They were also reminded that if they did not feel safe, they should stop by standing on the edges of the treadmill and indicate with either a hand gesture or verbally that they needed to stop, at which point the experimenter stopped the treadmill. The FS, FAS, Borg RPE, and HR instruments were administered pre-task (0-minutes), as well as every two minutes until after the cool-down period, and then again 10 minutes after the cool-down period. Figure 5 provides a detailed outline of the measures taken at each of the three phases of the walking task (i.e., warm-up, moderate-intensity walking, cool-down) and post-task.
3.6.4 Passive Sitting Task

During the control testing session, participants were instructed to sit quietly on a chair in the lab placed on the treadmill for 14 minutes. They were asked not to talk to anyone except in an emergency, or when asked to respond to a scale. The same sampling intervals were used as those described above for the moderate-intensity exercise session.

3.6.5 Post, 7-day Accelerometer-Determined PA Behaviour

As part of the parent study, participants were provided with an information session about wearing an accelerometer (see Figure 4). Participants were instructed to wear the accelerometer for seven days (which corresponded to 1-week following the completion of the current study), and return the accelerometer at the end of this time period to the experimenter.
Figure 5. Timeline of measures during the exercise (top) and sitting (bottom) tasks. RPE = BORG Rating of Perceived Exertion, FS= Feeling Scale, FAS = Felt Activation Scale, HR = Heart rate;
3.7 Statistical Analyses

3.7.1 Data Reduction

As per study objectives 1 and 2, any participant who did not: 1) achieve a HR within the moderate-intensity HR range of 64%-76% during the 10 minute bout of exercise, and/or 2) complete both tasks was excluded from all analyses. However, the majority of participants \( n=10 \) did not achieve a HR within the target HR range by the end of the 2-minute warm-up period, but had met their target HR during the 10-minute bout of exercise. To account for variations as to when participants achieved a HR within the target zone, mean HR, FS, FAS, and BORG scores were calculated for however long participants’ HRs were within the moderate-intensity target during the 10-minute exercise period. During the sitting task, mean HR, FS, FAS, and BORG scores were calculated from 2 minutes to 12 minutes to correspond with the 10-minute exercise task.

3.7.2 FS & FAS Validity check

As the PANAS represents the rotated version of the Circumplex Model of Affect (Ekkekakis & Petruzzello, 2002), both the FS and FAS together should explain variance in the Positive Activation and Negative Activation scales of the PANAS. Scores obtained while familiarizing participants with the FS and FAS during the pre-test procedures were compared to responses on the PANAS, which had been administered immediately prior to the FS and FAS, to determine concurrent validity. In order to do this, relative valence and activation components of the PANAS were first calculated by performing an orthogonal rotation of the Positive Activation and Negative Activation axes by 45° degrees clockwise. Next, Pearson correlations were examined between the calculated valence score derived from the PANAS with the FS, and the
calculated activation score derived from the PANAS with the FAS. Lastly, two separate multiple regressions were conducted to determine the total explained variance in the Positive and Negative Activation scales of the PANAS by the FS and FAS, respectively.

3.7.3 Study Objective 1: Changes in Affect during Exercise Compared to Sitting

Shapiro-Wilk tests and Q-Q plots were examined to test whether the inter-individual variability of affect during moderate-intensity exercise was normally distributed. For these analyses, both the mean in-task valence and activation scores and the mean change in valence and activation from baseline to in-task were assessed.

Two repeated measures analyses of variance (ANOVA) were then used to assess overall changes in affect, with FS and FAS scores as the dependent variables, time (baseline, in-task, immediately post-cool down, and 10-minutes post-cool down) and task (moderate-intensity exercise vs. passive sitting) as the within-subjects factors, and testing order as the between-subjects factor. As valence and activation are conceptually orthogonal, a MANOVA was deemed inappropriate. Significant results from the ANOVAs were followed up with the Tukey’s Honestly Significant Difference (HSD) post-hoc test, in accordance with the study hypotheses. Namely, affect scores at baseline were compared to affect: 1) in-task; 2) immediately post-task and 3) 10-minutes post-task, while affect scores during passive sitting were compared to affect scores during moderate-intensity exercise at: 1) pre-task, 2) in-task; 3) immediately post-task; and 4) 10-minutes post-task. Where deemed necessary, non-sphericity was corrected using the Greenhouse-Geisser correction.
3.7.4 Study Objective 2: Affect During Exercise as a Correlate of Future PA

All accelerometry data were downloaded and analyzed using ActiLife v6.11.2 software (“ActiLife 6,” 2014). Data were included in the analyses only if participants met Choi et al.’s (2011) with a minimum wear time criteria of 600 minutes per day for at least three weekdays and one weekend day (Troiano et al., 2008; Trost et al., 2005). Troiano and colleagues’ (2008) adult cut points were used to determine time spent in moderate PA (MPA; 2020 counts per minute) and vigorous PA (VPA; 5999 counts per minute) PA.

Pearson correlations were then calculated between mean affective scores during moderate-intensity exercise and accelerometer-determined MVPA behaviour. In particular, mean in-task valence and activation scores, as well as changes in mean valence and activation from baseline to in-task were correlated with: 1) total minutes spent in MPA, 2) total minutes spent in VPA, 3) total minutes spent in MVPA, 4) percentage of wear time spent in MVPA, and 5) average minutes spent in MVPA per day of wear time.

Two hierarchical regressions were conducted to determine if affect during the moderate-intensity exercise task predict later 7-day MVPA behaviour. In the first regression, mean valence and activation scores were regressed against average minutes of daily MVPA, whereas changes in mean valence and activation scores were regressed against average minutes of MVPA in the second regression. Given that valence is the most theoretically relevant predictor of PA (Ekkekakis et al., 2011; Ekkekakis & Dafermos, 2012), and has been shown to be predictive of PA in the studies summarized in Table 1, valence was used as the first predictor in the model (Step 1), followed by activation (Step 2) for each of the regressions.
Chapter 4

4 Results

4.1 Participants

A total of 21 participants were recruited for the study through the Centre for addiction and Mental Health in Toronto. Of the 21 participants, four were removed from data analysis for study objective 1, for the following reasons: one participant did not return for any subsequent appointments, one participant’s HR during the exercise task exceeded the target HR even at the lowest treadmill speed, one participant did not complete the exercise protocol and chose responses during the sitting task at random, and one participant’s HR monitor failed during the exercise task. Of the remaining 17 participants included in the analyses, one had invalid accelerometry data due to lack of wear time (i.e., less than four days with 10 hours or more of wear time), and therefore was excluded from the data analysis for study objective 2. Table 3 describes the complete sample (n=21), as well as the 17 participants included in the analyses. For continuous data, two-tailed independent \( t \)-tests revealed significant differences between participants who were included in analyses and those exclude in terms of AES scores, \( t(19)=2.66, p=.02 \), and number of cigarettes smoked per day, \( t(17)=2.13, p=.05 \). The excluded group had higher levels of apathy, driven primarily by the two participants who did not complete the study, and smoked more cigarettes per day than the included group. The excluded sample was too small to use a Chi-square test to compare categorical data.

The sample included in the final analyses was ethnically diverse and representative of the general outpatient (schizophrenia) population at the Centre for Addiction and Mental Health. Symptom severity scores ranged from a 2 (borderline) to 5 (markedly ill) on the CGI-Sand and
25 to 36 on the BPRS-A, suggesting that symptoms in this sample were generally moderate. On average, scores were low on the CDS and high on the SHAPS, demonstrating that depression levels were low and that the sample was capable of experiencing pleasure. The majority of participants were overweight or obese (87.5%), which is not uncommon in the schizophrenia population. The sample was generally well educated, but tended to be employed only part-time, which coincides with high moderate-to-high apathy scores on the AES.

Table 3. Summary of participant demographics.

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Complete Sample (n=21)</th>
<th>Included in Analyses (n=17)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male:Female</td>
<td>15:6</td>
<td>13:4</td>
</tr>
<tr>
<td>Testing Order</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise First</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Sitting First</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>42.4 (12.8)</td>
<td>43.4 (12.0)</td>
</tr>
<tr>
<td>Range</td>
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<td>28-62</td>
</tr>
<tr>
<td>Diagnosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schizophrenia</td>
<td>18</td>
<td>14</td>
</tr>
<tr>
<td>Schizoaffective</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Concurrent Substance Abuse/Dependence</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Symptom Severity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BPRS mean score (SD)</td>
<td>29.7 (7.1)</td>
<td>29.7 (7.6)</td>
</tr>
<tr>
<td>CGI mean score (SD)</td>
<td>3.4 (1.2)</td>
<td>3.4 (1.2)</td>
</tr>
<tr>
<td>AES mean score (SD)</td>
<td>30.3 (7.8)</td>
<td>28.3 (6.7)</td>
</tr>
<tr>
<td>SHAPS mean score (SD)</td>
<td>46.6 (6.7)</td>
<td>47.2 (6.9)</td>
</tr>
<tr>
<td>CDS mean score (SD)</td>
<td>1.6 (1.6)</td>
<td>1.5 (1.7)</td>
</tr>
<tr>
<td>BMI (kg/m2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>29.8 (6.7)</td>
<td>30.6 (6.6)</td>
</tr>
<tr>
<td>Normal Weight (BMI&lt;25)</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Overweight</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Obese (BMI&gt;30)</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>Waist Circumference (cm)</td>
<td>Mean (SD) (n=22)</td>
<td>99.1 (44.2)</td>
</tr>
<tr>
<td>Baseline MVPA (IPAQ) (minutes)</td>
<td>Mean (SD)</td>
<td>240.8 (316.7)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Count</td>
<td>Percent</td>
</tr>
<tr>
<td>----------------</td>
<td>-------</td>
<td>---------</td>
</tr>
<tr>
<td>African</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>White</td>
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<td>6</td>
</tr>
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<td>2</td>
</tr>
<tr>
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</tr>
<tr>
<td>Biracial</td>
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<td>3</td>
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</table>

<table>
<thead>
<tr>
<th>Employment</th>
<th>Count</th>
<th>Percent</th>
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</thead>
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<tr>
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<td>7</td>
</tr>
<tr>
<td>Student</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Part-time</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Other (Self-employed)</td>
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<td>1</td>
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<table>
<thead>
<tr>
<th>Education</th>
<th>Count</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some High School (no diploma)</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>At least some Postsecondary</td>
<td>17</td>
<td>14</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Marital Status</th>
<th>Count</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>17</td>
<td>13</td>
</tr>
<tr>
<td>Married</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Smoking Habits</th>
<th>Count</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current smokers</td>
<td>13</td>
<td>9</td>
</tr>
<tr>
<td>Mean (SD) cigarettes/day (n=13)</td>
<td>13.0 (7.1)</td>
<td>11.6 (6.9)</td>
</tr>
</tbody>
</table>

Note. Values are counts unless otherwise specified. BPRS = Brief Psychiatric Rating Scale 18-item anchored version, possible scores range from 18-126, with higher scores representing more severe illness; CGI = Clinical Global Impression Severity Scale, possible scores range from 1 (normal, not at all ill) to 7 (among the most extremely ill patients). AES = Apathy Evaluation Scale, possible scores 18-72, with higher values representing more amotivation; MVPA = moderate-to-vigorous physical activity; IPAQ = International Physical Activity Questionnaire

### 4.2 FS and FAS Validity Check

The calculated valence score of the PANAS was significantly correlated with the FS during familiarization ($r = .45, p = .04$). However, the calculated activation score of the PANAS was not correlated with the FAS ($r = -.06, p = .79$). Results of the regression revealed that the FS ($\beta = .48, p = .04$) and FAS ($\beta = .27, p = .21$) scores explained 24% of the variance in the Positive Activation Scale of the PANAS, although this value was not significant, $F(2, 18) = 2.85, p = .08$. Similarly, when regressed against the Negative Activation scale, the model was not significant, and only explained 11.6% of the variance of the Negative Activation scale, $\beta_{FS} = -.29, p = .21,$
\[ \beta_{\text{FAS}} = -0.25, p = 0.28, F(2, 18) = 1.18, p = 0.33. \] Overall, these results indicate poor concurrent validity between the PANAS and the combination of the FS and FAS.

### 4.3 Data Screening

Overall, there were no missing data or outliers \((\text{SD} \geq 3)\) identified in either the MVPA or affective data. A significant Shapiro-Wilk test was observed for mean FAS during moderate-intensity exercise, \(W(17) = 0.86, p = 0.01\), indicating that mean activation during moderate-intensity exercise was not normally distributed. However, mean FS, \(W(17) = 0.93, p = 0.18\), and changes in either the FS \(W(17) = 0.89, p = 0.052\) or the FAS \(W(17) = 0.947, p = 0.41\) from baseline to in-task were not significant, indicating that valence and changes in valence and activation during exercise were assumed to be normally distributed. Inspection of the Q-Q plots (Figures 6-9) confirmed the results of the Shapiro-Wilk tests. As hypothesized, FS scores and changes in FS both followed a normal distribution during exercise. During the moderate-intensity exercise task, five participants \((29.4\%)\) experienced a decrease in mean valence compared to baseline, five \((29.4\%)\) experienced an increase, and seven \((41.2\%)\) experienced no change. Meanwhile, activation decreased in three participants \((17.6\%)\), increased for 10 \((58.8\%)\), and remained unchanged in four participants \((23.5\%)\).
Figure 6. Normal Q-Q Plot of Mean FS at moderate-intensity exercise.

Figure 7. Normal Q-Q Plot of Mean FAS at moderate-intensity exercise.
Figure 8. Normal Q-Q Plot of Mean FS change at moderate-intensity exercise.

