An Investigation into the Effects of Light Exercise on Post-Natal Low Mood

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Abstract

Sustained low mood in the post-natal period can be a problem for a number of new mothers, which is experienced as distressing and can lead to the development of Post-Natal Depression (PND). Interventions need to recognise the challenges of new motherhood, and how these may impact upon a women's ability to seek treatment. The current study draws on previous research suggesting that exercise may be beneficial in improving the mood of new mothers. Whilst this positive effect has previously been demonstrated for women with PND, it has not been investigated for women with post-natal low mood.

The effects of a 12-week pram-walking programme on post-natal low mood were investigated. The impact of self-esteem and exercise-enjoyment on mood outcomes were also explored. Thirteen participants with post-natal low mood were recruited and randomly assigned to a walking intervention group or a stretching comparison group. All participants were under the same conditions in order to isolate the effects of walking.

Main findings suggest that mothers in the 12-week walking programme experienced statistically significant improvements in mood, however this was also the case for participants in the stretching comparison group. A relationship was found between self-esteem and mood throughout the study, but, unexpectedly, exercise enjoyment was not related to mood.

The implications of the findings are based on the potential for exercise to be implemented to address low mood and also act as a potential preventative measure for the development of PND. Further investigation into the role of self-esteem within the exercise-mood relationship, and specific exercise prescription variables that will best serve a post-natal population, is needed.

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Literature Review

Post-Natal Changes in Mood

While transitioning into parenthood can be happy and fulfilling, it can also be a uniquely challenging experience. The social assumptions of motherhood as a nurturing and loving time can feel far from reality when faced with a new set of demands while adjusting to the post-natal period. Emotional lability is a significantly common experience, with a range of moods reported during this time (Buttner, O'Hara & Watson, 2012). Literature suggests that women may experience post-natal mood changes on a continuum, ranging from mild to moderate mood declines, to more extreme mood disturbances (Ishikawa et al., 2011). At the lower end of the scale, although symptoms may remain below the threshold for a diagnosis of a Major Depressive Disorder, they may still hold significance for women and be experienced as distressing. In addition, literature suggests that low mood, if left untreated, can progress into a Major Depressive Disorder (O'Hara, Schlechte, Lewis & Wright, 1991). However, despite low mood being a relatively common experience, it is widely unexplored in the literature, is poorly defined, and evidence based treatment options have therefore not yet been developed.

Post-Natal Diagnoses

Before exploring low mood in post-natal women, it is important to understand how it may fit within existing conceptualisations of post-natal mood disorders. The literature primarily describes three such disorders. Firstly, a mild disturbance in mood known as the 'Baby Blues' is characterised by tearfulness, sleep disturbance, irritability and anxiety (Moslemi, Tabari, Montazeri, & Tadayon, 2012). A significant number of women experience the Baby Blues (up to 84%), which begins within 2-10 days after delivery but subsides a short time later (within two weeks) (Buttner et al., 2012). Secondly, Post-Natal Depression (PND) is the most common mental illness of the post-natal period, affecting up to 13% of women worldwide (Buttner et al., 2012). Symptoms reported in the literature include tearfulness, guilt, hopelessness, sleep and appetite disturbances, poor concentration, anxiety, irritability and feelings of inadequacy (Roberston, Grace, Wallington, & Stewart, 2004). These sypmtoms may onset within

the first month following childbirth, and can persit for between three and 12 months (National Institute of Health and Care Excellence (NICE), 2007). Adverse effects on children and additional family members have also been identified, which often persist well beyond the remission of PND (Atkinson et al., 2005). While specific etiology of PND is largely unknown, there is likely to be a number of contributors including psychological, environmental, social and biological factors (Payne, 2007). Lastly, more severe experiences of post-natal mood disturbances feature psychotic episodes. Post-Natal Psychosis is characterised by confusion, distractibility, and disturbance in sense making, additional to the symptoms of Post-Natal Depression (Weissman & Olfson, 1995).

The *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-5*), clearly situates post-natal problems within the diagnostic criteria for Major Depression Disorder (MDD). Depressive, manic or mixed episodes can be specified with 'postpartum onset', in which symptoms occur within four weeks of giving birth (5th ed., DSM-5; American Psychiatric Association, 2013). However, where symptoms of PND onset later than 4 weeks following delivery, although DSM-5 diagnostic criteria is not met, there is general agreement among the literature that episodes have many, if not all, features in common with those that onset within four weeks (Payne, 2007).

Low Mood in the Post-Natal Period

Considering that the Baby Blues affects such a significant portion of post-natal women, it is possible that a number of new mothers experience a decline in mood beyond the two-week period of the Baby Blues, but do not go on to develop a Major Depressive Disorder. In one early study by Dalton (1971), 25% of women in his sample showed prolonged, mild disturbances in mood after giving birth, which was not formally diagnosed. This trend can be observed in the general population as well; NICE (2009) note that persistent depressive symptoms below DSM threshold criteria are increasingly being recognised as disabling and distressing. It seems likely that this would also apply to post-natal women. However, while identification of the Baby Blues, PND and Post-Natal Psychosis is clearly important in order to attend to and resolve maladaptive

symptoms, the experience of sustained low mood in the post-natal period appears to have been overlooked.

The majority of literature that acknowledges low mood does so primarily in reference to its status as a risk factor for PND, and not as the specific focus of investigation (e.g. Bloch, Rotenberg, Koren, & Klein, 2006; Hannah, Adams, Lee, Glover, & Sandler, 1992). It is likely that this is largely due to the fact that there are no formal diagnostic criteria for low mood as a distinct post-natal experience beyond the Baby Blues. In addition, women with low mood may not present to health professionals. PND is sometimes referred to as 'the smiling depression' as women hide their symptoms in order to prevent the associated stigma of a diagnosis, and this may also be the case for women with low mood (Truant, 2005). It is also possible that women feel as though their symptoms are not bad enough to warrant seeking help. These reasons may partially explain why experiences of post-natal low mood have not been thoroughly investigated.

In essence, low mood is an important consideration in its own right, and should be considered independently within the post-natal experience. It may also present as a risk factor for PND. In order to understand more about the nature of low mood, a brief overview of how it may develop is discussed below.

The Development of Post-Natal Low Mood

The Baby Blues

Research into how the Baby Blues develops may offer insight into how prolonged low mood may also evolve. Hau and Levy (2003) found that age was a significant risk factor, with women between the ages of 35 and 39 showing lower rates of the Baby Blues. Delivery by caesarean section has also been found to be a risk factor (Gonidakis, Rabavilas, Varsou, Kreatsas & Christodoulou, 2007). Other factors that have been associated with the baby blues include smoking, being unmarried, having anxiety and/or depression during pregnancy, being ambivalent towards pregnancy, and being 'neurotic' (Condon & Watson, 1987). Whether these factors also play a part in the development of low mood is only speculation at present, but could be considered in future research.

Twenty percent of women who have the Baby Blues itself go on to develop a PND diagnosis within the first year post-partum, and therefore is considered to be a risk factor for the development of PND (O'Hara et al., 1991). However, it is not known how many people with the Baby Blues continue to feel down, but do not become clinically depressed. Nevertheless, an experience of the Baby Blues may be a risk factor for subsequent prolonged low mood.

Expectations versus Reality

Beyond the Baby Blues, research in post-natal mood in general has found an association between expectations about having a baby, and subsequent changes in mood. Haga, Lynne, Slinning and Kraft (2012) conducted a qualitative study exploring the experience of first time mothers transitioning into motherhood. They were aiming to gain a greater understanding of why some women find the transition emotionally taxing, and others do not. They found that women either had a 'relaxed' or 'controlled' approach, both of which influenced how the post-natal period was envisioned, and how it was experienced. A relaxed approach led to little value being placed on envisioning the birth, as there were no major expectations. If the post-natal period did not go the way they had imagined, there was little emotional consequence. However, having a controlled approach led to the opposite effect – women felt great disappointment if they were unable to 'master' the birth or the post-natal events. The authors concluded that discrepancies between expectations and reality increased the risk for negative emotional responses (Haga et al., 2012).

In a similar finding, Berggren-Clive (1998) found that where there was a discrepancy between the assumptions and realities of motherhood, feelings of inadequacy were evoked if women felt like they were not responding to their role as they should. In Knudson-Martin and Silverstein's (2009) qualitative investigation, women also felt that they were not living up to what they believed were standards for being a 'good mother' and because of that they felt ashamed, stressed and anxious. Similarly in a meta-synthesis by Beck (2002) a relationship was found between a) the incongruence between the expectations and realities of motherhood, b) loss of control, loss of self and loss of relationships, c) anxiety, guilt and anger, and d) difficulties relinquishing those

feelings. Further, Beck (2002) found that the inability to express such experiences in a validating context tended to maintain negative affect. These studies together demonstrate how low mood may develop based on a mismatch between expectations and reality, and may be perpetuated by the lack of opportunity to express their experiences in an appropriate context.

A Downward Spiral

Existing research has also highlighted a 'downward spiral' of emotions where women experience an initial number of symptoms that worsen over time. Symptoms include guilt, isolation, withdrawal, anger, worry and feeling overwhelmed (Beck, 2002). Low mood may reflect the beginning of this spiral. Berggren-Clive (1998) explored this concept in her qualitative research, where women who recounted their post-natal experiences identified a cumulative effect of declining mood. They attributed this to a changing dynamic with their partner, feelings of loss, unstable notions of self-identity and a disillusion with motherhood. Importantly, for some women, that distress may lead to a PND diagnosis, and for others it may be conceptualised as low mood. In any case, the experience of a downward spiral highlights the capacity for post-natal mood to sit upon a continuum, characterised by varying degrees of distress.

Treatment

Because there is no diagnostic category for low mood, there has been little investigation into treatment. However, as a lived experience for women in the post-natal period, it is important to consider the ways in which symptoms can be alleviated. This is particularly true in order to prevent it developing into more significant and severe difficulties. With limited research to draw from, exploring existing treatment methods for Post-Natal Depression, seems like a useful starting point. These methods have been widely researched and most recently focus on empirically based pharmaceutical and psychotherapeutic interventions (Blumenthal, Smith & Hoffman, 2012). The following section will provide a brief overview of treatment methods for PND, with consideration for how these might be applied to post-natal women with low mood.

Pharmaceutical

Pharmaceutical approaches play an important role in stabilising mood in perinatal women with severe and persistent mood disorders (Misri & Kendrick, 2007). However, for post-natal women there are unique considerations of this approach. In addition to the various problems associated with pharmaceutical methods for people with depression in general (adverse side effects, cost, adherence issues, stigma), there is a lack of consistent support for the safety of antidepressant medication on babies, and a number of infant health problems have been associated with antidepressant use in mothers. Chambers and colleagues (2006), for example, demonstrated a significant association between antidepressant use and pulmonary hypertension in the newborn. This condition results in minimal blood flow to the lungs and circulatory system, and has been correlated with hearing loss, cognitive delays and death in babies (Lipkin et al, 2002). Pharmaceutical treatment is therefore complicated, and breastfeeding mothers are particularly hesitant to take anti-depressants due to the potential damaging effects they could be imposing upon their child (Dennis & Chung-Lee, 2006). In addition, antidepressant medication is usually only implemented in cases of severe mood disturbances, and therefore may not be suitable for women reporting low mood.

Psychotherapy

Empirically supported psychotherapy interventions such as Cognitive Behavioural Therapy (CBT) intend to identify and re-structure maladaptive thinking patterns (Driessen & Hollon, 2012). CBT has been recommended by NICE (2009) for the treatment of mild to moderate depression both in the general population, and for post-natal women. However, while effective, a number of difficulties with psychotherapeutic interventions limit their utilisation. Firstly, they can be expensive and therefore are eliminated as an option for those who cannot afford it (Payne & Myhr, 2010). Secondly, access to therapeutic treatment can be difficult for people living in certain rural communities (Payne & Myhr, 2010). Thirdly, little research has been conducted on cross-cultural applicability, with some studies having indicated that culturally adapted forms of therapy are necessary in order to have an effect, but are not always implemented (Naeem, Waheed, Gobbi, Ayub & Kingdon, 2001). These limitations may

be compounded for post-natal women, particularly considering the additional unique, practical barriers to office-based treatments including difficulties with childcare, transportation, and napping and feeding schedules for babies that can interfere with appointments (O'Mahen & Flynn, 2008). In addition, the perceived stigma associated with seeking help has been found to influence mothers such that they avoid seeking the help they require (Beck, 2001). Furthermore, a significant minority of women report feeling worried that their baby will be 'taken away' if they are found to be suffering from depression, due to the effects they may be having upon the child (Dennis & Chung-Lee, 2006).

