



Examining the role of parental self-regulation in family physical activity: A mixed-methods approach.

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Examining the role of parental self-regulation in family physical activity: A mixed-methods approach

Physical activity is essential for good health. However, parents risk becoming less active because of the demands of parenting. This has consequences for children as parents are role models. The present study used a mixed-methods approach to explore parental self-regulation associated with physical activity. Data were collected from 36 parents with preschool-aged children. They were interviewed about their physical activity and their family's physical activity. Parents also completed physical activity and self-regulation questionnaires and wore an accelerometer for five days. Qualitative data were examined using an inductive approach to thematic analysis. It showed that parents felt that they had limited time for personal physical activity. Mothers' self-regulation was driven by an ethic of care and subjective norms, whereas fathers' self-regulation was driven by beliefs about the importance of autonomy. Nevertheless, both parents saw caring for their children as the main priority. Quantitative data were examined using multiple regression analyses. Results showed that different self-regulatory behaviours predicted the physical activity of mothers and fathers. Which predictors were significant depended on the type of activity and how it was measured. The findings warrant longitudinal research that would enable the effect of family dynamics on self-regulation associated with physical activity to be assessed.

Keywords: Physical activity, behaviour, exercise, parents, children, self-regulation

Introduction

Adequate physical activity (PA) is essential to maintaining good health and wellbeing (Australian Government Department of Health and Aging, 2005). However, parents with dependent children are at risk of being less active because of the demands of family life (Adamo, Langlois, Brett, & Colley, 2012; Hamilton & White, 2010; Hull et al., 2010). Hull et

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2
3 al. found that couples who had at least one child, engaged in almost three hours less PA per
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5 week than couples who were childless. Importantly, parents' PA behaviours not only impact
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7 their own health and wellbeing, but also that of their offspring, because parents play a pivotal
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9 role in the development of children's PA behaviours (Freedson & Evenson, 1991; Gustafson
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11 & Rhodes, 2006; Hamilton, Cox, & White, 2012).
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14 A meta-analysis examining the influence of parental socialisation behaviours on
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16 children's PA showed that there was a significant positive relationship between parental
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18 modelling behaviour and the PA of offspring (Pugliese & Tinsley, 2007). Additionally,
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20 Oliver, Schofield, and Schluter (2010) used accelerometer data to show that parental PA was
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22 positively associated with preschool-aged children's PA. This is compatible with an earlier
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24 study, which showed that 4-to-7 year old children with two active parents were almost six
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26 times more likely to be active than children with two inactive parents (Moore et al., 1991).
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29 However, the study by Moore et al. (1991) revealed that mothers' and fathers' PA
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31 modelling did not exert equal influence. Children with active mothers were approximately
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33 twice as likely to be active as children with inactive mothers, whereas children with active
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35 fathers were over three times more likely to be active than children with inactive fathers.
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37 Conversely, Spurrier, Magarey, Golley, Curnow, and Sawyer (2008) used self-report
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39 measures to show that the amount of time preschool-aged children spent playing outdoors
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41 was significantly associated with the frequency of their mothers' PA, whereas the results for
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43 their fathers' data were less clear. On balance, it appears that mothers and fathers both
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45 influence the PA of young children, but in different ways. This has been attributed to their
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47 different family roles (L. Craig, 2006; Nomaguchi & Bianchi, 2004). Mothers' PA behaviour
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49 is constrained because they are typically the primary caregiver (Bell & Lee, 2005; Jackson &
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51 Henderson, 1995; Miller & Brown, 2005). Indeed, mothers spend 2-3 times more time caring
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3 for children than fathers do (L. Craig, 2006). Fathers' parenting is largely focused on social
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5 interaction with their children (Bailey, 1994; L. Craig, 2006).
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8 Research that has examined the determinants of parental PA has primarily focused on
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10 family structure and demographics. These are relatively fixed variables, so there is a need to
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12 examine psychological variables that are amenable to change. This would facilitate the
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14 development of more effective interventions aimed at increasing PA in families (Hamilton &
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16 White, 2012; Hankonen, Absetz, Ghisletta, Renner, & Uutela, 2010). In the few studies that
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18 have examined psychological factors, the researchers have generally used Social Cognitive
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20 Theory (SCT) (Bandura, 1986, 1995) or the Theory of Planned Behaviour (TPB) (Ajzen,
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22 1985, 1991) as a conceptual framework. The SCT proposes that pursuing personal goals
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24 entails self-regulatory processes, involving self-monitoring, judgment, and action initiation.
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26 The TPB proposes that behaviour is predicted by intentions that are governed by attitudes,
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28 subjective norms, and perceived control. Intentions are translated into action via self-
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30 regulation (Hamilton & White, 2012; McGannon, Curtin, Schinke, & Schweinbenz, 2012;
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32 Miller & Brown, 2005), which can be defined as the processes that an individual employs to
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34 initiate, maintain, or cease behaviours in order to attain personal goals (Baumeister &
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36 Heatherton, 1996).
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41 Although it is assumed that SCT and TPB are universally applicable, there is evidence
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43 of gender differences associated with self-regulation. For example, a meta-analysis showed
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45 that women are better at delaying gratification than men (Silverman, 2003). Women have
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47 also been shown to make more use of planning associated with changes in exercise behaviour
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49 (Hankonen et al., 2010). However, a study of self-regulation processes in achievement
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51 domains found no gender differences (Baumeister, Heatherton, & Tice, 1993). The
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53 contradictory findings may be due to context-specific gender differences in self-regulation.
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3 In summary, previous research that has examined the role of family structure in
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5 parental PA suggests that mothers' and fathers' different roles strongly influence their PA
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7 behaviour (e.g., Hamilton & White, 2012; Hankonen et al., 2010). Equally, studies that have
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9 explored psychological variables have found that self-regulation is an important determinant
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11 of parental PA (e.g., Anderson, Wojcik, Winett, & Williams, 2006; Buckley & Cameron,
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13 2011). Some studies found gender differences (Hankonen et al., 2010), but others did not
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15 (Baumeister et al., 1993).
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19 In the present study, we aimed to explore which aspects of self-regulation are
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21 associated with different categories of PA in mothers and fathers. We also aimed to explore
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23 parents' beliefs about PA in relation to family life. It was anticipated that the findings would
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25 inform future intervention studies aimed at increasing PA in families.
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29 We expected self-regulatory behaviours to predict the PA of parents. However, we did
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31 not think the same self-regulatory behaviours would apply across all categories of PA.
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33 Furthermore, we posited that different aspects of self-regulation would predict PA for
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35 mothers and fathers. Specifically, formulating a plan to manage their PA would be a more
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37 important predictor of PA level for mothers than it would be for fathers.
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41 A qualitative approach was used to explore parents' beliefs about PA because it is an
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43 effective means of gaining a deep understanding of how individuals view their life
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45 experiences (Lewis & Ridge, 2005). McGannon and Schinke (2013) have highlighted the
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47 need for qualitative studies that give expression to mothers' thoughts and feelings about PA
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49 and how they manage the demands of motherhood. There is also a need to discover what
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51 fathers' think and feel about PA in relation to fatherhood. In the qualitative component of the
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53 present study, we aimed to provide a rich account of the parents' beliefs about their PA
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55 experiences that would enhance understanding of parents' PA behaviours.
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Method