Figure 9. Normal Q-Q Plot of Mean FAS change at moderate-intensity exercise.
Table 4. Summary of heart rate, Borg Rating of Perceived Exertion, Feeling Scale, and Felt Arousal Scale by time and task

<table>
<thead>
<tr>
<th>Task</th>
<th>Time (min):</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>24</th>
<th>Mean During Moderate Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>12</td>
<td>14</td>
<td>24</td>
<td>Mean During Moderate Intensity</td>
</tr>
<tr>
<td></td>
<td>HR (bpm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise</td>
<td></td>
<td>92.6</td>
<td>104.9</td>
<td>110.3</td>
<td>112.4</td>
<td>118.8</td>
<td>118.2</td>
<td>120.1</td>
<td>111.2</td>
<td>87.1</td>
<td>118.8 (7.2)</td>
</tr>
<tr>
<td></td>
<td>%Max HR</td>
<td>52.7</td>
<td>59.8</td>
<td>62.7</td>
<td>63.9</td>
<td>67.3</td>
<td>67.0</td>
<td>68.1</td>
<td>62.5</td>
<td>49.7</td>
<td>67.4 (3.5)</td>
</tr>
<tr>
<td>Borg RPE</td>
<td></td>
<td>7.7</td>
<td>9.2</td>
<td>10.2</td>
<td>10.6</td>
<td>11.3</td>
<td>11.0</td>
<td>11.1</td>
<td>9.3</td>
<td>7.5</td>
<td>10.9 (2.6)</td>
</tr>
<tr>
<td>FS</td>
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<td>2.6</td>
<td>3.1</td>
<td>3.1</td>
<td>2.9</td>
<td>3.2</td>
<td>3.0</td>
<td>2.8</td>
<td>3.9</td>
<td>3.9</td>
<td>2.8 (1.5)</td>
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<tr>
<td>FAS</td>
<td></td>
<td>0.0</td>
<td>0.9</td>
<td>0.8</td>
<td>1.0</td>
<td>1.2</td>
<td>1.4</td>
<td>1.6</td>
<td>1.4</td>
<td>1.1</td>
<td>1.4 (2.4)</td>
</tr>
<tr>
<td>Sitting</td>
<td></td>
<td>87.1</td>
<td>86.0</td>
<td>84.4</td>
<td>92.3</td>
<td>83.0</td>
<td>90.4</td>
<td>81.5</td>
<td>81.6</td>
<td>81.7</td>
<td>90.3 (30.6)</td>
</tr>
<tr>
<td></td>
<td>%Max HR</td>
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<td>49.2</td>
<td>48.1</td>
<td>52.1</td>
<td>47.7</td>
<td>51.0</td>
<td>46.2</td>
<td>46.4</td>
<td>46.4</td>
<td>50.8 (15.2)</td>
</tr>
<tr>
<td>Borg RPE</td>
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<td>8.2</td>
<td>8.2</td>
<td>8.3</td>
<td>7.9</td>
<td>7.9</td>
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<td>7.9</td>
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<td>8.0 (3.5)</td>
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<td>3.6 (1.3)</td>
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<tr>
<td>FAS</td>
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<td>0.5</td>
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<td>0.6</td>
<td>0.6</td>
<td>0.6</td>
<td>0.5</td>
<td>0.6</td>
<td>0.6 (2.6)</td>
</tr>
</tbody>
</table>

Note: Mean (SD); HR = Heart Rate; %Max HR = Percent of Age Calculated Maximum Heart Rate; FS = Feeling Scale; FAS = Felt Arousal Scale; Mean During Moderate Intensity is the mean values obtained while participants were in the target heart rate (i.e., 64%-76%); Mean 2-12 minutes is the mean values obtained during the period of sitting corresponding to the 10-min exercise period.
4.4 Objective 1: Changes in Affect during Exercise Compared to Sitting

Table 4 summarizes the mean HR, FS, FAS, and Borg RPE values obtained by time for each task.

4.4.1 Changes in Valence

Results from the repeated measures ANOVA revealed no significant main effect for testing order, $F(1,15)=.00$, $p=.97$, or any interactions between testing order and either task $F(1,15)=.82$, $p=.38$, time $F(3,45)=1.07$, $p=.37$, or task x time $F(1.45, 21.8)=.05$, $p =.90$, Greenhouse-Geisser correction, $\varepsilon = .48$. An overall main effect for time emerged, $F(3,45)=6.38$, $p=.001$, partial $\eta^2 = .30$. Contrary to hypothesis, no main effect for task was observed $F(1,15)=2.73$, $p=.12$, partial $\eta^2 = .15$ nor was the time x task interaction significant $F(1.45, 21.8)=3.32$, $p =.07$, Greenhouse-Geisser correction, $\varepsilon = .48$, partial $\eta^2 = 1.81$. After applying the Greenhouse-Geisser correction the observed power for the interaction was .49, indicating that the sample size was severely underpowered. Figure 10 displays valence scores across the specified measurement periods as a function of task. Overall, valence scores increased post-exercise compared to baseline, with no difference in scores between baseline and in-task. Contrary to what was hypothesized, no significant differences in valence responses emerged between the moderate-intensity exercise and passive sitting tasks at any time point.
4.4.2 Changes in Activation

Results from the repeated measures ANOVA revealed no significant main effect for testing order $F(1,15)=1.68, p=.22$, nor were there any interactions between testing order and either task $F(1,15)=2.44, p=.14$, time $F(2.16, 32.43)=.81, p=.50$, Greenhouse-Geisser correction, $\varepsilon = .72$, or task x time $F(2.53, 37.97)=.35, p=.79$, Greenhouse-Geisser correction, $\varepsilon = .70$. Contrary to hypothesis, no overall main effects for task $F(1,15)=1.99, p=.18$, partial $\eta^2 = .12$ or time $F(2.16, 32.43)=1.69, p = .20$ Greenhouse-Geisser correction, $\varepsilon = .72$, partial $\eta^2 = .24$ emerged for activation, nor was there a significant interaction effect between time x task $F(2.08, 31.26)=2.88, p = .07$, Greenhouse-Geisser correction, $\varepsilon = .70$, partial $\eta^2 = .32$. The observed power of the interaction was .41, indicating that the sample was underpowered. Figure 11 shows the activation responses across the two tasks at the specified time periods. Thus, contrary to

![Graph showing changes in valence during exercise and passive sitting tasks](image.png)

**Figure 10.** Changes in valence during the exercise and passive sitting tasks.
hypothesis, activation did not differ significantly during moderate-intensity exercise compared to sitting, nor did activation scores change significantly throughout the exercise task.

4.5 Objective 2: Affect During Exercise as a Correlate of MVPA Behaviour

Table 5 summarizes the correlations between 1) mean valence and activation during moderate-intensity exercise and MVPA behaviour, and 2) mean change in valence and activation from baseline to in-task and MVPA behaviour. Contrary to hypothesis, no significant correlations were shown between any of the affect outcomes and MVPA behaviour. Furthermore, neither of the hierarchical regression analyses (mean valence and activation; \( F_{\text{STEP1}}(1,14)=.26, p=.62; F_{\text{STEP2}}(1,13)=.37, p=.70 \); mean change in valence and activation;
\( F_{\text{STEP1}(1,14)}=.31, p=.59; F_{\text{STEP2}(1,13)}=.49, p=.62 \) were significant at either step, indicating no significant relationship between affect experienced during moderate-intensity exercise and MVPA behaviour.

**Table 5.** Pearson correlations between affect responses during exercise and accelerometry outcomes

<table>
<thead>
<tr>
<th>Accelerometry Outcomes:</th>
<th>Total Minutes MPA</th>
<th>Total Minutes VPA</th>
<th>Total Minutes of MVPA</th>
<th>% Time in MVPA</th>
<th>Average Minutes MVPA/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean FS ( r = )</td>
<td>0.11</td>
<td>-0.01</td>
<td>0.10</td>
<td>0.11</td>
<td>0.14</td>
</tr>
<tr>
<td>( p = )</td>
<td>0.70</td>
<td>0.97</td>
<td>0.71</td>
<td>0.69</td>
<td>0.62</td>
</tr>
<tr>
<td>Mean FAS ( r = )</td>
<td>-0.14</td>
<td>-0.28</td>
<td>-0.18</td>
<td>-0.03</td>
<td>-0.17</td>
</tr>
<tr>
<td>( p = )</td>
<td>0.60</td>
<td>0.29</td>
<td>0.52</td>
<td>0.91</td>
<td>0.52</td>
</tr>
<tr>
<td>Mean FS Change ( r = )</td>
<td>-0.11</td>
<td>-0.06</td>
<td>-0.11</td>
<td>-0.21</td>
<td>-0.15</td>
</tr>
<tr>
<td>( p = )</td>
<td>0.69</td>
<td>0.82</td>
<td>0.67</td>
<td>0.43</td>
<td>0.59</td>
</tr>
<tr>
<td>Mean FAS Change ( r = )</td>
<td>-0.19</td>
<td>-0.28</td>
<td>-0.22</td>
<td>-0.30</td>
<td>-0.26</td>
</tr>
<tr>
<td>( p = )</td>
<td>0.48</td>
<td>0.29</td>
<td>0.41</td>
<td>0.26</td>
<td>0.33</td>
</tr>
</tbody>
</table>

Note: FS = Feeling Scale; FAS = Felt Arousal Scale; PA = Physical Activity; MPA = Moderate Physical Activity; VPA = Vigorous Physical Activity; MVPA = Moderate to Vigorous Physical Activity; Average Minutes MVPA/day = minutes of MVPA per day of wear.
Chapter 5

5 Discussion

The present study examined the full-spectrum of affective responses to an acute bout of moderate-intensity exercise, using the Circumplex Model of Affect as a theoretical framework, within a sample of individuals with schizophrenia. The prospective relationship between affective responses during exercise and 7-day MVPA behaviour was also examined. Based on previous research in the area of affect and exercise, it was hypothesized that valence and activation would both increase during and after exercise, though changes in valence during exercise would also show significant inter-individual variation. Furthermore, these individual differences in affective responses, in particular valence, would be related to future MVPA. Ultimately, only valence changed significantly over time. Although not significantly different from baseline, changes in valence during exercise followed a normal distribution, with just as many participants experiencing an increase in valence as a decrease. The results of the study, validity of the instruments used, strengths, limitations, and implications for future research are described herein.

5.1 Affective Responses to Exercise & Evidence for the Dual-Mode Theory

Non-significant medium effect sizes were found for task by time interactions for both activation and valence. Overall, the trend indicates that participants experienced a small increase in valence after engaging in a 10-minute bout of moderate-intensity exercise, compared to baseline, though valence did not differ significantly from the quiet sitting condition. Contrary to
hypothesis, mean valence during the moderate-intensity exercise bout did not differ from valence immediately prior to the exercise session. These results are in partial support of previous evidence from the general population (Ekkekakis et al., 2011; Reed & Ones, 2006) and individuals with mental illness (Arbour-Nicitopoulos et al., 2011) that people experience more positively valenced affect after engaging in exercise. In fact, the effect size for the time by task interaction for valence observed in the current study (partial $\eta^2 = .18$) was almost identical to the effect observed by Arbour-Nicitopolous et al. (2011; partial $\eta^2 = .19$).

Contrary to the hypothesis, activation responses throughout the exercise bout did not significantly change from baseline nor did they differ from the passive sitting task. A trend was exhibited though towards increased activation during exercise that remained elevated after the exercise bout was complete, and tapered slowly with time. This trend corresponds to the relationship commonly observed within the affect and acute exercise literature, where activation increases during exercise, and remains elevated afterwards, but slowly begins to decline with time (Ekkekakis et al., 2011; Ekkekakis & Petruzzello, 1999). The fact that no significant differences were found for activation may simply be the result of lack of power due to a small sample size, as the time x task interaction approached significance ($p=.07$).

As predicted by the dual-mode theory (Ekkekakis, 2003; 2009a; 2009b; Ekkekakis et al., 2005), affective responses during moderate-intensity exercise varied greatly between participants. Equal numbers of participants experienced increases (29.4%) and decreases (29.4%) in valence compared to baseline. Furthermore, tests of normality showed that valence scores during exercise were normally distributed, as were changes in both valence and activation. Together, these results indicate that a great deal of inter-individual variability exists in affective response during moderate-intensity exercise for individuals with schizophrenia. This individual
variability of affective responses during exercise has been previously reported in adults (Kwan & Bryan, 2010a; Williams et al., 2008), and adolescents (Schneider et al., 2009), and, based on the current study results, has now also been observed in people with schizophrenia. However, more research is required to determine if this individual variability is a stable trait-like phenomenon or a variable state-like response. Ultimately, in combination with the pattern of change in valence that was observed post-exercise, this inter-individual variability supports the hypothesis that while participants experienced a general increase in valence after exercise, participants did not experience a uniform change in valence during exercise.

In sum, the observed changes in valence and activation indicate that people with schizophrenia experience affective changes in response to a brief bout of moderate-intensity exercise that are comparable to what is commonly observed in the general population. Specifically, participants reported feeling more pleasant affect post-exercise. It therefore appears that people with schizophrenia can potentially accrue the same short-term affective benefits that a 10-minute session of moderate-intensity exercise has to offer to the general population typically experiences, and that small bouts of moderate-intensity exercise may serve as a method of regulating affect on a daily basis. However, it must be noted that no significant differences in affect emerged between the passive sitting and exercise tasks. While no statistical difference was detected at baseline between the two tasks, valence prior to exercise was slightly lower than at the outset of the sitting task. This small difference may be reflective of any feelings of apprehension brought about due to unfamiliarity with using a treadmill. Anecdotally, several participants mentioned how this was their first time using a treadmill – a response that is not altogether surprising given that people with schizophrenia tend to have fewer economic resources (Hudson, 2005), and are generally less active than the general population (Cohn et al.,
Thus, changes in valence after the exercise task compared to baseline could be attributed to this initial apprehension and subsequent relief when the protocol was complete. However, activation was similarly lower at baseline during exercise compared to sitting. Given that nervousness is perceived as a high activation emotion, it is equally plausible that participants were not feeling nervous per se prior to exercise. Regardless, anticipating having to exercise may have systematically decreased participants’ affective valence prior to the task, and therefore changes in valence post-exercise may represent relief from the obligation to exercise, rather than pleasant feelings derived from engaging in exercise itself.