In light of these limitations, research has been conducted into interventions that offer ways to overcome some of the barriers identified. Such interventions include music therapy, light therapy, marital therapy, relaxation and exercise (Cooney, 2013). As well as on their own, some of these 'alternative' approaches have been successfully implemented in conjunction with conventional methods, offering a more dynamic approach to treatment. While these approaches have been primarily investigated for PND, they may also be beneficial for post-natal women with low mood. Of particular interest to the current study is the treatment utilising exercise.

Exercise

Exercise is conceptualised in a variety of ways across the literature. The New Zealand Ministry of Health in their national guidelines frame exercise as physical activity, lasting for at least thirty minutes on most days of the week. Activity is defined within four categories – aerobic, flexibility, balance and strength, and at two intensity levels – moderate and vigorous (Ministry of Health, 2013). Amongst wider literature, physical activity and exercise are often differentiated. Caspersen, Powell and Christenson (1985) note that whereas physical activity is defined as energy expenditure via body movements, exercise is a subset of that category, involving planned and structured activity in pursuit of enhanced or maintained fitness levels. A further breakdown stipulates aerobic exercise (sustained by aerobic metabolism such as walking or running), and anaerobic exercise (sustained by anaerobic metabolism such as weight training) (Wuest & Bucher, 2009), both of which have been widely investigated and are

demonstrated as being of significant value for improving health in all populations. It is worth remianing of aware of these varying conceptualisations as a reflection of the different ways in which researchers define exercise in this field.

The benefits of exercise. The benefits of regular exercise have been widely reported. Research demonstrating positive physical, psychological, and practical benefits of exercise in the general population has been drawn upon for research into treatment methods for PND. Such research demonstrates that from a physical point of view exercise plays a major role in the prevention and treatment of disease; it improves the functional capacity of the cardiovascular system, reduces the risk for hypertension, heart disease, obesity, cancer, osteoporosis and other pathological conditions (Mujovic & Cubrilo, 2012). In addition to these physical health impacts, the psychological benefits of exercise have also been well reported, regardless of whether mental illness is present or not. Such benefits include stress alleviation (Rosch & Kearney, 1985), anxiety inhibition (Raglin & Morgan, 1985), enhanced concentration and mental performance (Emery & Gatz, 1990), improved self-image (Ossip-Klein et al, 1989) and improved quality of sleep (Brassington & Hicks, 1995).

In light of these benefits, researchers have become interested in the effects of exercise upon mood, particularly as cross-sectional analyses have demonstrated that fewer depressive symptoms are reported among individuals who are more active (Ross & Hayes, 1988, Hassmen, Koivula & Uutela, 2000) and also are reduced among people already experiencing depressive symptoms (Camacho, Roberts, Lazarus, Kaplan & Cohen, 1991). In studies considering the exercise-depression relationship, meta-analytic data indicate large effect sizes (between groups) ranging from -0.72 to -1.4, suggesting that exercise does have a significant impact on mood (Craft & Landers, 1998, Lawlor & Hopker, 2001, North, McCullah & Tran, 1990, Stathopoulou, Powers, Berry, Smits & Otto, 2006).

Such findings are further enhanced by the practical capacity for exercise to be flexible and adaptable, and tailored to suit the individual. As a treatment method exercise can be implemented where appropriate on its own, and also as complimentary to an existing treatment plan. Barriers to treatment are minimized, as exercise is cost effective,

sustainable, side effect-free, and can be accessed across all cultures in a number of physical environments. Influential bodies such as NICE in the United Kingdom are responding to the evidence, recommending that health professions consider exercise in the treatment of depression and sub-threshold depression (NICE, 2009).

Considering that exercise offers positive psychological benefits despite whether mental illness is a factor or not, and given the known barriers to treatment for post-natal women, women who identify as having post-natal low mood may benefit from exercise interventions. However, there is a lack of research into this hypothesis as most studies focus on post-natal women who are likely to be depressed.

In order to understand more about how post-natal women with low mood may benefit from exercise, the following section will provide a brief overview into the available research investigating the relationship between exercise and PND.

Post-natal depression and exercise. The capacity for exercise to improve depressive symptoms in the post-natal period has been demonstrated across the small amount of research that is available. Individual studies investigating the relationship between exercise and PND vary substantially in size, control type, methodology and exercise modality. Although some studies show a positive association between depression and fitness levels, this does not necessarily imply a causal relationship. In fact much of the literature demonstrates improvements in PND following an exercise intervention when fitness levels do *not* increase (Da costa, Larouche, Drista & Brender, 2000, Craft, Freund, Culpepper & Perna, 2007).

As such, a number of studies have attempted to understand what it is about exercise that may be impacting upon post-natal mood. Researchers have drawn upon an array of biological, psychosocial and psychological explanations. Variables proposed to impact upon the exercise-mood relationship include both physiological changes, and psychological effects including self-esteem (Craft, 2005), exercise enjoyment (Currie & Develin, 2002), physical activation (Gauvin and Spence, 1996), social support (Mauthner, 1994), post-natal fatigue (Song, Chang, Park, Kim & Nam, 2010) and distraction (Raglin & Morgan, 1993). Turning to these now, the following discussion

will briefly investigate which mechanisms may be operating as post-natal mood is improved with exercise.

Mechanisms Behind the Exercise-Mood Relationship

Physiological Mechanisms

The endorphinergic system has been the focus of investigation into the physiological effects of exercise on mood, with most research having been derived from measurements of peripheral neurotransmitter levels in blood plasma, positron emission tomography (PET), and receptor blockade studies (Boecker et al., 2010). An array of biological systems are involved with the regulation of mood and behaviour, including neurotransmitters, brain growth factors and neuropeptides (Bloch et al, 2000). Of significance to mood, three monoamine catecholomines; serotonin, dopamine and noradrenaline, act to facilitate communication between mood-regulating neurons, with increasing doses appearing to stabilise mood (Young & Leyton, 2002). In cases of depression, these monoamines are diminished. Pharmaceutical treatment approaches target their genesis by means of monoamine re-uptake inhibition in the brain, but more recently monoamines have been found to increase following physical exercise regimes (Fragala et al, 2011).

Physiological theories within the post-natal period may be unique considering the hormonal changes associated with having a baby, and theorists suggest that such changes are obvious candidates for initiating a depressive event (Bloch et al., 2000). Tentative studies looking into the relationship between reproductive hormones and monoamines have found that decreased or fluctuating levels of estrogen (common in the postpartum period), is associated with diminishing levels of serotonin (a mood-regulating hormone) (Bethea, Lu, Gundlah & Streicher, 2002). These findings suggest that post-natal women may experience a decline in mood due to fluctuating estrogen levels, but serotonin can be increased by exercise and therefore could act to alleviate depressive symptoms.

However, there is limited research into the physiological effects of exercise on mood in the post-natal population, and given that there is no consistent evidence to suggest that hormone activity is unique to PND (as opposed to depression in general), similar mechanisms may operate. In a review by Teychenne and York (2013), although there was evidence to suggest that as exercise levels increased, depressive symptoms decreased, only leisure-time physical activity had the capacity to decrease depressive symptoms. This suggests that more contextual variables associated with physical activity play a key role in its antidepressant effect, such that the way exercise is subjectively experienced directly relates to changes in mood. Moving away from physiological explanations then, psychological factors may play a more important mediating role between exercise and mood in the post-natal period.

Psychological Mechanisms

Self-esteem. Self-esteem is considered to be an indicator of adjustment both in an emotional and a social sense, and a key component in the explanation for human behaviour (Fox, 2000). High self-esteem correlates with emotional stability, resilience to stress, and motivation to achieve more challenging goals (Biddle, 1997). Conversely, low self-esteem correlates with a higher likelihood of presenting with negative affect including anxiety, suicidal thoughts, body dissatisfaction and depression (Renouf & Harter, 1990). Studies have demonstrated that improvements in self-esteem can be observed in post-natal women following an exercise regime, which lead to improvements in mood.

Self-esteem has unique characteristics in the post-natal period, as a number of physical and psychological changes are experienced. For example, in the general population body dissatisfaction is correlated with negative self-esteem and low affect (Rodin, Silberstein & Striegel-Moore, 1985), but this correlation may be more prevalent for post-natal women given the physical changes experienced from pre to post pregnancy. A study by Jenkin (1997) found that after giving birth women reported feeling less satisfied with the weight and shape of their bodies than they were prior to becoming pregnant. Psychological wellbeing was also correlated with weight, such that the heavier they were, the less satisfied with their appearance they felt, and the higher they

rated on depressive symptom scales. In another study into the effects of exercise on PND among Taiwanese women, Heh, Huang, Ho & Wang (2008) found that body change was a significant factor in predicting mental health outcomes, particularly in terms of loss of control over body weight. Physical changes associated with exercise then (weight loss, increased muscle tone, etc.), may be particularly salient in the post-natal population as a mechanism to enhance self-esteem.

Self-efficacy has also been implicated in the self-esteem mechanism, that is, the level of confidence one has in their ability to achieve a desired outcome (Elavsky, 2010). Improvements in self-efficacy are thought to enhance self-perceptions, leading to global improvements in self-esteem (Elavsky, 2010). One of the most widely accepted mechanisms involved with the development of efficacy beliefs is that of mastery (Craft, 2005). Exercise may provide a valuable avenue through which to enhance efficacy beliefs, given its ability to offer meaningful mastery experiences. This sense of mastery and enhanced self-efficacy has been proposed as an explanation for the antidepressant effect of exercise. In an intervention study over nine weeks, Craft (2005) compared the mood of depressed women in an exercise group (facilitating feelings of mastery), to depressed women in a control group. Overall, women in the exercise group showed bigger improvements in mood demonstrating a strong, negative relationship with depression. This indicated that feelings of mastery enhanced self-efficacy, resulting in a reduction of depressive symptoms.

Specific ways in which the mastery experience of exercise may lead to enhanced self-efficacy and in turn to self-esteem have been suggested by Craft (2005). Firstly, for people who do not regularly exercise, the transition to regular exercise is seen as a proactive measure taken to maintain one's own physical health, facilitating belief in their motivational abilities, which enhances feelings of mastery and impacts upon daily affect. Secondly, people may consciously attribute improvements in mood to an exercise regime, facilitating the development of a belief that active management of depressive symptoms in a behavioural manner is possible. Moreover, as people learn about the 'process' of participating in an exercise regime they may perceive a mastering of new skills, which generalizes across to their ability to deal with mood symptoms. Finally, regular exercise offers the ability to determine a course of action, and stick to that course in order to master a desired outcome. Bandura (1997) suggests that this

teaches an individual how to set goals, monitor behaviours, and utilise positive reinforcement, which leads to improvements of mastery and subsequent mood improvements.

In light of these research findings, it seems that self-esteem may play a key role in the relationship between exercise and mood. This may be particluarly the case for post-natal women, during a period which may hold unique characteristics in terms of self-esteem dynamics.

The exercise experience. Most of the research in this field has focused on associations between changes in fitness levels and changes in mood. 'Exercise' is therefore conceptualized in a one-dimensional manner, such that it can be measured exclusively through assessment of cardiovascular fitness. For example, Armstrong and Edwards (2003) used submaximal testing for prediction of VO2 max. Da Costa and colleagues (2009) used a graded maximal exercise stress test, in order to individualize exercise prescription for developing and maintaining fitness. Heart rate monitors are also widely used in studies for monitoring intensity and output at different stages during exercise. However, because of this focus on fitness, little is known about how the subjective experience of exercise relates to mood outcomes (Gauvin & Spence, 1996).