The study was a mixed-method, cross-sectional, non-experimental design. The Victoria University Human Research Ethics Committee approved the study. Written informed consent was obtained from the participants.

Participants

Advertisements were used to recruit families in Melbourne, Australia. The families consisted of a mother, a father, and between one and three children. Both parents from each family participated in the study. They were required to be at least 18 years of age with one child between 3 years of age and 5.5 years of age. The majority of families (72%) had two children, while 17% had one child, and 11% had three children. The age-range for the children was 1-10 years. The mean age was 6.9 years. The median age-band for both mothers and fathers was 36-40 years. Almost half (47%) of the parents were in this category. Most of the parents (86%) were university educated and over half of them (61%) earned \$60,000 or more per year. All of the fathers worked full-time, whereas 23% of the mothers worked full-time, 39% worked part-time, and the remaining 38% did not identify themselves as being employed.

Sampling Procedure

The convention is for researchers to conduct power analysis to determine the sample size necessary to detect meaningful effects with a specified level of precision. However, power analysis is inexact because of uncertainty related to the estimation of the parameter values used in the analysis (Bland, 2009; Matthews, 1995; Wilcox, 2010). Recommendations for participant to predictor ratios in multiple linear regression vary from 10:1 (Miller & Kuncze, 1973) to 30:1 (Pedhazur & Schmelkin, 1991). Furthermore, the underlying assumptions of power analysis are often untenable (Bacchetti, 2010; Bacchetti, Deeks, & McCune, 2011).

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3 Bacchetti et al. (2011) argued that small preliminary studies that focus on estimated
4 effects and the level of uncertainty surrounding them are valuable because they contribute to
5 later systematic reviews. Therefore, the size of a sample should be based on maximizing the
6 expected value of the research whilst minimizing its cost. With this in mind, the present study
7 used convenience sampling to recruit 30 families through local athletic organizations,
8 recreational facilities, and family organizations. A sample of this size would make the
9 qualitative analysis tractable whilst enabling basic multiple regression analysis to be
10 conducted.
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22 *Instruments*

23 Most research that has explored the psychological determinants of PA has used
24 questionnaires to assess the participants' behaviour. However, data obtained using
25 questionnaires can be affected by poor recall, researcher demand, and social desirability bias
26 (Adamo et al., 2012; Adams, Matthews, & Ebbeling, 2005; McMinn, van Sluijs,
27 Wedderkopp, Froberg, & Griffin, 2008). Therefore, we used both questionnaires and
28 accelerometers to assess PA.
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37 The International Physical Activity Questionnaire - Long Form (IPAQ-LF) (C. Craig
38 et al., 2003) assesses PA in daily life over seven days. It evaluates PA across four domains:
39 Work, Active Transportation, Domestic/Garden Duties, and Leisure. The instrument has very
40 good reliability ($r = .81$) and fair to moderate criterion validity when compared to
41 accelerometers ($r = .33$) (C. Craig et al., 2003).
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48 Participants' PA was objectively measured using Actigraph GT3X+ accelerometers
49 (Actigraph, Pensacola, FL). The raw data was processed using Actilife 6 software. The
50 Actilife default Wear Time Validation algorithm (60 minutes of consecutive zeros with a two
51 minute spike tolerance) was used to identify non-wear time or sedentary behaviour. The
52 Actilife default adult cut points, which were developed by Freedson, Melanson, and Sirard
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3 (1998), were used to partition the PA into categories. Sixty-second epochs are used to
4
5 determine the following categories of activity: sedentary 0-99 counts per minute (CPM); light
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7 100-759 CPM; lifestyle 760-1951 CPM; moderate 1952-5724 CPM; vigorous 5725-9498
8
9 CPM; and very vigorous 9499> CPM. Lifestyle is an intermediate category of PA introduced
10
11 by Actigraph, in collaboration with Freedson, to enable greater discrimination between
12
13 activities requiring different levels of energy expenditure. It is comprised of activities of
14
15 everyday life that are of higher intensity than light PA, but lower intensity than moderate PA.
16
17 Actigraph accelerometers and software have been shown to be a valid and reliable means of
18
19 measuring PA (Rothney, Apker, Song, & Chen, 2008; Vanhelst et al., 2012; Welk, Schaben,
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21 & Morrow, 2004).