5.2 Affect During Exercise as a Correlate of Future PA Behaviour

Contrary to the relationship observed in previous research (Kwan & Bryan, 2010; Schneider et al., 2009; Williams et al., 2008) and hypothesized by hedonic theory, there was no association between affective states or changes during the moderate-intensity exercise session and future MVPA participation. These results also seem to conflict with self-reported correlates of PA, where affective attitudes have been consistently identified as a determinant of PA participation in people with schizophrenia (Vancampfort, Knapen, et al., 2011b). Perhaps for people with schizophrenia the anticipated outcomes (i.e. how someone expects to feel) are a more relevant correlate of PA than the resultant outcome experienced during exercise, a finding that is commonly reported in other areas of exercise psychology such as body image (Dyremyhr, Diaz, & Meland, 2014; Zach et al., 2013).

Additionally, since participants did not experience any difference in feeling states during or after exercise compared to passive sitting, this may suggest that people with schizophrenia
may not view exercise as any more or less enjoyable than simply being sedentary. However, sitting requires considerably less effort and may therefore be viewed as a preferable activity compared to MVPA. Therefore, it is unlikely that someone would choose to engage in regular MVPA, unless other beliefs – beyond just how enjoyable exercise feels in the moment – are held regarding exercise and MVPA that make it more appealing than sitting. If this is the case, social cognitive factors regarding PA participation such as risk perceptions, outcome expectancies, attitudes towards PA, and self-efficacy, may likely play a more direct role in contributing to MVPA participation, than simply how good the individual feels during a bout of exercise. Further work is warranted to examine the individual relationships between affect during and after exercise and social cognitive factors related to predicting and promoting MVPA within the schizophrenia population.

5.3 Validity of Affective Measures in the Schizophrenia Population

Overall, the PANAS showed poor concurrent validity with the FS and FAS combination. While this may represent poor comprehension and validity of at least one of the instruments used, this is not necessarily the case. While both sets of instruments may be measuring basic affect within the context of the Circumplex Model of Affect, their methods of doing so vary in considerable ways. First of all, items of the PANAS are predominantly descriptive of high activation states, and thus only represent the top half of the Circumplex Model of Affect (Ekkekakis & Petruzzello, 2002). Thus, theoretically, the PANAS only describes 50% of the possible variance in affect that the FS and FAS are capable of describing. Secondly, while several statistical manipulations were used to account for this (i.e. performing an orthogonal
rotation to calculate valence and activation component scores for the PANAS, as well as performing a regression), the scales of the PANAS measure the axes of a rotated variant of the Circumplex Model of Affect, while the FS and FAS measure unrotated variants. Despite the theorized 45° relationship between these variants, the scales used may not align perfectly with this hypothesized relationship (e.g. a 47° or 41° relationship may exist between the PANAS, and the FS and FAS combination), thus decreasing the correlation between the calculated valence and activation scores of the PANAS and the FS and FAS scores.

Although the PANAS has been validated for use in the schizophrenia population (Kring et al., 1993; Kring & Neale, 1996), Heerey and Gold (2007) have previously used two 9-item Likert scales to measure valence (1 = extremely unpleasant to 9 = extremely pleasant) and activation (1 = extremely calm to 9 = extremely arousing) when administering the International Affective Picture System that are very similar to the FS and FAS. They found that responses to these scales for each image set in the International Affective Picture System did not differ significantly from mean ratings, suggesting that individuals with schizophrenia were responding to the images with the same tendencies as the general population, and that these scales were being interpreted as intended. Therefore, despite the poor comparability between the FS and FAS combination with the PANAS, there is reason to believe that the FS and FAS were interpreted as intended because of the structural similarity with the scales used by Heerey and Gold (2007). Regardless, further research is warranted to develop valid and reliable measures of affect that can be used in the context of exercise with both the general population and people with mental illness or cognitive deficits. Developing such measures would allow for better comparison of results between target populations.
5.4 Affect & Exercise in the Context of Schizophrenia

While anhedonia (specifically as an inability to derive pleasure from normally pleasurable stimuli) has long been considered a core symptom of schizophrenia (Andreasen, 1982; Blanchard & Cohen, 2006; Kraepelin, 1971), it has recently been criticized as a diagnostic symptom of schizophrenia (Foussias & Remington, 2010; Horan, Kring, & Blanchard, 2006; Strauss, 2013; Strauss & Gold, 2012). Overall, people with schizophrenia tend to report similar feelings of happiness as individuals without schizophrenia (Agid et al., 2012), as well as they often experience similar changes in affect in response to affectively relevant stimuli (Kring et al., 1993; Kring & Neale, 1996), and report deriving similar amounts of pleasure from engaging in enjoyable activities (D. E. Gard, Kring, Gard, Horan, & Green, 2007) as individuals without schizophrenia, indicating that people with schizophrenia do experience pleasure in response to pleasurable stimuli. Given that the participants in this study experienced changes in feelings of pleasure after engaging in exercise, this is further evidence against the inclusion of anhedonia as a symptom of schizophrenia.

Although people with schizophrenia are able to derive pleasure from engaging in activities (termed “consummatory pleasure” (Horan et al., 2006; Klein, 1984), they anticipate deriving less pleasure from enjoyable activities (termed “anticipatory pleasure” (Horan et al., 2006; Klein, 1984) than the general population. As well, people with schizophrenia experience less anticipatory pleasure for goal-directed (e.g., doing errands, making dinner, working) versus non-goal directed (e.g., eating, watching TV, smoking) activities, and report participating in less goal-directed activities than controls (D. E. Gard et al., 2007). Foussias and Remington (2010) (see also Horan et al., 2006) suggest that this inability to experience anticipatory pleasure may contribute to the amotivation observed in the schizophrenia population. Specifically, based on
the evidence from Horan et al (2006), an inability to anticipate pleasure from an activity, especially a goal-directed activity such as a bout of exercise, may lead to less motivation to engage in the activity in the future. In the context of the present study, it is therefore unsurprising that, contrary to the initial hypothesis, there was no relationship between affect during the moderate-intensity exercise session and future MVPA participation, as it may not be the amount of pleasure that someone with schizophrenia derives from a brief bout of exercise that motivates them to engage in regular PA so much as whether they anticipate deriving pleasure from that behaviour.

Ultimately, it appears that while valence experienced during exercise was highly variable, participants experienced a trend towards an overall increase in valence post-exercise. Thus, short bouts of moderate-intensity exercise may be one strategy to help people with schizophrenia regulate affect on a daily basis and contribute to overall better mental well-being, even if the effect on mental health may be brief. This may be especially important for individuals with schizoaffective disorder or co-morbid depression where affect may be negatively valenced on a regular basis. Given that moderate-intensity exercise was not predictive of future MVPA, and previous literature shows larger effect sizes for changes in positively activate affect when engaging in light intensity versus moderate-intensity exercise (Reed & Ones, 2006), it may not be entirely necessary to target moderate-intensity exercise to accrue the affect-related mental health benefits for the schizophrenia population. Rather, any intensity of exercise might suffice.

5.5 Strengths, Limitations & Future Directions

This is the first study of its kind to examine basic affective responses to exercise in an exclusive sample of people with schizophrenia or schizoaffective disorder using a theory-based approach. Historically, an inability to experience pleasure has been considered a symptom of
schizophrenia, however this study provides another example in a growing body of evidence that consummatory pleasure remains intact. Additionally, the study used both a prospective design and an objective measure of PA to determine if a relationship exists between affect during exercise and MVPA participation. It is also the first study to examine this relationship in people with a mental illness. Finally although small, the sample was representative of an outpatient population between the ages of 18 and 64 years.

Despite strong evidence from previous research indicating that activation increases during exercise and then slowly tapers with time post-exercise (Ekkekakis, 2011), activation during and post-exercise was not statistically different from baseline, nor did it differ significantly from the passive sitting task. One reason for this null finding may be the result of a smaller than anticipated sample size, leading to low power. While valence was the most theoretically important affective construct (Ekkekakis, 2009a; 2009b; Ekkekakis et al., 2011; Ekkekakis & Dafermos, 2012) in terms of testing: 1) the dual-mode theory’s predictions during moderate-intensity exercise (i.e. variability during moderate-intensity exercise, uniform elevation post-exercise), and 2) predict future MVPA participation, changes in activation or arousal may be an important mediator in cognition (Hamann, 2001; Mujica-Parodi, Corcoran, Greenberg, Sackeim, & Malaspina, 2002) and may therefore mediate some of the acute cognitive benefits of exercise. Thus, a larger sample size would be required to confirm whether the absence of changes in activation is something that is unique to schizophrenia, or is simply a significant result that has gone undetected due to low power.

As a result of already being part of a study with four distinct meeting sessions, there was no dedicated treadmill familiarization session prior to the experimental sessions due to concerns about participant burden. Adding a treadmill familiarization session would serve a two-fold
benefit to the study. First, as mentioned before, there was a non-significant difference in valence between baseline measures of the passive sitting and exercise tasks, which may have represented feelings of apprehension related to exercising on the treadmill. Allowing participants to walk on the treadmill in an initial session prior to the experimental sessions may have reduced any anxiety experienced by participants immediately prior to the exercise session. However, this issue was not apparent until after data were analyzed. Secondly, while the majority of participants reached a HR corresponding to moderate-intensity, this target heart rate was rarely achieved immediately after the 2-minute warm-up period. As a result of this inability to achieve the target HR by the end of the 2-minute warm-up phase, mean scores during moderate-intensity exercise had to be calculated for the affective (FS, FAS) and physiological (Borg RPE, HR) outcomes to compare against the sitting task, despite the initial intention to provide a detailed characterization of affect throughout the 10-minute exercise task by assessing feeling states every 2 minutes. Furthermore, the number of observations used to calculate this mean varied by both participant and task, such that for the majority of participants (i.e. 59%) more observations were used to calculate the mean affect during sitting than mean affect during exercise.

Incorporating a familiarization session would allow the experimenter to determine a priori the speed required to elicit the target HR during the exercise task, ensuring that participants are walking at the target intensity for the entire duration of the exercise period. Therefore, it may be worthwhile for future studies to employ a familiarization period in order to minimize these issues, and maximize data collection.

In terms of bias, testing order had no effect on any of the affective outcomes. Overall, this suggests low risk of selection bias due to the randomization and allocation concealment. Furthermore, very few differences existed between those participants who were included in the
final analyses and those who were excluded. As could be expected, excluded participants reported higher levels of apathy on the AES than those included; as well, excluded participants smoked more cigarettes on average.

Despite the lack of association between affect during exercise and MVPA participation for the current study, when trying to promote PA to people with (or without) schizophrenia, interventionists should not discount the feelings of pleasure and enjoyment during exercise as unimportant. Theoretically, anticipatory pleasure may be an important mediator in developing the motivation to engage in PA. Therefore, it is important that people anticipate deriving pleasure from PA, and perhaps one of the most straightforward ways to accomplish this is to ensure they also derive pleasure from engaging in the behaviour. This may mean helping individuals find their preferred mode of activity, and finding an ideal intensity that optimizes health benefits while simultaneously promoting anticipatory pleasure the individual feels towards PA. Thus, the feelings of pleasure and displeasure experienced during exercise may still be relevant to promoting future PA to people with schizophrenia.

Studying the relationship between affect during exercise and PA participation in schizophrenia may also provide insight into this relationship in the general population. Perhaps the reason that affective valence during exercise has been consistently associated with PA participation in the general population is because anticipatory pleasure more accurately reflects feelings of consummatory pleasure in the general population, and thus the variance in anticipated pleasure explained by feelings during exercise would approach 100%. Hypothetically speaking, what appears to be a direct relationship between affect during exercise and PA participation, might be more accurately described with anticipatory pleasure (e.g. affective attitudes) mediating the relationship between affect during exercise and PA participation. In patients with
schizophrenia, this is not the case, and therefore no direct relationship is apparent. Future research is required to demonstrate whether or not affective valence during exercise acts as a direct determinant of PA participation or is mediated by anticipatory pleasure in both the general population and people with schizophrenia.
Chapter 6

6 Conclusion

In conclusion, this study provides initial theory-based evidence that people with schizophrenia feel more pleasant after engaging in exercise, and supports the dual-mode theory that valence varies between individuals during moderate-intensity exercise. Contrary to findings from previous studies in the general population, there was no relationship between affect during moderate-intensity exercise and future MVPA for the current sample. This study provides further evidence for re-conceptualizing anhedonia as a symptom of schizophrenia. Finally while pleasure during exercise did not relate to MVPA participation, anticipatory pleasure may be better predictive of motivations to engage in exercise. Therefore, future studies should examine both perceptions of anticipatory and consummatory pleasure in the context of exercise, and the interrelationship with regular PA participation.
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Appendices

Appendix A – Mini International Neuropsychiatric Interview

GENERAL INSTRUCTIONS

The M.I.N.I. was designed as a brief structured interview for the major Axis I psychiatric disorders in DSM-IV and ICD-10. Validation and reliability studies have been done comparing the M.I.N.I. to the SCID-P for DSM-III-R and the CIDI (a structured interview developed by the World Health Organization for lay interviewers for ICD-10). The results of these studies show that the M.I.N.I. has acceptably high validation and reliability scores, but can be administered in a much shorter period of time (mean 18.7 ± 11.6 minutes, median 15 minutes) than the above referenced instruments. It can be used by clinicians, after a brief training session. Lay interviewers require more extensive training.

INTERVIEW:

In order to keep the interview as brief as possible, inform the patient that you will conduct a clinical interview that is more structured than usual, with very precise questions about psychological problems which require a yes or no answer.

GENERAL FORMAT:

The M.I.N.I. is divided into modules identified by letters, each corresponding to a diagnostic category.
- At the beginning of each diagnostic module (except for psychotic disorders module), screening question(s) corresponding to the main criteria of the disorder are presented in a gray box.
- At the end of each module, diagnostic box(es) permit the clinician to indicate whether diagnostic criteria are met.

CONVENTIONS:

*Sentences written in « normal font » should be read exactly as written to the patient in order to standardize the assessment of diagnostic criteria.

*Sentences written in « CAPITALS » should not be read to the patient. They are instructions for the interviewer to assist in the scoring of the diagnostic algorithms.