Fitness levels have been shown *not* to impact upon depressive symptoms (Craft et al., 2007). As such, qualities of the exercise experience other than fitness may possibly be resulting in mood improvements. Rejeski (1994) supported this theory in a paper investigating mood as it related to the subjective experience of exercise. Positive perceptions of exercise were found to be essential to subsequent improvements in mood. In another study, mothers with PND taking part in a pram-walking programme attributed enjoyment as the most important reason for participating (Currie & Develin, 2001). Perhaps exercise enjoyment, then, plays a role in the exercise-mood relationship, and should be considered as an influential factor.

Exercise prescription that takes into account factors which are perceived as pleasant and beneficial by the participant, may enable mood improvements (Gauvin & Spence, 1996). Only one previous study looking into the effects of exercise on PND appears to have

explored this idea, in which exercise preference was considered. That notion of preference was based on past research which identified specific times and days of the week that mothers preferred to walk (Currie & Develin, 2002). While this goes some way towards facilitating exercise enjoyment, research that takes further steps in this direction will uncover the role of enjoyment within the exercise-mood relationship for post-natal women. Essentially, it is important that research disentangles the exercise stimulus per se from the perceived experience and social environment within which it occurs, in order to distinguish specific causal mechanisms.

Type of Exercise. Overall, little is known about the type and dose of exercise as it relates to mood outcomes (Gauvin & Spence, 1996). Within the relevant PND literature, exercise type is predominantly cardiovascular-focused of moderate to high intensity (Da Costa et al., 2009, Armstrong and Edwards, 2003, 2004). Some investigation into the effects of stretching on PND has been made, with Heh and colleagues (2008) finding positive psychological effects. However, of particular interest to researchers has been pram-walking, as a highly accessible form of exercise that may overcome potential barriers to involvement such as lack of childcare, time and money (Wearing & McArthur 1993). Two, small, randomised controlled trials (RCTs) have been conducted in Australia investigating the impact of group pram-walking on PND, both by Armstrong & Edwards (2003, 2004). In both studies, PND was assessed using the Edinburgh Post Natal Depression Scale (EPNDS), which is a well-validated measure that is quick and simple to use (Cox, Holden & Sagovsky, 1987). Results showed significant differences in scores between groups from the beginning to the end of the programmes, with the intervention groups improving and the control groups not. A number of issues with these studies are worth considering. Firstly, compliance to exercise was reported to be good, with 67% adherence in the 2003 study and 74% in the 2004 study. Barriers to participation, however, clearly impacted upon exercise adherence with 33% and 26% of participants respectively not taking part. Sample size was also low with 20 participants (2003) and 19 participants (2004) across the control and intervention groups. If adherence rates and sample size figures had been higher, it is possible that different results may have been produced. This is considering that potential outliers would have had less of an effect, and statistical power would have been increased for analysis. Essentially, a more reliable reflection of the true population may

have been observed. Secondly, exercise was conceptualised by these studies in terms of walking, at specified intensities, frequencies and durations. No consideration was made of how the perceived experience of those variables impacted upon adherence, or mood. While the authors were clearly interested in group pram-walking as an intervention, by uncovering this information it would provide insight into the mechanisms behind the exercise-mood relationship. Lastly, these studies provide no information on the long-term effect of walking interventions as no follow up data was obtained.
Community based group pram-walking programmes have been given considerable attention in the literature. Currie and Develin (2002) surveyed post-natal women on the perceived benefits of such programmes for women with PND. Ninety-two percent of women surveyed believed that they had the capacity to improve mental well-being and 87% believed that they could help to reduce PND. Reasons attributed to these beliefs included interacting with other mothers (92%), getting out of the house (26%), mind and body benefits (23%), tiredness and stress alleviation (14%), depression reduction (12%) and making friends (4%).

However, despite the perceived benefits, barriers to community pram-walking groups have also been identified. Currie and Develin (2002) also held focus groups where the discussion was focused around such groups. Most participants agreed that stigma attached to community programmes, unattractive starting times, difficulty taking older children walking and concern over the level of commitment could all inhibit participation. They also found that poor weather and a lack of time often contribute to a lack of adherence to exercise programmes. Similarly, in a previous study, the same authors found that a major reason for discontinuation of such groups was the inability of women to commit to fixed meeting times (Currie & Develin, 2001).

While research has focused on the benefits of walking in groups, little investigation has gone into the effects of pram-walking not organised around community programmes. But considering the mechanisms perceived to be responsible for mood improvements when pram-walking, it seems that community-based groups may not be necessary. Walking according to a mother's own preferences may even be more beneficial, particularly in light of the variability in motivations for pram-walking where participants have cited fitness, weight loss, a change in body shape, enjoyment, social

contact, stress reduction, and the ability to exercise with one's baby, as the most important factors for taking part (Currie and Develin, 2001). Walking which is not prescribed to groups enables variables such as time, speed, frequency, intensity and level of social interaction to be altered by an individual to suit her own needs. This may also facilitate exercise enjoyment, which may influence mood outcomes as well.

Other Mechanisms

While the effects of self-esteem, exercise enjoyment and exercise type seem to be of primary importance, it is useful to understand additional factors which have been considered by previous research, that may also have an effect on post-natal mood. Physical activation, social support, post-natal fatigue and distraction are briefly outlined below.

Physical activation. Wider research has considered the impact of reducing sedentary behaviour on depressive symptoms, in the general population. Sedentary behaviour can be defined as any activity which induces equal to or slightly higher than resting metabolic rate, performed through a variety of activities such as watching TV, using the computer, and passive recreation (Teychenne, Ball & Salmon, 2010). Gauvin and Spence (1996) conceptualised physical activation as moving from a sedentary lifestyle to an active one, and found positive psychological effects. Simply being active, as opposed to not, may initiate improvements in mood.

Within the post-natal population, the impact of physical activation has not been widely investigated. However, in an observational study of 51 new mothers, Vernon, Young-Hyman and Looney (2010) found a positive association between sedentary behaviour and PND symptoms, meaning those mothers who were more sendentary had higher rates of depressive symptoms. Notably, in studies considering the effects of exercise on PND, an inactive lifestyle is a prerequisite for participation, and thus reducing sedentary living could be having a significant effect on any reductions of depressive symptoms observed (e.g. Teychenne et al., 2010).

Social support. Across the literature, there is general agreement that higher levels of social support correlate with better mental health outcomes (McHugh & Lawlor, 2012). For women with PND this may particularly be the case, as isolation and loneliness are commonly reported emotions in the post-natal period, both of which have the power to influence mood (Beck, 2002). It is likely this is also the case for post-natal women with low mood. Semprevivo (1996) reported that women became isolated as a function of protecting themselves against the critical eye of others. To alleviate these feelings, contact with other mothers may help. A study by Mauthner (1994) supported this idea, finding that mothers' emotional and psychological wellbeing following childbirth was significantly influenced by their encounters with other mothers.

Among research into exercise and mood, social support is often examined, considering that physical activity can encourage social contact and thus alleviate isolation, offering a therapeutic avenue in itself (Malcolm, Evans-Lacko, Little, Henderson, & Thornicroft, 2013). While social support is clearly not a pre-requisite for exercise, it does provide a mechanism through which social contact can be enabled.

Armstrong and Edwards (2003) investigated the role of social support in the exercise-mood relationship, in a pilot study comparing exercise plus social support with usual care. But while the intervention group was more effective than the control group in reducing depressive symptoms, it is unknown whether the exercise itself, or the social support, or a combination of the two initiated those improvements. In their 2004 study the same authors compared exercise with social support, finding that social support alone was not enough to show improvements in mood. Exercise did have a significant added benefit for mood.

In other studies, the impact of social support may have been overlooked. Da Costa and colleagues (2000) conducted one of the earliest studies looking at the effect of exercise on PND. Participants in the intervention group showed significant improvements in depressive symptoms, but because an attention-placebo control group was not included, differences between the groups may be attributable to the attention given by the exercise therapist, who met with the women four times over the twelve week intervention. Although visits were limited to discussing progress and barriers related to the programme, some women may have perceived this as consistent social support. In sum,

social support during exercise may impact upon depressive symptoms, and should be considered as a potential contributing factor to any observable effects. It is unlikely, however, to act as the primary mechanism within the exercise-mood relationship for most women.

Post-natal fatigue. Post-natal fatigue is described as an ongoing and overwhelming feeling of exhaustion, which results in a decreased capacity to engage in mental and physical work (Song et al., 2010). Frequency is reported variably across literature, but it is said to be one of the most unpleasant symptoms for women following childbirth (Rychnovsky & Hunter, 2009). Researchers have demonstrated that post-natal fatigue is a significant risk factor for Post-Natal Depression (Runquist, 2007), and therefore may also contribute to low mood. Exercise has the capacity to reduce fatigue both in the general population and in the post-natal period. In a study by Dritsa, Da Costa, Dupuis, Lowensteyn & Khalife (2008), home-based exercise alleviated fatigue in post-natal women, partially mediated by improvements in perceived stress, and increased energy expenditure related to exercise. It is important to remain aware of the capacity for exercise to reduce post-natal fatigue, as it may contribute to the positive effects it has on mood.

Distraction. The idea of distraction has also been considered, with some literature suggesting that it is not the exercise per se that impacts upon depressive symptoms, but the respite from daily stressors that has an effect (Bahrke & Morgan, 1978). A number of studies have supported this finding, with exercise groups demonstrating similar reductions in depressive symptoms as control groups who meditate or rest quietly (e.g. Raglin & Morgan, 1993, and Glazer & O'Connor, 1992). Goode and Roth (1993) investigated runner's cognitions and reported significant correlations between engagements in non-associative thoughts while running and increased feelings of vitality post-exercise. Such findings demonstrate the importance of considering cognitions during exercise.

Other studies have found that distraction alone is insufficient for explaining depressive reduction (Fillingim, Roth & Haley, 1989) and that it may be more beneficial for enhancing mood rather than reducing depression, where they are not the antithesis of each other (Saklofske, Blomme & Kelly, 1992). As such, while the distraction

hypothesis remains plausible, it is important to consider it in the context of other factors related to exercise, which may also play a role in the improvement of mood. There is no research into the effects of distraction while exercising within the post-natal population to date, but could be considered in future research.

The Current Study

Literature suggests that exercise has a significant, positive impact upon mood for women with PND, and it seems likely that exercise will also have an impact for post-natal women with low mood. The mechanism through which this effect may occur is via improvements in self-esteem. It is also likely that improvements in mood will be related to high levels of exercise enjoyment. In consideration of the most effective type of exercise to see mood improvements, walking appears to be convenient, cost-effective and adpatable to suit a mother's needs. Within the literature, group pram-walking in particular has been shown to improve symptoms of PND (Armstrong & Edwards, 2003, 2004). However, research highlighting some of the barriers to group pram-walking suggest that walking which is not prescribed to be undertaken in groups may be a superior form of exercise in order to see mood improvements. These facts considered, the current study will investigate the effects of walking upon post-natal low mood, when variables such as time of the day, time of the week, frequency, duration, intensity level and presence of social company is freely decided by the walker. Relationships between mood, self-esteem, and exercise enjoyment will also be assessed.

Method

Study Aims

The current study aimed to determine whether exercise through walking, when variables are mostly self-determined, has an effect on post-natal low mood. It also aimed to determine whether there is a relationship between exercise enjoyment and low mood, and self-esteem and low mood for post-natal women.

Hypotheses

One

Participants in the walking group would show greater improvements in mood (EPNDS) than the participants in the stretching comparison group from the beginning (week 0) to the end (week 12) of the programme.

Two

Participants in the walking group would show greater improvements in self-esteem (RSES) than participants in the stretching comparison group from the beginning (week 0) to the end (week 12) of the programme.

Three

There would be a negative relationship between self-esteem and mood for both groups, such that higher self-esteem scores (RSES) will be related to lower depressive symptoms (EPNDS).

Four

There would be a negative relationship between exercise enjoyment and mood for both groups, such that higher exercise-enjoyment scores (PACES) will be related to lower depressive symptoms (EPNDS).

Recruitment

The current study aimed to recruit a diverse range of post-natal women from across the whole of New Zealand. Recruitment and study procedures were carried out online so that there were no geographic limitations to participation. A variety of recruitment methods were employed to enlist participants for the study, and these are outlined below.

