

**Are illness representations of individuals living with Chronic Kidney Disease
predictive of levels of physical activity and associated to depression?**

Thesis submitted to the University of Leicester

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By

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Declaration

I hereby declare that I am solely responsible for the current thesis except stated otherwise by reference or acknowledgment, that the work contained herein is original, and has not been submitted for any other academic award or professional qualification.

Are illness representations of individuals living with Chronic Kidney Disease predictive of levels of physical activity and associated to depression?

Ryan Nah

Thesis Abstract

The Common Sense Model (CSM) of illness representations is a prominent psychological approach used to understand the motivation behind health behaviours. This thesis sought to understand the utility of the CSM by examining the relationship between facets of illness representations and health behaviours in individuals with Cardiovascular Disease (CVD) and Chronic Kidney Disease (CKD).

Literature Review

CVD confers significant costs, which is mitigated by a physically active lifestyle. However, many CVD patients do not undertake sufficient exercise. This prompted studies to examine if illness representations underpin the motivation behind such health behaviours. Despite a growing body of research in this area, no review has systematically interrogated and synthesised the corpus of research evidence. The current review aims to systematically review the relationship between illness representations and indices of physical activity in CVD. Ten studies were elicited with overall findings being equivocal; the majority of the studies demonstrated a relationship between illness representations and indices of physical activities with domains of timeline, control and consequences of the CSM most often revealed associations. Future research exploring putative causal relationships between illness representations and indices of physical activity is warranted.

Empirical Study

CKD is a debilitating condition, which is further exacerbated by depression. While being physically active have scope to mitigate adverse impacts, many do not meet the recommended physical activity guideline. The current study examined the relationship between illness representations and levels of physical activity in CKD. Seventy non-dialysing patients were recruited from an outpatient renal clinic. Results indicated that timeline cyclical of the CSM predicted levels of physical activity and was not moderated or mediated by depression while timeline cyclical, consequences, emotional representations, personal control and illness coherence were significantly associated with depression. Future research regarding the development of psychological interventions based on an illness representations framework is proposed.

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¹ Field supervisor has not been named for confidentiality purposes.

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List of abbreviations

Acute Coronary Bypass (ACB)
Acute Coronary Syndrome (ACS)
Beck Depression Inventory (BDI-II)
Baseline (BL)
Body Mass Index (BMI)
Brief Illness Perception Questionnaire (Brief IPQ)
Cardiac Diet Self-Efficacy Instrument (CDSEI)
Cardiac Exercise Self-Efficacy Instrument (CESEI)
Congestive Heart Failure (CHF)
Coronary Heart Disease (CHD)
Confidence Interval (CI)
Chronic Kidney Disease (CKD)
Cardiac Prevention and Rehabilitation Programme (CPRP)
Cardiac Rehabilitation (CR)
Cross-Sectional Cohort Study (CSCS)
Common Sense Model (CSM)
Cardiovascular Disease (CVD)
Data Analysis (DA)
Duke Activity Status Index (DASI)
Diet Outcome Expectation Scale (DOES)
Department of Health (DOH)
Estimated Glomerular Filtration Rate (eGFR)
Exercise Maintainers (EM)
Exercise Outcome Expectation Scale (EOES)
Emotional Representations (ER)

Exercise Self-Efficacy (ESE)

European System for Cardiac Operative Risk Evaluation (euroSCORE)

General Adherence Scale (GAS)

Godin Leisure-Time Exercise questionnaire (GLTE)

Generalized Self-Efficacy Scale (GSES)

Hospital Anxiety and Depression Scale (HADS)

Health Belief Model (HBM)

Health Promoting Lifestyle Profile (HPLP)

Irregular Exercisers (IE)

Inactive Participants (IP)

International Physical Activity Questionnaire (IPAQ)

Short Form International Physical Activity Questionnaire (IPAQ-SF)

Illness Perception Questionnaire (IPQ)

Illness Perception Questionnaire-Psychometrically Shortened (IPQ-PS)

Illness Perception Questionnaire-Revised (IPQ-R)

Integrated Research Application System (IRAS)

Leisure Score Index (LSI)

Leisure-Time Physical Activity (LTPA)

Myocardial Infarction (MI)

Morisky Medication Adherence Scale (MMAS)

Montreal Cognitive Assessment (MoCA)

Medical Outcomes Study Social Support Survey (MOSSSS)

National Health Service (NHS)

Open-Heart Surgery (OHS)

Physical Activity (PA)

Positive and Negative Affect Scale (PANAS)

Personal Control (PC)

Percutaneous Coronary Intervention (PCI)

Prospective Longitudinal Cohort Study (PLCS)

Randomised Control Trials (RCTs)

Research Ethics Committee (REC)

Standard Deviation (SD)

Self-Efficacy (SE)

Subjective Socioeconomic Position (SEP)

Short Form Health Survey (SF-12)

Short Form 36 Health Survey (SF-36)

Stage of Change (SoC)

Timeline Acute (TA)

Timeline Cyclical (TC)

Unstable Angina (UA)

United Kingdom (UK)

Versus (vs.)

World Health Organization (WHO)

PART 1: Literature Review

Illness representations as predictors of indices of physical activity in Cardiovascular Disease (CVD): A systematic review

Abstract

Background and aims: The Common Sense Model (CSM) of illness representations hypothesises that individuals with health problems constructs appraisals of their conditions, which influence their propensity to engage in health behaviours. Despite the growing body of research investigating the association between illness representations and indices of physical activity in Cardiovascular Disease (CVD), no review has systematically interrogated and synthesised the corpus of research evidence. This paper systematically reviews the association of illness representations and indices of physical activity in individuals with CVD.

Method: Systematic searches of PsycINFO, PubMed, and CINAHL were conducted in July 2016 and again in March 2017 to identify peer-reviewed papers using quantitative methodology published in the last ten years. The elicited studies were then quality appraised, evaluated and synthesised.

Results: Ten studies met eligibility criteria. Overall findings were equivocal, with the majority of the studies demonstrating a relationship between participants' illness representations and various indices of physical activities. Five of the six studies that examined the relationship between illness representations and the levels of physical activity/exercise found significant associations/predictions while three of the five studies exploring associations/predictions between illness representations and adherence to exercise or cardiac rehabilitation had statistically significant results. All three studies that explored associations/predictions between illness representations and exercise self-efficacy were statistically significant. Overall, domains of timeline, control and consequences of the CSM most often revealed associations with indices of physical activity.

Conclusions: The overall findings in the current review have demonstrated that components of illness representations were associated with and/or predicted indices of physical activity. The results have clinical implications and relevance as illness representations have been found to be modifiable through psychological intervention. Future research should explore putative causal relationships between illness representations and indices of physical activity which could evidence and inform innovative cardiac rehabilitation programmes addressing patient appraisals.

1 Introduction

Cardiovascular disease (CVD), an umbrella term that encompasses heart and circulatory conditions usually arising from reduced blood flow to the heart or peripheral vessels consequent on atheroma or thrombosis (National Institute for Health and Care Excellence, 2010), is one of the leading causes of death globally (Lozano *et al.*, 2012). It is a primary cause of morbidity and mortality in the UK (National Health Service, 2016), with approximately 5.6 million individuals living with cardiovascular pathologies (British Heart Foundation, 2016) such as coronary heart and peripheral arterial diseases, as well as congenital conditions, deep vein thrombosis and pulmonary embolism (World Health Organisation, n.d.).

1.1 Societal and personal costs

CVD confers significant costs to individuals and society. Fiscal estimates suggest £11 billion attributable to healthcare costs yearly (British Heart Foundation, 2016), as well as informal care-related costs and lost productivity approaching £30 billion (Luengo-Fernandez *et al.*, 2006). With an annual mortality rate of 160,000 (British Heart Foundation, 2016), CVD accounts for almost 34 per cent of all deaths in England (National Institute for Health and Care Excellence, 2010), and its most frequent manifestation, Coronary Heart Disease (CHD) is the leading single cause of death in the UK, responsible for almost 70,000 deaths each year (British Heart Foundation, 2016). Living with CHD such as angina, myocardial infarction and heart failure adversely affects quality of life (Ford *et al.*, 2008; Garster *et al.*, 2009; Longmore *et al.*, 2011; Muhammad *et al.*, 2016) both psychologically and functionally. Approximately 20 per cent of individuals who suffer but recover from myocardial infarction meet criteria for minor and major depression (Thombs *et al.*, 2006) three months post event (Larsen, 2013), with major depression associated with increased risk of not returning to work (de Jonge *et al.*, 2014; O’Neil *et al.*, 2010; Schleifer *et al.*, 1989).

1.2 Role and importance of physical activity

In order to mitigate impacts and risks of CVD, both for those who have experienced a cardiovascular event or for those who are asymptomatic or have not yet experienced an acute episode, individuals are exhorted to modify their lifestyle

(Reges *et al.*, 2013), notably in physical activity. A standardised case-control study conducted in 52 countries found that insufficient physical activity was one of the nine potentially modifiable risk factors for myocardial infarction (Yusuf *et al.*, 2004). Exercise confers benefits; specifically, preventing the onset of coronary artery disease, slowing its progression and reversing risk factors (Chan *et al.*, 2006; Hambrecht *et al.*, 1993; Niebauer *et al.*, 1997; Peterson *et al.*, 2014; Swardfager *et al.*, 2012). The strength of evidence regarding exercise and physical activity has prompted the World Health Organisation (WHO) to agree a global strategy on physical activity amongst other risk factors (National Institute for Health and Clinical Excellence, 2010). In the UK, the National Institute for Health and Clinical Excellence (2016) has also recommended individuals with, or at high risk of CVD commit weekly to at least 150 minutes of moderate intensity aerobic activity or 75 minutes of vigorous intensity aerobic activity and muscle-strengthening activities. For those individuals who have already experienced myocardial infarction, cardiac rehabilitation programme with an exercise component should be offered (National Institute for Health and Clinical Excellence, 2013).

1.3 Barriers to physical activity

There is a wealth of evidence reporting cardiovascular benefits of exercise (Agarwal, 2012; Fransson *et al.*, 2003; Leon *et al.*, 1997; Yu *et al.*, 2003) and well-publicised recommendations to enhance physical activity for those with CVD (National Institute for Health and Clinical Excellence, 2010, 2013, 2016; Smith *et al.*, 2001). Yet many do not undertake sufficient exercise (Heart UK, n.d.; Reges *et al.*, 2013), take up offers of rehabilitation (Sniehotta *et al.*, 2009) or once in rehabilitation, adhere to guidelines (Reges *et al.*, 2013). Over 60% of men and over 70% of women in 2008 do not meet the recommended levels of physical activity (Heart UK, n.d.), and whilst post-MI, angioplasty and graft cardiac patients increase their exercise levels in the immediate period after discharge, it is not maintained only two months later (Reid *et al.*, 2006). Indeed, with sub-optimal take-up of exercise-based rehabilitation programmes as well as difficulties maintaining long-term exercise in the months and years after completion of cardiac rehabilitation programmes, individuals' health may still be compromised (Chase, 2011).

Given that failure to adhere to guidance on exercise may well compromise future health, a significant focus of research activity has sought to understand why those at risk of, or living with CVD, do not undertake sufficient physical activity (Karmali *et al.*, 2014). Research findings have suggested that, in addition to external obstacles and physical limitations, psychological factors are significant barriers (Rogerson *et al.*, 2012), and are crucial to address for participation and adherence in cardiac rehabilitation programmes (Anderson & Emery, 2014; Beswick *et al.*, 2005; Millen & Bray, 2008). Research in health and clinical psychology over the last 20 years has sought to develop and apply theories that can explain health behaviours such as adherence to exercise and medication, and use these to enhance interventions seeking behaviour change (Booth *et al.*, 2000; Holmes *et al.*, 2014; Johnston, 2005; Nigg *et al.*, 2002).

1.4 Self-regulation models

Dominant amongst psychological approaches have been self-regulation models, which offer socio-cognitive frameworks to understand cognitive and emotional responses to health challenges and diagnoses (Abraham *et al.*, 1998; de Ridder and de Wit, 2008; Hagger, 2010; Teixeira, 2015). These are often iterative process capturing an individual's dynamic system of response to health challenge, via coping mechanisms, setting goals, devising and using strategies to achieve them, monitoring progress and refining the goals and strategies. Core to such models are appraisals that individuals have of their condition and coping and these are argued to affect propensity to engage in health-related behaviours as well as physical and mental well-being. Social-cognitive models such as the Health Belief Model, Protection Motivation Theory and Theory of Planned Behaviour are advanced as self-regulation models that theorise health behaviours (de Ridder & de Wit, 2008). These social-cognitive models privilege mainly intention formation and future action via a cost-benefit analysis, but are less precise regarding goal setting and goal striving, which are characteristics of self-regulation. Additionally, these models cannot explain an individual's current experience and intentions that influence immediate health behaviours and were thus criticised as rudimentary self-regulation models (de Ridder & de Wit, 2008).

1.5 Value of the Common Sense Model (CSM)

The Common Sense Model (CSM) of illness representations by Leventhal and Cleary (1980), on the other hand, is an advanced self-regulatory model, which hypothesises that an individual faced by a health challenge will appraise and construct illness representations of their condition. From study of multiple conditions, they advanced five common perceptions relating to (a) identity, (b) cause, (c) time-line, (d) consequences and (e) curability/controllability (Hale *et al.*, 2007). Leventhal and Cleary's Illness Representations Model is considered as a better self-regulation model as it incorporated concepts from stress-coping theory, which elucidates the process of goal striving under adversity and the individual current experience and intentions (de Ridder & de Wit, 2008). The model also articulates how individuals concurrently process and regulate their belief about their illness and their emotional control towards it, which ultimately influences their health behaviours and outcomes (Hale *et al.*, 2007). The Illness Representations Model is thus regarded as more predictive of actual health behaviour change than other social-cognitive models (Maes & Karoly, 2005) with a meta-analytic review of the model revealing predictable relations between illness perceptions, coping and outcome, which demonstrated the model's theoretical robustness (Hagger & Orbell, 2003). Its utility in cardiovascular disease has been advanced for cardiac rehabilitation (Coats *et al.*, 1995; SIGN, 2002) to effectively address the psychological needs of patients.