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25 The Self-regulation Questionnaire (SRQ) (Brown, Miller, & Lawendowski, 1999) was
26
27 used to measure parents' behavioural self-control. The SRQ assesses seven aspects of self-
28
29 regulation: receiving relevant information; evaluating the information and comparing it to
30
31 norms; triggering change; searching for options; formulating a plan; implementing the plan;
32
33 assessing the plan's effectiveness. The SRQ has excellent internal consistency (Cronbach's α
34
35 =.91), excellent test-re-test reliability ($r = .94$) and fair to moderate content validity ($r = -.23$ to
36
37 $-.46$) (Aubrey, Brown, & Miller, 1994). Although the r values reported by Aubrey et al.
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39 showed that the SRQ has only fair to moderate content validity, the researchers stated that it
40
41 had shown robust convergence with related instruments. This is supported by research (Neal
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43 & Carey, 2005; Patock-Peckham, Cheong, Balhorn, & Nagoshi, 2001) that has shown a
44
45 positive association ($r = .60$) with the Self-Control Schedule (Rosenbaum, 1980) and an
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47 inverse association ($r = -.44$) with the Eysenck Impulsiveness Scale (Eysenck, Pearson,
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49 Easting, & Allsopp, 1985).

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54 Semi-structured interviews that were approximately 90 minutes in length were
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56 conducted to explore parents' beliefs about PA in relation to family life. The interviews were
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3 audio recorded and transcribed verbatim. Four broad topics were covered: the respondent's
4 PA, their partner's PA, their pre-school-aged child's PA, and the family's PA. The
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7 respondents were encouraged to talk about their personal experiences. When necessary, the
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10 researcher guided the discussion by asking questions about what facilitated and what impeded
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12 the respondent supporting their partner's PA; the respondent's engagement with their child
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14 and the feedback they gave their child regarding the child's PA; and what facilitated being
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16 active as a family group and what changes the respondent would like to make regarding their
17
18 family's PA.
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20 21 22 *Procedure*

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24 A researcher interviewed the mothers and fathers on separate occasions (the interview
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26 schedule is available upon request). On a later occasion the researcher met with the
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28 participants to demonstrate how to use the accelerometers, which were worn on a belt around
29
30 the waist and positioned superior to the iliac crest. The participants were instructed to wear
31
32 the accelerometer, during waking hours, for five consecutive days (3 weekdays and 2
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34 weekend days). They were also given the SRQ and IPAQ to complete. The participants were
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36 instructed to include the five days that the accelerometer was worn in the 7-day recall period
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38 for the IPAQ. The researcher collected the completed questionnaires and the accelerometers
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40 at least seven days later.
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45 46 *Analyses*

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48 Qualitative analysis of the interviews was accomplished using QSR NVivo 9 software. An
49
50 inductive approach to thematic analysis was used to explore the data (Braun & Clarke, 2006).
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52 The transcripts were read and re-read and noteworthy aspects of the data were systematically
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54 coded. Then the coded text was organized into broad themes. Following this, the themes were
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56 reviewed, refined, and named.
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5 Quantitative analyses were conducted using SPSS version 20[©] software. Data were
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7 screened and assumption violations dealt with using standard statistical practices (Tabachnick
8 & Fidell, 2007). Multiple imputation was used to deal with missing data, as it has become the
9 preferred method (Mackinnon, 2010; Sterne et al., 2009). Bivariate correlation analyses were
10 performed to explore associations between parents' PA and the self-regulation variables.
11
12 Where there were statistically significant correlations that were consistent with Social
13
14 Cognitive Theory and the Theory of Planned Behavior, multiple linear regression analyses
15
16 were used to determine which self-regulation variables predicted PA measured by
17
18 accelerometers and which self-regulation variables best predicted PA measured by self-
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20 report. The significance level was set a .05.
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27 Only a small number of variables have been identified as correlates of PA in adults.
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29 They are: self-efficacy; intention to exercise; male sex; reported health; and previous physical
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31 activity (for a comprehensive summary of systematic reviews see Bauman, Reis, Sallis,
32
33 Wells, Loos, and Martin, 2012). As self-efficacy and intentions are an intrinsic part of the
34
35 self-regulation construct (Bandura, 1995; Hamilton & White, 2012; McGannon, Curtin,
36
37 Schinke, & Schweinbenz, 2012), it was considered unnecessary to independently control for
38
39 them. The data for females and males were analysed separately. The study participants were
40
41 in good health. Prior exercise history was not included as a quantitative variable because of
42
43 the small sample size.
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47 Reporting of analyses that employed multiple imputations was informed by the
48
49 recommendations of Sterne et al. (2009). APA Task Force on Statistical Inference (Wilkinson
50
51 & The Task force on Statistical Inference, 1999) recommendations for reporting statistics
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53 were adopted.
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Results

The qualitative results are reported first. The themes that were identified are presented separately. When quotes are used, the family role of the respondent is indicated. In the quantitative results section, the results for mothers' and fathers' are presented separately.

The sample size that was achieved (18 families) fell short of the intended sample of 30 families. Consequently, only 36 semi-structured interviews were conducted. The small sample size also impacted on the quantitative analysis as it reduced the ability to reliably identify small to medium sized effects.

Qualitative Results

Four themes were identified in the interviews. They were: hard to commit to own (parent) regular PA/exercise; readiness to be active with young family; play not PA/exercise for kids; and parents plan activities for their children. In the interest of brevity, only hard to commit to own (parent) regular PA/exercise and readiness to be active with young family are reported, as they were the most frequently occurring themes. They are also the themes that are the most salient to the role of self-regulation in parental PA.

Hard to Commit to Own (Parent) Regular PA/Exercise

The interviews showed that the parents felt that they had little time for personal exercise or sports activities, since having children. Instead, their time was taken up with work, activities of daily life, and meeting the needs of their children.