Distributing Flyers (physical and digital versions)

Flyers were distributed to various organisations around New Zealand involved with new mothers. These organisations included Plunket, The Post-Natal Distress Support Network Trust, regional Green Prescription clinics, child-care facilities, recreational facilities and child-friendly cafes. Digital flyers were also posted in online newsletters of child-focused organisations, including Kiwi Families and Essential Mums. See flyer in Appendix A.

Social Media

The researcher created a Facebook page titled 'Active Mothers New Zealand'. The page included information about the study, as well a direct link to the study website. The researcher's contact details were provided on the page. The use of social media broadened the capacity for recruitment by targeting appropriate audiences. The page also enhanced the potential for recruitment by snowballing, as it gave people the ability to easily share the study details with friends.

Plunket New Zealand posted details of the study on their Facebook page, which generated substantial interest. Other organisations including Baby and Beyond post-natal sleep consultants, Kiwi Families, Play Centre and various community organisations also posted programme details to their own Facebook pages.

Word of Mouth

Some participants already recruited into the study asked the researcher if they could encourage their friends or associates to also take part in the study. "Word of mouth" therefore played a role in the recruitment of participants for this study.

Presentation

The researcher presented information about the study to a New Mums Plunket Group in Devonport, Auckland, and left flyers for women to take home with them.

Eligibility of Participants

A number of eligibility criteria were applied to this study and are outlined below.

- In an effort to effectively capture the post-natal demographic, participants had to have babies aged between three and eighteen months of age. There is general agreement in the literature that mood within this time frame may be uniquely related to having a baby. Similar studies have also used this criteria when investigating the effect of exercise upon PND.
- Women had to be reporting low mood, which would have been unusual prior to giving birth. This was in order to ensure that the experience of low mood was unique to the post-natal period.
- Pregnant women were excluded at the time of recruitment. The researcher assessed that pregnancy was likely to impact on study results as mood states during pregnancy may have a different etiology to post-natal mood states. The current study aimed to isolate the post-natal period for determining how it may be impacted upon by exercise.
- Access to a pram was a requirement. Although it was not compulsory to use a pram in the intervention, if participants were allocated to the walking group it was important they had the option to walk with their baby. If this option was unavailable it could have been financially burdensome for mothers to find childcare while they were undertaking exercise as part of this study.

- Access to the Internet was also a requirement. This was because surveys were administered online and exercise was logged on a website. They also had to have proficient English language ability in order to complete the surveys and online component.
- Having had a caesarean section was also an exclusion criterion. The American College of Obstetricians and Gynaecologists (ACOG) (1994) recommends that 6 weeks after giving birth by caesarean may be sufficient time to wait before safely returning to exercise. They report, however, that exercise should be cleared by a physician because muscles, tendons and joints do not return to their pre-pregnancy state for at least 9-12 months. They also state that some women may not feel completely recovered for up to 6 months (ACOG, 1994). As such, a doctor's certificate would have been necessary to ensure the safety of participants. Consequently, the participant would have had to spend money on a doctor's consultation. Unfortunately, this project had insufficient funds to pay for doctor's appointments, so women who had had caesarean sections were excluded from the study.
- Participants were required to complete the Edinburgh Post-Natal Depression Scale (EPNDS) and were assessed as ineligible to participate if their scores indicated that they were likely to be clinically depressed (≥14) (Cox, Holden and Sagovsky, 1987).

Procedure

People interested in taking part were directed to a webpage hosted by Massey University School of Psychology using Qualtrics survey software. The webpage consisted of an online information sheet explaining the study and what would be involved (Appendix E and F). Clicking on the 'Next' button took people through to a screening criteria page where they could tick boxes to determine their eligibility, as well as non-identifying demographic information (see flowchart in Appendix B). If initial eligibility criteria were met, participants completed the Edinburgh Post Natal Depression Scale (EPNDS) as the final screening criteria.

Ineligible Participants

If eligibility criteria were not met, a page was displayed explaining that they were unable to take part, and support services information was provided (see flowchart in Appendix B). It was important to ensure that ineligible participants had access to this information, particularly if they wanted to seek help relating to their mood.

Eligible Participants

For eligible participants an online consent form was displayed. Here participants agreed or declined to take part under the conditions set out in the information sheet (see consent form in Appendix C). If agreed, participants entered their name and email address into the box provided, which was then linked to an ID number within the Qualtrics data file.

When the participant clicked on the 'Next' button, Qualtrics survey software randomly assigned the participant to either the walking intervention group, or the stretching group, and the appropriate instruction sheet was displayed. Participants could print this page if they wished (see instruction sheets in Appendices E and F).

On the following page, participants were then asked some introductory exercise related questions (Appendix D), before finally completing the Rosenberg Self Esteem Scale (RSES).

For each participant that signed up and went through this process, the researcher was then notified, through Qualtrics, by email. The researcher created an email address for the participant and a personal account for an online exercise-logging programme called Map My Run. The researcher became 'friends' with the participant in order to enable viewing and recording of their exercise logs. Login details for the individualised Map My Run account were emailed to the participant by the researcher. In the same email, the appropriate instruction sheet was attached. Participants could then begin their programme.

Exercise Programmes

Pram walking group. Those in the walking group received instructions to walk for a minimum of 30 minutes, three days a week for 12 weeks. These specifications are in line with recommendations from NICE (2009) for people with sub-threshold depression. In addition, participants were able to walk at any intensity, at any time, and on any day that suited them.

Stretching comparison group. Those in the comparison group received instructions to follow a YouTube stretching regime, which lasted for 15 minutes, to be performed at least three times a week for 12 weeks. Participants were also able to stretch at any time and on any day that suited them. It was decided that a YouTube clip would be used in order to encourage some consistency of the condition across participants. Specifying 15 minutes only was intended to ensure the participant remained engaged. Having a baby at home was also considered in this decision where participants may not have been able to leave him/her for longer periods of time.

Exercise Logs

After every stretch or walk, participants in both groups logged into their personal Map My Run account and entered the time, date, duration and optional extra notes pertaining to their session. This enabled the researcher to track each participant's activity – an important assurance of programme adherence. Exercise logs also gave participants the ability to look back and see their progress.

Surveys

At weeks 6 and 12, participants were emailed a link to an online survey containing the EPNDS, RSES and Physical Activity Enjoyment Scale (PACES). At week 18 (follow-up), participants were emailed a final link to an online survey containing the EPNDS and the RSES, to determine whether there were any lasting effects upon mood and/or self-esteem. Within the follow-up survey there was a box for participants to enter their postal address into, which the researcher used to post out a $20 supermarket voucher in

appreciation of their time. Please see Appendix B for a flowchart detailing the procedural steps. When results were collated the researcher posted a summary of the results to participants. Please see Appendix H for this letter.

Study Design

The current study is a randomised comparison design. To control for extraneous factors that may have influenced outcomes, all study components other than the intervention (walking) were designed to remain the same, for example, participants in both groups logged weekly activity online. As such, benefits observed in the walking group were likely to be due to the effects of walking, and not to other confounding variables. To alleviate the potential effects of social support from the researcher, no personal interaction between the researcher and participant was required. Participants received information and instruction sheets online, and necessary correspondence was made via email.

Participant Information

One hundred and ninety-one women in total accessed the website to view the study details. Ninety-four women progressed through screening criteria and were deemed either eligible or ineligible. Sixty-seven women were deemed ineligible for the reasons outlined in Table 1.

Table 1

Reasons for Ineligibility to Take Part

Eligibility Criteria Not Met	Number of Participants
Did not give birth in the last 3-18 months	4
Did not have low mood which would have been unusual prior to giving birth	18
Gave birth by caesarean section	10
Were pregnant at the time of screening	2
EPNDS ≥14	33

Twenty-seven women were deemed eligible to participate. Two of those women did not progress further and exited the sign-up process early. The remaining 25 women were allocated ID numbers. Thirteen women were allocated to the stretching group and 12 to the walking group.

During the programme 12 participants decided not to continue and dropped out of the study all together. Those who discontinued were asked why they could no longer participate. For three participants a lack of time was the main reason, and for one participant a relapse in post-natal depression meant she felt unable to cope. Other participants did not respond.

Thirteen participants completed the programme with seven participants in the walking group, and six in the stretching comparison group. Demographic information for participants is presented in Table 2.

Ethics

Tthis study was approved by the Massey University Human Ethics Committee Southern: A, approval number 13/60, in September 2013. It was also approved by the Plunket Ethics Committee for access to Plunket clients for recruitment (Appendix G).

Table 2

Demographic Information for Study Participants

Characteristic	Walking[a]	Comparison[b]
Age (years)		
19-21	1	0
22-24	0	1
25-28	1	3
29-32	0	2
33-36	1	0
37-40	3	0
41-44	1	0
Relationship Status		
Single	0	0
Married	5	4
De Facto	2	2
Civil Union	0	0
Other	0	0
Number of Children		
One	2	5
Two	4	1
Three	0	1
Employment		
Full time	0	0
Part time	0	1
Casual	0	1
Not Employed	6	3
Maternity Leave	0	1
Self-Employed	0	1

[a]n = 7. [b]n = 6.

Measures

Edinburgh Post Natal Depression Scale (EPNDS)

Post-Natal Depression is commonly defined according to a cut off point on the EPNDS. The EPNDS is a 10 item self-report measure using a 4-point likert scale. Higher scores indicate increasingly depressed mood, with a score of 13 or more suggesting possible clinical depression. The maximum score is 30. The benefits of the EPNDS include that it can be completed within five minutes, it is user friendly, non-threatening and simple to score.

Cox, Holden and Sagovsky (1987) have validated the EPNDS, finding satisfactory sensitivity and specificity, and also sensitivity to change in mood over time. It is widely used around the world, and some cross-cultural validation has been investigated (Clifford, Day, Cox & Werrett, 1999) finding a high level of correlation across cultures. White (2008) also found satisfactory validity and reliability when used with a sample of New Zealand pakeha women.

In the current study, the EPNDS was used as a screening measure, in order to identify and included participants with low mood and not depression. Participants with scores <14 met criteria. The EPNDS was also used as a means to track mood over time. It was administered via email link at weeks 0, 6, 12 and 18 (follow-up).

Physical Activity Enjoyment Scale (PACES)

The PACES is an 18-item measure rated with a 7-point scale, capturing an individual's subjective response to a specific physical activity. Scores can range from 18-126 with higher scores indicating higher exercise enjoyment. Validation studies have confirmed high internal validity and reliability of PACES (Kendzierski & DeCarlo, 1991). This study employed the scale in order to determine exercise enjoyment and was administered via email link at weeks 6 and 12.

Rosenberg Self Esteem Scale (RSES)

The RSES is a widely used measure for assessing self-esteem. It has been deemed reliable by a number of studies and has received more empirical validation than any other self-esteem measure (Byrne, 1996). It is a 10-item scale containing five items which are positively worded and five items which are negatively worded (Rosenberg, 1965). Participants rate 'how they feel about themselves' across each item on a 4-point scale ranging from 1 (strongly disagree) to 4 (strongly agree). Negatively worded items are reverse-scored to determine an overall self-esteem score, with higher scores indicting higher self-esteem (Rosenberg, 1965). This study employed the scale in order to evaluate self-esteem and was administered by email link at weeks 0, 6, 12 and 18 (follow-up).

Analysis

Statistical analyses were performed using SPSS version 21. In order to investigate Hypotheses One and Two, it was necessary to determine a) changes in mood/self-esteem within groups and b) changes in mood/self-esteem between groups. In order to do this, analysis of variance (ANOVA) would have determined differences between means at various time points during the study. However, due to the small sample size (walking group n=7, stretching comparison group n=6), it was decided that the non-parametric tests would be more appropriate for within and between group analysis ,as they do not require normal distribution of the population.

To determine changes in mood and self-esteem within groups, the Wilcoxon signed-rank test was run. In order to compare groups, Wilcoxon rank-sum tests identified that there were no significant differences in baseline scores between groups for both EPNDS scores and RSES scores. The Wilcoxon rank-sum test was subsequently used to compare scores between groups at each time point in order to detect statistically significant differences.