1.6 Rationale for review

Despite an increasing evidence base examining the association between illness representations and indices of physical activity, there has been no recent interrogation and synthesis of the corpus of research evidence. To date there appears to be only one systematic review that has explored the relationship between illness representations and indices of physical activity, that of French *et al.* (2006) reviewing adherence to cardiac rehabilitation. However, this review included only individuals with coronary heart disease, did not explore the association between illness representations and other prominent indices of physical activity such as levels of physical activity or exercise self-efficacy, and warrants updating.

Furthermore, conducting a systematic review of the literature on the relationship between illness representations and indices of physical activity in individuals diagnosed with cardiovascular disease has high clinical applicability. Illness representations are potentially modifiable by cognitive behaviour therapy (Hale *et al.*, 2007) and if links between illness representations and indices of physical activity have been established, intervention programmes targeting the modification of illness representations to increase physical activity or adherence to cardiac rehabilitation programmes could be formulated.

1.7 Aims of review

The current review aims to bridge the knowledge gap of French *et al.* (2006) review and elicit, evaluate and systematically review the research papers examining the association between illness representations and indices of physical activity, specifically the link between (a) illness representations and levels of physical activity/exercise, (b) illness representations and exercise/cardiac rehabilitation adherence and (c) illness representations and exercise self-efficacy.

2 Method

A systematic and rigorous examination of the available literature was completed according to the PRISMA guideline for systematic review (Moher *et al.*, 2009). In order to understand the parameters of illness representations and physical activity research in CVD, an initial scoping search was carried out on Google and PsycINFO in July 2016, enabling formulation of a question to be reviewed. Subsequently, searches were conducted on various databases to examine the quantity of research studies that utilised illness representations and physical activity as research variables. The searches included an examination of the literature prior to 2006 as a quality check. Backward reference searching was conducted on the final selected articles to ensure no pertinent research studies were omitted.

2.1 Search strategy

Literature searches were conducted in July 2016, September 2016 and March 2017² in PsycINFO, PubMed and CINAHL databases to elicit empirical studies that met inclusion criteria. Additionally, grey literature was interrogated and manual searches of reference lists contained within included articles were undertaken. General search terms pertinent to interest variables, illness representations and physical activity were utilised to ensure that all relevant articles were included.

Boolean search operators ‘AND’ and truncation were used to identify appropriate articles to optimise search effectiveness. Search terms were permuted with the Boolean search operator ‘AND’ to address the main focus of the current review: “illness representation” (“illness perception*”; “common-sense model”; “illness perception questionnaire”; “self-regulatory model”; “parallel process model”) and “physical activit*” (“exercise”; “physical fitness”; “health behaviour”; “coping behaviour”; “exercise training”; “aerobic fitness”). The search terms “parallel process model”, “health behaviour” and “coping behaviour” were removed after the initial database search since search terms appeared too broad and numerous irrelevant abstracts were returned. The number of articles retrieved for each search string can be found in Appendix A.

² Searches were conducted in March 2017 to ensure the current review does not neglect and exclude any recent research studies.

2.2 Selection criteria

Application of search strategy generated 5, 909 records and trainee and supervisor screened abstracts and titles. The following inclusion criteria were applied such that papers were required to:

- comprise original research
- be in English language and peer-reviewed.
- include illness representations as a key study variable
- include indices of physical activity as key study variable
- assess illness representations and indices of physical activity with psychometrically robust tools
- recruit samples with diagnosed cardiovascular disease

Studies were excluded if they were:

- abstracts, commentaries, editorials, meta-analyses, protocols, reports and reviews
- not investigating the association between illness representations and indices of physical activity
- comprising samples with long term conditions without CVD, or in which data on CVD could not be discerned

Through the first round of the screening process, 70 records were identified as meeting inclusion criteria. Duplicates were then removed with 43 records remaining. The final phase of the search involved full text appraisals for the remaining 43 records against the eligibility criteria again, which identified 10 relevant records comprising those for review (see Appendix B, and PRISMA diagram, Appendix C).

2.3 Quality appraisal and data extraction

Those full text articles meeting inclusion criteria were independently assessed by the trainee and supervisor. A standardised data extraction form was constructed and utilised to summarise methodological parameters (study design, sample characteristics, statistical methods) and key findings (see Appendix D).

Methodological quality was assessed by the Downs and Black quality assessment checklist (1998), a tool designed to assess quality of randomised and non-

randomised studies of health care interventions, and given its rigour as an appraisal tool (Downs & Black, 1998) for systematic reviews (Deeks *et al.*, 2003) and its fit for the design of most of the elicited studies. Of the 10 articles selected, seven articles were non-randomised cohort studies of health care interventions while one article was a randomised controlled trial. The remaining two articles were cross-sectional, non-interventional studies.

The appraisal checklist comprises 27 questions that assess the methodological quality in four different domains, namely, reporting, external validity, internal validity and power. All of the questions in the original scoring system are awarded 1 point ('yes') or 0 point ('no'/'unable to determine') except for Question 5, which was rated on a 2-point scale and Question 27, which was rated on a 5-point scale. For this review, scoring for this latter question was modified to a 1-point scale in keeping with previous systematic reviews (Hooper *et al.*, 2008; Morton *et al.*, 2014; Silverman *et al.*, 2012). Fourteen questions were modified slightly to ensure applicability to cross-sectional non-interventional studies whilst retaining the essence of the question. Modified questions were asterisked with the modifications bold (see Appendix E). Categorisation of quality was based on previous studies (Hooper *et al.*, 2008; O'Connor *et al.*, 2015; Silverman *et al.*, 2012) with scores rated; excellent (26-28), good (20-25), fair (15-19) and poor (≤ 14). The Downs and Black checklist can be found at Appendix E, Table 4.

3 Results

The main results of the 10 elicited studies have been separated into two elements. The first elucidates the study characteristics, comprising (a) sample characteristics, (b) study methodologies, (c) study measures and (d) assessment of study quality. Main findings of the studies with regard to the relationship between illness representations and indices of physical activity are reported in the second element. The overall findings were synthesised, summarised and presented in the discussion section.

3.1 Study characteristics

Ten studies, published between 2006 and 2016 were undertaken in six countries: Australia (Platt *et al.*, 2013); Canada (Flora *et al.*, 2015; Leung *et al.*, 2007); Israel (Reges *et al.*, 2013); Jordan (Mosleh & Almalik, 2014); New Zealand (Broadbent *et al.*, 2009); and United Kingdom (Kidd *et al.*, 2015; Lau-Walker, 2006; Lau-Walker, 2007; Sniehotta *et al.*, 2009). Tables in Appendix F summarised the main characteristics of the studies based on the study design.

3.1.1 *Sample characteristics*

Studies had unique samples except for Lau-Walker (2006) and Lau-Walker (2007), which used the same sample with the later study presenting longitudinal data and conducting separate analyses. As such, only one of the two studies' sample characteristics was considered in the subsequent reported findings. A total of 2,134 individuals with varying forms of diagnosed cardiovascular disease (Coronary Heart Disease, Myocardial Infarction, Angina, Congestive Heart Failure and Acute Coronary Syndrome) were included in this current review. Study sample size ranged from 49 (Flora *et al.*, 2015) to 661 (Leung *et al.*, 2007) with a mean age range of 52.0 (Mosleh & Almalik, 2014) to 67.98 years (Kidd *et al.*, 2015). The total percentage of male participants in the studies was 76.5% with a range of 56.9% (Mosleh & Almalik, 2014) to 89% (Kidd *et al.*, 2015). One study (Flora *et al.*, 2015) was excluded from the aforementioned calculation as the percentages of male and female research participants were not documented.

3.1.2 Study methodologies

Only one study employed an experimental study design in the form of a Randomised Controlled Trial (RCT) (Broadbent *et al.*, 2009): the remainder utilised an observational study design (Flora *et al.*, 2015; Kidd *et al.*, 2015; Lau-Walker, 2006; Lau-Walker, 2007; Leung *et al.*, 2007; Mosleh & Almalik, 2014; Platt *et al.*, 2013; Reges *et al.*, 2013; Sniehotta *et al.*, 2009). Of the nine observational studies, seven adopted a prospective longitudinal cohort design (Flora *et al.*, 2015; Kidd *et al.*, 2015; Lau-Walker, 2006; Lau-Walker, 2007; Leung *et al.*, 2007; Reges *et al.*, 2013; Sniehotta *et al.*, 2009) and two, a cross-sectional cohort design (Mosleh & Almalik, 2014; Platt *et al.*, 2013). The length of follow-up for the seven prospective longitudinal cohort studies ranged from two months (Sniehotta *et al.*, 2009) to three years (Lau-Walker, 2007).

All studies recruited participants through convenience sampling. Three studies (Broadbent *et al.*, 2009; Kidd *et al.*, 2015; Reges *et al.*, 2013) recruited participants from a single site and five studies (Lau-Walker, 2006; Lau-Walker, 2007; Leung *et al.*, 2007; Mosleh & Almalik, 2014; Platt *et al.*, 2013) undertook recruitment at multiple sites. The remaining two studies (Flora *et al.*, 2015; Sniehotta *et al.*, 2009) accessed participants via regional locations, specifically, cardiac rehabilitation programmes provided by municipal health regions and regional health boards. In terms of randomisation, only the RCT (Broadbent *et al.*, 2009) used the random allocation method. None of the studies adopted a blinding or masking technique for group assignment.

3.1.3 Study measures

As the variables of interest in the current review were illness representations and indices of physical activity, only measures used to assess the aforementioned variables are reported. The Brief Illness Perception Questionnaire (Brief IPQ: Broadbent *et al.*, 2006), Illness Perception Questionnaire (IPQ: Weinman *et al.*, 1996), Illness Perception Questionnaire-Psychometrically Shortened (IPQ-PS: Sniehotta *et al.*, 2009) and Illness Perception Questionnaire-Revised (IPQ-R: Moss-Morris *et al.*, 2002) were self-report psychometric measures used to assess illness representations in all of the studies. All studies used the full original version of the IPQ, IPQ-R or Brief IPQ with three exceptions; Sniehotta *et al.* (2009) utilised the

IPQ-PS, a psychometrically shortened version of the IPQ-R that consists of three items with the highest factor loading from each subscale. Broadbent *et al.* (2009) used a combination of the Brief IPQ and causal scale of the IPQ-R. Reges *et al.* (2013) used only the Personal and Treatment control components of the IPQ-R. Three of eight cohort studies (Leung *et al.*, 2007; Reges *et al.*, 2013; Sniehotta *et al.*, 2009) measured illness representations only during baseline, while remaining studies assessed illness representations at multiple time points.

Indices of physical activity as dependent variables were assessed with self-report measures, specifically; the Health Behaviours Scale (Weinman *et al.*, 2000), International Physical Activity Questionnaire (IPAQ: Craig *et al.*, 2003), Cardiac Exercise Self-Efficacy Instrument (CESEI: Hickey *et al.*, 1992), exercise behaviour subscale of Health Promoting Lifestyle Profile (HPLP: Walker *et al.*, 1987), modified Minnesota Leisure-Time Physical Activity (LTPA: Taylor *et al.*, 1978), Godin Leisure-Time Exercise questionnaire (GLTE: Godin & Shephard, 1985), General Adherence Scale (GAS: DiMatteo *et al.*, 1992) and study specific questions on self-efficacy and cardiac rehabilitation attendance and participation. One study (Sniehotta *et al.*, 2009) used only the Leisure Score Index of the Godin Leisure-Time exercise questionnaire to measure self-reported physical exercise.

3.1.4 Assessment of study quality

Quality appraisal revealed a total mean score across studies of 16.4 (of a 28 point maximum), with a range of 13 to 21 points. Six studies were rated as ‘fair’, three as ‘poor’ and only one study as ‘good’ (see table 1 and Appendix G).

Table 1 Overall quality score of studies assessed by the Downs and Black quality assessment checklist

Author (year)	Overall quality score
Broadbent <i>et al.</i> (2009)	19 (Fair)
Flora <i>et al.</i> (2015)	17 (Fair)
Kidd <i>et al.</i> (2015)	21 (Good)
Lau-Walker (2006)	17 (Fair)
Lau-Walker (2007)	18 (Fair)
Leung <i>et al.</i> (2007)	14 (Poor)

Reges <i>et al.</i> (2013)	16 (Fair)
Sniehotta <i>et al.</i> (2009)	15 (Fair)
Mosleh & Almalik (2014)	13 (Poor)
Platt <i>et al.</i> (2013)	14 (Poor)

3.2 Relationship between illness representations and indices of physical activity

All studies explicitly examined the relationship between illness representations and indices of physical activity. Indices of physical activity has been categorised into the following (a) levels of physical activity/exercise, (b) exercise/cardiac rehabilitation adherence and (c) exercise self-efficacy.

3.2.1 Illness representations and levels of physical activity/exercise

Six studies (Broadbent *et al.*, 2009; Kidd *et al.*, 2015; Leung *et al.*, 2007; Mosleh & Almalik, 2014; Reges *et al.*, 2013; Sniehotta *et al.*, 2009) examined the relationship between illness representations and levels of physical activity/exercise in individuals diagnosed with CVD.

All studies except one (Kidd *et al.*, 2015) found a significant association between illness representations and levels of physical activity/exercise. Leung *et al.* (2007) revealed that timeline acute/chronic and attribution to-self component of illness representations significantly differentiated participants who maintained their exercise habits and participants who exercised irregularly or were inactive. Participants who were exercise maintainers were less likely to attribute the cause of Coronary Artery Disease (CAD) to their own behaviour and perceive their condition as chronic. Sniehotta *et al.* (2009) established that ‘cyclical timeline’ was predictive and negatively associated with levels of physical activity, that is participants who perceived their heart condition as less cyclical were more likely to be physically active. Mosleh and Almalik (2014) also found via the brief IPQ that timeline, coherence and personal control were predictors of physical activity. Participants who perceived their illness as less chronic, having more personal control and understood their condition were more likely to be physically active. Additionally, Mosleh and Almalik (2014) reported linear associations between

illness representation components (consequences, timeline, personal control, concern and coherence) and exercise frequency. Furthermore, Reges *et al.* (2013) found that the personal control component of illness representations was positively associated with active lifestyle for Arab participants six months after discharge. Such findings suggest personal control, coherence, attribution-to-self and timeline elements of illness representations are predictive of levels of physical activity. Additionally, perceptions of consequences and concern also appear associated with levels of physical activity. These findings echo Broadbent *et al.* (2009) who found participants receiving an intervention explicitly directed at such perceptions, reported an increased in strenuous exercise across baseline, three and six-month follow up as compared to a control group. All findings were reported to be statistically significant by all studies. By contrast, Kidd *et al.* (2015) found no significant association between the personal and treatment control of the illness representations and physical activity.