Mothers in the present study found it particularly difficult to find time for personal PA, as they were the primary carers. The following quotes provide a rich description of their experiences. The names used are pseudonyms:

Quote 1: My husband has just taken on a new role and it's a lot more demanding for him. So if he doesn't get home until nine o'clock at night, I can't get out. It's trying to work around that

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2
3 because I don't want to be the nagging wife... it depends on his workload and how the staff are,
4 it's constantly changing.

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6 Quote 2: I used to get to the gym a lot more. Now it's really trying to fit it in around them. I find now I
7 go to the park a lot more. I never used to go to the park when I didn't have them (children). We do lots
8 of walking around the streets. We go to the shops in the pram.

9
10 Quote 3: I don't sit down all day. I am running around after them or you know, putting the washing out
11 or doing something around the house.

12
13 Quote 4: Because he works so much I try not to have ...not to take time away from when we have
14 family time.

15
16 Quote 5: School days it's usually getting them (2 boys) out of bed, getting them ready to go to school,
17 driving part of the way, walking the other half, getting Joe to school, coming back and just do
18 shopping, housework, running around Andy outside. If Andy needs to go to kinder, I'll take him to
19 kinder; we either drive or catch the tram depending on the weather and then go picking them up, taking
20 them home, cooking, cleaning, and then getting them ready to go off to bed...

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30 Fathers felt similarly time pressured. However, they often replaced exercise routines
31 and participation in sports with activities of daily life, such as active transport (e.g. cycling to
32 work), which can be done independently. The following four quotes demonstrate the fathers'
33 experience:
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37

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39 Quote 6: So again, I didn't go back to the level of PA when my study finished because the kids came
40 along and I always wanted to be one of these people that was around for my wife. So it kind of meant
41 just not doing a lot of PA during those first few years. Often when I get home from work... she would
42 just need to look at me and say, I've had enough of these children. Can you... I am like, yeah, I can
43 look after them. It's not a problem. So that time is blocked out which means I can't do any high impact
44 exercise for myself.

45
46 Quote 7: We spend a lot of time just looking after the children when we are not at work. We probably
47 don't organize activities that will get us both involved.

48
49 Quote 8: For me it is to prioritize riding my bike... I ride to work four days a week from here, so about
50 14.5 kilometres. It's a really nice ride. Having kids actually makes you prioritize having time for
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3 yourself. You don't have a lot of personal time and space. My ride to work is really one of the times I
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5 have to myself.

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7 Quote 9: I would say I ride to and from work every day, that's like half hour of activity or an hour of
8
9 activity, probably half an hour each direction riding to and from work. So, that's during the week day...

10 11 *Readiness to be Active with Young Family*

12 While weekday PA usually involved one parent and one or more children, weekend PA
13
14 involved both parents. This was because the parents felt that it was important to find time
15
16 to engage in PA together as a family. The following quote captures the experiences of the
17
18 mothers regarding being active with a young family. The names used are pseudonyms:
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22 Quote 10: ...during the school holidays, it's trying to find the activities that keep them occupied. We
23
24 spend a lot of time outside if the weather is good. Just so they're out there doing stuff. If Barney's
25
26 home, they'll usually be playing football or soccer or ride around on their bikes and so on. I don't
27
28 participate in that because usually that's my time to do more housework. That's basically what we do;
29
30 we don't really do much more than that.

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33 The following quote typifies the experiences of the fathers with regard to being active
34
35 with a young family:

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37 Quote 11: During weekends, we try to get out and do some physical activity; often that is getting on a
38
39 bicycle and riding to a café, taking the children to a playground, supervising them while running
40
41 around the playground.

42 43 *Quantitative Results*

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45 Due to the small number of participants (5) who engaged in very vigorous activity, the
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47 vigorous and very vigorous categories were collapsed. The accelerometer total lifestyle
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49 activity variable and the accelerometer total vigorous to very vigorous activity variable had
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51 missing data for three mothers and three fathers because of equipment failure. The IPAQ
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53 domestic/garden duties variable for fathers had missing data, as one participant did not enter
54
55 a response. Missing data were dealt with using multiple imputations. The method was fully
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3 conditional specification with 25 iterations. It was assumed that the data were missing at
4
5 random. The model for scale variables was linear regression. Twenty imputed datasets were
6
7 created.

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10 We used bivariate correlation analyses to identify statistically significant relationships
11
12 between variables. In the interest of brevity, only the pooled results are reported. There were
13
14 significant and strong correlations between IPAQ and accelerometer variables. For mothers
15
16 accelerometer total minutes light activity was correlated with IPAQ total estimated minutes
17
18 of transport activity, $r(16) = .58, p = .03$ and IPAQ total estimated minutes activity, $r(16) =$
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20 $.62, p .02$. Accelerometer total minutes lifestyle activity was correlated with IPAQ total
21
22 estimated minutes of activity, $r(16) = .69, p = .01$. For fathers, accelerometer total lifestyle
23
24 activity was correlated with IPAQ total minutes of activity, $r(16) = .63, p = .01$ and
25
26 accelerometer total vigorous activity was correlated with IPAQ total minutes of leisure
27
28 activity, $r(16) = .52, p = .04$.