To investigate Hypotheses Three and Four, multiple regression could have uncovered important characteristics about the relationship between self-esteem, exercise enjoyment, and mood, and determine how much of the variation in EPNDS score was due to exercise enjoyment, and how much was due to self-esteem. However, guidelines recommend a large sample size in order to detect significant relationships between variables (Cohen and Cohen, 1983), and this condition was not met. Therefore, to determine whether there was a relationship between a) self-esteem and mood, and b) exercise-enjoyment and mood, Pearson's correlation analyses were performed. The strength and direction of the relationship was observed each point, in order to make overall observations about the relationship between variables.

Results

Statistical Analysis

Statistical analyses were performed using SPSS version 21. The analysis is presented according to each hypothesis. An alpha level of .05 was used for all statistical tests. At this level, observed effects have a 5% chance of having occurred by chance and this was considered an acceptable rate in order to minimize the chance of a Type II error occurring (when an effect occurs but fails to be recognised).

Changes in mood and self-esteem over time were of interest to this study, for participants in both the walking intervention group and the stretching comparison group. The assumption of normality for statistical analysis using parametric methods was violated, according to the Shapiro-Wilk's test ($p<.05$), presumably because sample size was small ($n=6$, $n=7$). As such, it was decided that parametric tests would not be sufficiently robust and therefore two non-parametric tests were performed. The Wilcoxon signed-rank test was used to determine changes within groups. This test involves the summation of ranks, to compare the central tendency of two related samples. It does not require data to be normally distributed (Howell, 2011). Additional assumptions for this test were met, which include that samples are related groups and the dependent variable is continuous. The distribution of the differences was also symmetrical in shape, meeting this final assumption of the test. The dependent variable (DV) was EPNDS score or RSES score, and the independent variable (IV) consisted of participants at time one and again at time two.

In order to determine differences between groups, the Wilcoxon rank-sum test was performed. This test also involves the summation of ranks, but compares the central tendency of two independent samples. It also does not require data to be normally distributed (Howell, 2011). Additional assumptions for this test were met, which include that samples are independent, distributions are equal, and the dependent variable (EPNDS score) is continuous (Howell, 2011).

The relationship between a) mood and self-esteem and b) mood and exercise-enjoyment was also of interest. Analysis using regression was not possible as the sample size was too small, and therefore was unlikely to produce reliable results (Knofczynski & Mundfrom, 2008). Instead, Pearson's correlations were performed in order to determine simple relationships between variables. As measures were assessed at a number of time points throughout the study (weeks 0, 6, 12, follow-up), correlations were also made at these points. Although change over time in the strength and direction of relationships was not of interest, it was decided that conclusions could best be made based on the overall nature of the relationships between variables across time.

Map My Run data was also assessed to determine adherence to the exercise programmes. On average, participants completed approximately three sessions per week, although this varied from zero to five sessions. If participants missed more than three sessions they were contacted by the researcher, and in all cases the participants explained that they had been doing the exercise, but hadn't managed to log their workouts. This was done retrospectively. Overall, while some participants skipped a small number of sessions, adherence to both the walking and stretching programmes was very good.

Hypothesis One

The walking group will show greater improvements in mood than the stretching comparison group

For the analysis, Wilcoxon signed-rank tests were performed to determine changes in mood within groups over time. Following this, Wilcoxon rank-sum tests were performed to determine whether there were any significant differences in mood between groups at each time point.

Table 3 shows the means, standard deviations, medians and range for Edinburgh Post-Natal Depression Scale (EPNDS) score of walking group participants and stretching comparison group participants over time. Mean scores for both groups decreased at each time point, indicating progressive improvements in mood from

the beginning of the programme to follow-up. The median score in the walking group decreased from baseline to Week Six, and then stabilised at Week Six. Median score for the comparison group progressively decreased from baseline to follow-up.

Table 3

Descriptive Statistics for EPNDS Score Over Time and Group

	Walking[a]				Comparison[b]			
Week	*M*	*SD*	*Mdn*	Range	*M*	*SD*	*Mdn*	Range
Zero (Baseline)	10.29	1.6	10	9-13	9.5	2.07	10	7-12
Six	6.57	2.76	5	4-12	8	5.22	9	1-14
Twelve	6.14	2.41	5	4-10	6.33	2.42	7	3-9
Eighteen (Follow-up)	5.57	2.51	5	2-8	5	2.76	5	2-8

[a]n = 7. [b]n = 6.

Change within Groups

Firstly, changes in mood *within* the walking and stretching comparison groups were assessed. The measure of central tendency with the use of Wilcoxon-signed rank tests is the median. Therefore unless otherwise stated, data are written as medians in the analysis.

Walking group. Wilcoxon signed-rank tests determined that there were statistically significant median decreases in mood score (EPNDS) from Week Zero (Median = 10) to Six (5), $Z = -2.13$, $p = .033$, $r = -.81$; Zero (10) to Twelve (5), $Z = -2.23$, $p = .026$, $r = -.84$; and Zero (10) to Follow-Up (5), $Z = -2.37$, $p = .018$, $r = -.90$. No other statistically significant differences were observed between time points (see Table 4).

Stretching comparison group. Wilcoxon signed-rank tests determined that there were statistically significant median decreases in mood score (EPNDS)

from Week Zero (10) to Twelve (7), $Z = -2.23$, $p = .026$, $r = -.91$; Twelve (7) to Follow-Up (5), $Z = -2.07$, $p = .038$, $r = -.85$; and Zero (10) to Follow-Up (5), $Z = -2.21$, $p = .027$, $r = -.90$. No other statistically significant differences were observed between time points (see Table 4).

In summary of these results, Table 4 shows the statistically significant differences in EPNDS scores between time points within each group, and indicates the median difference in EPNDS score between those points. While the nature of change varies within each group, mood in both groups significantly improved from the beginning to the end of the programme.

Table 4

Statistically Significant Differences in EPNDS Score over Time within Groups

	Walking[a]		Comparison[b]	
Week	Significance	Median Diff	Significance	Median Diff
0-6	S	-4	NS	
6-12	NS		NS	
0-12	S	-5	S	-3.5
12- Follow-up	NS		S	-1.5
0-Follow-up	S	-4	S	-5

Note. Significant at the p<.05 level. S = Significant. NS = Not significant.
[a]n = 7. [b]n = 6.

Change Between Groups

Secondly, changes in mood *between* the walking and stretching comparison groups were assessed.

Overall, the walking group improved by 5 median EPNDS points, and the stretching group improved by 3.5 median EPNDS points from the beginning to the end of the programme. However, Wilcoxon rank-sum tests suggest that there was no significant difference in scores between groups at Week Six, Week

Twelve, or Follow-up. This suggests that while mood in the walking group did improve by a greater degree, statistical significance of this effect was not observed.

In order to conduct the Wilcoxon rank-sum test for determining differences between groups, it was important that there was no significant difference between groups at baseline. A Wilcoxon rank-sum test was performed and indicated no significant difference in EPNDS score between groups at baseline, meaning they were essentially equivalent on EPNDS scores.

Wilcoxon rank-sum tests indicated no significant difference in EPNDS score between the walking and stretching comparison group at Week Six, Twelve, or Follow-up.

Hypothesis Two

The walking group will show greater improvements in self-esteem than the stretching comparison group

As above, Wilcoxon signed-rank tests were performed to determine changes in mood within groups, and Wilcoxon rank-sum tests were performed to determine significant differences in mood between groups at each time point.

Table 5 shows the means, standard deviations, medians and range for Rosenberg Self Esteem Scale (RSES) score of walking group participants and comparison group participants over time. Notably, median score at baseline differed by 5 RSES points between groups. However, this was not a statistically significant difference according to a Wilcoxon rank-sum test.

Table 5

Descriptive Statistics for RSES Score over Time and Group

	Walking[a]				Comparison[b]			
Week	*M*	*SD*	*Mdn*	Range	*M*	*SD*	*Mdn*	Range
Zero (Baseline)	17.29	6.07	19	9-28	14.83	3.06	14.0	11-19
Six	19.29	5.88	21	10-26	19.17	5.00	18.5	13-25
Twelve	22.14	3.76	22	17-27	21.00	4.43	20.5	15-28
Eighteen (Follow-up)	22.71	5.09	23	14-30	20.67	4.32	20.0	16-28

[a]n = 7. [b]n = 6.

Mean and median scores for both groups increased from baseline to Week Twelve, indicating progressive improvements in self-esteem from the beginning to the end of the programme. From the end of the programme to follow-up, the walking group slightly improved and the comparison group became slightly worse in mean and median RSES score.

Change Within Groups

Firstly, changes in mood *within* the walking and stretching comparison groups were assessed, using Wilcoxon signed-rank tests.

Walking group. Wilcoxon signed-rank tests determined that there were statistically significant median decreases in self-esteem score (RSES) from Week Zero (19) to Twelve (22), $Z = 2.00$, $p = .046$, $r = .76$, and Six (21) to Twelve (22), $Z = 2.22$, $p = .026$, $r = .84$. No other statistically significant differences were observed between time points (see Table 6).

Stretching comparison group. Wilcoxon signed-rank tests determined that there were statistically significant median decreases in self-esteem score (RSES) from Week Zero (14) to Twelve (20.5), $Z = 2.03$, $p = .042$, $r = .83$; and Zero (14) to Follow-Up (20), $Z = 2.21$, $p = .027$, $r = .90$. No other statistically significant differences were observed between time points (see Table 6).

In summary of these results, Table 6 shows significant differences in RSES scores between time points for each group, and indicates the median difference in RSES score between those points. While the nature of change varies within each group, self-esteem in both groups significantly improved from the beginning to the end of the programme.

Table 6

Statistically Significant Differences in RSES Score over Time within Groups

	Walking[a]		Comparison[b]	
Week	Significance	Median Diff	Significance	Median Diff
0-6	NS		NS	
6-12	S	+2	NS	
0-12	S	+4	S	+6.5
12-Follow-up	NS		NS	
0-Follow-up	NS		S	+4

Note. Significant at the $p<.05$ level. S = Significant. NS = Not significant.
[a]n = 7. [b]n = 6.

Change Between Groups

Secondly, changes in mood *between* the walking and stretching comparison groups were assessed, using Wilcoxon rank-sum tests.

Overall, the walking group improved by 4 median RSES points, and the stretching group improved by 6.5 median RSES points from the beginning to the end of the programme. However, Wilcoxon rank-sum tests suggest that there was no significant difference in scores between groups at Week Six, Week Twelve or Follow-up. This suggests that while, unexpectedly, self-esteem in the comparison group improved by a greater degree than the walking group, statistical significance of this effect was not observed.

In order to conduct the Wilcoxon rank-sum test for determining differences between the walking and stretching comparison groups, it was important that there was no significant difference between groups at baseline. A Wilcoxon rank-sum test was performed and indicated no significant difference in RSES score between groups at baseline.

Wilcoxon rank-sum tests indicated no significant differences in RSES score between the walking and stretching comparison group at Weeks Six, Twelve or Follow-up.

Hypothesis Three

There will be a negative correlation between self-esteem and mood for all participants

Pearson's correlations were conducted to assess the relationship between self-esteem (RSES score) and mood (EPNDS score) at Weeks Zero (baseline), Six, Twelve and Eighteen (follow-up) for walking and comparison group participants. All correlations were negative, as expected, indicating that as self-esteem increases mood improves.

Table 7 displays correlation coefficients, explained variance and significance values for EPNDS score and RSES score at each time point. Although only the correlation at Week Six was significant, overall, it seems likely that there was a moderate-strong, negative relationship between self-esteem and mood in this study.

Table 7

Correlation Coefficients for EPNDS and RSES Scores Over Time

Week	r	r^2	p
Zero (baseline)	-.329	.108	.272
Six	-.582	.339	.037
Twelve	-.309	.095	.305
Eighteen (follow-up)	-.437	.191	.135

Hypothesis Four

There will be a negative correlation between exercise-enjoyment and mood for all participants

Table 8 shows the means and standard deviations for Physical Activity Enjoyment Scale (PACES) scores at Week Six and Week Twelve, for each group. The walking group had higher mean scores at both time points, indicating that participants in the walking group had higher levels of enjoyment than participants in the stretching group.