3.2.2 Illness representations and exercise/cardiac rehabilitation adherence

Five studies explored potential associations between illness representations and exercise/cardiac rehabilitation adherence (Flora *et al.*, 2015; Lau-Walker, 2006; Platt *et al.*, 2013; Reges *et al.*, 2013; Sniehotta *et al.*, 2009), with three (Flora *et al.*, 2015; Lau-Walker, 2006; Reges *et al.*, 2013) demonstrating significant relationships.

Lau-Walker (2006) reported that participants attending cardiac rehabilitation programmes as opposed to those who did not, perceived greater negative consequences of their condition, and thus had high scores for the ‘Consequences’ component of illness perception. Reges *et al.* (2013) found that participants who had higher perceived personal control, were more likely to participate in a cardiac prevention and rehabilitation programme. By contrast, Flora *et al.* (2015) found participants who perceived their illness conferring negative consequences, with many symptoms were attributable to their condition, were significantly less likely to adhere to cardiac rehabilitation exercise. Two papers (Platt *et al.*, 2013; Sniehotta *et al.*, 2009) found no significant relationships between illness representations and adherence to exercise or cardiac rehabilitation; Sniehotta *et al.* (2009) reporting no domain of the IPQ-PS subscale to be significantly correlated with cardiac

rehabilitation attendance, while Platt *et al.* (2013) found that consequences, timeline cyclical and emotional representations predicted exercise adherence, but were not maintained in regression models in which a transtheoretical model variable, exercise stage of change, remained as a predictor and contributed significantly to the overall variance of exercise adherence.

3.2.3 *Illness representations and exercise self-efficacy*

Three studies (Lau-Walker, 2006; Lau-Walker, 2007; Platt *et al.*, 2013) explored the relationship between illness representations and exercise self-efficacy. Platt *et al.* (2013) concluded significant associations, with exercise self-efficacy negatively associated with timeline acute/chronic, consequences and emotional representations: participants who reported negative emotional responses generated by their illness and perceived their illness as being chronic and having more consequences were less likely to report exercise self-efficacy. Timeline and control/cure were found to significantly predict exercise self-efficacy during baseline while timeline, identity, the change in identity score predicted exercise self-efficacy at nine months follow-up (Lau-Walker, 2006). Components of illness representations, specifically, identity, timeline and control/cure also significantly predicted exercise self-efficacy for participants three years after hospital discharge (Lau-Walker, 2007).

4 Discussion

4.1 Summary of main results

This is the first review to examine systematically, relationships between illness representations and indices of physical activities in populations with CVD. Ten quantitative studies were elicited by rigorous search in which illness representations were revealed to show significant associations with three different indices of physical activity, albeit varied perception domains showed relationships. Overall, elements of timeline, control and consequences of the CSM most often predicted and correlated with the indices of physical activity.

Regarding specific indices of physical activities, the link between illness representations and levels of physical activity/exercise was evidenced in five of six studies. In particular, perceptions of timeline and personal control most frequently acted as correlates and predictors. Participants who have little personal control, perceived CVD symptoms as unpredictable and their condition as more chronic were less likely to engage in physical activity. This may be because the expression of less personal control over CVD may reflect lack of agency over the condition, reducing motivation to engage in coping strategies. Furthermore, holding a belief that the condition is chronic and variable might provoke denial and avoidance for the fear of aggravating pre-existing symptoms. This hypothesis is supported by findings of a meta-analytic review (Hagger & Orbell, 2003) on the relationship between illness representations and health behaviour. They reported that personal control was positively associated with coping strategies while timeline dimensions were positively correlated to avoidance and denial (Hagger & Orbell, 2003). In other words, individuals who have low personal control, perceived their condition as chronic and variable were less likely to employ coping strategies and health behaviour because they tend to be more avoidant and be in denial. Such findings are consistent with the theoretical underpinnings of self-regulation models and health behaviour. According to de Ridder and de Wit (2008), self-regulation model such as the CSM of illness representations delineates the parallel processing of cognitive beliefs and management of emotional response, which influence individuals' dynamic motivational system of setting goals and the subsequent behaviours in achieving them. That is to say, the appraisal that individuals have of

their illness will affect their motivation to engage in health-related behaviours. Hence, based on the present evidence, the hypothesis that illness representations are associated to levels of physical activity/exercise is supported.

However, there are caveats to the interpretation of such findings particularly, the relationship between perceptions of personal control and levels of physical activity/exercise. The two studies (Mosleh & Almalik, 2014; Reges *et al.*, 2013) that evidenced this link were methodologically assessed as ‘poor’ and ‘fair’ quality. On the other hand, the study (Kidd *et al.*, 2015) that was appraised as ‘good’ did not find a statistically significant association between personal control and levels of physical activity/exercise. As such, the conclusion drawn by the current review should be interpreted with caution.

Physical activity, as assessed via exercise self-efficacy (albeit an intention-based proxy), also showed significant relationships with dimensions of illness representations in all three studies included, with timeline prominently. However, findings were inconsistent - Platt *et al.* (2013) found individuals that were more likely to perceive their illness as long-term were less likely to hold beliefs that they can perform or maintain exercise, but Lau-Walker’s (2006, 2007) reported participants who perceived their illness as more chronic were more likely to have higher exercise self-efficacy. Nonetheless, these studies found that timeline dimension had a significant relationship with exercise self-efficacy. The association between illness representations and exercise self-efficacy is not surprising and can be understood in the context of theoretical underpinnings of self-regulation models. Illness representations were based on the common sense model (Leventhal & Diefenbach, 1991; Leventhal *et al.*, 1980), which has been considered as a bottom-up theory as compared to social cognitive theory (Bandura, 1986), a top-down theory. According to Bandura (1986), exercise self-efficacy is considered as a derivative of social cognitive theory. As such, the association between illness representations and exercise self-efficacy would be expected as both variables are considered as appraisal constructs, which overlaps and are not orthogonal.

In respect of exercise/cardiac rehabilitation adherence as an index of activity, findings appeared more equivocal. Three of five studies found an association between components of illness representations and adherence to cardiac

rehabilitation programmes and two studies did not. The consequences dimension most often evidenced the relationship but with inconsistencies. Lau-Walker (2006) found in a comparative analysis (independent sample t-test) that participants who attended cardiac rehabilitation programme perceived more negative consequences than those who did not. On the contrary, Flora *et al.* (2015) found significant group differences (ANCOVA) where individuals who perceived their illness as having more negative consequences were less likely to adhere to cardiac rehabilitation exercise. Likewise, the previous review by French *et al.* (2006) also reported that the consequences dimension was correlated to the adherence of cardiac rehabilitation programmes. Similar inconsistent findings were evident in the French *et al.* (2006) review of exercise and cardiac rehabilitation where significant heterogeneity was found; two studies yielded opposite direction effect size estimates for perceptions of consequences and adherence to cardiac rehabilitation, which differed to other studies. Such discrepant findings may be an artefact of the many factors influencing exercise and cardiac rehabilitation adherence, notably pragmatic lack of transport, time constraints and other health priorities could be acting as barriers and confounding significance of illness representations. Indeed Savage *et al.* (2013) found cultural barriers to cardiac rehabilitation such as fatalistic attitudes and short-termism were precipitated by disadvantaged socioeconomic position. Furthermore, a qualitative systemic review by Clark *et al.* (2012) revealed occupational and financial constraints, long distances to services and the lack of family support acted as barriers to the adherence of cardiac rehabilitation programmes.

There are caveats to the interpretation of the findings. The 10 studies adopted different designs and measures to capture physical activity. Of the six studies that measured the levels of physical activity/exercise, only two studies (Mosleh & Almalik, 2014; Sniehotta *et al.*, 2009) utilised the same psychometric tool to measure levels of physical activity. Furthermore, all studies adopted study specific ways of measuring exercise self-efficacy and exercise and cardiac rehabilitation adherence. Additionally, despite attempts made to select studies using similar measures, (Brief IPQ, IPQ or IPQ-R to measure illness representations), there were still some variability as each showed different psychometric properties, and some studies modified questionnaires. For example, one study (Reges *et al.*, 2013)

utilised only the personal and treatment control components of IPQ-R, which is not representative of the entire CSM of illness representations. This difference in methodology complicated the comparison process across studies.

Additionally, despite the majority of findings establishing a relationship between illness representations and indices of physical activity, the results of the studies were generally inconsistent. There were no clear trends as different components of illness representations were associated with different indices of physical activity. Furthermore, associations between similar illness representations and indices of physical activity yielded different directions. This could be explained by the different methodologies employed by the studies (Mosleh & Almalik, 2014) as well as use of self-report measures, potential subject to recall biases (Mosleh & Almalik, 2014). Recall biases leading to the provision of inaccurate responses reduce the validity of the research findings (Raphael, 1987). Lastly, the findings reported suggested only a correlational relationship between illness representations and levels of physical activity as all of the studies except for Broadbent *et al.* (2009) employed an observational study design. That is to say, causal effects cannot be concluded based on the results of the study except for the study by Broadbent *et al.* (2009).

Included studies afford limited generalisability since all studies were conducted in developed countries. Participants from the 10 studies were predominantly male (with the total percentage of male participants being 76.5%), and older (with a mean age range of 52.0 to 67.98 years), and not easily generalised to younger adults and females with cardiovascular disease. The sample characteristics were however congruent with epidemiological data given male dominance in diagnosis of Coronary Heart Disease and experienced Myocardial Infarction compared to women (British Heart Foundation, 2016). The results of the studies also cannot be generalized to individuals who have dropped out of the studies or did not consent to participate in the studies.

4.2 Ethical considerations and issues

There were some ethical considerations and issues that surfaced through the reviewing of the studies. According to Broadbent *et al.* (2009), illness representations interventions had resulted in improved outcomes for the

experimental group such as faster rate of return to work, lower anxiety, increased likelihood of attending cardiac rehabilitation classes and higher levels of exercise. However, it was not reported in the study that illness representations interventions were provided to the control group after the RCT has ended despite efficacy of the intervention has been established. Besides that, researchers who have identified participants who did not adhere to exercise or cardiac rehabilitation were being placed in an ethical dilemma position knowing that the participation and adherence to exercise and cardiac rehabilitation is beneficial and yet unable to advocate for adherence as they are not clinicians. As mentioned earlier in the review, there are many barriers to cardiac rehabilitation and exercise adherence. A possible solution to circumvent this ethical issue is to offer the possibility of referring participants who did not adhere to exercise or cardiac rehabilitation to staff members of the cardiac rehabilitation programme to explore the reasons behind non-attendance.

4.3 Strengths and limitations

The systematic and comprehensive search (pursuing grey literature and researchers in the field) which underpins this review is a strength. Rigour of quality appraisal, with two independent raters is also a strength, albeit that with only 10 studies of fair quality and published in English, conclusions should be cautiously drawn. There are several limitations in the current review. Firstly, only studies that measured illness representations with psychometrically robust tools were selected, which inevitably excluded studies that measured illness representations in a qualitative approach. Secondly, the results of the current review could have possibly been diluted as the current review examined various factors related to physical activity instead of only levels of physical activity itself. Diversity and methodological heterogeneity of studies made comparison and synthesis across studies difficult, a limitation of the review. Furthermore, even though the total quality index mean score for the 10 studies met the cut-points for the 'fair' quality, methodological weaknesses such as the lack of randomisation and blinding were a flaw in all studies. Altman and Schulz (2001) reported that blinding decreases performance and ascertainment bias. There was a lack of methodological rigour for the studies as demonstrated by the quality appraisal of the 10 studies.

4.4 Clinical implications and directions for future research

The present review found that components of illness representations, notably, elements of timeline, control and consequences of the CSM are predictive and associated with indices of physical activity. This finding is congruent with the increasing number of research evidencing the association between illness representations and important outcomes, including self-management behaviours in a broadening range of chronic illnesses (Petrie *et al.*, 2007). Such results have clinical implications and relevance as illness representations have been found to be modifiable by cognitive behaviour therapy (Hale *et al.*, 2007), with the potential to increase health-related behaviours such as adherence to exercise and cardiac rehabilitation programme. The RCT conducted by Broadbent *et al.* (2009) demonstrated that illness representations intervention led to a significant increase in levels of physical activity for participants in the experimental group but not the control group. Furthermore, illness representations based interventions were found to be efficacious in improving clinical and psychological outcomes in patients with diabetes (Keogh *et al.*, 2011). Such findings lend further credence to the efficacy of illness representations intervention in increasing health behaviours. As such, resources should be invested in the development of illness representations intervention targeted in increasing physical activity and cardiac rehabilitation adherence in CVD patients. For instance, psychoeducation about CVD and its symptoms may increase the knowledge of patients, which could increase personal control and minimise cognitive distortions about the negative consequences of the condition.

In terms of directions for future research, more studies appear warranted to assess the causal relationship between illness representations and indices of physical activity to provide evidence for illness representations intervention and inform and innovate cardiac rehabilitation programmes. Besides that, there is an increasing evidence base examining the joint effect of illness representations and self-efficacy beliefs on health behaviours in the research literature. The complementary effect of both theories in predicting health-related behaviour has been reported by Leventhal and Mora (2005). Hence, future literature reviews could investigate both illness representations and self-efficacy beliefs as predictor variables of physical exercise.