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33 SRQ variables with statistically significant and theoretically meaningful bivariate
34
35 relationships with IPAQ variables and/or accelerometer variables were entered into multiple
36
37 regression analyses to determine which models of self-regulation best predicted PA for
38
39 mothers and fathers. As no SRQ variables were significantly correlated with the IPAQ
40
41 variables for fathers, regression analyses were not conducted using IPAQ variables for
42
43 fathers. Only summary statistics from the original data set are reported for the overall
44
45 regression models, as SPSS version 20[©] does not provide pooled results from the imputed
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47 data sets for them. Unless the results were trivial, they are followed by statistics from the
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49 pooled results for individual predictor variables, as these provide greater precision regarding
50
51 estimated parameters. The means and standard deviations for the multiple regression outcome
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53 and predictor variables can be seen in Table 1. It shows that the pooled results were quite
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55 similar to the results from the original data set for the variables with missing data.
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Mothers' Accelerometer Lifestyle PA

A three-step hierarchical regression analysis was performed to test our prediction that mothers' self-regulation associated with receiving information, evaluating the information, and formulating a plan to manage PA would predict mothers' lifestyle PA, measured using accelerometers. SRQ receiving information was the first predictor to be entered, followed by SRQ evaluating the information, and then SRQ formulating a plan. Although the model was not significant at any step, including SRQ evaluating the information enabled the model to account for 27% of the variance in mothers' lifestyle PA, while the addition of SRQ formulating a plan increased the accounted for variance to 30% (see Table 2).

Although SRQ evaluating the information was not a significant unique predictor, its squared semi-partial correlation shows that it contributed 16%, to the accounted for variance in mothers' lifestyle PA (see Table 3). A one point increase in SRQ evaluating information was associated with a 17.74 minute decrease in lifestyle PA. The other predictors were not significant and only made a small contribution to the accounted for variance in the outcome variable. The 95% CIs for the predictors were somewhat wide, which raises questions about the precision of the estimated parameters.

Mothers' Accelerometer Vigorous to Very Vigorous PA

We tested our prediction that mothers' self-regulation associated with receiving information, evaluating the information, and formulating a plan to manage PA would predict mothers' vigorous to very vigorous PA, measured using accelerometers. The model was not significant at any step. Furthermore it accounted for little of the variance in mothers' vigorous to very vigorous PA (see Table 2), so the analysis is not reported further.

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3 *Mothers' IPAQ Total Estimated Minutes of Garden and Domestic Duties*

4
5 A three-step hierarchical regression analysis was performed to test our prediction that
6 mothers' self-regulation associated with receiving information, evaluating the information,
7 and formulating a plan to manage PA would predict mothers' total estimated minutes of
8 garden and domestic duties, measured by the IPAQ. The model was significant at each step.
9
10 When SRQ Receiving information was the sole predictor, the model accounted for 37% of
11 the variance in mothers' total estimated minutes of garden and domestic duties. The addition
12 of SRQ evaluating the information increased the accounted for variance in the outcome
13 variable to 40%. Including SRQ formulating a plan increased the accounted for variance to
14 62% (see Table 2).
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27 SRQ receiving information and SRQ formulating a plan were significant unique
28 predictors of mothers' total estimated minutes of garden and domestic duties. The squared
29 semi-partial correlations show that the predictors contributed 48% and 23% to the accounted
30 for variance in the outcome variable, respectively (see Table 3). The B weights show that
31 whilst a one point increase in SRQ receiving information was associated with a 162.02
32 minute increase in mothers' total estimated minutes of garden and domestic duties, when the
33 other predictors were held constant, a one point increase in SRQ evaluating the information
34 was associated with a 23.25 minute decrease in total estimated minutes of garden and
35 domestic duties. The upper and lower bounds of the 95% CIs for SRQ receiving information
36 and SRQ formulating a plan were plausible. The total unique variance accounted for 72% of
37 the variance in the outcome variable. This was greater than the amount of variance in
38 mothers' total estimated minutes of garden and domestic duties accounted for by the overall
39 regression model. Associations between the predictor variables that reduced their collective
40 ability to predict mothers' total estimated minutes of garden and domestic duties probably
41 caused this.
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Mothers' IPAQ Total Estimated Minutes of Activity

We tested our prediction that mothers' self-regulation associated with receiving information, evaluating information, and formulating a plan to manage PA would predict mothers' total estimated minutes of activity, measured by the IPAQ. The model was significant at each step (see Table 2). When SRQ receiving information was the sole predictor, the model accounted for 39% of the variance in mothers' total estimated minutes of activity. With the addition of SRQ evaluating the information, the accounted for variance increased to 53% of the outcome variable. Including SRQ formulating a plan increased the accounted for variance to 65% (see Table 2).

The three unique predictors were significant (see Table 3). Although the p value for SRQ evaluating the information shows that it was not significant, the 95% CI did not contain zero. Therefore it can be concluded that SRQ evaluating the information was a significant predictor of mothers' total estimated minutes of activity. The squared semi-partial correlations show that the predictors contributed 40%, 10%, and 12% to the accounted for variance in mothers' total estimated minutes of activity, respectively. The B weights show that whilst a one point increase in SRQ receiving information was associated with a 184.71 minute increase in mothers' total estimated minutes of activity when the other predictors were held constant, a one point increase in SRQ evaluating information was associated with a 95.01 minute decrease in total estimated minutes of activity. Likewise, a one point increase in SRQ formulating a plan was associated with a 57.35 minute decrease in total estimated minutes of activity. The lower and upper bounds of the 95% CIs for the predictors were plausible.