Table 8

Descriptive Statistics for PACES Score over Time and Group

	Walking[a]		Comparison[b]	
Week	*M*	*SD*	*M*	*SD*
Six	106.29	10.69	94.67	12.71
Twelve	105.43	12.46	99.67	13.56

[a]n = 7. [b]n = 6.

A Pearson's correlation was conducted between exercise enjoyment (PACES score) and mood (EPNDS score) at Week Six and Week Twelve in order to assess the relationship between those variables for walking and comparison group participants.

Pearson's correlations suggest there was a negative correlation between PACES score and EPNDS score at Week Six, $r = -.230$, $r^2 = -.053$; and at Week Twelve, $r = -.254$. $r^2 = -.065$. Overall, results indicate a non-significant, weak negative relationship indicating that as exercise enjoyment increases mood improves.

Discussion

The rationale for this study was based on literature suggesting that low mood, which is unique to the post-natal period, may be a distinct experience for some women. Previous research suggesting that exercise may be beneficial in order to improve mood was drawn from, and the effects of a 12-week walking intervention were assessed for women with post-natal low mood. This investigation was the first of its kind in New Zealand, providing insights into the benefits of walking for women with low mood who have recently given birth, and the associated relationships between mood, self-esteem and exercise enjoyment. Unique aspects of this study included the implementation of a stretching comparison group, online application of recruitment and study procedures, the use of an online exercise logging programme, and a follow-up measure to determine the long-term effects of the intervention.

Major findings from this research suggest that mood was improved following a 12-week walking programme, however this was also the case for participants in a stretching comparison group. Mood improvements were sustained at the follow-up measure six weeks later for both groups. In addition, self-esteem also significantly improved for both the walking and stretching comparison group from the beginning to the end of the programme. There was a moderate correlation between self-esteem and mood for both groups. Unexpectedly, there was only a weak correlation between exercise-enjoyment and mood.

Changes in Mood

As hypothesised, the walking group improved by a greater number of median EPNDS points than the comparison group in this study, however, this observation was not statistically significant. Theories in the literature support the finding that walking improves mood. Physiological hypotheses relating to exercise suggest that specific hormones (serotonin, dopamine and noradrenaline) are released in the brain, directly impacting upon mood (Young & Leyton, 2002). The effects of 'getting out of the house' have also been suggested (Currie & Develin, 2002).

However, this finding also suggests that there may be factors at play, other than the walking in and of itself, within the exercise-mood relationship for post-natal women with low mood. Previous research has highlighted the effects of physical activation (Gauvin & Spence, 1996), adhering to a routine (Veale, 2008), distraction from daily events (Raglin & Morgan, 1993), logging weekly activity (Bandura, 1997), and the psychological implications of being involved in a study (McCambridge, Kypri & Elbourne, 2014). All of these have been shown to positively impact upon mood. The current study is unique in that walking was somewhat isolated from the effects of such variables, as participants in the stretching comparison group were also exposed to them. As the stretching comparison showed significant improvements in mood, results from this study tentatively support the research suggesting that variables such as these may have an effect on mood.

Patterns of Change

While both groups showed overall improvements in mood over the course of the 12-week programme, during the first half of the programme, the walking group improved whereas the stretching group did not. This suggests that the walking group improved at a faster rate than the stretching group, and is a similar finding to that of Armstrong and Edwards' (2004), where participants in a pram-walking intervention demonstrated significant mood improvements by week six of a 12-week programme, compared to controls. It could be the case that the associated benefits of walking, as previously mentioned, begin to occur within this early period, or that factors such as self-esteem and exercise-enjoyment facilitate improvements in mood at a faster rate for participants who walk.

In addition, median mood score for the walking group was the same at week six as it was as at week 12. This means that mood improved to its greatest degree by half way through the programme. Pram-walking interventions in the literature are all 12-weeks in length, in line with UK-based physical activity guidelines for people with depression or sub-clinical depression (NICE, 2009). Findings of the current study appear to be in contrast this timeframe, as six weeks of the walking prescription was sufficient for initiating mood improvements. However, this may

not be a robust finding due to the small sample size particularly as previous studies using similar interventions have shown further mood improvements from week 6-12. Further quantitative research with larger sample sizes may help to clarify this finding.

In the six weeks following the end of the programme (from week 12 to follow-up), the walking group median mood score stayed the same, and the stretching comparison group score showed statistically significantly improvements. Previous studies into the effects of pram-walking on mood have not administered follow-up measures and so no comparisons are possible. For the stretching group, significant improvements from the end of the programme to the follow-up measure may highlight natural variations in mood, or improvements over time. It is also possible that this group continued stretching and thus also continued to experience benefits. It is encouraging to find that mood improvements in the walking group were sustained for up to six weeks after the programme ended. It may also be that participants continued to walk, and therefore continued to experience the benefits, or that mood was lifted during the programme and became stabilised, or that a ceiling effect occurred.

Mechanisms of Change

Specific factors related to exercise that may have influenced mood were identified in the literature review to include self-esteem and exercise-enjoyment, and these were measured in this study. Findings suggest that there was a negative correlation between mood and self-esteem, as expected, indicating that high self-esteem is correlated with low EPNDS scores. But only a weak correlation was found between mood and exercise-enjoyment.

Self-Esteem

Moderate-large correlations in both the walking and stretching groups were found, indicating that high self-esteem is related to lower depressive symptoms. However, unfortunately, sample size was not large enough to conduct multiple regression analyses in order to determine how much of the variance in mood

could be explained by self-esteem.

Previous studies have not investigated the relationship between self-esteem and mood in exercise programmes for post-natal women. Within the non-perinatal population, Ryan (2008) found a strong relationship between self-esteem and mood, such that the direct effects of physical activity on symptoms of depression were negligible when the effects of self-efficacy, and self-esteem were controlled for. Based on those findings, it was concluded that self-esteem and self-efficacy mechanisms might offer a sufficient explanation for the mood improvements observed following the exercise regime in that study. While it is unlikely that self-esteem was solely responsible for mood improvements in the current study, findings add support to the literature that situates self-esteem within the exercise-mood relationship.

There are a number of reasons why self-esteem may have improved for both groups. Firstly, self-esteem can improve via the acquisition of a new skill (Craft, 2005). It is possible that, for both groups, the activity itself and also the online logging component were perceived as new skills that they had acquired. Secondly, setting goals and self-monitoring behaviours are thought to assist in creating feelings of mastery, leading to subsequent global improvements in self-esteem (Bandura, 1997). By enrolling in the study participants were, in a way, setting a goal to complete the 12-week programme. Logging may also have acted as a kind of activity diary for participants to monitor their exercise and look back on their progress. Both of these features may have facilitated mastery experiences. Another way in which mastery may have been enhanced is through encouraging an individual's belief that they are able to take proactive measures to maintain both their physical and psychological health (Bandura, 1997). This could have impacted positively upon perceptions regarding their own motivational abilities, which translated to feelings of mastery. It may be the case that feelings of self-worth were enhanced, via perceptions pertaining to the individual's involvement in a programme, with the ability to stick to and complete that programme. Lastly, it is possible that natural improvements in self-esteem occurred as a function of time, and that the programmes did not facilitate the effect.

Unexpectedly, greater improvements in self-esteem were found in the stretching comparison group than in the walking intervention group overall. Research factors may have contributed to this finding. Although participants were drawn from the same population, mean RSES scores differed by two points at baseline (the comparison group had an average score of 15, two points below the average walking group score of 17). It is possible that this increased the extent to which the average score could improve before reaching a ceiling effect. However, it is also possible that genuine improvements were experienced to a higher degree in the comparison group.

For both groups, self-esteem did not improve by a statistically significant amount during the first half of the programme (week 0-6). It is possible that self-esteem takes time to evolve, in order to utilise the mechanisms which influence its improvement, and this is why no effect was observed in the initial period of the programme. Self-esteem did statistically significantly improve during the second half (week 6-12) of the programme for the walking group, but not the stretching group. It is unknown why this effect was observed but it is possible that a cumulative effect saw walkers become increasingly confident with aspects of the programme, such as the online logging and commitment to a routine. These may have facilitated feelings of mastery, as has been suggested by Craft (2005), which impacted upon self-esteem. Having completed two sets of surveys by week six, participants may also have felt supported within a programme aimed at lifting mood. This may have further enhanced their self-esteem.

On average, self-esteem plateaued at the end of the programme (week 12) for both groups, with follow-up measures (at week 18) indicating stabilised scores. It is possible that participants reached a ceiling effect, with walking participants ending the programme on an average score of 22 (out of a possible 30 points) and stretching participants on an average score of 21, both of which sit above average on the RSES. It is also possible that these scores simply reflect the effects of the programme, where further involvement would have meant further improvements in self-esteem.

Exercise Enjoyment

Exercise enjoyment has not been widely examined in the literature relating to the effects of exercise on mood in post-natal women. However, from a review of broader research it seemed likely that the subjective experience of exercise was an important predictor of mood outcomes. Results of the current study show that, on average, the walking group enjoyed their activity more that than stretching group, albeit to a small degree. Regardless of the extent to which each activity was enjoyed though, an important finding was that only a weak relationship was found between mood and exercise enjoyment. The direction of the small relationship was in the predicted direction indicating that higher exercise enjoyment was related to lower depressive symptoms. While it is difficult to determine why this finding was observed, it may simply be the case that the level of exercise enjoyment had limited or no bearing on mood in this programme.

It may also be the case that the subjective experience of exercise is not well represented by exercise-enjoyment. Rejeski (1994) found hat the subjective experience of exercise was essential in order to see mood improvements. However, while the subjective experience may include feelings of enjoyment, it might also be represented by additional factors, such as perceived benefits by the participant. It is possible that participants in this study did experience their programme as positive, but this may not be reflected in the exercise enjoyment measure. The extent to which exercise prescription should take into account factors that are perceived as enjoyable by the participant is still unclear, and further research should attempt to understand this.

Additional Factors

While self-esteem and exercise enjoyment were the measured variables, it is also important to consider other factors which may have contributed to mood improvement. Firstly, physical activation has been implicated in the exercise-mood relationship where simply moving from an inactive lifestyle to an active one can induce positive psychological effects (Craft, 2005). From inspection of questionnaire data, all but one participant increased the amount of weekly

exercise they were doing as a result of being involved with this study. It is possible then, that physical activation had an impact on mood improvements. Secondly, exercise may be beneficial even at low levels of intensity and this may explain why mood of the stretching participants improved. Specifically, previous studies have found that stretching and yoga in particular act as effective stress management tools for perinatal women (Javnbakht, Kenari & Ghasemi, 2009).

Implications of the Findings

Findings of this study should be considered in the context of its smaller than anticipated sample size. Generalisations cannot be made to the wider post-natal population. However, the results do offer some insight into how a 12-week walking programme can impact upon mood for post-natal women experiencing low mood, with tentative implications.

Firstly, recruitment of participants for the current study supports the idea that post-natal low mood is a real experience. Health professionals should recognise the experience of low mood, to enable a meaningful pathway through which women can seek treatment. Routine screening by midwives, doctors and maternity nurses might be the most effective way to pick up cases of mood disturbances. The EPNDS, as used in this study, is already widely used in psychological healthcare settings, and could be easily administered in order to identify cases of low mood among new mothers.

Secondly, this study supports previous research finding that as a particular type of exercise, walking helps to improve mood for women with post-natal mood disturbances. Further, mood improvements may not be contingent on variables such as intensity, duration and frequency, but rather the walker may freely decide these. This means that health professionals could recommend walking as a treatment method, without requiring specific exercise prescription knowledge. Further research into walking as a modality, with consideration of these variables should be undertaken.

Lastly, participants in both the walking group and stretching comparison group showed significant improvements in mood during the programme. In light of this, it is possible that activity logging may be useful for women involved in exercise regimes. Online programmes such as Map My Run are free, easy to use, and may assist with self-esteem and motivation. Such programmes could be easily advised in conjunction with exercise prescription. A specific online logging programme for post-natal women could be a positive future development, which could be tailored to address a woman's needs in this period. Further research into the impact of such programmes upon both mood and self-esteem for a post-natal population would offer a greater understanding of their usefulness.