*Sentences written in « bold » indicate the time frame being investigated. The interviewer should read them as often as necessary. Only symptoms occurring during the time frame indicated should be considered in scoring the responses.

Answers with an arrow above them (→) indicate that one of the criteria necessary for the diagnosis(es) is not met. In this case, the interviewer should go to the end of the module, circle « NO » in all the diagnostic boxes and move to the next module.

When terms are separated by a slash (/) the interviewer should read only those symptoms known to be present in the patient (for example, question 65).

*Phrases in (parentheses) are clinical examples of the symptom. These may be read to the patient to clarify the question.

RATING INSTRUCTIONS:

All questions must be rated. The rating is done at the right of each question by circling either Yes or No. Clinical judgment by the rater should be used in coding the responses. The rater should ask for examples when necessary, to ensure accurate coding. The patient should be encouraged to ask for clarification on any question that is not absolutely clear.

The clinician should be sure that each dimension of the question is taken into account by the patient (for example, time frame, frequency, severity, and/or alternatives). Symptoms better accounted for by an organic cause or by the use of alcohol or drugs should not be coded positive in the MINI. The M.I.N.I. Plus has questions that investigate these issues.
A. MAJOR DEPRESSIVE EPISODE

(→ MEANS: GO TO THE DIAGNOSTIC BOXES, CIRCLE NO IN ALL DIAGNOSTIC BOXES, AND MOVE TO THE NEXT MODULE)

| A1 | Have you been consistently depressed or down, most of the day, nearly every day, for the past two weeks? | NO | YES |
| A2 | In the past two weeks, have you been much less interested in most things or much less able to enjoy the things you used to enjoy most of the time? | NO | YES |

IS A1 OR A2 CODED YES?

| A3 | Over the past two weeks, when you felt depressed or uninterested: |
| a | Was your appetite decreased or increased nearly every day? Did your weight decrease or increase without trying intentionally (i.e., by ±5% of body weight or ±8 lbs. or ±3.5 kgs., for a 160 lb./70 kg. person in a month)? |
| b | Did you have trouble sleeping nearly every night (difficulty falling asleep, waking up in the middle of the night, early morning wakening or sleeping excessively)? |
| c | Did you talk or move more slowly than normal or were you fidgety, restless or having trouble sitting still almost every day? |
| d | Did you feel tired or without energy almost every day? |
| e | Did you feel worthless or guilty almost every day? |

IF A3e = YES: ASK FOR AN EXAMPLE. THE EXAMPLE IS CONSISTENT WITH A DELUSIONAL IDEA. ◊ NO ◊ YES

| f | Did you have difficulty concentrating or making decisions almost every day? |
| g | Did you repeatedly consider hurting yourself, feel suicidal, or wish that you were dead? |

ARE 5 OR MORE ANSWERS (A1-A3) CODED YES?

| NO | YES * |

IF PATIENT HAS CURRENT MAJOR DEPRESSIVE EPISODE CONTINUE TO A4, OTHERWISE MOVE TO MODULE B:

| A4 | During your lifetime, did you have other episodes of two weeks or more when you felt depressed or uninterested in most things, and had most of the problems we just talked about? |
| b | In between 2 episodes of depression, did you ever have an interval of at least 2 months, without any depression and any loss of interest? |

| NO | YES |

MAJOR DEPRESSIVE EPISODE, CURRENT

MAJOR DEPRESSIVE EPISODE, RECURRENT
D. (HYPO) MANIC EPISODE

(→ MEANS: GO TO THE DIAGNOSTIC BOXES, CIRCLE NO IN ALL DIAGNOSTIC BOXES, AND MOVE TO THE NEXT MODULE)

Do you have any family history of manic depressive illness or bipolar disorder or a family member treated with a mood stabilizer, (like lithium, Depakote, Valproate, Lamictal or Tegretol)?

IF YES, PLEASE SPECIFY WHO: ____________________________

D1  a  Have you ever had a period of time when you were feeling ‘up’ or ‘high’ or ‘hyper’ or so full of energy or full of yourself that you get into trouble, or that other people thought you were not your usual self? (Do not consider times when you were intoxicated on drugs or alcohol.)

IF PATIENT IS PUZZLED OR UNCLEAR ABOUT WHAT YOU MEAN BY ‘UP’ OR ‘HIGH’ OR ‘HYPER’, CLARIFY AS FOLLOWS: By ‘up’ or ‘high’ or ‘hyper’ I mean: having elated mood; increased energy; needing less sleep; having rapid thoughts; being full of ideas; having an increase in productivity, motivation, creativity, or impulsive behavior.

IF NO, CODE NO TO D1b: IF YES ASK:

b  Are you currently feeling ‘up’ or ‘high’ or ‘hyper’ or full of energy?

D2  a  Have you ever been persistently irritable, for several days, so that you had arguments or verbal or physical fights, or shouted at people outside your family? Have you or others noticed that you have been more irritable or over reacted, compared to other people, even in situations that you felt were justified?

IF NO, CODE NO TO D2b: IF YES ASK:

b  Are you currently feeling persistently irritable?

IS D1a OR D2a CODED YES?

D3  IF D1b OR D2b = YES: EXPLORE THE CURRENT AND THE MOST SYMPTOMATIC PAST EPISODE, OTHERWISE IF D1b AND D2b = NO: EXPLORE ONLY THE MOST SYMPTOMATIC PAST EPISODE

During the times when you felt high, full of energy, or irritable did you:

<table>
<thead>
<tr>
<th></th>
<th>Current Episode</th>
<th>Past Episode</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Study Name
Subject ID: Initials: Visit Date (dd/mm/yyyy): NO YES NO YES
Rater Initials:
f Become so active or physically restless that others were worried about you? NO YES NO YES
g Want so much to engage in pleasurable activities that you ignored the risks or consequences (for example, spending sprees, reckless driving, or sexual indiscretions)? NO YES NO YES

D3 (summary): Are 3 or more D3 answers coded YES (or 4 or more if D1a is NO [in rating past episode] and D1b is NO [in rating current episode])? NO YES
Rule: Elation/excitement requires only three D3 symptoms while irritable mood alone requires 4 of the D3 symptoms.
Verify if the symptoms occurred during the same time period.

D4 Did these symptoms last at least a week and cause significant problems at home, at work, socially, or at school, or were you hospitalized for these problems? NO YES NO YES

The episode explored was a: □ □ □ □

Is D4 coded NO?
Specify if the episode is current or past.

Is D4 coded YES?
Specify if the episode is current or past.

Hypomanic Episode
Current □ Past □

Manic Episode
Current □ Past □
J. ALCOHOL ABUSE AND DEPENDENCE

Means: go to diagnostic boxes, circle NO in both and move to the next module.

<table>
<thead>
<tr>
<th>J1</th>
<th>In the past 3 months, have you had 3 or more alcoholic drinks within a 3 hour period on 3 or more occasions?</th>
<th>NO</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td>J2</td>
<td>In the past 3 months:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>Did you need to drink more in order to get the same effect that you got when you first started drinking?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>b</td>
<td>When you cut down on drinking did your hands shake, did you sweat or feel agitated? Did you drink to avoid these symptoms or to avoid being hungover, for example, “the shakes”, sweating or agitation?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>During the times when you drank alcohol, did you end up drinking more than you planned when you started?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>d</td>
<td>Have you tried to reduce or stop drinking alcohol but failed?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>e</td>
<td>On the days that you drank, did you spend substantial time in obtaining alcohol, drinking, or in recovering from the effects of alcohol?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>f</td>
<td>Did you spend less time working, enjoying hobbies, or being with others because of your drinking?</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>g</td>
<td>Have you continued to drink even though you knew that the drinking caused you health or mental problems?</td>
<td>NO</td>
<td>YES</td>
</tr>
</tbody>
</table>

**ARE 3 OR MORE J2 ANSWERS CODED YES?**

* IF YES, SKIP J3 QUESTIONS, CIRCLE N/A IN THE ABUSE BOX AND MOVE TO THE NEXT DISORDER. DEPENDENCE PREEMPTS ABUSE.

| J3 | In the past 3 months:                                                                                           |     |     |
| a  | Have you been intoxicated, high, or hungover more than once when you had other responsibilities at school, at work, or at home? Did this cause any problems? (CODE YES ONLY IF THIS CAUSED PROBLEMS.) | NO  | YES |
| b  | Were you intoxicated more than once in any situation where you were physically at risk, for example, driving a car, riding a motorbike, using machinery, boating, etc.? | NO  | YES |
| c  | Did you have legal problems more than once because of your drinking, for example, an arrest or disorderly conduct? | NO  | YES |
| d  | Did you continue to drink even though your drinking caused problems with your family or other people?           | NO  | YES |

**ARE 1 OR MORE J3 ANSWERS CODED YES?**

NO N/A YES

ALCOHOL ABUSE CURRENT
K. NON-ALCOHOL PSYCHOACTIVE SUBSTANCE USE DISORDERS

Now I am going to show you / read to you a list of street drugs or medicines.

K1 a In the past 3 months, did you take any of these drugs more than once, to get high, to feel better, or to change your mood? → NO YES

CIRCLE EACH DRUG TAKEN:
- Cocaine: snorting, IV, freebase, crack, "speedball".
- Narcotics: heroin, morphine, Dilaudid, opium, Demerol, methadone, codeine, Percodan, Darvon, OxyContin.
- Hallucinogens: LSD ("acid"), mescaline, peyote, PCP ("angel dust", "peace pill"), psilocybin, STP, "mushrooms", "ecstasy", MDA, MDMA, ketamine ("special K").
- Inhalants: "glue", ethyl chloride, "rush", nitrous oxide ("laughing gas"), amyl or butyl nitrate ("poppers").
- Marijuana: hashish ("hash"), THC, "pot", "grass", "weed", "reefer".
- Tranquilizers: Quaalude, Secinal ("reds"), Valium, Xanax, Librium, Ativan, Dalmane, Halcion, barbiturates, Miltown, GHB, Roofinol, "Roofies".
- Miscellaneous: steroids, nonprescription sleep or diet pills. Any others?

SPECIFY MOST USED DRUG(s): __________________________ CHECK ONE BOX

ONLY ONE DRUG / DRUG CLASS HAS BEEN USED

ONLY THE MOST USED DRUG CLASS IS INVESTIGATED.

EACH DRUG CLASS USED IS EXAMINED SEPARATELY (PHOTOCOPY K2 AND K3 AS NEEDED)

b SPECIFY WHICH DRUG/DRUG CLASS WILL BE EXPLORED IN THE INTERVIEW BELOW IF THERE IS CONCURRENT OR SEQUENTIAL POLYSUBSTANCE USE: ____________________________

K2 Considering your use of (NAME THE DRUG / DRUG CLASS SELECTED), in the past 3 months:

a Have you found that you needed to use more (NAME OF DRUG / DRUG CLASS SELECTED) to get the same effect that you did when you first started taking it? NO YES

b When you reduced or stopped using (NAME OF DRUG / DRUG CLASS SELECTED), did you have withdrawal symptoms (aches, shaking, fever, weakness, diarrhea, nausea, sweating, heart pounding, difficulty sleeping, or feeling agitated, anxious, irritable, or depressed)? Did you use any drug(s) to keep yourself from getting sick (withdrawal symptoms) or so that you would feel better?

IF YES TO EITHER, CODE YES.

c Have you often found that when you used (NAME OF DRUG / DRUG CLASS SELECTED), you ended up taking more than you thought you would? NO YES

d Have you tried to reduce or stop taking (NAME OF DRUG / DRUG CLASS SELECTED) but failed? NO YES

e On the days that you used (NAME OF DRUG / DRUG CLASS SELECTED), did you spend substantial time (~2 hours), obtaining, using or in recovering from the drug, or thinking about the drug? NO YES
Study Name
Subject ID: ___________ Initials: ___________ Visit Date (dd/mm/yyyy): ___________ Rater Initials: ___________

f  Did you spend less time working, enjoying hobbies, or being with family or friends because of your drug use?
NO  YES

ɡ  Have you continued to use (NAME OF DRUG / DRUG CLASS SELECTED), even though it caused you health or mental problems?
NO  YES

ARE 3 OR MORE K2 ANSWERS CODED YES?

SPECIFY DRUG(S): ______________________________

* IF YES, SKIP K3 QUESTIONS, CIRCLE N/A IN THE ABUSE BOX FOR THIS SUBSTANCE AND MOVE TO THE NEXT DISORDER. DEPENDENCE PREEMPTS ABUSE.

Considering your use of (NAME THE DRUG CLASS SELECTED), in the past 3 months:

K3
a  Have you been intoxicated, high, or hungover from (NAME OF DRUG / DRUG CLASS SELECTED) more than once, when you had other responsibilities at school, at work, or at home? Did this cause any problem?
NO  YES

(CODE YES ONLY IF THIS CAUSED PROBLEMS.)

b  Have you been high or intoxicated from (NAME OF DRUG / DRUG CLASS SELECTED) more than once in any situation where you were physically at risk (for example, driving a car, riding a motorbike, using machinery, boating, etc.)?
NO  YES

c  Did you have legal problems more than once because of your drug use, for example, an arrest or disorderly conduct?
NO  YES

d  Did you continue to use (NAME OF DRUG / DRUG CLASS SELECTED), even though it caused problems with your family or other people?
NO  YES

ARE 1 OR MORE K3 ANSWERS CODED YES?

SPECIFY DRUG(S): ______________________________

NO  N/A  YES

SUBSTANCE ABUSE CURRENT
**Study Name**

**Subject ID:**

**Initials:**

**Visit Date (dd/mm/yyyy):**

**Rater Initials:**

---

**L. PSYCHOTIC DISORDERS - Part 1**

Ask for an example of each question answered positively. Code **YES** only if the examples clearly show a distortion of thought or of perception or if they are not culturally appropriate. Before coding, investigate whether delusions qualify as "bizarre".

Delusions are "bizarre" if clearly implausible, absurd, not understandable, and cannot derive from ordinary life experience.