References

*Indicates studies include in current review

- Abraham, C., Sheeran, P., & Johnston, M. (1998). From health beliefs to self-regulation: Theoretical advances in the psychology of action control. *Psychology & Health*, 13(4), 569-591.
- Agarwal, S. K. (2012). Cardiovascular benefits of exercise. *International Journal of General Medicine*, 5, 541.
- Altman, D.G., & Schulz, K.F. (2001). Concealing treatment allocation in randomised trials. *BMJ*, 323(7310), 446-447.
- Anderson, D.R., & Emery, C.F. (2014). Irrational health beliefs predict adherence to cardiac rehabilitation: A pilot study. *Health Psychology*, 33(12), 1614-1617.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.
- Beswick, A.D., Rees, K., West, R.R., Taylor, F.C., Burke, M., Griebisch, I. *et al.* (2005). Improving uptake and adherence in cardiac rehabilitation: Literature review. *Journal of Advanced Nursing*, 49(5), 538-555.
- Booth, M.L., Owen, N., Bauman, A., Clavisi, O., & Leslie, E. (2000). Social-cognitive and perceived environment influences associated with physical activity in older australians. *Preventive Medicine*, 31(1), 15-22.
- British Heart Foundation (2016). *CVD Statistic – BHF UK Factsheet*. Retrieved 15 October 2016 from <https://www.bhf.org.uk/-/media/files/research/heart-statistics/bhf-cvd-statistics---uk-factsheet.pdf?la=en>
- *Broadbent, E., Ellis, C.J., Thomas, J., Gamble, G., & Petrie, K.J. (2009). Further development of an illness perception intervention for myocardial infarction patients: A randomized controlled trial. *Journal of Psychosomatic Research*, 67(1), 17-23.

- Broadbent, E., Petrie, K.J., Main, J., & Weinman, J. (2006). The Brief Illness Perception Questionnaire (BIPQ). *Journal of Psychosomatic Research*, 60, 631-637.
- Chan, S.Y., Mancini, G.B., Burns, S., Johnson, F.F., Brozic, A.P., Kingsbury, K. *et al.* (2006). Dietary measures and exercise training contribute to improvement of endothelial function and atherosclerosis even in patients given intensive pharmacologic therapy. *Journal of Cardiopulmonary Rehabilitation*, 26(5), 288-293.
- Chase, J.A. (2011). Systematic review of physical activity intervention studies after cardiac rehabilitation. *The Journal of Cardiovascular Nursing*, 26(5), 351-358.
- Clark, A.M., King-Shier, K., Thompson, D.R., Spaling, M.A., Duncan, A.S., Stone, J.A. *et al.* (2012). A qualitative systematic review of influences on attendance at cardiac rehabilitation programs after referral. *American Heart Journal*, 164(6), 835-845.
- Coats, A., McGee, H., Stokes, H., & Thompson, D.R. (Eds.). (1995). *British Association for Cardiac Rehabilitation (BACR) guidelines for cardiac rehabilitation*. Oxford: Blackwell Science.
- Craig, C.L., Marshall, A.L., Sjostrom, M., Bauman, A.E., Booth, M.L., Ainsworth, B.E. *et al.* (2003). International physical activity questionnaire: 12-country reliability and validity. *Medicine and Science in Sports and Exercise*, 35(8), 1381-1395.
- Deeks, J.J., Dinnes, J., D'Amico, R., Sowden, A.J., Sakarovitch, C., Song, F. *et al.* (2003). Evaluating non-randomised intervention studies. *Health Technology Assessment*, 7(27), iii-x, 1-173.
- de Jonge, P., Zuidersma, M., & Bültmann, U. (2014). The presence of a depressive episode predicts lower return to work rate after myocardial infarction. *General Hospital Psychiatry*, 36(4), 363-367.

- de Ridder, D.T.D., & de Wit, J.B.F. (2008). Self-regulation in health behavior: Concepts, theories, and central issues. *Self-regulation in health behavior* (pp. 1-23) John Wiley & Sons, Ltd.
- DiMatteo, M.R., Hays, R.D., & Sherbourne, C.D. (1992). Adherence to cancer regimens: Implications for treating the older patient. *Oncology (Williston Park, NY)*, 6(2 Suppl), 50-57.
- Downs, S.H., & Black, N. (1998). The feasibility of creating a checklist for the assessment of the methodological quality both of randomised and non-randomised studies of health care interventions. *Journal of Epidemiology and Community Health*, 52(6), 377-384.
- Ford, E.S., Mokdad, A.H., Li, C., McGuire, L.C., Strine, T.W., Okoro, C.A. *et al.* (2008). Gender differences in coronary heart disease and health-related quality of life: Findings from 10 states from the 2004 behavioral risk factor surveillance system. *Journal of Women's Health*, 17(5), 757-768.
- *Flora, P.K., Anderson, T.J., & Brawley, L.R. (2015). Illness perceptions and adherence to exercise therapy in cardiac rehabilitation participants. *Rehabilitation Psychology*, 60(2), 179-186.
- Fransson, E.I.M., Alfredsson, L.S., de Faire, U.H., Knutsson, A., & Westerholm, P.J.M. (2003). Leisure time, occupational and household physical activity, and risk factors for cardiovascular disease in working men and women: The WOLF study. *Scandinavian Journal of Public Health*, 31(5), 324.
- French, D.P., Cooper, A., & Weinman, J. (2006). Illness perceptions predict attendance at cardiac rehabilitation following acute myocardial infarction: A systematic review with meta-analysis. *Journal of Psychosomatic Research*, 61(6), 757-767.
- Garster, N., Palta, M., Sweitzer, N., Kaplan, R., & Fryback, D. (2009). Measuring health-related quality of life in population-based studies of coronary heart disease: Comparing six generic indexes and a disease-specific proxy score. *Quality of Life Research*, 18(9), 1239-1247.

- Godin, G., & Shephard, R.J. (1985). A simple method to assess exercise behavior in the community. *Canadian Journal of Applied Sport Sciences*, 10(3), 141-146.
- Hagger, M.S. (2010). Self- regulation: An important construct in health psychology research and practice. *Health Psychology Review*, 4(2), 57-65.
- Hagger, M.S., & Orbell, S. (2003). A meta-analytic review of the common-sense model of illness representations. *Psychology and Health*, 18(2), 141-184.
- Hale, E.D., Treharne, G.J., & Kitas, G.D. (2007). The common-sense model of self-regulation of health and illness: How can we use it to understand and respond to our patients' needs? *Rheumatology*, 46(6), 904-906.
- Hambrecht, R., Niebauer, J., Marburger, C., Grunze, M., Kalberer, B., Hauer, K. *et al.* (1993). Various intensities of leisure time physical activity in patients with coronary artery disease: Effects on cardiorespiratory fitness and progression of coronary atherosclerotic lesions. *Journal of the American College of Cardiology*, 22(2), 468-477.
- Heart UK (n.d.). Key facts & figures. Retrieved 01 January 2017 from <https://heartuk.org.uk/press/press-kit/key-facts-figures>
- Hickey, L., M., Owen, V., S., & Froman, D., R. (1992). Instrument development: Cardiac diet and exercise self- efficacy. *Nursing Research*, 41(6), 347-353.
- Holmes, E.A.F., Hughes, D.A., & Morrison, V.L. (2014). Predicting adherence to medications using health psychology theories: A systematic review of 20 years of empirical research. *Value in Health*, 17(8), 863-876.
- Hooper, P., Jutai, J. W., Strong, G., & Russell-Minda, E. (2008). Age-related macular degeneration and low vision rehabilitation: A systematic review. *Canadian Journal of Ophthalmology*, 43(2), 180-187.
- Johnston, M. (2005). Means and meanings in health psychology. *European Health Psychologist*, 1, 6-8.

- Karmali, K.N., Davies, P., Taylor, F., Beswick, A., Martin, N., & Ebrahim, S. (2014). Promoting patient uptake and adherence in cardiac rehabilitation. *The Cochrane Database of Systematic Reviews*, (6):CD007131. doi(6), CD007131.
- Keogh, K. M., Smith, S. M., White, P., McGilloway, S., Kelly, A., Gibney, J. *et al.* (2011). Psychological family intervention for poorly controlled type 2 diabetes. *The American Journal of Managed Care*, 17(2), 105-113.
- *Kidd, T., Poole, L., Leigh, E., Ronaldson, A., Jahangiri, M., & Steptoe, A. (2015). Health-related personal control predicts depression symptoms and quality of life but not health behaviour following coronary artery bypass graft surgery. *Journal of Behavioral Medicine*, 39(1), 120-127.
- Larsen, K.K. (2013). Depression following myocardial infarction. *Danish Medical Journal*, 60(7), 1-18.
- *Lau-Walker, M. (2006). Predicting self-efficacy using illness perception components: A patient survey. *British Journal of Health Psychology*, 11(4), 643-661.
- *Lau-Walker, M. (2007). Importance of illness beliefs and self-efficacy for patients with coronary heart disease. *Journal of Advanced Nursing*, 60(2), 187-198.
- Leon, A.S., Myers, M.J., & Connett, J. (1997). Leisure time physical activity and the 16-year risks of mortality from coronary heart disease and all-causes in the multiple risk factor intervention trial (MRFIT). *International Journal of Sports Medicine*, 18(S 3), S208-215.
- *Leung, Y.W., Ceccato, N., Stewart, D.E., & Grace, S.L. (2007). A prospective examination of patterns and correlates of exercise maintenance in coronary artery disease patients. *Journal of Behavioral Medicine*, 30(5), 411-421.

- Leventhal, H., & Cleary, P. (1980). The smoking problem: A review of the research and theory in behaviour risk modification. *Psychological Bulletin*, 88, 370–405.
- Leventhal, H., & Diefenbach, M. (1991). The active side of illness cognition. In J. A. Skelton & R. T. Croyle (Eds.), *Mental representation in health and illness* (pp. 247–272). New York, NY: Springer.
- Leventhal, H., Meyer, D., & Nerenz, D. (1980). The common sense representation of illness danger. In S. Rachman (Ed.), *Medical psychology (Vol. II, pp. 7–30)*. New York, NY: Pergamon Press.
- Leventhal, H., & Mora, P.A. (2005). Is there a science of the processes underlying health and illness behaviors? A comment on Maes and Karoly. *Applied Psychology*, 54, 255–266.
- Longmore, R.B., Spertus, J.A., Alexander, K.P., Gosch, K., Reid, K.J., Masoudi, F.A. *et al.* (2011). Angina frequency after myocardial infarction and quality of life in older versus younger adults: The prospective registry evaluating myocardial infarction: Event and recovery study. *American Heart Journal*, 161(3), 631-638.
- Lozano, R., Naghavi, M., Foreman, K., Lim, S., Shibuya, K., Aboyans, V. *et al.* (2012). Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: A systematic analysis for the Global Burden of Disease Study 2010. *The Lancet*, 380(9859), 2095-2128.
- Luengo-Fernández, R., Leal, J., Gray, A., Petersen, S., & Rayner, M. (2006). Cost of cardiovascular diseases in the United Kingdom. *Heart*, 92(10), 1384-1389.
- Maes, S., & Karoly, P. (2005). Self-Regulation assessment and intervention in physical health and illness: A review. *Applied Psychology*, 54(2), 267-299.
- Millen, J.A., & Bray, S.R. (2008). Self- efficacy and adherence to exercise during and as a follow- up to cardiac rehabilitation. *Journal of Applied Social Psychology*, 38(8), 2072-2087.

- Moher, D., Liberati, A., Tetzlaff, J., & Altman, D.G. (2009). Preferred reporting items for systematic reviews and meta- analyses: The PRISMA statement. *Annals of Internal Medicine*, 151(4), 264.
- Morton, S., Barton, C.J., Rice, S., & Morrissey, D. (2014). Risk factors and successful interventions for cricket- related low back pain: A systematic review. *British Journal of Sports Medicine*, 48(8), 685.
- *Mosleh, S.M., & Almalik, M.M. (2014). Illness perception and adherence to healthy behaviour in Jordanian coronary heart disease patients. *European Journal of Cardiovascular Nursing*, 15(4), 223-230.
- Moss-Morris, R., Weinman, J., Petrie, K.J., Horne, R., Cameron, L.D., & Buick, D. (2002). The Revised Illness Perception Questionnaire (IPQ-R). *Psychology and Health*, 17, 1-16.
- Muhammad, I., He, H., Kowitlawakul, Y., & Wang, W. (2016). Narrative review of health- related quality of life and its predictors among patients with coronary heart disease. *International Journal of Nursing Practice*, 22(1), 4-14.
- National Health Service (2016). *Cardiovascular disease*. Retrieved 15 October 2016 from <http://www.nhs.uk/conditions/cardiovascular-disease/Pages/Introduction.aspx>
- National Institute for Health and Clinical Excellence (2010). *Cardiovascular disease prevention: public health need and practice*. Retrieved 18 December 2016 from <https://www.nice.org.uk/guidance/ph25/chapter/2-Public-health-need-and-practice>
- National Institute for Health and Clinical Excellence (2013). *Myocardial infarction: cardiac rehabilitation and prevention of further cardiovascular disease*. Retrieved 15 October 2016 from <https://www.nice.org.uk/guidance/cg172/chapter/1-Recommendations#cardiac-rehabilitation-after-an-acute-myocardial-infarction-mi-2>

- National Institute for Health and Clinical Excellence (2016). *Cardiovascular disease: risk assessment and reduction, including lipid modification*. Retrieved 15 October 2016 from <https://www.nice.org.uk/guidance/cg181/chapter/1-Recommendations#lifestyle-modifications-for-the-primary-and-secondary-prevention-of-cvd>
- Niebauer, J., Hambrecht, R., Velich, T., Hauer, K., Marburger, C., Kalberer, B. *et al.* (1997). Attenuated progression of coronary artery disease after 6 years of multifactorial risk intervention: Role of physical exercise. *Circulation*, 96(8), 2534-2541.
- Nigg, C.R., Allegrante, J.P., & Ory, M. (2002). Theory- comparison and multiple-behavior research: Common themes advancing health behavior research. *Health Education Research*, 17(5), 670.
- O'Connor, S.R., Tully, M.A., Ryan, B., Bradley, J.M., Baxter, G.D., & McDonough, S.M. (2015). Failure of a numerical quality assessment scale to identify potential risk of bias in a systematic review: A comparison study. *BMC Research Notes*, 8(1), 224.
- O'Neil, A., Sanderson, K., & Oldenburg, B. (2010). Depression as a predictor of work resumption following myocardial infarction (MI): A review of recent research evidence. *Health and Quality of Life Outcomes*, 8(1), 95.
- Peterson, J.C., Charlson, M.E., Wells, M.T., & Altemus, M. (2014). Depression, coronary artery disease, and physical activity: How much exercise is enough? *Clinical Therapeutics*, 36(11), 1518-1530.
- Petrie, K. J., Jago, L. A., & Devcich, D. A. (2007). The role of illness perceptions in patients with medical conditions. *Current Opinion in Psychiatry*, 20(2), 163-167.
- *Platt, I., Green, H.J., Jayasinghe, R., & Morrissey, S.A. (2013). Understanding adherence in patients with coronary heart disease: Illness representations and