Limitations of the Research

Sample size was a major limitation of this research. With only 13 participants, analysis was restricted, and although insight was provided into simple changes and relationships between variables, there was limited scope for in-depth exploration. A larger sample size would have enabled deeper investigation into the relationships between time, mood, self-esteem and exercise-enjoyment, and could have given a greater assurance that results could be generalised to post-natal women in New Zealand, who also identify as having low mood.

Details of activities performed post-intervention were also unknown, meaning the follow-up measure needed to be interpreted with caution. It is possible that participants continued their allocated activity, which may have further impacted upon mood in this period. In addition, the extent to which social support may have impacted upon mood is also unknown. Participants were also not asked whether they engaged in social interaction while walking, but previous studies have found that contact with others, particularly other mothers, can have a significant effect on mood in the post-natal period (Mauthner, 1994). It is possible, therefore, that social contact played a role in mood improvements for some women in this study.

Potential expectancy effects may have influenced this study. Women were told about the anti-depressant effects of exercise in the information sheet and so may

have anticipated a lift in mood as a result of taking part in the programme. Ojanen (1994) notes that this is a difficult methodological problem to control in studies investigating the effects of exercise upon mood. Ryan (2008) accounted for this effect by disguising symptom measures and the study purpose to participants. This could be a measure future research takes in order to account for possible expectancy effects.

The lack of a control group could also be seen as a limitation of this research. While the stretching group enabled a comparison in order to isolate the effects of walking, that group was still under conditions where mood and self-esteem could change due to involvement with the programme. An additional control group could have offered a comparison against all participants for whom no change would be expected. This may be particularly important considering that participants had low mood, and not depression, where mood may be more likely to change as a result of natural improvements over time. It could also be the case that low intensity exercise has an impact on mood in its own right. Research to date is limited in investigating the effects of low intensity exercise on post-natal mood and further research would help to understand more about this relationship.

It is also important to consider who might be missing out on access to the study, and therefore which populations are not represented by the findings. As Internet access was a requirement, people who could not afford a connection were unable to take part. This may reflect people in low-socioeconomic environments, or people in rural communities. However, while restriction of such participants may be seen as a limitation of the research, the Internet may also have included a number of participants who would have been unable to take part if the study involved face to face recruitment and physical survey administration.

Conclusion

Findings of the current study add to the growing consensus that exercise does have a positive impact upon mood. While most of the research in this field has focused on women with PND, this study suggests that exercise may also be beneficial for post-natal women do not meet the diagnostic threshold for a Major Depressive Disorder. Exercise is cost-effective, can be done in almost any environment, can be done with or without an individual's child, can facilitate social contact, encourage self-esteem, and is not linked to stigma associated with post-natal mood disturbances. Also, in New Zealand, temperate weather conditions for most of the year mean that regular walking is a realistic and achievable activity. For these reasons, exercise seems to be a suitable treatment recommendation for post-natal women with low mood.

This study offers potentially valuable insights and support to previous research in the field. Women with low mood in the post-natal period do deserve a meaningful avenue through which symptoms can be recognised, and treatment methods such as exercise, can be recommended. This study provides a foundation from which future research can help to facilitate that.

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Appendix A.
Flyer

An Investigation into the Effects of Light Exercise on Post-Natal Low Mood

I'm looking for **60 women** to be involved with this project!

Have you…

- ✓ Given birth in the past 3-18 months (not by caesarean)?
- ✓ Recently been experiencing low mood, which would have been unusual prior to giving birth?
- ✓ Got regular access to a pram, and the Internet?

…If so, you could be part of this exciting research.

You will be assigned to **either** a 12 week stretching **or** walking programme, where you will exercise 3 x a week, in your own time, wherever suits you.

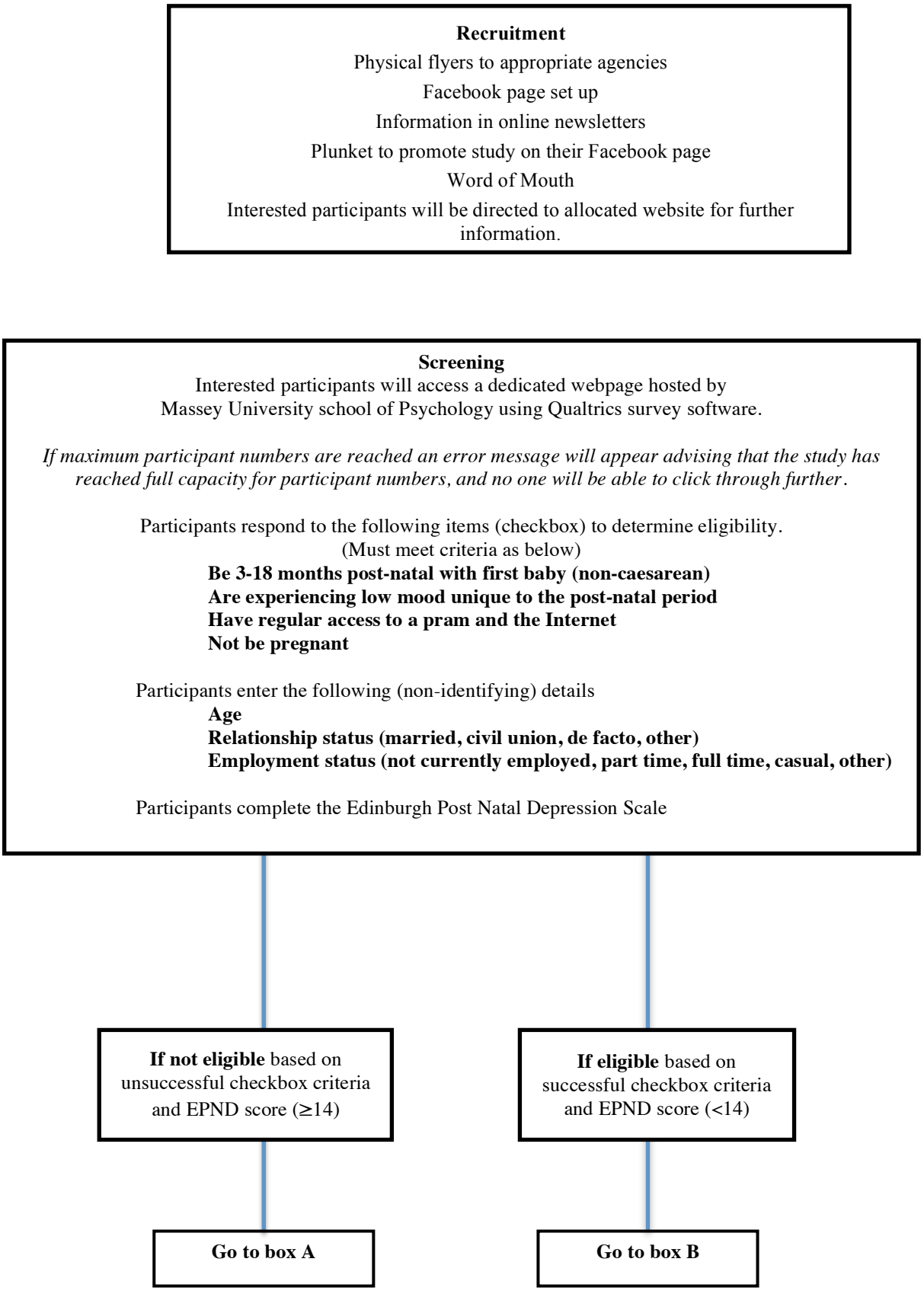
Interested? We would love to have you on board.
All participants will be given a $20 supermarket voucher in appreciation of your time.

Go to psych-research.massey.ac.nz or
www.facebook.com/activemothersnewzealand

Or contact Clare for more details
ce.kinsella@gmail.com
0276179155

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern A, Application 13/60. If you have any concerns about the conduct of this research, please contact Dr Brian Finch, Chair, Massey University Human Ethics Committee: Southern A, telephone 06 350 5799 x 84459, email humanethicsoutha@massey.ac.nz.

Appendix B.
Flowchart



BOX A

Thank you for participating. It appears that there may be obstacles for you to take part in this study at the current time. If you are concerned about your mental health we recommend that you contact your GP. Alternatively you can contact the following support agencies. We wish you all the best.

The Post Natal Distress Support Network Trust
09 836 6967
info@postnataldistress.org.nz
www.postnataldistress.org.nz

Postnatal Depression Family/Whanau NZ Trust
www.mothersmatter.co.nz
See the 'support' tab for agencies in your area.

Ministry of Health Healthline
0800 611 116

Plunket
0800 933 922
www.plunket.org.nz

Mothers Helpers – Christian Support
0800 00 27 17
info@mothershelpers.co.nz
www.mothershelpers.co.nz

BOX B

We are pleased to advise that you are eligible to take part in this study, and if you would still like to be involved we are excited to have you on board. Please note that if you are concerned about your mental health at any stage we recommend that you contact your GP. Alternatively you can contact the following support agencies.

The Post Natal Distress Support Network Trust
09 836 6967
info@postnataldistress.org.nz
www.postnataldistress.org.nz

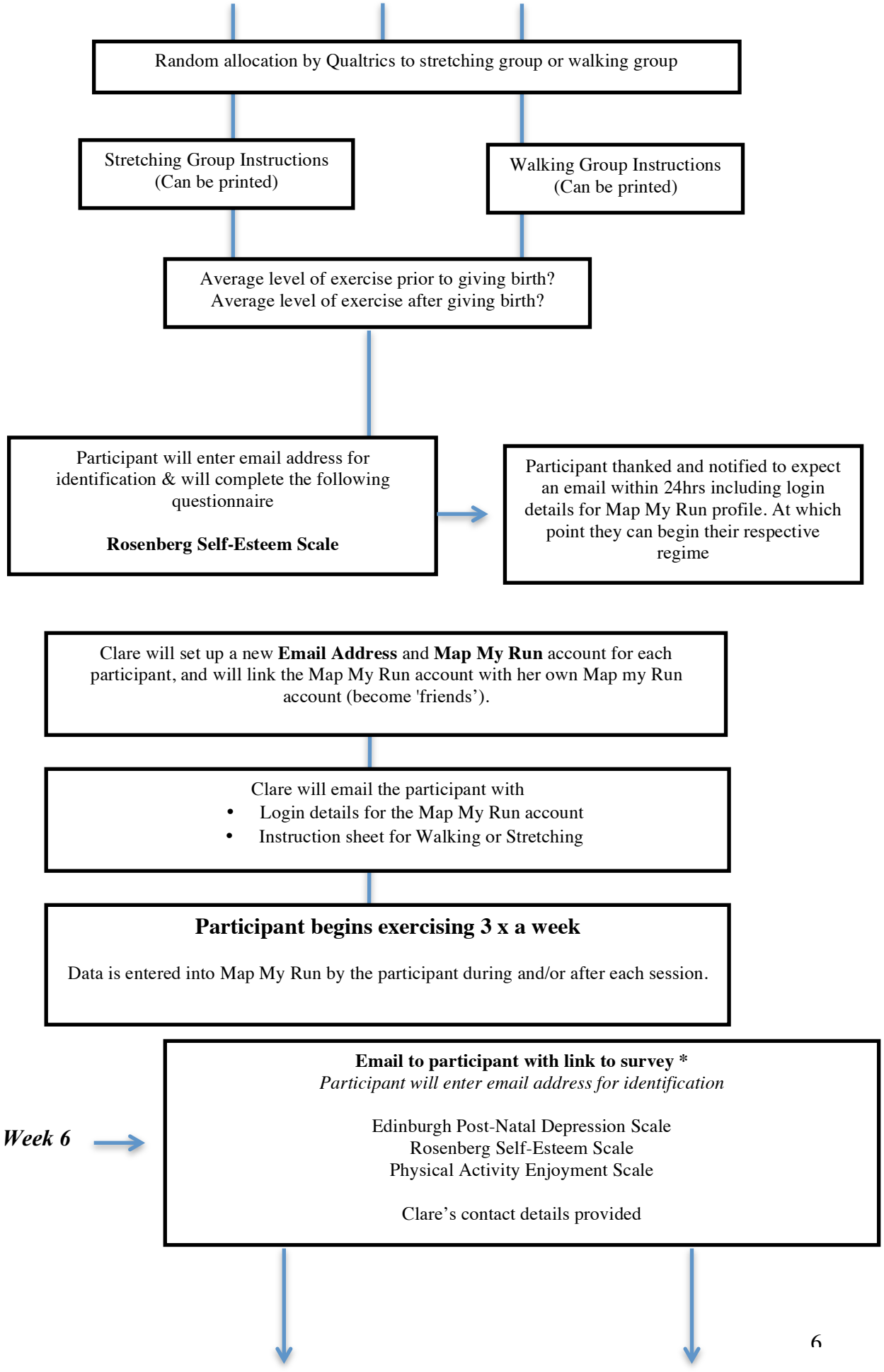
Postnatal Depression Family/Whanau NZ Trust
www.mothersmatter.co.nz
See the 'support' tab for agencies in your area.