Hallucinations are scored "bizarre" if a voice comments on the person's thoughts or behavior, or when two or more voices are conversing with each other.

All of the patient's responses to the questions should be coded in column A. Use the clinician judgment column (column B) only if the clinician knows from other outside evidence (for example, family input) that the symptom is present but is being denied by the patient.

Now I am going to ask you about unusual experiences that some people have.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Response</td>
<td>Clinician Judgment (if necessary)</td>
</tr>
</tbody>
</table>

|a| b
|---|---
|Have you ever believed that people were spying on you, or that someone was plotting against you, or trying to hurt you?| NO | YES | YES | YES |
| if YES / YES BIZARRE: Do you currently believe these things?| NO | YES | YES |
| NOTE: Ask for examples, to rule out actual stalking. |

|a| b
|---|---
|Have you ever believed that someone was reading your mind or could hear your thoughts or that you could actually read someone's mind or hear what another person was thinking?| NO | YES | YES |
| if YES / YES BIZARRE: Do you currently believe these things?| NO | YES |

|a| b
|---|---
|Have you ever believed that someone or some force outside of yourself put thoughts in your mind that were not your own, or made you act in a way that was not your usual self? Have you ever felt that you were possessed?| NO | YES | YES |
| CLINICIAN: Ask for examples and discount any that are not psychotic. |
| if YES / YES BIZARRE: Do you currently believe these things?| NO | YES |

|a| b
|---|---
|Have you ever believed that you were being sent special messages through the TV, radio, or newspaper, or that a person you did not personally know was particularly interested in you?| NO | YES | YES |
| if YES / YES BIZARRE: Do you currently believe these things?| NO | YES |

|a| b
|---|---
<p>|Have your relatives or friends ever considered any of your beliefs strange or unusual?| NO | YES | YES |
| INTERVIEWER: Ask for examples. Code YES only if the examples are clearly delusional ideas (for example, somatic or religious delusions or delusions of grandiosity, jealousy, guilt, kin or destitution or others not explored in L1 to L4). |
| if YES / YES BIZARRE: Do they currently consider your beliefs strange?| NO | YES | YES | YES |</p>
<table>
<thead>
<tr>
<th>Study Name</th>
<th>Subject ID:</th>
<th>Initials:</th>
<th>Visit Date (dd/mm/yyyy):</th>
<th>Rater Initials:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>L6</th>
<th>Have you ever heard things other people couldn't hear, such as voices?</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>NO</td>
</tr>
<tr>
<td>b</td>
<td>YES</td>
</tr>
</tbody>
</table>

**Hallucinations are scored "Bizarre" only if patient answers yes to the following:**

**IF YES:** Did you hear a voice commenting on your thoughts or behavior, or did you hear two or more voices talking to each other?

| YES |    | YES |
|     | L6 |     |

<table>
<thead>
<tr>
<th>L7</th>
<th>Have you ever had visions when you were awake or have you ever seen things other people couldn't see?</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>NO</td>
</tr>
<tr>
<td>b</td>
<td>YES</td>
</tr>
</tbody>
</table>

**Clinician's judgment**

<table>
<thead>
<tr>
<th>L8</th>
<th>Is the patient currently exhibiting incoherence, disorganized speech, or marked loosening of associations?</th>
</tr>
</thead>
<tbody>
<tr>
<td>b</td>
<td>NO</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>L9</th>
<th>Is the patient currently exhibiting disorganized or catatonic behavior?</th>
</tr>
</thead>
<tbody>
<tr>
<td>b</td>
<td>NO</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>L10</th>
<th>Are negative symptoms of schizophrenia, for example, significant affective flattening, poverty of speech (alogia) or an inability to initiate or persist in goal-directed activities (avolition) prominent during the interview?</th>
</tr>
</thead>
<tbody>
<tr>
<td>b</td>
<td>NO</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>L11</th>
<th>Are there at least one &quot;YES&quot; from L1 to L10b?</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>NO</td>
</tr>
<tr>
<td>b</td>
<td>YES</td>
</tr>
</tbody>
</table>

**If yes, specify if the last episode is current (at least one "b" question is coded "yes" from L1b to L10b) and/or lifetime (any "a" or "b" question coded yes from L1a to L10b) and pass to the next diagnostic section.**

IF NO, continue.

**Psychotic disorder not otherwise specified**

- **Current**
- **Lifetime**

*Provisional diagnosis due to insufficient information available at this time.*

**WARNING:** If at least one "b" question is coded yes, code L11c and L11d. If all "b" questions are coded no, code only L11d.
Study Name
Subject ID:

L11c

Initials: Visit Date (dd/mm/yyyy):

Rater Initials:

OR

FROM L1b TO L6b: ARE ONE OR MORE "b" ITEMS CODED "YES BIZARRE"?

ARE TWO OR MORE "b" ITEMS FROM L1b TO L10b CODED "YES" BUT NOT "YES BIZARRE"?

AND DID AT LEAST TWO OF THE PSYCHOTIC SYMPTOMS OCCUR DURING THE SAME 1 MONTH PERIOD?

NO

Then Criterion "A" of Schizophrenia is not currently met

YES

Then Criterion "A" of Schizophrenia is currently met

L11d

FROM L1a TO L6a: ARE ONE OR MORE "a" ITEMS CODED "YES BIZARRE"

OR

ARE TWO OR MORE "a" ITEMS CODED FROM L1a TO L7a "YES" BUT NOT "YES BIZARRE"?

(CHECK THAT AT LEAST 2 ITEMS OCCURRED DURING THE SAME 1 MONTH PERIOD.)

NO

Then Criterion "A" of Schizophrenia is not met Lifetime

YES

Then Criterion "A" of Schizophrenia is met Lifetime

OR

IS L11c CODED "YES"

L12a

Were you taking any drugs or medicines just before these symptoms began?

☐ No ☐ Yes

b

Did you have any medical illness just before these symptoms began?

☐ No ☐ Yes

c

IN THE CLINICIAN'S JUDGMENT, ARE EITHER OF THESE LIKELY TO BE DIRECT CAUSES OF THE PATIENT'S PSYCHOSIS?

(IF NECESSARY, ASK OTHER OPEN-ENDED QUESTIONS.)

☐ No ☐ Yes

d

HAS AN ORGANIC CAUSE BEEN RULED OUT?

☐ No ☐ Yes ☐ UNCERTAIN

IF L12d = NO: SCORE L13 (a, b) AND GO TO THE NEXT DISORDER

IF L12d = YES: CODE NO IN L13 (a, b) AND GO TO L14

IF L12d = UNCERTAIN: CODE UNCERTAIN IN L13 (a, b) AND GO TO L14
Study Name
Subject ID: Initials: Visit Date (dd/mm/yyyy): Rater Initials:

L13a Is L12d coded no because of a general medical condition?
If yes, specify if the last episode is
current (at least one "b" question is coded yes from L1b to L10b)
and/or lifetime ("a" or "b") question is coded yes from L1a to L10b.

L13b Is L12d coded no because of a drug?
If yes, specify if the last episode is
current (at least one question "b" is coded yes from L1b to L10b)
and/or lifetime (any "a" or "b" question coded yes from L1a to L10b).

L14 How long was the longest period during which you had those beliefs or experiences?
If <1 day, go to the next section.

L15a During or after a period when you had these beliefs or experiences, did you have difficulty working, or difficulty in your relationships with others, or in taking care of yourself?
   b If yes, how long did these difficulties last?
   If ≤6 months, go to L16.
   c Have you been treated with medications or were you hospitalized because of these beliefs or experiences, or the difficulties caused by these problems?
   d If yes, what was the longest time you were treated with medication or were hospitalized for these problems?

L16a The patient reported disability (L15a coded yes) or was treated or hospitalized for psychosis (L15c = yes).
   b Clinician’s judgment: Considering your experience, rate the patient’s lifetime disability caused by the psychosis.
   
   absent □ 1
   mild □ 2
   moderate □ 3
   severe □ 4

L17 What was the total duration of the psychosis, taking into account the active phase (L14) and the associated difficulties (L15b) and psychiatric treatment (L15d).

L18a How old were you when you first began having these unusual beliefs or experiences?
   b Since the first onset how many distinct times did you have significant episodes of these unusual beliefs or experiences?
PSYCHOTIC DISORDERS - PART 2

DIFFERENTIAL DIAGNOSIS BETWEEN PSYCHOTIC AND MOOD DISORDERS

CODE THE QUESTIONS L19 TO L23 ONLY IF THE PATIENT DESCRIBED AT LEAST 1 PSYCHOTIC SYMPTOM (L11a = YES AND L11b = NO), NOT EXPLAINED BY AN ORGANIC CAUSE (L11d = YES OR UNCERTAIN).

L19  a. DOES THE PATIENT CODE POSITIVE FOR CURRENT AND/OR PAST MAJOR DEPRESSIVE EPISODE (QUESTIONS A3 SUMMARY OR A4b CODED YES)?

   NO  YES

   b. IF YES: Is A1 (DEPRESSED MOOD) CODED YES?

   NO  YES

   c. DOES THE PATIENT CODE POSITIVE FOR CURRENT AND/OR PAST MANIC EPISODE (QUESTION D4 IS CODED YES)?

   NO  YES

   d. Is L19a or L19c coded YES?

   NO  YES

   ↓

   STOP.

NOTE: VERIFY THAT THE RESPONSES TO THE QUESTIONS L20 TO L23 REFER TO THE PSYCHOTIC, DEPRESSIVE (A3 SUMMARY OR A4b) AND MANIC EPISODES (D4), ALREADY IDENTIFIED IN L11c AND L11d, A3 SUMMARY OR A4b AND D4.
IN CASE OF DISCREPANCIES, REEXAMINE THE SEQUENCE OF DISORDERS, TAKING INTO ACCOUNT IMPORTANT LIFE ANCHOR POINTS/MILESTONES AND CODE L20 TO L23 ACCORDINGLY.

L20  When you were having the beliefs and experiences you just described (GIVE EXAMPLES TO PATIENT), were you also feeling depressed/high/irritable at the same time?

   NO  YES

   ↓

   STOP.

   Skip to L24

L21  Were the beliefs or experiences you just described (GIVE EXAMPLES TO PATIENT) restricted exclusively to times you were feeling depressed/high/irritable?

   NO  YES

L22  Have you ever had a period of two weeks or more of having these beliefs or experiences when you were not feeling depressed/high/irritable?

   NO  YES

   ↓

   STOP.

   Skip to L24

L23  a) Which lasted longer: these beliefs or experiences or the periods of feeling depressed/high/irritable?

   1  mood

   2  beliefs, experiences

   3  same

   IF THE RESPONSE TO L23b WAS 2, ASK L23b) AND L23c).

   b) Did the beliefs or experiences you just described (GIVE EXAMPLES OF DELUSIONS OR HALLUCINATIONS TO PATIENT) occur for at least 2 weeks without your also feeling depressed/high/irritable?

   NO  YES

   c) Did the depressed/high/irritable feelings last more than 50% of the total time that you had these beliefs and experiences? (GIVE EXAMPLES TO PATIENT)

   NO  YES

L24  AT THE END OF THE INTERVIEW, GO TO THE DIAGNOSTIC ALGORITHM FOR PSYCHOTIC DISORDERS.

CONSULT ITEMS L11a AND L11b:

IF THE CRITERION "A" OF SCHIZOPHRENIA IS MET (L11c AND/OR L11d = YES) GO TO DIAGNOSTIC ALGORITHM I

IF THE CRITERION "A" OF SCHIZOPHRENIA IS NOT MET (L11c AND/OR L11d = NO) GO TO DIAGNOSTIC ALGORITHM II

FOR MOOD DISORDERS GO TO THE DIAGNOSTIC ALGORITHM III.
For both current and life-time diagnosis circle the appropriate diagnostic box (separately if necessary). One positive diagnosis excludes the others for that time frame. If criterion A of schizophrenia is not currently met, but is present life-time, current and life-time diagnoses may be different.
PSYCHOTIC DISORDERS: DIAGNOSTIC ALGORITHM II

For both current and life-time diagnoses circle the appropriate diagnostic box (separately if necessary). One diagnosis excludes the others for that time frame. If criterion A of schizophrenia is present life-time, current and life-time diagnoses may be different.

Criterion "A" of Schizophrenia Not Met

Psychotic only during Mood Episode
L21 = YES
AND
L22 = NO

Psychotic without Mood Episode
L 19d = NO
OR
L 20 = NO

Psychotic and Mood Episode sometimes together
L 1 = NO
AND
L 22 = YES

Mood Disorder with Psychotic Features Life-time
Go to Mood Disorders: Diagnostic Algorithm III

Psychotic Sx last longer
L 23 = 2

Psychotic Sx last longer or the same
L 23 = 1 OR L23 = 3

Duration < 1 month
L 17 = 1

Duration > 1 month
L 17 = 2 or L17 = 3

Either an auditory or visual hallucination is prominent
(L6 or L7 = YES)

There is at least one non-bizarre delusion
(L1 or L2 or L4 = YES)

Dysfunction Absent
L 16a = NO
and L16b = 1

Dysfunction Present
L16a = YES
or L16b = 2, 3 or 4

Brief Psychotic Disorder
Current
Life-time

Psychotic Disorder NOS
Current
Life-time

Mood Disorder with Psychotic Features or Mood Disorder NOS
<table>
<thead>
<tr>
<th>MODULE M:</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 a IS L20 CODED NO?</td>
<td>NO</td>
<td>YES</td>
<td>* GO TO 2c</td>
</tr>
<tr>
<td>b IS L21 CODED NO AND L22 CODED YES?</td>
<td>NO</td>
<td>YES</td>
<td>* CODE NO IN 2c, 2d AND 2e</td>
</tr>
<tr>
<td>c IS L21 CODED YES OR L22 CODED NO?</td>
<td>NO</td>
<td>YES</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MODULES A and D:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2 a IS A DELUSIONAL IDEA IDENTIFIED IN A3e?</td>
<td>No ☐</td>
<td>Yes ☐</td>
</tr>
<tr>
<td>b IS A DELUSIONAL IDEA IDENTIFIED IN D3a?</td>
<td>No ☐</td>
<td>Yes ☐</td>
</tr>
</tbody>
</table>
| c Is a Major Depressive Episode present?  
and is a Hypomanic and Manic Episodes absent?  
Specify: WITHOUT Psychotic Features: IF 1a = YES and 2a = NO  
WITH Psychotic Features: IF 1a = NO and 2a = YES  
Specify if last depressive episode is current or past | NO | YES |
| d Is a Manic Episode present?  
Specify: WITHOUT Psychotic Features: IF 1a = YES and 2a = NO and 2b = NO  
WITH Psychotic Features: IF 1a = NO and 2a = YES and 2b = YES  
Specify if the last mood episode is current or past | NO | YES |
| e Is a Major Depressive Episode present?  
and a Hypomanic Episode present?  
and a Manic Episode absent?  
Specify if the last mood episode is current or past | NO | YES |
Appendix B – Physical Activity Readiness Questionnaire

PAR-Q & YOU

(A Questionnaire for People Aged 15 to 69)

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe for most people. However, some people should check with their doctor before they start becoming much more physically active.