- readiness to engage in healthy behaviours. *Australian Psychologist*, 49(2), 127-137.
- Raphael, K. (1987). Recall bias: A proposal for assessment and control. *International Journal of Epidemiology*, 16(2), 167.
- *Reges, O., Vilchinsky, N., Leibowitz, M., Khaskia, A., Mosseri, M., & Kark, J. D. (2013). Illness cognition as a predictor of exercise habits and participation in cardiac prevention and rehabilitation programs after acute coronary syndrome. *BMC Public Health*, 13(1), 956.
- Reid, R.D., Morrin, L.I., Pipe, A.L., Dafoe, W.A., Higginson, L.A.J., Wielgosz, A.T. *et al.* (2006). Determinants of physical activity after hospitalization for coronary artery disease: The tracking exercise after cardiac hospitalization (TEACH) study. *European Journal of Cardiovascular Prevention & Rehabilitation*, 13(4), 529-537.
- Rogerson Michelle, C., Murphy Barbara, M., Stephen, B., & Tony, M. (2012). “I don’t have the heart”: A qualitative study of barriers to and facilitators of physical activity for people with coronary heart disease and depressive symptoms. *International Journal of Behavioral Nutrition and Physical Activity*, 9(1), 140.
- Savage, M., Dumas, A., & Stuart, S.A. (2013). Fatalism and short- termism as cultural barriers to cardiac rehabilitation among underprivileged men. *Sociology of Health & Illness*, 35(8), 1211-1226.
- Schleifer, S. J., Macari-Hinson, M. M., Coyle, D. A., Slater, W. R., Kahn, M., Gorlin, R. *et al.* (1989). The nature and course of depression following myocardial infarction. *Archives of Internal Medicine*, 149(8), 1785-1789.
- Scottish Intercollegiate Guidelines Network (SIGN). (2002). *Cardiac rehabilitation: A national clinical guideline*, January 2002. SIGN publication no. 57. Edinburgh: SIGN Executive, Royal College of Physicians.

- Silverman, S.R., Schertz, L.A., Yuen, H.K., Lowman, J.D., & Bickel, C.S. (2012). Systematic review of the methodological quality and outcome measures utilized in exercise interventions for adults with spinal cord injury. *Spinal Cord*, 50(10), 718-727.
- Smith, S.C., Blair, S.N., Bonow, R.O., Brass, L.M., Cerqueira, M.D., Dracup, K. *et al.* (2001). AHA/ ACC guidelines for preventing heart attack and death in patients with atherosclerotic cardiovascular disease: 2001 update: A statement for healthcare professionals from the american heart association and the american college of cardiology. *Circulation*, 104(13), 1577-1579.
- *Sniehotta, F.F., Gorski, C., & Araújo-Soares, V. (2009). Adoption of community-based cardiac rehabilitation programs and physical activity following phase III cardiac rehabilitation in Scotland: A prospective and predictive study. *Psychology & Health*, 25(7), 839-854.
- Swardfager, W., Herrmann, N., Cornish, S., Mazereeuw, G., Marzolini, S., Sham, L. *et al.* (2012). Exercise intervention and inflammatory markers in coronary artery disease: A meta- analysis. *American Heart Journal*, 163(4), 666-676.e3.
- Taylor, H.L., Jacobs, D.R., Schucker, B., Knudsen, J., Leon, A.S., & Debacker, G. (1978). A questionnaire for the assessment of leisure time physical activities. *Journal of Chronic Diseases*, 31(12), 741-755.
- Teixeira, P.J. (2015). A primer on self-regulation and health behavior change. *Archives of Exercise in Health and Disease*, 5(1-2), 326-337.
- Thombs, B.D., Bass, E.B., Ford, D.E., Stewart, K.J., Tsilidis, K.K., Patel, U. *et al.* (2006). Prevalence of depression in survivors of acute myocardial infarction. *Journal of General Internal Medicine*, 21(1), 30-38.
- Walker, N., Susan, Sechrist, R., Karen, & Pender, J.N. (1987). The health-promoting lifestyle profile: Development and psychometric characteristics. *Nursing Research*, 36(2), 76-81.

- Weinman, J. Petrie, K.J., Moss-Morris, R., & Horne, R. (1996). The Illness Perception Questionnaire: A new method for assessing illness perceptions. *Psychology and Health*, 11(3), 431-446.
- Weinman, J., Petrie, K.J., Sharpe, N., & Walker, S. (2000). Causal attributions in patients and spouses following first- time myocardial infarction and subsequent lifestyle changes. *British Journal of Health Psychology*, 5(3), 263-273.
- World Health Organization (n.d.). Cardiovascular diseases. Retrieved 20 December 2016 from <http://www.euro.who.int/en/health-topics/noncommunicable-diseases/cardiovascular-diseases/cardiovascular-diseases2>
- Yu, S., Yarnell, J.W.G., Sweetnam, P.M., & Murray, L. (2003). What level of physical activity protects against premature cardiovascular death? the caerphilly study. *Heart*, 89(5), 502.
- Yusuf, S., Hawken, S., Ôunpuu, S., Dans, T., Avezum, A., Lanas, F. *et al.* (2004). Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. *The lancet*, 364(9438), 937-952.

PART 2: Research Report

**Are illness representations of individuals living with Chronic Kidney Disease
predictive of levels of physical activity and associated to depression?**

Abstract

Background and aims: Chronic Kidney Disease (CKD) is a debilitating condition that confers significant costs. Its adverse impacts can be further exacerbated by depression. Whilst such adverse impacts can be mitigated by engagement in physical activity, many CKD patients remain physically inactive, with this physical inactivity potentially influenced by how CKD is appraised. Hence, the current study aims to understand whether illness representations are predictive of physical activity and associated to depression.

Method: Non-dialysing CKD patients completed the Revised Illness Perception Questionnaire (IPQ-R), Beck Depression Inventory (BDI-II) and Short-Form International Physical Activity Questionnaire (IPAQ-SF) while demographic information was obtained via medical records. Correlation and regression analyses were conducted to determine the relationship of illness representations with levels of physical activity and severity of depression. Moderation and mediation analyses were performed to investigate the role of depression in any relationship between illness representations and physical activity levels.

Results: Seventy participants with a mean age of 60 ± 16 years, the majority being male (60%) took part in the study. Facets of illness representations, personal control was positively associated with levels of physical activity ($r=.288$, $p<.05$) while timeline cyclical was a significant predictor (Beta $=-.423$, $p=.008$). Severity of depression was positively associated to timeline cyclical ($r=.582$, $p<.01$), consequences ($r=.463$, $p<.01$), and emotional representations ($r=.654$, $p<.01$) while negatively associated with personal control ($r=-.354$, $p<.01$) and illness coherence ($r=-.277$, $p<.05$). Severity of depression was neither a moderator ($b=.023$, 95% CI $[-.015, .061]$, $t=1.201$, $p=.23$) nor a mediator ($b=-.021$, BCa CI $[-.082, .008]$, $p=.33$).

Conclusions: Facets of illness representations had significant relationships with levels of physical activity and severity of depression. Psychological assessment and intervention to assess and modify illness representations is recommended to increase the uptake of physical activity. Future research concerning the development and validation of psychological interventions based on an illness representations framework is proposed.

1 Introduction

1.1 Chronic Kidney Disease

Chronic Kidney Disease (CKD) is a prevalent and irreversible long-term condition characterised by progressive kidney function loss over time [1] due to functional and/or structural abnormalities [2]. Classification of the condition is staged [3], largely based on estimated glomerular filtration rate (eGFR) with Stage 1 defined as normal kidney function with some indication of structural abnormalities while Stage 5 delineates renal failure, which is also known as End-Stage Renal Disease (ESRD) [4]. Due to the lack of specific symptoms in the early stages of CKD, it is often undetected and undiagnosed until an advanced stage where costs can be significant both for the individual and society [1, 2, 5, 6].

1.2 Societal and personal costs

CKD poses a major public health issue [7] and confers a significant mortality rate with approximately 13, 000 deaths per annum in the UK attributable to the condition [5]. Since the risk of developing CKD increases with age [2, 6], it has become a major concern as the British population ages [8] where 1 in 6 Briton is aged 65 and over [9]. Furthermore, individuals with moderate to severe CKD have an increased risk of developing other medical conditions such as cardiovascular disease [1-3, 6] and are more likely to experience significant adverse outcomes, for instance, adverse kidney injury and frailty [2, 10]. In addition to the burden imposed on patients and families, CKD also imposes enormous financial costs. Estimates suggest National Health Service (NHS) England expenditure on CKD was between £1.44 to £1.45 billion in 2009-10 [11], with treatments for those with ESRD alone comprising approximately 1-2 per cent of the NHS budget despite these patients comprising only 0.05 per cent of the UK population [8].

1.3 CKD and depression

Adverse impacts of CKD appear further exacerbated by co-morbid mental health problems. Depression has been reported to be prevalent in individuals with CKD and ESRD [8, 12] where 20 to 30 per cent of patients meet diagnostic criteria for depression [13] compared to the point prevalence of 2 to 4 per cent in the general

community and 5 to 10 per cent in primary care settings [14]. Indeed, depression has a higher prevalence in CKD compared to other chronic diseases [15]. Diagnosed depression in individuals with CKD is significantly associated with sexual dysfunction [16-18], marital dissatisfaction [19, 20], cognitive impairment [21], poor quality of life [22-24] and mortality [25]. Depression in those with CKD is also predictive of nonadherence such as inter-dialytic weight gain [26], poor medication compliance [27], poor commitment to dietary and fluid guidelines [28] and withdrawal from dialysis [29]. Furthermore, individuals with CKD and depression are 4.5 times more likely to be hospitalised than those without mood disorders [30].

1.4 Role and importance of physical activity

As both CKD and depression have adverse repercussions, and depression is a significant co-morbidity magnifying adverse impact, increased attention has been drawn to both conditions and the possible interventions that might mitigate their impact. Over the last decade, CKD and depression have been prioritised in UK Quality and Outcomes Framework for General Practice (QOF) to incentivise their identification and management in primary care [11, 31,32]. Studies have found that engagement in physical activities, such as exercise, accrues significant physiological benefits for individuals with CKD. These benefits include an improvement in eGFR, quality of life and physical functioning, a reduction in inflammation, and an increase in peak oxygen consumption [33, 34]. Indeed, a systematic review of physical activity's impact on depression suggests significant benefit for those with CKD [35]. Similarly, a Cochrane review of forty-five studies similarly reported evidence demonstrating beneficial effects of physical activity in individuals with CKD and the association between activity and mood [36]. The positive findings on exercise and physical activity have prompted creation of guidelines recommending individuals with CKD commit to 90-150 minutes of moderate exercise weekly [37, 38].

However, although activity and exercise have scope to mitigate the adverse impact of CKD and alleviate depression in CKD patients, there are barriers to engage in physical activities, which often limit patient participation [39, 40]. Motivation has been identified as one of the major barriers [33, 40]. In view of the clinical utility

of physical activity for depressed individuals with CKD, greater attention has been given to factors that underpin and direct the motivation to engage in this health behaviour.

1.5 Common Sense Model of Illness Representations

In the last 20 years, researchers in the field of health psychology have endeavoured to understand and explain participation in health behaviours such as engagement and adherence to physical activity, and have developed explanatory theories to inform health behavioural change interventions [41-43]. Some of the most influential psychological approaches have been self-regulation models. These models attempt to describe and explain an individual's cognitive and emotional responses to health conditions using socio-cognitive frameworks [44-46], are founded on evidence that undertaking health-related behaviours derived from and were influenced by appraisal of health and illness [44]. Notable amongst these self-regulation models is Leventhal and Cleary's Common Sense Model (CSM) of illness representations [47]. The Illness Representations Model³ hypothesises that individuals with illnesses construct five common illness beliefs about their health conditions, namely, (a) identity, (b) cause, (c) time-line, (d) consequences and (e) curability/controllability [48]. Unlike other rudimentary self-regulation models, the Illness Representations Model incorporates aspects of the stress-coping theory, specifically, a goal striving process under adversity [44] and views the appraisal process as dynamic; individuals regulate their illness beliefs and emotion control towards it iteratively [48]. As such, it is considered as an advanced self-regulatory model, its explanatory power reflected in robust prediction of actual behaviour change [49] evidenced by a meta-analytic review [50].

1.6 Rationale and study aims

The growing interest in self-regulation models has generated extensive research investigating how illness representations have influenced health behaviours in different chronic illnesses, notably chronic fatigue syndrome, rheumatoid arthritis, chronic obstructive pulmonary disease (COPD) and multiple sclerosis [48]. However, there is a paucity of research exploring the relationship between illness

³ The term 'Illness Representations Model' is used interchangeably with the Common Sense Model (CSM).

representations of individuals with CKD and its association with health behaviour. No known studies have examined the roles of illness representations regarding engagement of physical activity for those living with CKD, particularly those not receiving renal replacement therapy.

Given the importance of physical activities in mitigating the impact of depression in CKD and CKD itself, and that illness representations are modifiable with benefits to those receiving rehabilitation [48], the study aimed to:

1. Determine the correlational relationship of illness representations with levels of physical activity and severity of depression in non-dialysing CKD patients;
2. Investigate if components of illness representations are predictive of levels of physical activity;
3. Examine the association of severity of depression with levels of physical activity;
4. Investigate whether severity of depression has a moderating or mediating effect between illness representations and levels of physical activity.

Facets of illness representations were assessed by the Illness Perceptions Questionnaire-Revised (IPQ-R), severity of depressive symptoms by the Beck Depression Inventory-II (BDI-II) and levels of physical activity by the International Physical Activity Questionnaire Short Form (IPAQ-SF). Pearson correlations were employed first to investigate the associations between illness representations, levels of physical activity and severity of depression. Subsequently, hierarchical multiple regression analyses were used to model the relationship between illness representations and levels of physical activity and control for participant characteristics. Lastly, mediation and moderation analyses were utilised to explore whether severity of depression has a moderating or mediating effect. Based on past research, it was hypothesised that illness representation components are associated and predictive of levels of physical activities, while the severity of depression is associated with levels of physical activity and components of illness representations. It was also hypothesised that severity of depression has either a moderating or mediating effect on the relationship between illness representations and levels of physical activity.