Ministry of Health Healthline
0800 611 116

Plunket
0800 933 922
www.plunket.org.nz

Mothers Helpers – Christian Support
0800 00 27 17
info@mothershelpers.co.nz
www.mothershelpers.co.nz

CONSENT FORM + Email address for identification


Random allocation by Qualtrics to stretching group or walking group
Stretching Group Instructions (Can be printed)
Walking Group Instructions (Can be printed)
Average level of exercise prior to giving birth? Average level of exercise after giving birth?
Participant will enter email address for identification & will complete the following questionnaire
Rosenberg Self-Esteem Scale
Participant thanked and notified to expect an email within 24hrs including login details for Map My Run profile. At which point they can begin their respective regime
Clare will set up a new Email Address and Map My Run account for each participant, and will link the Map My Run account with her own Map my Run account (become 'friends').
Clare will email the participant with
• Login details for the Map My Run account
• Instruction sheet for Walking or Stretching
Participant begins exercising 3 x a week
Data is entered into Map My Run by the participant during and/or after each session.
Week 6
Email to participant with link to survey *
Participant will enter email address for identification
Edinburgh Post-Natal Depression Scale
Rosenberg Self-Esteem Scale
Physical Activity Enjoyment Scale
Clare's contact details provided

EPNDS Score <14

Thanks for completing these surveys. We hope the program is going well for you. If you have any questions or concerns please contact Clare or Angela on the contact details below. Otherwise, you can expect to hear from us again in 6 weeks time.

Clare - ce.kinsella@gmail.com
0276179155

Angela - A.McNaught@massey.ac.nz
09 414 0800 ext 41224

EPNDS Score ≥14

Thanks for completing these surveys. Unfortunately your scores suggest that your mood may be lower than expected.

If you are concerned about your mental health we recommend that you contact your GP. Alternatively you can contact the following support agencies. (Support Agency information provided as previous).

Please leave your contact details below if you would like to be contacted by the supervisor for this study, Dr Angela McNaught, to have a chat about how you are doing at the moment. Angela is an experienced clinical psychologist.

Name ……
Phone ……
Email ……..
Best time for contact ……

If you wish to continue with the study, thats great! Please continue as usual and we will be in contact with you in 6 weeks time.

If you would like to withdraw from the study please contact Clare on 0276179155, or at ce.kinsella@gmail.com. You can also contact Angela on 09 414 0800 ext 41224, or at A.McNaught@massey.ac.nz.

Week 12

→ **Email to participant with link to survey**
As above *

→ All participants notified of the end of the programme.
Thanked, and reminded to expect a final survey to be emailed in 6 weeks time.

Week 18 →

Email to all participants with link to survey

Edinburgh Post-Natal Depression Scale
Rosenberg Self-Esteem Scale

Final page to notify the close of the study.

Participant asked to enter postal details in a text box, in order for $20 supermarket voucher to be sent to them.

Reminder given that they will be sent a summary of the findings when available.

Clare's contact details given should they have any questions or issues regarding the study

→

Researcher posts $20 supermarket voucher to participant along with a letter of thanks.

Appendix C.
Consent Form

An Investigation into the Effects of Exercise on Low Mood in New Mothers

PARTICIPANT CONSENT FORM

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

If I am injured during participation in this programme I agree to manage my own health whether that be by contacting my GP, ACC, or other appropriate healthcare agencies.

I am willing to participate in this study under the conditions set out in the Information Sheet.

- ○ I agree
- ○ I do not agree

Appendix D.
Questions Relating to Exercise Habits

(Tick-box)

Prior to giving birth, on average I exercised

- Not at all
- Once a week
- Twice a week
- Three times a week
- More than three times a week

After giving birth, on average I exercise

- Not at all
- Once a week
- Twice a week
- Three times a week
- More than three times a week

Appendix E.
Instruction Sheet (Stretching)

Congratulations you have been assigned to the **stretching programme!**

Please read the following instructions, which will guide your participation over the duration of the programme.

You may wish to print this page to make it easy to refer back to.

The programme will run for 12 weeks.

Try to stick to the programme as closely as you can. If you miss up to three sessions for whatever reason, don't worry. I may get in touch if it becomes more that this, just to check if you're still keen to continue.

The Stretch

Please stretch three times a week for fifteen minutes in duration.

- You can stretch on any days that suit you.
- The following link will take you to 15-minute stretching regime. Please use the video clip as a guide to help you through a number of stretching exercises.

http://www.youtube.com/watch?v=P8DOZRtIIEQ
Or you can search in YouTube for
Feel Good Stretching Routine - Fitness Blender's Relaxing Cool Down Stretch Workout.

After Each Stretch

After every stretching session please enter your data into your Map My Run account, using the login details provided to you.

- Go to www.mapymyrun.com and login
- Click on ‘LOG WORKOUT’
- In the ‘WORKOUT’ field type in ‘Stretch’
- Click on ‘SHOW DETAILS’ and fill out the fields
- The ‘How did it go?’ field is optional
- Under 'Choose an Activity' select: Program / Video Workout - Stretch / Sculpt
- Click on ‘SAVE’

At the 6 and 12 Week Mark

You will receive two short surveys by email, one at week 6 and one at week 12. After the final survey you will receive an email from me to indicate the end of the programme.

You will have the option to keep or close your Map My Run account.

At 6 Weeks Following the End of the Programme

You will receive a final short survey by email to complete.

At this stage you will have the option to take part in the 12 week walking programme if you wish. Please contact Clare for further information.

A $20 supermarket voucher will be sent to you in appreciation of your time.
You will be emailed a summary of the research findings when these are available.

Please contact me if you require any further information, or if you have any questions or concerns at any time throughout the programme.

Clare Kinsella
ce.kinsella@gmail.com
0276179155

Appendix F.
Instruction Sheet (Walking)

Congratulations you have been assigned to the **walking programme!**

Please read the following instructions, which will guide your participation over the duration of the programme.

You may wish to print this page to make it easy to refer back to.

The programme will run for 12 weeks.

Try to stick to the programme as closely as you can. If you miss up to three walks for whatever reason, don't worry. I may get in touch if it becomes more that this, just to check if you're still keen to continue.

The Walk

Please walk at least three times a week for at least thirty minutes in duration.

- You can walk on any days that suit you.
- You may wish to push your baby in a pram, or you may wish to walk on your own, if your baby can be cared for by someone else.
- Aim to walk at a comfortable pace for you, this may be a stroll or a brisk walk

After Each Walk

After every walk, please enter your data into your Map My Run account, using the login details which will be provided to you.

- Go to www.mapymyrun.com and login
- Click on ‘LOG WORKOUT’
- In the ‘WORKOUT’ field type in ‘Walk’
- Click on ‘SHOW DETAILS’ and fill out the fields
- The ‘How did it go?’ field is optional
- You only need to enter details up to the weather icon, however you can complete more fields if you wish
- Under 'Choose an Activity' select **Walk**
- Click on ‘SAVE’

At the 6 and 12 Week Mark

You will receive two short surveys by email, one at week 6 and one at week 12. After the final survey you will receive an email from me to indicate the end of the programme. Some of you will be invited to take part in a short interview with me to chat about the programme. You can choose not to take part if you wish.

You will have the option to keep or close your Map My Run account.

At 6 Weeks Following the End of the Programme

You will receive a final short survey by email to complete.

A $20 supermarket voucher will be sent to you in appreciation of your time.

You will be emailed a summary of the research findings when these are available. Please contact me if you require any further information, or if you have any questions or concerns at any time during the programme.

Clare Kinsella
ce.kinsella@gmail.com
027 617 9155

Appendix G.
Plunket Ethical Approval

UNIVERSITY of OTAGO
Te Whare Wānanga o Otāgo
NEW ZEALAND

Ms Clare Kinsella
35 Prospect Tce
Mt Eden
Auckland

3 December 2013

Dear Clare

An investigation into the Effects of Light Exercise on Post-natal Low Mood

Thank you for this very thorough set of responses to the queries raised by the Ethics Committee. I have been through each of them, on behalf of the Ethics Committee, and I am happy to give you final approval to proceed with the project from the ethics standpoint. I note that the project will no longer be confined to first time mothers; hence, the change in title.

On behalf of the Ethics Committee I would like to wish you well with the project.

Yours sincerely

D Gareth Jones
Chair
Plunket Ethics Committee

(re-sent 28 January 2014)

Department of Anatomy - Otago School of Medical Sciences
PO Box 913, Dunedin 9054, New Zealand
Tel +64 3 479 7362 • Fax +64 3 479 7254 • Email anatomy@otago.ac.nz
www.otago.ac.nz/anatomy/

Appendix H.
Summary Letter to Participants

An Investigation into the Effects of Light Exercise on Post-Natal Low Mood

MASSEY UNIVERSITY
COLLEGE OF HUMANITIES AND SOCIAL SCIENCES
TE KURA PŪKENGA TANGATA

I would like to sincerely thank you for participating in this research. In doing so you have made a valuable contribution to what we know about this subject, and I really appreciate your effort during the programme. Please find a brief summary of the study below.

Research Summary
Massey University

Researcher: Clare Kinsella
Supervisor: Dr Angela McNaught

RATIONALE

Low mood can be a difficult experience for women, and may also act as a potential risk factor for the development of further mood difficulties. However, low mood has been largely unexamined in the existing literature, so this study aimed to fill this gap.

In researching treatments for low mood, exercise was identified as a potentially successful intervention with advantages as a free, accessible activity and proven benefits for both mental and physical health.

Research also suggests that improvements in fitness are not necessary in order for mood to improve. So, this study was interested in a walking based intervention where participants could freely determine the time, day, duration, intensity and social company, with the only requirement being that they exercise three times each week.

THE STUDY

A 12-week walking group and a 12-week stretching group were compared. Self-esteem and exercise enjoyment were identified as two potential factors through which walking may lead to mood improvements, and so were also measured throughout the study.

THE FINDINGS

The study found statistically significant improvements in mood in the walking group, but also in the stretching group. This finding suggests that while the 12-week walking programme was effective, involvement in a stretching programme was equally effective. Interestingly, maximum improvements were reached half way through the programme for walking group participants. So the good news is that walking seems to work, particularly within the first six weeks.

Considering that the stretching group also improved, it may be the case that additional factors such as following a weekly routine, reaching a goal, being involved with a programme and logging activity online also contributes to mood improvements.

The study also indicated that self-esteem might play an important role in the exercise-mood relationship, and previous studies have also supported this idea. But only a very small relationship was found between exercise enjoyment and mood.

LOOKING AHEAD

In light of the findings, it seems that regular, light exercise is beneficial for enhancing mood, and I would encourage you to continue with this in your daily lives! Also, the use of Map My Run may have contributed to improvements in self-esteem, particularly through allowing you to look back and see how much exercise you have done. These improvements may have helped to lift mood. So it might be helpful to create your own personal account and log your activity online.

Future research that further explores the impact of both self-esteem and exercise-enjoyment within the exercise-mood relationship, will enhance our understanding of this important subject. In the mean time, you have contributed to a greater understanding of how exercise can influence mood, and I hope you found it valuable on a personal level.

Thank you again for your involvement with this research. If you have any questions about the study please don't hesitate to contact me.

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