If you are planning to become much more physically active than you are now, start by answering the seven questions in the box below. If you are between the ages of 15 and 69, the PAR-Q will tell you if you should check with your doctor before you start. If you are over 69 years of age, and you are not used to being very active, check with your doctor.

Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly: check YES or NO.

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?</td>
<td></td>
</tr>
<tr>
<td>2. Do you feel pain in your chest when you do physical activity?</td>
<td></td>
</tr>
<tr>
<td>3. In the past month, have you had chest pain when you were not doing physical activity?</td>
<td></td>
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<tr>
<td>4. Do you lose your balance because of dizziness or do you ever lose consciousness?</td>
<td></td>
</tr>
<tr>
<td>5. Do you have a bone or joint problem (for example, back, knee or hip) that could be made worse by a change in your physical activity?</td>
<td></td>
</tr>
<tr>
<td>6. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?</td>
<td></td>
</tr>
<tr>
<td>7. Do you know of any other reason why you should not do physical activity?</td>
<td></td>
</tr>
</tbody>
</table>

If you answered YES to one or more questions

Talk with your doctor by phone or in person BEFORE you start becoming much more physically active or BEFORE you have a fitness appraisal. Tell your doctor about the PAR-Q and which questions you answered YES.

- You may be able to do any activity you want — as long as you start slowly and build up gradually. Or, you may need to restrict your activities to those which are safe for you. Talk with your doctor about the kinds of activities you wish to participate in and follow his/her advice.
- Find out which community programs are safe and helpful for you.

If you answered NO honestly to all PAR-Q questions, you can be reasonably sure that you can:
- Start becoming much more physically active — begin slowly and build up gradually. This is the safest and easiest way to go.
- Take part in a fitness appraisal — this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively. It is also highly recommended that you have your blood pressure evaluated. If your reading is over 144/94, talk with your doctor before you start becoming much more physically active.

DELAY BECOMING MUCH MORE ACTIVE:
- If you are not feeling well because of a temporary illness such as a cold or a fever — wait until you feel better; or
- If you are or may be pregnant — talk to your doctor before you start becoming more active.

PLEASE NOTE: If your health changes so that you then answer YES to any of the above questions, tell your fitness or health professional. Ask whether you should change your physical activity plan.

Informed Use of the PAR-Q: The Canadian Society for Exercise Physiology, Health Canada, and their agents assume no liability for persons who undertake physical activity, and if in doubt after completing this questionnaire, consult your doctor prior to physical activity.

No changes permitted. You are encouraged to photocopy the PAR-Q but only if you use the entire form.

NOTE: If the PAR-Q is being given to a person before he or she participates in a physical activity program or a fitness appraisal, this section may be used for legal or administrative purposes.

"I have read, understood and completed this questionnaire. Any questions I had were answered to my full satisfaction."

NAME ____________________________

SIGNATURE ____________________________

SIGNATURE OF PARENT or GUARDIAN (for participants under the age of majority) ____________________________

DATE ____________________________

WITNESS ____________________________

Note: This physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if your condition changes so that you would answer YES to any of the seven questions.

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Appendix C – MacArthur Competence Assessment Tool For Clinical Research

Understanding

U-1 Nature of Project

“You have been asked to be in a research study to examine how people with schizophrenia respond emotionally to a small amount of physical activity. We also want to see what your response to physical activity can tell us about your typical physical activity levels. We are asking you to participate because you have schizophrenia. The study lasts for two sessions within a single week. The total time commitment is about 2 hours. The first session will be a little longer than the second because you need to fill out some questionnaires before we begin. In one session you will be asked to sit quietly, in the other you will be asked to do 14 minutes of physical activity. During the sessions you will be asked to fill out a few questionnaires and answer questions about how you are feeling emotionally.”

“Do you have any questions about what I just said?”

Can you tell me your understanding of what I just said?”

[Record responses below]

a) Purpose of study

[If subject fails to mention spontaneously, ask: “What is the purpose of the research study I described to you?”]

b) Duration of study

[If subject fails to mention spontaneously, ask: “How long will the research study last?”]

c) Interview

[If subject fails to mention spontaneously, ask: “How many sessions are there?”]

d) Nature of interview questions

[If subject fails to mention spontaneously, ask: “What will you be asked to do in the two sessions?”]
**U-2 Primary purpose is research, not a physical activity program.**

“It is important for you to understand that the study in which you have been asked to participate in is a research study. That means its main purpose is to help researchers better understand the relationship between emotions and physical activity for persons with schizophrenia. The main purpose of the study is to evaluate a single bout of physical activity. We are not to evaluating an entire program, nor are we offering such a program.”

“Do you have any questions about what I just said?”

Can you tell me your understanding of what I just said?”

[Record responses below]

**U-3 Benefits of participation**

“There are no direct benefits guaranteed to you from taking part in this study. However, this study will give you an opportunity to reflect on your thoughts and feelings regarding physical activity. From this study, researchers hope to get results that will allow them to improve the care people with schizophrenia receive.”

“Do you have any questions about what I just said?”

Can you tell me your understanding of what I just said?”

[Record responses below]

a) **Personal benefit**

   [If subject fails to mention spontaneously, ask: “In what way might people who volunteer be better off by being in this research study?”]

b) **Societal Benefit**

   [If subject fails to mention spontaneously, ask: “What might researchers learn about physical activity if people decide to be in this research study?”]
U-4 Risks/Discomforts of Participation

“There are minor risks and discomforts to which people in this study will be exposed. In particular, there is a risk of heart complications during exercise for people in the general population. This risk is estimated to be approximately 1 in 8,000-18,000. As the physical activity that is to be performed in this study is similar to the physical activity that would be performed as a normal part of daily activities (such as walking quickly to make an appointment) we do not believe you are at any elevated risk as a result of participating in this research. Some people who do not do this kind of physical activity on a regular basis may feel some muscles soreness after participating, but this is temporary. You will also be asked to respond to questions about your feelings and emotions during, and some people may find this uncomfortable. You should only respond to questions you feel comfortable with. However, it is important for you to be honest with the answers to questions you give to ensure the other risks remains low.”

“Do you have any questions about what I just said?”

Can you tell me your understanding of what I just said?”

[Record responses below]

a) Health risk (e.g. cardiovascular complication)

[If subject fails to mention spontaneously, ask: “What health risks may people be exposed to if they volunteer in this study?”]

b) Discomfort after physical activity

[If subject fails to mention spontaneously, ask: “How might people feel after doing physical activity?”]

c) Telling others about how you feel/only answer questions you feel comfortable answering

[If subject fails to mention spontaneously, ask: “What uncomfortable things will you be asked about?”]

U-5 Ability to Withdraw

“No one has to be in this study. People who agree to be in this research study can change their minds at any time. If they don’t agree to be in this study or if they decide to stop, they may do so
without giving a reason, with no repercussions to their healthcare and with no disadvantage to themselves.”

“Do you have any questions about what I just said?”

Can you tell me your understanding of what I just said?”

[Record responses below]

[If subject fails to mention spontaneously, ask: “What will happen if a person refuses to be in the study, or decides to stop once it begins?”]

**Appreciation**

*Subject believes that his or her personal benefits are not the primary objective of the study*

“Do you believe that you have been asked to be in this study primarily for your personal benefit?”

Then ask: “What makes you believe that this (was/wasn’t) the reason you were asked?

[Record responses below]

*Subject believes that a personal decision to decline/withdraw will be honoured*

“What do you believe will happen if you were to decide not to be in the study?”

Then ask: “What makes you believe that this would happen?

[Record responses below]

**Expressing a Choice**

“As you know, you have been invited to participate in a research study to evaluate how people with schizophrenia feel during physical activity. Do you think you are more likely to want to participate or not to want to participate?”

[Record responses below]
Reasoning

R-1/R-2 Consequential and comparative meaning

“You think that you are more likely to want (insert subject’s first choice) in the study. Tell me what it is that makes that option better than the other.”

[Record responses below]

R-3 Generating consequences

“I told you about some of the possible benefits and risks or discomforts of participating in the research study. The benefits are the opportunity to reflect on one’s thoughts and feelings regarding physical activity, and that the study will help researchers improve care for persons with schizophrenia. The risks and discomforts are that some people may experience a heart complication, they may be sore after physical activity, and that they might be asked questions they feel uncomfortable about. What are some ways that these could affect your everyday activities if you participate in the research study?”

[Record responses below]

[If subject fails to mention a consequence of either the benefits or the risks/discomforts, ask: “How might (restate benefit or risk) affect your everyday life?”]

Final Choice

“A few minutes ago you told me that you favoured participating/not participating in the research study. What do you think now that we have discussed everything? What do you want to do?”

[Record choice below]

Reasoning

R-4 Logical consistency of choice

[Interviewer records and explains presence or absence of logical consistency in subject’s choice.]
Understanding (Each item is rated 0 – 2)

1. Nature of project
   a) _______________________________________
   b) _______________________________________
   c) _______________________________________
   d) _______________________________________

   Subtotal: ______

2. Primary purpose is research: ______

   Subtotal: ______

3. Benefits
   a) _______________________________________
   b) _______________________________________

   Subtotal: ______

4. Risks/Discomforts
   a) _______________________________________
   b) _______________________________________
   c) _______________________________________

   Subtotal: ______
5. Ability to withdraw: ________

Subtotal: ________

TOTAL Understanding Score (0-22)

Appreciation (Each item is rated 0 – 2)

1. Object not personal benefit: _____________
2. Withdrawal possible: __________

TOTAL Appreciation Score (0-4)

Reasoning (Each item is rated 0 – 2)

1. Consequential reasoning: _____________
2. Comparative reasoning: _____________
3. Generating consequences: _____________
4. Logical consistency of choice: _________

TOTAL Reasoning Score (0-8)

Expressing a Choice (Rate 0 – 2): __________

TOTAL Expressing a Choice Score (0-2)
Appendix D – Feeling Scale

**Feeling Scale (FS)**  
(Hardy & Rejeski, 1989)

While participating in exercise, it is common to experience changes in mood. Some individuals find exercise pleasurable, whereas others find it to be unpleasant. Additionally, feeling may fluctuate across time. That is, one might feel good and bad a number of times during exercise. Scientists have developed this scale to measure such responses.

+5  Very good  
+4  
+3  Good  
+2  
+1  Fairly good  
0  Neutral  
-1  Fairly bad  
-2  
-3  Bad  
-4  
-5  Very bad
Appendix E – Felt Arousal Scale

FELT AROUSAL SCALE (FAS)
(Svebak & Murgatroyd, 1985)
Estimate here how aroused you actually feel. Do this by circling the appropriate number. By “arousal” we meant how “worked-up” you feel. You might experience high arousal in one of a variety of ways, for example as excitement or anxiety or anger. Low arousal might also be experienced by you in one of a number of different ways, for example as relaxation or boredom or calmness.

-5 – Low Arousal
-4
-3
-2
-1
0
1
2
3
4
5 – High Arousal
Appendix F – Positive and Negative Affect Schedule

Worksheet 3.1  The Positive and Negative Affect Schedule (PANAS; Watson et al., 1988)

PANAS Questionnaire
This scale consists of a number of words that describe different feelings and emotions. Read each item and then list the number from the scale below next to each word. Indicate to what extent you feel this way right now, that is, at the present moment OR indicate the extent you have felt this way over the past week (circle the instructions you followed when taking this measure)

<table>
<thead>
<tr>
<th></th>
<th>1 Very Slightly or Not at All</th>
<th>2 A Little</th>
<th>3 Moderately</th>
<th>4 Quite a Bit</th>
<th>5 Extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Interested</td>
<td>11. Irritable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Distressed</td>
<td>12. Alert</td>
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<td></td>
<td>3. Excited</td>
<td>13. Ashamed</td>
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<td></td>
<td>5. Strong</td>
<td>15. Nervous</td>
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<td></td>
<td>7. Scared</td>
<td>17. Attentive</td>
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<td></td>
<td>8. Hostile</td>
<td>18. Jittery</td>
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<td></td>
<td>9. Enthusiastic</td>
<td>19. Active</td>
<td></td>
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Scoring Instructions:
Positive Affect Score: Add the scores on items 1, 3, 5, 9, 10, 12, 14, 16, 17, and 19. Scores can range from 10 – 50, with higher scores representing higher levels of positive affect. Mean Scores: Momentary = 29.7 ($SD = 7.9$); Weekly = 33.3 ($SD = 7.2$)

Negative Affect Score: Add the scores on items 2, 4, 6, 7, 8, 11, 13, 15, 18, and 20. Scores can range from 10 – 50, with lower scores representing lower levels of negative affect. Mean Score: Momentary = 14.8 ($SD = 5.4$); Weekly = 17.4 ($SD = 6.2$)

**Appendix G – Brief Psychiatric Rating Scale**

**DIRECTIONS:** There are 18 items to be rated. Half of the items (items 3,4,6,7,13,14,16,17 and 18)** should be rated on the basis of observations made during the interview. For these items, 1 = Not Observed. The remaining items should be rated on the basis of reported (i.e. Subjective) information pertaining to the past month. For these items 1 = not reported.