Fathers' Accelerometer Lifestyle PA

A three-step hierarchical regression analysis was performed to test our prediction that fathers'

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3 self-regulation associated with receiving information, evaluating information, and
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5 formulating a plan to manage PA would predict fathers' lifestyle PA, measured using
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7 accelerometers. There was a trend toward the model being significant at steps two and three.
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9 When SRQ evaluating the information was added, the model accounted for 38% of the
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11 variance in fathers' lifestyle PA. Including SRQ formulating a plan increased the accounted
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13 for variance to 43% (see Table 4).
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17 Table 5 shows that SRQ evaluating the information was the only significant unique
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19 predictor of fathers' lifestyle PA. The squared semi-partial correlations show that it
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21 contributed 34% to the accounted for variance in the outcome variable. The B weights show
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23 that a one point increase in SRQ evaluating information was associated with a 33.51 minute
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25 decrease in lifestyle PA. The lower and upper bounds of the 95% CI for SRQ evaluating the
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27 information were plausible.
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30 31 32 *Fathers' Accelerometer Vigorous to Very Vigorous PA*

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34 We tested our prediction that fathers' self-regulation associated with receiving information,
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36 evaluating information, and formulating a plan to manage PA would predict fathers' vigorous
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38 to very vigorous PA, measured using accelerometers. There was a trend toward significance
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40 at steps one and two and the model was significant at step three (see Table 4). When SRQ
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42 receiving information was the sole predictor, the model accounted for 25% of the variance in
43
44 fathers' vigorous to very vigorous PA. The addition of SRQ evaluating the information
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46 increased the accounted for variance in the outcome variable to 40%. Including SRQ
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48 formulating a plan in the model increased the accounted for variance to 63%.
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53 Table 5 shows that SRQ receiving information was a significant unique predictor of
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55 fathers' vigorous to very vigorous PA. The squared semi-partial correlations show that it
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57 contributed 18% to the accounted for variance. Although the p value for SRQ formulating a
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3 plan shows that it was not significant, the 95% CI did not contain zero. Therefore it can be
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5 concluded that SRQ formulating a plan was also a significant predictor of fathers' vigorous to
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7 very vigorous PA. It contributed 14% to the accounted for variance in the outcome variable.
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9 The B weights show that whilst a one point increase in SRQ receiving information was
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11 associated with an 8.27 minute increase in fathers' vigorous to very vigorous PA when the
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13 other predictors were held constant, a one point increase in SRQ formulating a plan was
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15 associated with an 8.73 minute decrease in vigorous to very vigorous PA. The lower and
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17 upper bounds for the 95% CIs for SRQ receiving information and SRQ formulating a plan
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19 were plausible.
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24 **Discussion**

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27 We posited that different self-regulatory behaviours would predict the PA of mothers and
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29 fathers with young children and that the predictors would depend on the type of PA. Our
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31 quantitative results provide support for this proposition. Self-regulatory behaviours accounted
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33 for a substantial amount of the variance in mothers and fathers lifestyle activity measured by
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35 accelerometers, whereas self-regulatory behaviours only accounted for the variance in
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37 fathers' vigorous to very vigorous activity measured by accelerometers. Self-regulatory
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39 behaviours accounted for a substantial amount of the variance in mothers' self-reported
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41 estimates of time engaged in PA associated with garden and domestic duties and total time
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43 spent in all types of PA. We proposed that formulating a plan to manage PA would be a more
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45 important predictor of PA for mothers than for fathers. However, the results were not clear-
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47 cut, as the relative importance of formulating a plan to manage PA depended on the category
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49 of PA and how it was measured.
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54 Our qualitative findings provide insight into what drove the self-regulation of
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56 mothers' and fathers' PA. Parents felt that they did not have time for personal exercise or
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3 sports activities because most of their time was taken up with work, the activities of daily life,
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5 and meeting their children's needs. The way mothers and fathers responded was largely
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7 determined by their family role, which appeared to be influenced by gender. During the
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9 week, mothers' time was taken up with caregiving, whereas fathers were able to engage in
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11 autonomous activities, such as cycling to work. Additionally, when fathers were not at work,
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13 they were more likely to participate in leisure activities with their children, rather than
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15 caregiving. Whereas weekday activities typically involved one parent and the children,
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17 weekend activities involved both parents, because they felt that it was important to make time
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19 to engage in PA together as a family.
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23 Our quantitative data showed that self-regulatory behaviors predicted objectively
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25 measured lifestyle PA for both parents, though the effect was stronger for fathers. Evaluating
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27 relevant information was by far the strongest unique predictor of parents PA. Interestingly, it
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29 was associated with a small decrease in mothers' and fathers' lifestyle PA. Our qualitative
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31 data suggest this may be explained by parents monitoring what needs to be done and
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33 adjusting their activities as the need arises in daily life. What is not clear from our data is
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35 whether the decreases in lifestyle PA were the result of time spent evaluating information or
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37 because evaluating the information allowed the parents to use their time more efficiently.
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39 Nevertheless, our findings are consistent with Bandura's (1986, 1995) contention that self-
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41 regulatory processes involve self-monitoring, judgment, and action initiation (or cessation)
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43 and Ajzen's (1985, 1991) claim that goal-directed behaviour is often guided by conscious
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45 self-regulatory processes.
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50 Our quantitative analyses showed that self-regulatory behaviors predicted objectively
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52 measured vigorous to very vigorous PA for fathers, but not mothers. Analysis of the
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54 qualitative data indicated that this was because fathers replaced their sport and/or exercise
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56 routines with daily living activities such as active transport because they felt guilty about
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3 continuing their sport and exercise regimens, given the demands of family life. Notably,
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5 active transport gave fathers the opportunity to engage in vigorous to very vigorous PA. This
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7 finding is consistent with research that has shown that fathers generally having strong beliefs
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9 about engaging in exercise for autonomous reasons (Hamilton et al., 2012). It is also
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11 compatible with research that has shown that fathers are more advantaged and/or motivated
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13 than mothers to find time to exercise (Nomaguchi & Bianchi, 2004). Mothers in the present
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15 study had little opportunity to engage in independent PA because they spent most of their
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17 time with their children. Furthermore, even when fathers were present, mothers were unlikely
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19 to engage in independent PA because they felt that spending time together as a family was
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21 more important.
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25 Notably, our qualitative data shows that during the week fathers engaged in PA that
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27 did not require them to invest in much conscious self-regulation, because the PA was a
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29 functional part of their daily routine. Whereas, on the weekend they evaluated the PA options
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31 that were available and regulated their behaviour accordingly. This is consistent with
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33 Bandura's (1986, 1995) suggestion that individuals employ both conscious and non-
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35 conscious self-regulatory processes when pursuing personal goals.
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39 Self-regulatory behaviors predicted mothers' self-reported PA associated with
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41 domestic and garden duties and total PA. These outcome variables were highly correlated.
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43 Presumably, this is because mothers' total self-reported PA was largely composed of
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45 domestic and garden duties. The finding is indicative of mothers' subscribing to an ethic of
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47 care that is associated with their role within the family (Hamilton et al., 2012; Hankonen et
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49 al., 2010; Lewis & Ridge, 2005). Consistent with this, mothers' adherence to this principle is
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51 evident in the Hard to Commit to Own (Parent) Regular PA/Exercise theme from our
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53 qualitative results.
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3 The reason why our quantitative data showed that self-regulatory behaviors predicted
4 mothers', but not fathers', self-reported PA is unclear. One possibility is that females place
5 greater importance on subjective norms than males (Hamilton et al., 2012; Leslie et al., 1999;
6 Phongsavan, McLean, & Bauman, 2007). This is clearly demonstrated in our qualitative
7 findings, where a mother indicated her preparedness to give up personal time because she did
8 not want to be seen as 'the nagging wife'. This is somewhat at odds with research that found
9 that although subjective norms had more influence on intention associated with PA than
10 attitude and perceived behavioural control did, intention was not a strong predictor of
11 behaviour in young to mid-life women (Pearson, 2008).
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23 The time that mothers estimated they were engaged in garden and domestic duties was
24 substantially greater than their objectively measured time engaged in lifestyle activities (see
25 Table 1). This may be another indication that mothers place importance on subjective norms.
26 However, it should be noted that the self-report measure of PA was over a 7-day recall
27 period, whereas the objectively measured PA was over a 5-day period. Additionally, the two
28 measurement instruments use different criteria to define PA categories, so they are not
29 directly comparable.
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38 Another possible reason why self-regulatory behaviors predicted mothers', but not
39 fathers', self-reported PA is that the instrument used to measure self-regulation (the SRQ) is
40 somewhat flawed. This is supported by the substantial amount of accounted for variance that
41 was common to the predictors in two of the multiple regression analyses. Additionally, in
42 another analysis the sum of the accounted for variance uniquely contributed by the predictors
43 was appreciably larger than the variance accounted for by the overall regression model.
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52 Finally, we postulated that formulating a plan to manage PA would be a more
53 important predictor of PA for mothers than for fathers. However, the results were equivocal.
54 It was an important predictor for mothers' total estimated garden and domestic duties and
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3 total estimated activity, measured by the IPAQ. Conversely, it was an important predictor of
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5 fathers' vigorous to very vigorous activity, measured by accelerometers. Hence, the
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7 importance of formulating a plan to manage PA depended on the method of measurement and
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9 the category of PA. This is consistent with previous research Cleland et al., (2011) who noted
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11 that whether or not variables were associated with PA often depended on the means of
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13 measurement.
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16 In summary, our quantitative and qualitative findings support the proposition that
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18 different self-regulatory behaviours predict the PA of mothers and fathers with young
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20 families. The predictors that are significant depend on the type of PA and how it is measured.
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22 Our qualitative data indicate that mothers' self-regulation associated with PA is driven by
23
24 subjective norms and an ethic of care that is consistent with the role of mothers' role as the
25
26 primary caregiver. Alternatively, fathers' self-regulation associated with PA is driven by their
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28 beliefs about the importance of autonomy. Notwithstanding this, both parents saw meeting
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30 the needs of their children as their main priority.
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33 34 35 *Strengths and limitations*