2 Method

2.1 Overview and study design

A within-group cross-sectional survey design was utilised in this study. Participants were recruited through convenience sampling method and a face-to-face approach in renal outpatient clinic waiting rooms from August 2016 to January 2017. A survey pack and a stamped addressed envelope were given to participants to take home for completion in their own time. Participants' medical records were accessed after completed surveys were returned to extract relevant clinical details (medical co-morbidities, blood and urine test results and medications). For the primary analysis, the independent variables comprised the domains of illness representations and the severity of depressive symptoms, whilst the dependent variable comprised level of physical activity. Regarding the examination of the correlational relationship between illness representations and depression, facets of illness representations are the independent variables whereas severity of depressive symptoms constitutes the dependent variable.

2.2 Power analysis

Using G*Power 3.1, the sample size was determined by an *a priori* power analysis based on the main statistical method selected (multiple linear regression). Based on the statistical test of multiple linear regression (fixed model, R^2 deviation from zero), Cohen's [51] recommended effect size of 0.15 (medium effect size), an estimation of 8 independent predictors, 0.05 alpha level, and 0.8 power as the input parameters, the suggested sample size was 109 participants.

2.3 Ethical considerations and procedure

Ethical approval was obtained from the host NHS Trust Research and Development department (see Appendix J), the local Ethics Committee (see Appendix K) and Health Research Authority (see Appendix L). All participants recruited into the study provided informed consent.

Eligible participants were approached and recruited at a renal outpatient clinic in the East Midlands. During clinic recruitment, a notice was placed prominently on the reception desk informing patients that a research survey was taking place. The

notice also appealed to patients to inform the clinic clerk if they preferred not to be approached. Patients were approached randomly and were briefly introduced to the nature of the survey and given the Patient Invitation Letter (see Appendix N) to peruse. Thereafter, patients who expressed their willingness to consider participation in the survey were provided with the Patient Information Sheet (see Appendix O). Sufficient time was given to patients to read through the Patient Information Sheet before it was explained verbally. To minimise coercion, patients were informed that participation was voluntary and their clinical care would not be affected irrespective of their decision to participate. Additionally, it was emphasised that participants had the right to withdraw at any point without providing a reason. Confidentiality issues were discussed and opportunities were given to the patients to ask questions. During this interaction, patients were not recruited if they were unable to communicate well enough to provide full informed consent, or were deemed unable to complete the study survey. Patients who were willing and able to participate were asked to complete and sign the Patient Consent Form (see Appendix P). A study survey booklet (see Appendix I) with a written participant code were then given to the patient to be taken away to be completed in their own time, with a stamped addressed envelope in which to return it to the research office.

Participants who did not return the survey booklets after ten days were contacted once via telephone reminder to complete and return the survey booklets. This was done only when participants had given permission to be re-contacted in the Consent Form. Thereafter, participants who did not return survey booklets were withdrawn from the study.

Consent was obtained during the same clinic visit as initial approach and provision of the Patient Information Sheet, rather than allowing the potential participant 24 hours to consider taking part. This was justified as follow:

1. The study was non-interventional and non-invasive, consisting of a single survey;
2. Many patients only attended the outpatient clinic once every three, six or even 12 months and therefore to wait until the next appointment for consent was not feasible. Besides that, it was considered too much of a burden for

the participant to make separate visits to the clinic for this simple survey study;

3. Although consent was obtained within a short time of being given the study information, participants were able to take the Patient Information Sheet and survey booklet away to complete and return later on in their own time. Participants were able to withdraw from the study by not returning the survey booklet if they have changed their mind about participation. This was explained in the Patient Information Sheet and was verbally outlined.

Individuals with CKD are often adversely affected by their condition, and may experience physical sequelae notably fatigue. To minimise the burden on participants, the choice and form of measures were carefully selected. Participants were referred to their consultant if they disclosed significant psychological distress and risk to themselves or others in the study survey booklet.

2.4 Participants

Adults with a diagnosis of CKD and not receiving renal replacement therapy were approached and recruited for the study. Participants were recruited based on the study protocol's inclusion and exclusion criteria.

2.4.1 Inclusion criteria

- (1) Individuals with a diagnosis of CKD
- (2) Individuals who are willing and able to give informed consent for study participation
- (3) Male or Female aged 18 years or above

2.4.2 Exclusion criteria

Individuals who were medically unstable, had experienced acute medical problems such as myocardial infarction, in the preceding three months and had a physical disability were excluded from the study. The rationale to exclude patients who had acute medical problems and were medically unstable was to remove potential confounders of serious medical conditions. Additionally, individuals who were not confident in their grasp of the English language or were unable to understand, read, write and consent for any other reason were excluded from the study as an

understanding of the English language was required to complete the study survey booklet.

2.5 Measures

The current research comprised part of a larger study that utilised seven measures (see Appendix I). However, only measures relevant to this research are described. Three measures in the survey booklet were used to assess the current research interest variables, namely, facets of illness representations (Illness Perceptions Questionnaire-Revised), severity of depressive symptoms (Beck Depression Inventory-II) and levels of physical activity (International Physical Activity Questionnaire Short Form). The survey booklet also included a study-specific section used to assess participants' demographic information (age, gender, ethnicity, smoking status, education level, the number of months since the onset of CKD, CKD stage, eGFR and presence of comorbidity).

a) Revised Illness Perception Questionnaire (IPQ-R)

The IPQ-R comprised an 84-item self-report quantitative questionnaire that measures the five components of Leventhal's illness perception model [52]. The IPQ-R is divided into three sections: the first section is the identity subscale; the second section consists of seven subscales: consequences, timeline acute/chronic and cyclical, personal and treatment control/cure, illness coherence, and emotional representations; the causal subscale forms the third section [53]. The items in the first section are rated as 'yes' or 'no', where 'yes' is given a score of 1 and 'no' a score of 0. Each item in the second and third section is rated on a five-point Likert-style scale (strongly disagree, disagree, neither agree or disagree, agree, strongly agree) where strongly disagree is given a score of 1 while strongly agree is given a score of 5 [53]. The higher the subscale scores, the greater endorsement of the given construct [54]. High scores on identity, consequences, timeline acute/chronic and cyclical subscales represent negative illness beliefs that an illness confers many symptoms, has adverse impacts, is chronic and cyclical in nature respectively. Whereas high scores on illness coherence and personal and treatment control indicate positive illness beliefs where individuals understand their condition, feel that they have personal control over their condition and that the treatment they receive controls/cures the illness. Lastly, high scores in emotional representations

dimension suggest a negative emotional response to the illness. The test-retest reliability of the IPQ-R in individuals with renal disease demonstrated good stability with a correlation range of 0.46 to 0.88 over three weeks [52].

b) Beck Depression Inventory (BDI-II)

The BDI-II is a 21-item self-report questionnaire that measures the severity of cognitive and somatic depressive symptoms in individuals in the past two weeks [55]. Each item is rated on a four-point Likert scale ranging from 0 to 3 and the higher the overall score, the greater the severity of depression [56]. The BDI-II total score is further categorised into the following depression severity categories: 'Minimal Depression' (0-13), 'Mild Depression' (14-19), 'Moderate Depression' (20-28) and 'Severe Depression' (29-63) [57]. The BDI-II has high reliability with internal consistency found to be around 0.9 while the test-retest reliability ranged from 0.73 to 0.96 [58]. According to Wang & Gorenstein [58], the BDI-II demonstrates criterion-based validity; good sensitivity and specificity in detecting depression in individuals when compared to a DSM-IV depression diagnosis. The BDI-II clinical cut off score of ≥ 11 was established as having the best diagnostic accuracy for depressive disorder in non-dialysing CKD patients [59].

c) International Physical Activity Questionnaire Short Form (IPAQ-SF)

The IPAQ-SF is a seven-item self-report questionnaire that assesses the levels of physical activity in individuals in the past seven-day period [60]. The levels of physical activity are differentiated into four different intensity levels: vigorous-intensity activity; moderate-intensity activity; walking and; sitting [61]. The IPAQ-SF can be calculated as a continuous score by multiplying the aforementioned activities' metabolic equivalent (MET) with the time spent (minutes) and the number of days engaged in those activities [62]. Individuals can also be categorised into three levels of physical activity based on their categorical score, specifically, 'Inactive', 'Minimally Active' and 'Health Enhancing Physical Activity (HEPA) active' [62]. According to Brown *et al.* [63], the IPAQ-SF has acceptable level of test-retest reliability and 79 per cent agreement with three other physical activity measures – Active Australia Survey, Australian National Health Survey, Behavioural Risk Factor Surveillance System.

2.6 Data analysis

Demographic data were collated both from the questionnaires' demographic section and ascertained by the patients' medical records. All data were entered into Microsoft Excel and the outcome measures' total and sub-scale scores were calculated according to the respective measure scoring guidelines. Data were numerically coded and statistical analyses were performed using IBM SPSS (Version 24). Descriptive statistics were employed for participant characteristics. Continuous variables were described using mean and standard deviation while dichotomous variables were described using percentages.

To ensure methodological robustness, non-normal data were transformed first to correct for distributional problems and to achieve normality. Subsequently, bootstrapping was ran in all analyses when applicable as the independent variables, eGFR and Timeline Acute/Chronic, did not achieve normality despite transformation. Bootstrapping has been established as a robust method, which is employed to resolve issues pertaining to the violation of assumptions. The main advantage of bootstrapping is that the bootstrap confidence intervals and significance values do not rely on the assumptions of parametric statistics such as assumptions of normality and homoscedasticity [64]. Hence, these outputs provide an accurate estimate of the value of b for each independent variable of the true population [64]. As such, all analyses when applicable were bootstrapped using 1000 samples and computed based on a bias-corrected and accelerated (BCa) confidence interval.

Pearson correlations were used to investigate the associations between components of illness representations, levels of physical activity, severity of depression and participant characteristics. In addition, hierarchical multiple regression analyses were used to model the relationships between components of illness representations, levels of physical activity, and participant characteristics. Mediation and moderation analyses were performed using the PROCESS macro for SPSS written by Andrew Hayes [65]. The mediation and moderation analyses were carried out to investigate the role of depression in the hypothesised relationship between dimensions of illness representations and level of physical activities.

According to the scoring manual of the IPQ-R, the causal subscale should not be interpreted as scale data and the recommended statistical method is factor analysis, which was not within the remit of the current study. As such, the causal subscale data was not utilised. The 'Identity' subscale of the IPQ-R was also excluded from data analyses to avoid the biasing of results due to a significantly low response rate. Additionally, 'Treatment Control' subscale, which measures individual's beliefs on the efficacy of treatment, was not considered as a predictor variable and excluded from regression analyses as the sample consisted of non-dialysing participants with no active treatment. The subscale was considered lacking salience in predicting levels of physical activity, and simple correlation examined between treatment control and levels of physical activity yielded no significant association.

Regarding missing data, cases were excluded from the calculation of overall BDI score if there were more than one missing datum, whereas the management of missing data for the IPQ-R was based on the measure's recommended data cleaning guidelines. Expectation maximisation was used to manage the missing data for IPAQ-SF for correlation and regression analyses. Little's Missing Completely at Random (MCAR) test was run to ensure that missing data for IPAQ-SF were completely random [66]. All statistical analyses adopted a pairwise exclusion method.

3 Results

3.1 Recruitment

Recruitment was carried out over a six-month period (from August 2016 to January 2017). A total of 164 patients were approached with 64 declining to take part in the study. Of these, 100 patients consented to participate in the study but 30 of them did not return their study survey booklet and were withdrawn from the study. The final sample comprised of 70 patients with CKD (43% participation rate).

3.2 Description of sample

3.2.1 *Demographics and clinical data*

The majority of the 70 non-dialysing participants were male (60%) and identified as 'White British' (80%). The mean age for the sample was 60 ± 16 years. Slightly more than half of the participants reported that they did not smoke before (52.9%) while 40% had a history and 7.1% were smoking currently. Forty-five per cent of the participants described themselves as having a tertiary education qualification and 33.8% as having secondary school qualification, while 20.6% reported qualifications that did not match the options provided. The majority of the participants stated that they were at stage four CKD (45.7%) and reported the presence of comorbidity (75.8%). The mean number of months since the onset of CKD for the sample was 110.6 ± 100.6 . Participants had a mean eGFR of $34.5 \pm 22.3 \text{ ml/min/1.73m}^2$. Demographics and clinical data are reported in Table 2.

Table 2 Sample characteristics

Study sample (n=70)	
Age	
Mean age (SD)	60.1 (15.9)
Median age (in years)	60
Age range (%)	
18-39 years	8 (11.4%)
40-59 years	26 (37.1%)
60 years and above	36 (51.4%)
Gender (%)	

Male	42 (60%)
Female	28 (40%)
<i>Ethnicity (n=67)</i>	
White British	56
Indian	7
White any other background	1
White and Black Carribean	1
White Asian	1
Pakistani	1
<i>Level of Education (n=68) (%)</i>	
Lower Secondary Qualification	17 (25%)
Upper Secondary Qualification	6 (8.8%)
University or College below a degree	16 (23.5%)
University or College degree	15 (22.1%)
None of these	14 (20.6%)
<i>Smoking Status (%)</i>	
Never smoked	37 (52.9%)
Current smoker	5 (7.1%)
Ex-smoker	28 (40%)
<i>Comorbidity Reported (n=66) (%)</i>	
Yes	50 (75.8%)
No	16 (24.2%)
<i>Stage of CKD (%)</i>	
Stage 1	2 (2.9%)
Stage 2	16 (22.9%)
Stage 3	14 (20%)
Stage 4	32 (45.7%)
Stage 5	6 (8.6)
<i>Onset of CKD (n=69)</i>	
Onset of CKD range (in months)	0.5 - 360
Mean onset of CKD in months (SD)	110.6 (100.6)
<i>eGFR (n=68) (ml/min/1.73m²)</i>	
eGFR range	8 - 90
Mean eGFR (SD)	34.5 (22.3)

3.2.2 Depression severity

Participants generally fell into the category of ‘Minimal Depression’ with 63.2% of the participants meeting the criteria for ‘Minimal Depression’, 17.6% for ‘Mild Depression’, 11.8% for ‘Moderate Depression’ and 7.4% for ‘Severe Depression’ (Table 3). The mean BDI-II score for the sample was 12.0 ± 9.6 with a range of 0-45. According to Hedayati *et al.* [59], the best diagnostic accuracy for depressive disorder in CKD patients not receiving renal replacement therapy is a BDI-II cut-off score of ≥ 11 . Half (50%) of the participants had a BDI-II cut-off score of ≥ 11 . Two cases were excluded from the results due to having more than one missing datum.