<p>| | |</p>
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| **1.** | **SOMATIC CONCERN:** Degree of concern over present bodily health rate the degree to which physical health is perceived as a problem by the patient, whether the complaints have a realistic basis or not. Do not rate mere reporting of somatic symptoms. Rate only concerns for (or worrying about) physical problems (real or imagined).

  "Have you been concerned about your physical health?"  "Have you had any physical illness or seen a medical doctor lately? (What does your doctor say is wrong? How serious is it?)"

  "Has anything changed regarding your appearance?"

  "Has it interfered with your ability to perform your usual activities and/or work?"

  "How often are you concerned about [use individual's description]?"

  "Have you expressed any of these concerns to others?"

  1 = Not Reported.

  2 = Very Mild: Occasionally is somewhat concerned about body, symptoms, or physical illness.

  3 = Mild: Occasionally is moderately concerned about body, or often is somewhat concerned.

  4 = Moderate: Occasionally id very concerned, or often is moderately concerned.

  5 = Moderately Severe: Often is very concerned.

  6 = Severe: Is very concerned.

  7 = Very Severe: Is very concerned nearly all of the time.

| **2.** | **ANXIETY:** Worry, fear, or overconcern for present or future. Rate solely on the basis of verbal report of patient’s own subjective experiences. Do not infer anxiety from physical signs or from neurotic defense mechanism. Do not rate if restricted to somatic concern.

  "Have you been worried a lot during the past month? Have you been nervous or apprehensive? (What do you worry about?)"

  "Are you concerned about anything? How about finances or the future?"

  "When you are feeling nervous, do your palms sweat or does your heart beat fast (or shortness of breath, trembling, choking)?"

  "How much of the time have you been [use individual's description]?"

  "Has it interfered with your ability to perform your usual activities/work?"

  1 = Not Reported.

  2 = Very Mild: Occasionally feels somewhat anxious.

  3 = Mild: Occasionally feels moderately anxious, or often feels somewhat anxious.

  4 = Moderate: Occasionally feels very anxious, or often feels moderately anxious.

  5 = Moderately Severe: Often feels very anxious.

  6 = Severe: Feels very anxious most of the time.

  7 = Very Severe: Feels very anxious nearly all of the time.

| **3.*** | **EMOTIONAL WITHDRAWAL:** Deficiency in resisting to the interviewer and to the interview
situation. Overt manifestations of this deficiency include poor/absence of eye contact, failure to orient oneself physically toward the interviewer, and a general lack of involvement or engagement in the interview. Distinguish from BLUNTED AFFECT, in which deficits in facial expression, body gesture, and voice pattern are scored.

1 = Not Reported  
2 = Very Mild: e.g. Occasionally exhibits poor eye contact  
3 = Mild: e.g. Above but more frequent.  
4 = Moderate: e.g. Exhibits little eye contact, but still seems engaged in the interview and is appropriately responsive to all questions.  
5 = Moderately Severe: e.g. Stares at floor or orients self away from interviewer, but still seems moderately engaged.  
6 = Severe: e.g. As above, but more persistent or pervasive.  
7 = Very Severe: e.g. Appeared “spacey” or “out of it” (total absence of emotional relatedness) and is disproportionately uninvolved or unengaged in the interview.  
(DO NOT SCORE IF EXPLAINED BY DISORIENTATION.)

4.* CONCEPTUAL DISORGANIZATION: Degree of speech incomprehensibility. Include any type of formal thought disorder (e.g. Loose associations, incoherence, flight of ideas, neologisms). DO NOT include mere circumstantially or pressured speech, even if marked. DO NOT rate on the patient’s subjective impressions (e.g. “My thoughts are racing. I can’t hold a thought.” “My thinking gets all mixed up”). Rate ONLY on the basis of observations made during the interview.

1 = Not Reported  
2 = Very Mild: e.g. Somewhat vague, but of doubtful clinical significance.  
3 = Mild: Frequently vague, but the interview is able to progress.  
4 = Moderate: Occasional irrelevant statements, infrequent use of neologisms, or moderate loosening of associations.  
5 = Moderately Severe: As above, but more frequent.  
6 = Severe: Formal thought disorder is present for most of the interview, and the interview is severely strained.  
7 = Very Severe: Very little coherent information can be obtained.

5. GUILT FEELINGS: Overconcern or remorse for past behavior. Rate on the patient’s subjective experiences of guilt as evidenced by verbal report. Do not infer guilt feelings from depression, anxiety, or neurotic defenses.

"Is there anything you feel guilty about? Have you been thinking about past problems?"  
"Do you tend to blame yourself for things that have happened?"  
"Have you done anything you're still ashamed of?"  
"How often have you been thinking about [use individual's description]?"  
"Have you disclosed your feelings of guilt to others?"

1 = Not Reported  
2 = Very Mild: Occasionally feels somewhat guilty  
3 = Mild: Occasionally feels somewhat guilty, or often feels somewhat guilty.  
4 = Moderate: Occasionally feels very guilty, or often feels moderately guilty.  
5 = Moderately Severe: Often feels very guilty.
<table>
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<tr>
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<th>TENSION: Rate motor restlessness (agitation) observed during the interview. DO NOT rate on the basis of subjective experiences reported by the patient. Disregard suspected pathogenesis (e.g. tardive dyskinesia).</th>
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<tbody>
<tr>
<td>1</td>
<td>Not Reported</td>
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<tr>
<td>2</td>
<td>Very Mild: Occasionally fidgets.</td>
</tr>
<tr>
<td>3</td>
<td>Mild: e.g. Frequently fidgets.</td>
</tr>
<tr>
<td>4</td>
<td>Moderate: e.g. Constantly fidgets or frequently fidgets. Wrings hands and pulls clothing.</td>
</tr>
<tr>
<td>5</td>
<td>Moderately Severe: e.g. Constantly fidgets. Wrings hands and pulls clothing.</td>
</tr>
<tr>
<td>6</td>
<td>Severe: e.g. Cannot remain seated (i.e. must pace).</td>
</tr>
<tr>
<td>7</td>
<td>Very Severe: e.g. Paces in a frantic manner.</td>
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<tbody>
<tr>
<td>1</td>
<td>Not Reported</td>
</tr>
<tr>
<td>2</td>
<td>Very Mild: odd behavior but of doubtful clinical significance, e.g. occasional unprompted smiling, infrequent lip movements.</td>
</tr>
<tr>
<td>3</td>
<td>Mild: Strange behavior but not obviously bizarre, e.g. infrequent head-tilting (from side to side) in a rhythmic fashion, intermittent abnormal finger movements.</td>
</tr>
<tr>
<td>4</td>
<td>Moderate: e.g. Assumes yoga position for a brief period of time, infrequent tongue protrusions, rocking.</td>
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<td>5</td>
<td>Moderately Severely Severe: e.g. Assumes and maintains yoga position throughout interview, unusual movements in several body areas.</td>
</tr>
<tr>
<td>6</td>
<td>Severe: As above, but more frequent, intense, or pervasive.</td>
</tr>
<tr>
<td>7</td>
<td>Very Severe: e.g. Bizarre posturing throughout most of the interview, continuous abnormal movements in several body areas.</td>
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<tr>
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<th>GRANDIOSITY: Inflated self-esteem (self-confidence), or inflated appraisal of one’s talents, powers, abilities, accomplishments, knowledge, importance, or identity. Do not score mere grandiose quality of claims (e.g. “I’m the worst sinner in the world.” “The entire country is trying to kill me”) unless the guilt/persecution is related to some special exaggerated attribute of the individual. Also, the patient must claim exaggerated attributes: e.g. If patient denies talents, powers etc., even if he/she states that others indicate that he/she has these attributes, this item should not be scored.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Not Reported</td>
</tr>
<tr>
<td>2</td>
<td>Very Mild: e.g. Is more confident than most people, but of only possible clinical significance.</td>
</tr>
<tr>
<td>3</td>
<td>Mild: e.g. Definitely inflated self-esteem or exaggerates talents somewhat out of proportion to the circumstances.</td>
</tr>
</tbody>
</table>
| 4 | Moderate: e.g. Inflated self-esteem clearly out of proportion to the circumstances, or suspected
grandiose delusion(s).
5 = Moderately Severe: e.g. A single (definite) encapsulated grandiose delusion, or multiple fragmentary grandiose delusion.
6 = Severe: e.g. A single (definite) grandiose delusion/delusional system, or multiple (definite) grandiose delusions that the patient seem preoccupied with.
7 = Very Severe: e.g. As above, but nearly all conversation is directed towards the patient’s grandiose delusion(s).

9. **DEPRESSIVE MOOD:** Subjective report of feeling depressed, blue, “down in the dump.” etc. Rate only the degree of reported depression. Do not rate on the basis of inferences concerning depression based upon general retardation and somatic complaints.

"How has your mood been recently? Have you felt depressed (sad, down, unhappy, as if you didn't care)?"
"Are you able to switch your attention to more pleasant topics when you want to?"
"Do you find that you have lost interest in or get less pleasure from things you used to enjoy, like family, friends, hobbies, watching TV, eating?"
"How long do these feelings last?" "Has it interfered with your ability to perform your usual activities?"

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Not Reported</td>
</tr>
<tr>
<td>2</td>
<td>Very Mild: Occasionally feels somewhat depressed.</td>
</tr>
<tr>
<td>3</td>
<td>Mild: Occasionally feels moderately depressed, or often feels somewhat depressed.</td>
</tr>
<tr>
<td>4</td>
<td>Moderate: Occasionally feels very depressed, or often feels moderately depressed.</td>
</tr>
<tr>
<td>5</td>
<td>Moderately Severe: Often feels very depressed.</td>
</tr>
<tr>
<td>6</td>
<td>Severe: Feels very depressed most of the time.</td>
</tr>
<tr>
<td>7</td>
<td>Very Severe: Feels very depressed nearly all of the time.</td>
</tr>
</tbody>
</table>

10. **HOSTILITY:** Animosity, contempt, belligerence, disdain for other people outside the interview situation. Rate solely on the basis of the verbal report of feelings and actions of the patient toward others. Do not infer hostility from neurotic defenses, anxiety or somatic complaints.

"How have you been getting along with people (family, co-workers, etc.)?"
"Have you been irritable or grumpy lately? (How do you show it? Do you keep it to yourself?)"
"Were you ever so irritable that you would shout at people or start fights or arguments? (Have you found yourself yelling at people you didn't know?)"
"Have you hit anyone recently?"

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Not Reported</td>
</tr>
<tr>
<td>2</td>
<td>Very Mild: Occasionally feels somewhat angry.</td>
</tr>
<tr>
<td>3</td>
<td>Mild: Often feels somewhat angry, or occasionally feels moderately angry.</td>
</tr>
<tr>
<td>4</td>
<td>Moderate: Occasionally feels very angry, or often feels moderately angry.</td>
</tr>
<tr>
<td>5</td>
<td>Moderately Severe: Often feels very angry.</td>
</tr>
<tr>
<td>6</td>
<td>Severe: Has acted on his anger by becoming verbally or physically abusive on one or two occasions.</td>
</tr>
<tr>
<td>7</td>
<td>Very Severe: Has acted on his anger on several occasions.</td>
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Appendix H – Clinical Global Impression

CGI SCALE

Rater: ______________
Patient ID: _____________
Date: ______________

CLINICAL GLOBAL IMPRESSION

1. SEVERITY OF ILLNESS

Considering your total clinical experience with this particular population, how mentally ill is this patient at this time?

0 = Not assessed
1 = Normal, not at all ill
2 = Borderline, mentally ill
3 = Mildly ill
4 = Moderately ill
5 = Markedly ill
6 = Severely ill
7 = Among the most extremely ill patients

Rating =
Appendix I – Apathy Evaluation Scale

Apathy Evaluation Scale (Self-rated)

Name: ___________________________________________ Date: __/__/____

For each statement, circle the answer that best describes the subject’s thoughts, feelings, and activity in the past 4 weeks.

1. I am interested in things.
   NOT AT ALL  SLIGHTLY  SOMewhat  A LOT

2. I get things done during the day.
   NOT AT ALL  SLIGHTLY  SOMewhat  A LOT

3. Getting things started on my own is important to me.
   NOT AT ALL  SLIGHTLY  SOMewhat  A LOT

4. I am interested in having new experiences.
   NOT AT ALL  SLIGHTLY  SOMewhat  A LOT

5. I am interested in learning new things
   NOT AT ALL  SLIGHTLY  SOMewhat  A LOT

6. I put little effort into anything.
   NOT AT ALL  SLIGHTLY  SOMewhat  A LOT

7. I approach life with intensity.
   NOT AT ALL  SLIGHTLY  SOMewhat  A LOT

8. Seeing a job through to the end is important to me.
   NOT AT ALL  SLIGHTLY  SOMewhat  A LOT

9. I spend time doing things that interest me.
   NOT AT ALL  SLIGHTLY  SOMewhat  A LOT
10. Someone has to tell me what to do each day.