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37 A strength of the present study is that it used a mixed method approach that enabled the
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39 triangulation of results, thereby reducing the effect of the weaknesses that are inherent in
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41 single method studies. The study also looked at factors that are amenable to change rather
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43 than comparatively fixed variables such as demographics and family structure. Another
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45 strength of the present study is that it collected data from both mothers and fathers, whereas
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47 studies examining parental PA typically only seek information from mothers. Finally, the
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49 magnitude of the effects in the present study indicated that they were meaningful.
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53 However, there are some limitations to the study. Convenience sampling was used to
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55 recruit participants from local athletic organisations, recreational facilities, and family
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57 organisations. Therefore our findings may not accurately reflect the behaviours of individuals
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3 who do not frequent those types of organizations. The small sample restricted the number of
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5 predictor variables that could be entered into regression models and the ability to reliably
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7 detect small to medium sized effects. Because we employed a cross-sectional design, changes
8
9 in family dynamics could not be assessed and causal inferences could not be drawn from the
10
11 findings. Finally, the study used a limited conception of what constitutes a family; therefore
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13 our findings may not generalize to all types of families.
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16 17 18 **Conclusions**

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20 A lack of time is frequently cited as a major cause of reduced PA in parents with pre-school
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22 aged children (Adamo et al., 2012; Hamilton & White, 2010; Hull et al., 2010). However,
23
24 additional reasons associated with self-regulatory behaviour have also been identified
25
26 (Anderson et al., 2006; Hamilton & White, 2012). **Notwithstanding the small and**
27
28 **homogeneous sample, the present study contributed to knowledge in this area by**
29
30 **demonstrating that self-regulatory behaviours predicted the PA of the parents. Importantly, it**
31
32 **also showed that the self-regulatory behaviours of the mothers and fathers were manifested in**
33
34 **different ways and at different times. Further research needs to be conducted to determine**
35
36 **whether this is also the case in families with a different structure. Research examining family**
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38 **PA would also benefit from studies that enable the association between changing family**
39
40 **dynamics and self-regulation to be assessed. A dynamic systems approach might be**
41
42 **particularly fruitful in this regard (e.g. van Geert & Lichtwarck-Aschoff, 2005).**
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Table 1. Means and standard deviations for the outcome and predictor variables from the original data set ($n = 15$ mothers & 15 fathers) and pooled imputed data sets ($n = 18$ mothers & 18 fathers).