Table 3 BDI-II results summary

Study sample (n=68)	
<i>Depression severity category (%)</i>	
Minimal Depression	43 (63.2%)
Mild Depression	12 (17.6%)
Moderate Depression	8 (11.8%)
Severe Depression	5 (7.4%)
<i>BDI score</i>	
Mean BDI score (SD)	12.0 (9.6)
<i>BDI cut-off score criteria (%)</i>	
BDI score ≥ 11	34 (50%)

3.2.3 Levels of physical activity

A total of 54 participants completed the IPAQ-SF. Approximately a third of the participants (35%) were sedentary, meeting the criteria of low/inactive level of physical activity. Individuals in this category were considered as insufficiently active. Thirty-nine per cent individuals met the criteria of ‘Minimally Active’ and were considered as achieving the recommended minimum level of activity for adults based on an activity, but insufficient when considering total level of physical activity. Only 26% of the sample met the HEPA active category, which describes individuals as exceeding the minimum public health physical activity guidelines and leading a healthy lifestyle. The sample’s median level of physical activity

expended per week is 1386 MET-min, which meets the category ‘Minimally Active’.

3.3 Correlation analyses

Pearson product-moment correlation analyses (2-tailed) were used to study the association between participant characteristics, components of illness representations, reported levels of physical activity and severity of depression. Correlation findings were based on 1000 bootstrap samples. Findings are presented in Table 4.

Results from the analyses suggested some significant positive and negative relationships between participant characteristics, illness representations and levels of physical activity. Severity of depression was associated significantly with components of illness representations but not with participant characteristics and levels of physical activity. The strength of association was determined based on Cohen’s guidelines for interpreting effect size (small $r=.10$ to $.29$; medium $r=.30$ to $.49$; large $r=.50$ to 1.0) [67].

3.3.1 *Participant characteristics*

There was a small negative correlation between age and eGFR levels ($r=-.277$, $p<.05$), suggesting that older adults have lower eGFR levels, thus a higher CKD stage based on the NKF KDOQI classification. This parallels prevalence model trends where increasing age leads to lower eGFR levels [68] and higher CKD stage prevalence [69]. By contrast eGFR levels had a medium negative relationship with the consequences component of illness representations ($r=-.425$, $p<.01$). This finding implies that individuals with lower levels of eGFR, consequently a more severe renal impairment, scored higher on the consequences subscale, perceiving more adverse consequences of their illness. Age was negatively correlated with levels of physical activity ($r=-.291$, $p<.05$), indicating that older adults were less likely to undertake physical activity. A moderate negative correlation between age and timeline cyclical ($r=-.310$, $p<.05$) was found, reflecting that older participants were less likely to perceive the symptoms of their condition as variable. There was a medium negative relationship between age and emotional representations ($r=-$

.368, $p < .01$) implying that older adults had fewer negative emotional responses such as feeling anxious or angry because of their illness.

3.3.2 Levels of physical activity and depression severity

Level of physical activity was negatively correlated with depression severity but was not statistically significant ($r = -.245$, $p = .074$). This finding indicates that there was no significant relationship between depression and the engagement of physical activity. However, a post-hoc simple correlation between the original data with no imputation of missing data for levels of physical activity found statistical significance ($r = -.283$, $p = .049$), indicating that individuals who were more depressed were less likely to be physically active.

3.3.3 Levels of physical activity and illness representations

There was a small positive correlation between personal control and level of physical activity ($r = .288$, $p < .05$), suggesting that individuals who perceived themselves as having more personal control were more likely to engage in higher levels of physical activity. Correlations between timeline cyclical and levels of physical activity approached statistical significance ($r = -.242$, $p = .078$). No other components of illness representations were significantly associated with levels of physical activity.

3.3.4 Depression severity and illness representations

Severity of depression was positively associated with timeline cyclical ($r = .582$, $p < .01$), consequences ($r = .463$, $p < .01$), and emotional representations ($r = .654$, $p < .01$) while negatively associated to personal control ($r = -.354$, $p < .01$) and illness coherence ($r = -.277$, $p < .05$). Participants who perceived their CKD condition as highly variable and unpredictable, having more adverse consequences and had negative emotional responses because of their condition were more likely to experience higher levels of depression. Whereas, individuals were less likely to be depressed if they perceived themselves as having more personal control over their illness and personally understood their condition.

3.3.5 Relationship between components of illness representations

Time acute/chronic had a moderate positive correlation with treatment control ($r=.489, p<.01$), which evidenced that individuals who perceived their condition as chronic were more likely to feel that their illness was controllable by their treatment. Besides that, there was a medium positive relationship between timeline cyclical and consequences ($r=.403, p<.01$). This finding suggests that individuals who perceived their CKD as being more cyclical were more likely to hold beliefs that their condition has more adverse impact on their life. Similar medium positive relationships were observed for personal control with treatment control ($r=.475, p<.01$) and illness coherence ($r=.435, p<.01$). These statistically significant associations indicate that individuals who felt that they have personal control over CKD also understood their illness and believed that the treatment received was efficient in controlling the condition. Emotional representations had medium positive relationships with timeline cyclical ($r=.470, p<.01$) and consequences ($r=.430, p<.01$) but was negatively correlated with personal control ($r=-.366, p<.01$) and illness coherence ($r=-.544, p<.01$). These findings indicate that individuals who had negative emotional reaction to CKD were more likely to perceive CKD and its symptoms as cyclical, negatively impacting on their lives, having low personal control over their illness and poor understanding of their condition.

Table 4 Correlations for participant characteristics, levels of physical activity, illness representations and severity of depression

	Participant Characteristics					IPQ-R				IPAQ-SF	BDI-II
	1	2	3	4	5	6	7	8	9	10	11
1. Age	-	-.277*	-.042	-.310*	-.096	-.132	-.134	.013	-.368**	-.291*	-.168
2. eGFR		-	.095	-.073	-.425**	.125	-.134	.087	-.035	.227	-.010
3. Timeline (Acute/Chronic)			-	.041	-.136	.113	.489**	-.268	-.067	.071	-.154
4. Timeline Cyclical				-	.403**	-.073	.178	-.245	.470**	-.242	.582**
5. Consequences					-	-.197	-.016	-.165	.430**	-.109	.463**
6. Personal Control						-	.475**	.435**	-.366**	.288*	-.354**
7. Treatment Control							-	.079	-.153	.125	-.071
8. Illness Coherence								-	-.544**	-.042	-.277*
9. Emotional Representations									-	-.003	.654**
10. IPAQ-SF										-	-.245
11. Overall BDI-II Score											-

Note: * $p < 0.05$; ** $p < 0.01$ (2-tailed).

3.4 Regression analyses

Regression analyses were utilised to examine if components of illness representations are predictive of levels of physical activity and contributed to its variance after controlling for age and eGFR levels. IPAQ-SF overall score comprised the dependent variable while all IPQ-R subscales except for ‘Identity’ and ‘Treatment Control’ comprised the independent variables. The rationale for the exclusion of the aforementioned IPQ-R subscales were explained in the data analysis section.

3.4.1 *Sample size*

Based on the power analysis, 109 participants were required to achieve a medium effect size for multiple regression analyses. With expectation maximisation, the sample size for the dependent variable IPAQ-SF is 70, which is underpowered but close to the rule of thumb of 10 cases per predictor for multiple regression analyses [70]. As recommended by Pallant [71], the Adjusted R square values are reported in this study to account for a small sample size. Additionally, a post-hoc regression analysis was conducted with only the predictors that made a statistically significant contribution to the main regression analysis. This model was constructed to address the small sample size issue by utilising fewer predictors and to verify if the results were still significant.

3.4.2 *Preliminary data screening and analyses*

Assumptions for multiple regression analyses were ascertained through preliminary data screening and analyses. The assumption of normality was assessed by the Kolmogorov-Smirnov test ($p > .05$) with eGFR, Timeline Acute/Chronic, Timeline Cyclical, Emotional Representations, IPAQ-SF and BDI indicating non-normal distribution. Histograms and Q-Q plots were referred and confirmed non-normality for eGFR, Timeline Acute/Chronic, IPAQ-SF and BDI while Timeline Cyclical and Emotional Representations looked reasonably normal. To address the issue of normality, transformations were computed for eGFR⁴, IPAQ-SF⁵, Timeline

^{4,5} Log transformation was employed.

Acute/Chronic⁶ and BDI⁷ and all regression analyses were bootstrapped. Assumption for homoscedasticity was assessed by Levene's test with all variables meeting the assumption as the Levene's test was non-significant ($p>.05$). There was no indication of multicollinearity as predictors have correlation coefficients of less than 0.7 (refer to Table 4). The Variance Inflation Factor (VIF) and Tolerance statistics for the preliminary analyses indicated no cause for concern as the highest VIF value is not substantially greater than 1 while the lowest Tolerance value is not below 0.2 (Emotional Representations, $VIF=2.38$, $Tolerance=.42$). The data demonstrated that the assumption of independent errors had been met (Durbin-Watson value=1.97). Lastly, the inspection of the scatterplot suggested no extreme outliers since there were no standardised residuals exceeding 3.29, which was confirmed by the casewise diagnostics where only one case was flagged as having a standardised residual of -3.27. Refer to Appendix H for the results for Kolmogorov-Smirnov test and Levene's test.

3.4.3 *Primary regression analysis*

The change in Adjusted R Square scores ($\Delta R^2_{Adjusted}=.142$, $p=.027$) indicated that illness representation components accounted for 14.2% of the variance in IPAQ-SF scores after the effects of age and eGFR were removed (Table 5). Amongst illness representation components, only timeline cyclical ($Beta=-.423$, $p=.008$) made a statistically significant contribution to the variance reported. Overall, Model 2 is significantly better at predicting the outcome with improvement greater than the inaccuracy within the model ($F(8, 47)= 3.23$, $p=.005$). The variables in Model 2, including age and eGFR, contributed to 24.5% of the variance in IPAQ-SF scores ($R^2_{Adjusted}=.245$, $p=.027$). Other than time cyclical, age is the only other predictor that made a significant unique contribution in Model 2 ($Beta=-.353$, $p=0.41$). Timeline cyclical made the largest unique contribution between the two predictors.

⁶ Reflect and square root transformation was employed.

⁷ Square root transformation was employed.

Table 5 Multiple regression analysis for levels of physical activity (IPAQ-SF), with 95% BCa confidence intervals reported in parentheses. Confidence intervals and standard errors based on 1000 bootstrap samples

Variable	Model 1				Model 2			
	<i>b</i>	<i>SE B</i>	β	<i>p</i> (2-tailed)	<i>b</i>	<i>SE B</i>	β	<i>p</i> (2-tailed)
Age	-.016 (-.035, -.001)	.009	-.277	.081	-.021 (-.039, -.004)	.009	-.353	.041
eGFR	.541 (-.194, 1.323)	.360	.171	.138	.450 (-.399, 1.264)	.448	.143	.358
Timeline Acute/Chronic					-.052 (-.246, .137)	.114	-.057	.656
Timeline Cyclical					-.106 (-.181, -.029)	.036	-.423	.008
Consequences					.016 (-.044, .078)	.031	.101	.612
Personal Control					.067 (.005, .137)	.036	.343	.093
Illness Coherence					-.057 (-.118, .009)	.033	-.307	.106
Emotional Representations					-.002 (-.068, .060)	.035	-.011	.968

Note: $R^2=.136$ and $R^2_{\text{Adjusted}}=.103$ for Model 1; $\Delta R^2=.219$ and $\Delta R^2_{\text{Adjusted}}=.142$ for Model 2 ($p<.05$).

3.4.4 Post-hoc regression analysis

A post-hoc hierarchical multiple regression analysis was conducted with the significant predictors from the main analysis, age and timeline cyclical, as variables to address the small sample size issue and to verify if the main findings are valid and significant. Collinearity diagnostics from the analysis demonstrated that there is no cause of concern for multicollinearity (VIF=1.055, Tolerance=.948). Additionally, the assumption of independent errors was met (Durbin-Watson value=2.104). Casewise diagnostics indicated that two outliers had standardised residuals in excess of 3.29. However, none of the outliers has a Cook's distance greater than 1 and both outliers have centred leverage values smaller than three times the average. Hence, both outliers did not exert undue influences over the model.

Timeline cyclical accounted for 8.1% of the variance in IPAQ-SF scores after controlling for age ($\Delta R^2_{\text{Adjusted}}=.081, p=.009$) while the Model 2 as a whole explains 21.1% of the variance ($R^2_{\text{Adjusted}}=.211, p=.009$). Both timeline cyclical (Beta = -.312, $p=.005$) and age (Beta=-.451, $p=.011$) made a statistically significant contribution to the variance reported. Overall, Model 2 significantly improved the predictability of IPAQ-SF scores compared to not fitting the model ($F(2, 61)= 9.44, p<.001$). Refer to Table 6 for the post-hoc regression analysis results.

Table 6 Post-hoc regression analysis for levels of physical activity (IPAQ-SF), with 95% BCa confidence intervals reported in parentheses. Confidence intervals and standard errors based on 1000 bootstrap samples

	<i>b</i>	<i>SE B</i>	β	<i>p</i> (2-tailed)
Model 1				
<i>Age</i>	-.023 (-.039, -.009)	.008	-.380	.017
Model 2				
<i>Age</i>	-.028 (-.046, -.012)	.008	-.451	.011
<i>Timeline Cyclical</i>	-.085 (-.139, -.031)	.027	-.312	.005

Note: $R^2=.144$ and $R^2_{\text{Adjusted}}=.130$ for Model 1; $\Delta R^2=.092$ and $\Delta R^2_{\text{Adjusted}}=.081$ for Model 2 ($ps<.01$).