NOT AT ALL  SLIGHTLY  SOMewhat  A LOT

11. I am less concerned about my problems than I should be.

NOT AT ALL  SLIGHTLY  SOMewhat  A LOT

12. I have friends.

NOT AT ALL  SLIGHTLY  SOMewhat  A LOT

13. Getting together with friends is important to me.

NOT AT ALL  SLIGHTLY  SOMewhat  A LOT

14. When something good happens, I get excited.

NOT AT ALL  SLIGHTLY  SOMewhat  A LOT

15. I have an accurate understanding of my problems.

NOT AT ALL  SLIGHTLY  SOMewhat  A LOT

16. Getting things done during the day is important to me.

NOT AT ALL  SLIGHTLY  SOMewhat  A LOT

17. I have initiative.

NOT AT ALL  SLIGHTLY  SOMewhat  A LOT

18. I have motivation.

NOT AT ALL  SLIGHTLY  SOMewhat  A LOT

The Apathy Evaluation Scale was developed by Robert S. Marin, M.D. Development and validation studies are described in RS Marin, RC Biedrzycki, S Firinciogullari: “Reliability and Validity of the Apathy Evaluation Scale,” Psychiatry Research, 38:143-162, 1991
Appendix J – Snaith-Hamilton Pleasure Scale

1) I would enjoy my favourite television or radio programme:

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

2) I would enjoy being with my family or close friends:

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

3) I would find pleasure in my hobbies and pastimes:

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

4) I would be able to enjoy my favourite meal:

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

5) I would enjoy a warm bath or refreshing shower:

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

6) I would find pleasure in the scent of flowers or the smell of a fresh sea breeze or freshly baked bread:

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

7) I would enjoy seeing other people’s smiling faces:

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

8) I would enjoy looking smart when I have made an effort with my appearance:

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

9) I would enjoy reading a book, magazine or newspaper:

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

10) I would enjoy a cup of tea or coffee or my favourite drink:

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

11) I would find pleasure in small things, for example: a bright sunny day, a telephone call from a friend:

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

12) I would be able to enjoy a beautiful landscape or view

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

13) I would get pleasure from helping others

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

14) I would feel pleasure when I receive praise from other people:

| Strongly Disagree | Disagree | Agree | Strongly Agree |
Appendix K – Calgary Depression Scale For Schizophrenia

Interviewer:  Ask the first question as written. Use follow up probes or qualifiers at your discretion. Time frame refers to last two weeks unless stipulated. N.B. The last item, #9, is based on observations of the entire interview.

1. DEPRESSION: How would you describe your mood over the last two weeks? Do you keep reasonably cheerful or have you been very depressed or how spirited recently? In the last two weeks how often have you (own words) every day? All day?
   0. Absent
   1. Mild  Expresses some sadness or discouragement on questioning.
   2. Moderate  Distinct depressed mood persisting up to half the time over last 2 weeks present daily.
   3. Severe  Markedly depressed mood persisting daily over half the time interfering with normal motor and social functioning.

2. HOPELESSNESS: How do you see the future for yourself? Can you see any future? or has life seemed quite hopeless? Have you given up or does there still seem some reason for trying?
   0. Absent
   1. Mild  Has at times felt hopeless over the last two weeks but still has some degree of hope for the future.
   2. Moderate  Persistent, moderate sense of hopelessness over last week. Can be persuaded to acknowledge possibility of things being better.
   3. Severe  Persisting and depressing sense of hopelessness.

3. SELF-DEPRECIATION: What is your opinion of your self compared to other people? Do you feel better, not as good, or about the same as others? Do you feel inferior or even worthless?
   0. Absent
   1. Mild  Some inferiority, not amounting to a feeling of worthlessness.
   2. Moderate  Subject feels worthless, but less than 50% of the time.
   3. Severe  Subject feels worthless more than 50% of the time. May be challenged to acknowledge otherwise.

4. GUILT/Idea Of Reference: Do you have the feeling that you are being blamed for something or even wrongly accused? What about? (Do not include justifiable blame or accusation. Exclude delusions of guilt.)
   0. Absent
   1. Mild  Subject feels blamed but not accused less than 50% of the time.
   2. Moderate  Persisting sense of being blamed, and/or occasional sense of being accused.
   3. Severe  Persistent sense of being accused. When challenged, acknowledges that it is not so.

5. PATHOLOGICAL GUILT: Do you tend to blame yourself for little things you may have done in the past? Do you think that you deserve to be so concerned about this?
   0. Absent
   1. Mild  Subject sometimes feels over-guilty about some minor pecadillo, but less than 50% of time.
   2. Moderate  Subject usually (over 50% of time) feels guilty about past actions the significance of which he exaggerates.
   3. Severe  Subject usually feels so as to blame for everything that has gone wrong, even when not his fault.

6. MORNING DEPRESSION: When you have felt depressed over the last 2 weeks have you noticed the depression being worse at any particular time of day?
   0. Absent  No depression.
   1. Mild  Depression present but no discernable variation.
   2. Moderate  Depression spontaneously mentioned to be worse in a.m.
   3. Severe  Depression markedly worse in a.m. with impaired functioning which improves in p.m.

7. EARLY WAKING: Do you wake earlier in the morning than is normal for you? How many times a week does this happen?
   0. Absent  No early waking.
   1. Mild  Occasionally wakes (up to twice weekly) 1 hour or more before normal time to wake or alarm time.
   2. Moderate  Often wakes early (up to 5 times weekly) 1 hour or more before normal time to wake or alarm.
   3. Severe  Daily wakes 1 hour or more before normal time.

8. SUICIDE: Have you felt that life wasn’t worth living? Did you ever feel like ending it all? What did you think you might do? Did you actually try?
   0. Absent
   1. Mild  Frequent thoughts of being better off dead, or occasional thoughts of suicide.
   2. Moderate  Deliberately considered suicide with plan, but made no attempt.
   3. Severe  Suicidal attempt apparently designed to end in death (i.e.: accidental discovery or insufficient means)

9. OBSERVED DEPRESSION: Based on interviewer’s observations during the entire interview. The question “Do you feel like crying?” used at appropriate points in the interview, may elicit information useful to this observation.
   0. Absent
   1. Mild  Subject appears sad and mournful even during parts of the interview, involving affectively neutral discussion.
   2. Moderate  Subject appears sad and mournful throughout the interview, with genny men'sentric voice and is tearful or close to tears at times.
   3. Severe  Subject chokes on distressing topic, frequently sighs deeply and cries openly, or is persistently in a state of frozen misery if examiner is sure that this is present

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Appendix L – Demographics

Date: _________________  ID: ________________

Age (yrs): ________________

Sex: Male □ Female □

Ethnicity:
African □ Aboriginal □ Asian □
S.Asian □ Hispanic □ White □

Living Arrangements:
Independent □ Group (meals provided) □ With Family □
Group (no meals provided) □

Employment Status:
Full-time □ Part-time □ Not employed □
Student □ Retired □ Other: ________________ □

Educational Attainment:
High school (no diploma) □ High school (diploma) □ Postsecondary □
Other: ________________ □

Marital Status: Single □ Married □ Separated □ Divorced □

Diagnosis (MINI)
Plus chart review:
Schizophrenia □ Schizoaffective □
Psychosis NOS □
Other □ Specify: ____________________________

Substance Abuse: Yes □ No □
**Psychiatric History:**
Date of first hospitalization (dd/mm/yy): ______________________

Date of first antipsychotic rx (dd/mm/yy): ______________________

**Smoking:** Number of cigarettes/day ______ Years as a regular smoker ______

**Medication:**

I. Current antipsychotic:
   
<table>
<thead>
<tr>
<th>Medication</th>
<th>Dose (mg)</th>
<th>Duration (mth)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

II. Concomitant Psychiatric:

<table>
<thead>
<tr>
<th>Medication</th>
<th>Dose (mg)</th>
<th>Duration (mth)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

III. Concomitant Medical:

<table>
<thead>
<tr>
<th>Medication</th>
<th>Dose (mg)</th>
<th>Duration (mth)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Measurements:**

Height (cms): ______________________

Weight (kgs): ______________________

Waist circumference (cms): ______________________
Appendix M – Short Form Health Survey

**General Well-Being Questionnaire (SF-12v2)**

This questionnaire asks how you feel about several aspects of your well-being. There are no right or wrong answers. Just read the statements and circle the answer that best describes you. Your answer will be kept strictly confidential.

1. In general, would you say your health is

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>Very good</td>
<td>Good</td>
<td>Fair</td>
<td>Poor</td>
</tr>
</tbody>
</table>

The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

2. Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling or playing golf

<table>
<thead>
<tr>
<th>Yes, limited a lot</th>
<th>Yes, limited a little</th>
<th>No, not limited at all</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

3. Climbing several flights of stairs

   | 1 | 2 | 3 |

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

4. Accomplished less than you would like

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

5. Were limited in the kind of work or other activities

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

6. Accomplished less than you would like

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>
7. Didn’t do work or other activities as carefully as usual

8. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td>Slightly</td>
<td>Moderately</td>
<td>Quite a bit</td>
<td>Extremely</td>
</tr>
</tbody>
</table>

These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please tick the one answer that comes closest to the way you have been feeling.

How much of the time during the past 4 weeks . . .

<table>
<thead>
<tr>
<th>All of the time</th>
<th>Most of the time</th>
<th>Some of the time</th>
<th>A little of the time</th>
<th>None of the time</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. Did you feel full of energy?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Have you felt calm and peaceful?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Have you felt downhearted and blue?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

12. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends or relatives etc.)?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>All of the time</td>
<td>Most of the time</td>
<td>Some of the time</td>
<td>A little of the time</td>
<td>None of the time</td>
</tr>
</tbody>
</table>

This is the end of the questionnaire, thank you for participating.
Appendix N – International Physical Activity Questionnaire

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the moderate activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

1. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, brisk walking, bicycling at a regular pace, or doubles tennis? Do not include walking casually.

   _____ days per week

   □ No moderate physical activities ➔ Skip to question 5

2. How much time did you usually spend doing moderate physical activities on one of those days?

   _____ minutes per day

   □ Don’t know/Not sure

Think about all the vigorous activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?

   _____ days per week

   □ No vigorous physical activities ➔ Skip to question 3

4. How much time did you usually spend doing vigorous physical activities on one of those days?
The last question is about the time you spent sitting on weekdays during the last 7 days. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

5. During the last 7 days, how much time did you spend sitting on a week day?

______ hours and ______ minutes per day

☐ Don’t know/Not sure
Appendix O – Accelerometry Information Sheet and Log

What is an accelerometer?
An accelerometer is a device that measures and records movement patterns. It counts the number of movements you make every few seconds, and these numbers can tell us how much you were moving (or physical activity levels) during the entire time that you are wearing the accelerometer. This is why it’s really important to remember to wear your accelerometer during the week that you will have it. The device is small and compact (4.6cm x 3.3cm).

Are accelerometers safe to use?
There is no risk associated with the use of these devices.

What happens if I break/lose the accelerometer?
Although we expect that you will take good care of the accelerometer, we understand that accidents do happen. We will not charge you for lost or damaged equipment, but please let us know as soon as possible if your accelerometer is lost or damaged.

What do I have to do with the accelerometer?
• Wear the accelerometer snugly on the right side of your waist (above the hip) for 7 days.
• Make sure that you haven’t put it on upside down! You’ll know that it is the right way up if someone standing in front of you can reach the name “ActiGraph” off of the device.
• Put it on when you wake up in the morning & take it off when you go to bed.
• Do not let the accelerometer get wet. Take it off if you have a bath/shower or if you go swimming. Remember to put it back on as soon as you’re dry.

PLEASE COMPLETE YOUR LOGBOOK
• Write in every day AT THE TOP when you put your accelerometer on in the morning
• Write in every day AT THE BOTTOM when you take it off before you go to bed
# 7-DAY ACCELEROMETER WEAR TIME LOG

Please write out the date and times, and check the ‘NO’ or ‘YES’ options for each day:

<table>
<thead>
<tr>
<th>Date (M/D/Y):</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
<th>Day 6</th>
<th>Day 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device put ON at what time? (AM)</td>
<td>:</td>
<td>:</td>
<td>:</td>
<td>:</td>
<td>:</td>
<td>:</td>
<td>:</td>
</tr>
<tr>
<td>Device taken OFF at what time? (PM)</td>
<td>:</td>
<td>:</td>
<td>:</td>
<td>:</td>
<td>:</td>
<td>:</td>
<td>:</td>
</tr>
<tr>
<td>Was the device removed during wear time?</td>
<td>☐ No</td>
<td>☐ No</td>
<td>☐ No</td>
<td>☐ No</td>
<td>☐ No</td>
<td>☐ No</td>
<td>☐ No</td>
</tr>
<tr>
<td>If yes, during which times:</td>
<td>:</td>
<td>:</td>
<td>:</td>
<td>:</td>
<td>:</td>
<td>:</td>
<td>:</td>
</tr>
<tr>
<td>Did you take the device off a second time? During which times?</td>
<td>:</td>
<td>:</td>
<td>:</td>
<td>:</td>
<td>:</td>
<td>:</td>
<td>:</td>
</tr>
<tr>
<td>Did you experience any problems? Please explain:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix P – Borg Rating of Perceived Exertion

While doing physical activity, we want you to rate your perception of exertion. This feeling should reflect how heavy and strenuous the exercise feels to you, combining all sensations and feelings of physical stress, effort, and fatigue. Do not concern yourself with any one factor such as leg pain or shortness of breath, but try to focus on your total feeling of exertion.

Look at the rating scale below while you are engaging in an activity; it ranges from 6 to 20, where 6 means "no exertion at all" and 20 means "maximal exertion." Choose the number from below that best describes your level of exertion. This will give you a good idea of the intensity level of your activity, and you can use this information to speed up or slow down your movements to reach your desired range.

Try to appraise your feeling of exertion as honestly as possible, without thinking about what the actual physical load is. Your own feeling of effort and exertion is important, not how it compares to other people's. Look at the scales and the expressions and then give a number.

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>No exertion at all</td>
</tr>
<tr>
<td>7</td>
<td>Extremely light</td>
</tr>
<tr>
<td>8</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Very light</td>
</tr>
<tr>
<td>10</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Light</td>
</tr>
<tr>
<td>12</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Somewhat hard</td>
</tr>
<tr>
<td>14</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Hard (heavy)</td>
</tr>
<tr>
<td>16</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Very hard</td>
</tr>
<tr>
<td>18</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Extremely hard</td>
</tr>
<tr>
<td>20</td>
<td>Maximal exertion</td>
</tr>
</tbody>
</table>

9 corresponds to "very light" exercise. For a healthy person, it is like walking slowly at his or her own pace for some minutes. 13 on the scale is "somewhat hard" exercise, but it still feels OK to continue. 17 "very hard" is very strenuous. A healthy person can still go on, but he or she really has to push him- or herself. It feels very heavy, and the person is very tired. 19 on the scale is an extremely strenuous exercise level. For most people this is the most strenuous exercise they have ever experienced.