Variable	Mothers				Fathers			
	Original		Pooled		Original		Pooled	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
IPAQ estimated minutes domestic & garden duties	695.56	759.29	695.56	759.29				
IPAQ total estimated minutes activity	1321.94	944.72	1321.94	944.72				
Accelerometer vigorous to very vigorous activity	19.13	18.29	16.92	21.82	40.93	74.42	41.07	67.66
Accelerometer lifestyle activity	421.53	142.58	413.11	139.83	445.67	204.31	445.53	185.54
SRQ receive	32.22	3.46	32.22	3.46	30.00	3.87	30.00	3.87
SRQ evaluate	29.17	3.22	29.17	3.22	28.13	3.68	28.13	3.68
SRQ formulate	32.17	6.01	32.17	6.01	32.87	3.09	32.87	3.09

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NB: SRQ receive = SRQ receiving information; SRQ evaluate = SRQ evaluating the information; SRQ formulate = SRQ formulating a plan.

Table 2. Regression model summary statistics for mothers.

Outcome Variable	Step	Predictors Variables	<i>F</i>	<i>p</i>	<i>R</i> ²	ΔR^2	Δp
Acc Lifestyle	1	SRQ Receive	.19	.67	.01		
	2	SRQ Receive, SRQ Evaluate	2.26	.15	.27	.26	.06
	3	SRQ Receive, SRQ Evaluate, SRQ Formulate	1.58	.25	.30	.03	.52
Acc Vigorous	1	SRQ Receive	.002	.97	.000		
	2	SRQ Receive, SRQ Evaluate	.004	.97	.001	.001	.69
	3	SRQ Receive, SRQ Evaluate, SRQ Formulate	.06	.98	.02	.02	.69
IPAQ Gard/Dom	1	SRQ Receive	9.43	.01	.37		
	2	SRQ Receive, SRQ Evaluate	5.01	.02	.40	.03	.40
	3	SRQ Receive, SRQ Evaluate, SRQ Formulate	8.00	.01	.63	.23	.01
IPAQ Total	1	SRQ Receive	10.15	.01	.39		
	2	SRQ Receive, SRQ Evaluate	8.39	.004	.53	.14	.05
	3	SRQ Receive, SRQ Evaluate, SRQ Formulate	8.57	.002	.65	.12	.05

P = <.05 Note: Acc Lifestyle = Accelerometer lifestyle PA; Acc Vigorous = Accelerometer vigorous to very vigorous PA; IPAQ Gard/Dom = IPAQ total estimated minutes of garden and domestic duties; IPAQ Total = IPAQ total estimated minutes of activity.

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Table 3. Pooled results for the hypothesized predictors of mothers Accelerometer lifestyle activity, IPAQ total estimated minutes of garden and domestic duties, and IPAQ total estimated minutes of activity.

Outcome	Predictor	B	Std error	t	p	S ²	95% CI
Acc Lifestyle							
	SRQ Receive	2.28	10.54	.22	.83	.01	[-18.40, 22.93]
	SRQ Evaluate	-17.74	11.35	-1.56	.12	.16	[-40.01, 4.52]
	SRQ Formulate	-3.52	5.91	-.60	.55	.02	[-15.11, 8.06]
IPAQ Gard/Dom							
	SRQ Receive	162.02	37.89	4.28	<.000	.48	[87.76, 236.28]
	SRQ Evaluate	-23.25	39.17	-.59	.55	.01	[-100.03, 53.59]
	SRQ Formulate	-64.08	21.62	-2.96	.003	.23	[-106.47, -21.70]
IPAQ Total							
	SRQ Receive	184.71	46.11	4.01	<.000	.40	[94.34, 275.10]
	SRQ Evaluate	-95.01	47.67	-1.99	.05	.10	[-188.45, -1.58]
	SRQ Formulate	-57.35	26.32	-2.18	.03	.12	[-108.93, -5.77]

p < .05

Table 4. Regression model summary statistics for fathers.

Outcome Variable	Step	Predictors Variables	<i>F</i>	<i>p</i>	<i>R</i> ²	ΔR^2	Δp
Acc Lifestyle	1	SRQ Receive	.00	.99	.00		
	2	SRQ Receive, SRQ Evaluate	3.72	.06	.38	.38	.02
	3	SRQ Receive, SRQ Evaluate, SRQ Formulate	2.77	.09	.43	.05	.35
Acc Vigorous	1	SRQ Receive	4.31	.06	.25		
	2	SRQ Receive, SRQ Evaluate	4.01	.05	.40	.15	.11
	3	SRQ Receive, SRQ Evaluate, SRQ Formulate	6.21	.01	.63	.23	.03

P = <.05

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Table 5. Pooled results for the hypothesized predictors of fathers' lifestyle PA and vigorous to very vigorous PA measured by accelerometer.

Outcome	Predictor	B	Std error	t	p	S ²	95% CI
Acc Lifestyle							
	SRQ Receive	8.27	9.32	.89	.38	.03	[-9.10, 26.54]
	SRQ Evaluate	-33.51	11.89	-2.82	.005	.34	[-56.81, -10.21]
	SRQ Formulate	-8.73	9.66	-.90	.37	.04	[-27.67, 10.21]
Acc Vigorous							
	SRQ Receive	-6.96	3.33	-2.09	.04	.18	[-13.48, -.43]
	SRQ Evaluate	7.06	4.23	1.67	.10	.11	[-1.23, 15.35]
	SRQ Formulate	6.28	3.44	1.83	.07	.14	[-.46, -13.03]

p < .05