3.5 Moderation and mediation analyses

Moderation analysis was conducted with levels of physical activity (IPAQ-SF) as the dependent variable, timeline cyclical as the independent variable and severity of depression (BDI-II) as the moderator variable (Table 7). Findings suggest that the relationship between timeline cyclical and levels of physical activity is not moderated by severity of depression as the interaction effect is not significant ($b = .023$, 95% CI $[-.015, .061]$, $t = 1.201$, $p = .23$).

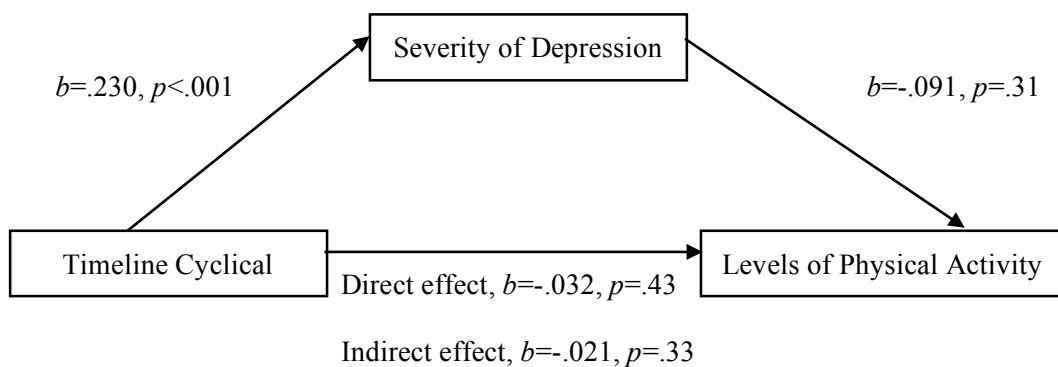
Table 7 Moderation analysis for levels of physical activity (IPAQ-SF)

	<i>b</i>	<i>SE B</i>	<i>t</i>	<i>p</i>
<i>BDI-II</i>	-.095 (-.260, .070)	.0825	-1.153	.254
<i>Timeline Cyclical</i>	-.029 (-.093, .036)	.032	-.888	.378
<i>BDI-II x Timeline Cyclical</i>	.023 (-.015, .061)	.0191	1.201	.23

Note: $R^2 = .078$ ($p = 0.56$).

Similarly, mediation analysis was conducted with levels of physical activity (IPAQ-SF) as the dependent variable, timeline cyclical as the independent variable and severity of depression (BDI-II) as the mediator variable. Results indicated that severity of depression was not a mediator as there is no significant indirect effect of timeline cyclical on levels of physical activity through severity of depression ($b = -.021$, BCa CI $[-.082, .008]$, $p = .33$). Refer to Figure 1 for mediation analysis results.

Figure 1 Mediation analysis for levels of physical activity (IPAQ-SF)



4 Discussion

4.1 Overview of study aims

Illness representations and their impact on health behaviours have been well researched and documented in other chronic illnesses. However, to date, no studies have investigated the relationship between illness representations and levels of physical activity in CKD patients not receiving renal replacement therapy. As such, the main aim of the current study was to bridge this knowledge gap by examining if components of illness representations associate and predict levels of physical activity for non-dialysing CKD patients. Furthermore, the study aimed to confirm the relationship of severity of depression with levels of physical activity and illness representations. The final study aim was to investigate if severity of depression is a moderator or mediator between components of illness representations that were significant predictors of levels of physical activity.

4.2 Summary and interpretation of study findings

4.2.1 *Sample characteristics*

The study sample has a mean and median age of 60 years, similar to studies with a non-dialysing CKD sample such as Greenwood *et al.* [72] $M=59$ and Kosmadaki *et al.* [73] $Mdn=58$ but lower than that of Vickery *et al.* [74] $M=68$ and Hedayati *et al.* [14] $M=64.5$. Consistent with the stratification of patients with CKD stage 3 to 5 from 2004 to 2010, the study sample revealed an increasing percentage of individuals with CKD as chronological age increased [75, 68]. In terms of gender proportions, there were more males (60%) in the current study, paralleling studies conducted by Hedayati *et al.* [14] (99.3%), Vickery *et al.* [74] (65.3%) and Kosmadaki *et al.* [73] (57.5%) but differing from Greenwood *et al.* [72] (47.5%). The CKD prevalence model offered by Public Health England [69] notes a higher prevalence of women than men with CKD stage 3 to 5, not reflected in the current study's sample characteristics. This might be because the current study sample comprised only non-dialysing CKD patients (thus excluding CKD patients receiving renal replacement therapy or had kidney transplants).

Numbers of non-smokers (52.9%) exceeded current smokers (7.1%) in this sample, while forty per cent of the participants were former smokers. This trend is similar to the stratification statistics of individuals diagnosed with CKD stage 3 to 5 from 2004 to 2010 [75]. The mean eGFR level of the sample is 34.5ml/min/1.73m², considerably higher than the eGFR data reported by Hedayati *et al.* [14], Kosmadaki *et al.* [73] and Vickery *et al.* [74] ($M=31.4\text{ml/min/1.73m}^2$, $M=26.1\text{ml/min/1.73m}^2$ and $M=18\text{ml/min/1.73m}^2$ respectively); Greenwood *et al.* [72] did not report the eGFR levels. Half of the sample in the current study had a BDI-II cut-off score of ≥ 11 , which is indicative of a depressive presentation. This rate is more than twice reported by Hedayati *et al.* [14] and a systematic review on the prevalence of depression in CKD [76].

4.2.2 Relationship between variables

The study yielded findings that support the research hypotheses, which proposed that components of illness representations are associated and predictive of levels of physical activity.

Regarding associative relationship, only one component of illness representations, personal control, had a statistically significant positive correlation with levels of physical activity, suggesting that non-dialysing CKD patients in the sample who perceived themselves as having more personal control over their illness were more likely to engage in physical activity and undertake higher levels of physical activity. This is consistent with the findings of a meta-analytic review by Hagger and Orbell [50] who examined the relationship between CSM of illness representations with health behaviours and illness outcomes in 23 illnesses and conditions. They found that CSM cure/control dimension, classified as equivalent to personal control, was positively correlated with both generic and specific problem-focused coping strategies such as exercise [50]. Having the perception of personal control over illness was related to active coping strategies, which was reflected in our results. Participants in the current study with higher personal control were more likely to cope with their illness by being physically active. Similarly, French and colleagues' [77] systematic review with meta-analysis reported cardiovascular disease (CVD) patients disclosing greater CSM cure/control appraisals were more likely to attend cardiac rehabilitation, perhaps also indicating active coping through the

engagement of health behaviour. The positive association between personal control and levels of physical activity has also been established in CVD research studies where individuals with beliefs of high personal control undertook more physical activity or exercise [78, 79].

Timeline cyclical dimension predicted levels of physical activity and remained statistically significant for the post-hoc regression analysis. Non-dialysing CKD patients who considered their illness and symptoms as unpredictable and cyclical undertook lower levels of physical activity. This finding paralleled to Sniehotta *et al.* [80] who similarly concluded that timeline cyclical predicted levels of physical activity in CVD patients. It may be that unpredictability of symptoms deters the engagement in physical activity. CKD symptoms can be debilitating and hinder the performance of physical activity, and it might be easier and less aversive to avoid being physical active due to the unpredictability occurrence of symptoms. Such explanation is congruent with Hagger and Orbell [50] who found that timeline dimension, which consists of both acute/chronic and cyclical components, was positively associated with avoidance and denial. It is possible that non-dialysing CKD patients who perceived their condition as cyclical and chronic may be in denial and adopt an avoidant coping style by not employing health behaviours for the fear of aggravating their symptoms [80].

The aforementioned significant results paralleled with the findings of other self-regulation models. Personal control dimension in the CSM is closely related to the self-efficacy belief of the Social Cognition Theory. A sense of self-efficacy refers to a belief of personal action control or agency to do something, while personal control of the CSM is defined as an appraisal of having personal control over an illness. Self-efficacy studies have found that individuals with high self-efficacy are more likely to engage in physical exercise [81], which corresponds to the positive relationship between personal control and levels of physical activity found in the current study. Besides that, the ‘perceived severity’ dimension of the Health Belief Model (HBM) overlaps with timeline cyclical component of the CSM. Variability and unpredictability of symptoms can contribute to an illness perception that the condition is more severe. This hypothesis is ascertained by the significant positive correlations between timeline cyclical and consequences reported. Findings from HBM studies indicated a negative relationship between perceived severity and the

engagement of health behaviours [82], which is in line with the negative relationship found between timeline cyclical and the levels of physical activity.

It should be noted that personal control, which was significantly associated with levels of physical activity, did not significantly predict levels of physical activity after controlling for participant characteristics, age and eGFR. This could possibly be explained by the confounder bias driven by the participant characteristics' variables, which were controlled for in a multiple regression analysis [83]. On the other hand, timeline cyclical was not significantly associated but significantly predicted levels of physical activity. This phenomenon could be attributed by either the incidental cancellation or suppression effect [84]. That is to say, other variables could have cancelled out or suppressed the association relationship between timeline cyclical and levels of physical activity as demonstrated in the correlation analysis results. Multiple regression partials out such effects, thus yielding the unique variance contributed by each predictor variable, which was significant.

Unexpectedly, the third hypothesis, that severity of depression would be associated with levels of physical activity (as evidenced by other studies), was not substantiated. However, the association between both variables was approaching statistical significance. One possible explanation for the lack of significance was that missing data in the IPAQ-SF, substituted by suggested values through expectation maximisation technique, could have influenced the statistical significance. This appears confirmed by a post-hoc simple correlation analysis using the original IPAQ-SF data with no data imputation where results indicated a significant negative relationship between severity of depression and levels of physical activity.

Based on the study results, the predictive relationship between timeline cyclical and levels of physical activity were neither moderated nor mediated by the severity of depression. In other words, the hypothesis that severity of depression has either a moderating or mediating effect on the relationship between illness representations and levels of physical activity was not substantiated. This demonstrated that timeline cyclical is an important predictor and on its own has a direct effect on levels of physical activity. This is a crucial finding, which has important clinical implications.

It is important to note that illness representation components were also associated with participant characteristics, severity of depression and intercorrelated. The study found that individuals who are older perceived their condition to be less unpredictable and having lower negative emotional responses. This could be due to older adults being more likely to have a comorbidity, which increases the number and frequency of symptoms and may lead to a belief that their illness is less cyclical. Post-hoc point-biserial correlation between age and comorbidity ($r_{pb} = .305, p = .013$) confirmed this hypothesis. This hypothesis is in line with the findings reported by Almutary and colleagues who found that older adults experience more comorbidities and higher CKD symptom burden and frequency [85]. Consequently, older adults may have fewer negative emotional responses to their illness as they perceive themselves as having a more stable condition because of lower variability of symptoms. This explanation appeared validated by findings of a positive correlation between timeline cyclical and emotional representations. The positive association between timeline acute/chronic and treatment control (suggesting that individuals who perceived their illness as more chronic felt that their condition was more controllable by their treatment) was counterintuitive but explainable. The treatment control subscale consists of questions with two main themes: the curability of illness (e.g. 'My treatment will be effective in curing my illness') and the management of illness (e.g. 'My treatment can control my illness'). As the sample comprised non-dialysing CKD patients with no active treatment, they might perceive that the treatment they were receiving was managing rather than curing their chronic condition.

Illness representations in this study were found to be associated with severity of depression. This relationship has also been observed in studies with sample both not receiving and receiving renal replacement therapy [86] and a sample who initiated dialysis within three months [87]. Indeed, a systematic review by Foxwell and colleagues [88] found that illness representations were correlated to mood in coronary heart disease patients. The associations found in the study between components of illness representations were expected as illness representation components have been established as a functioning group of interrelated beliefs with logical interrelationships [89]. This also means that targeted interventions on certain facets of illness representations might influence others. For instance, due to

the positive relationship between illness coherence and personal control, interventions targeted at improving the knowledge of one's condition might increase a sense of personal control.

4.3 Limitations

There are several limitations in the current study to be acknowledged. Results emerged from the current study adopted a within group cross-sectional survey design, which precluded causal examination and comparisons across groups. Due to the design of the study, data of interest variables were collected at a single point in time and from self-report measures. Interest variables assessed, such as illness representations and severity of depression, are state dependent and susceptible to contextual factor influences. For instance, an individual may over-report an illness as having more negative consequences and experiencing more severe depression if the individual has recently been affected negatively by the symptoms of the illness. In addition, self-report measures like those used in the present study namely, BDI-II and IPAQ-SF, are prone to recall bias, which threatens the validity of the data [90]. Furthermore, the survey pack was issued to participants to be taken away and completed in their own time, which potentially could have introduced several confounding variables that cannot be controlled for such as environment and influences by others, reducing standardisation across all participants.

There are some further considerations regarding the study sample. The sample size is below the recommended amount based on power analysis. Despite efforts to recruit in excess of 100 participants, the study did not achieve the intended sample size within the sampling timeframe and is underpowered ($n=70$). As a result, findings should be interpreted with caution. However, attempts were made to address this issue. A post-hoc regression analysis with two predictor variables was conducted, which met the 15 cases per predictor variable requirement for social sciences research [91]. Another limitation was the exclusion of the identity facet of illness representations from analysis due to limited cases and a substantial amount of missing data for the identity subscale. As such, the findings may not be as comprehensive. With participant characteristics of the sample indicating more males than the prevalence model [68], and the sample reporting more depression compared to other studies [75, 76], results are not entirely generalisable to the CKD

population, and are restricted to non-dialysing CKD patients. Finally, non-dialysing CKD patients who declined to take part in the study or have changed their mind after consent might be different from those who volunteered for the study, resulting in non-response bias [92].

4.4 Clinical implications

Despite the limitations outlined, the present study offers a valuable contribution to the literature, being the first to examine the relationship between illness representations and levels of physical activity in non-dialysing CKD patients. Findings of this study suggest that illness representation components are associated and predictive of levels of physical activity in accordance with assumptions underpinning the CSM model, in which representations of illness influence coping and the utilisation of health behaviours [93]. This finding is crucial and has important clinical implications as many studies found that CKD patients do not undertake enough physical activity [94-97], with potential adverse consequences [94, 98]. Furthermore, research has found that exercise is beneficial for CKD patients [36] and associated with better outcomes [99], including those not on renal replacement therapy [34, 100].

Given components of illness representations appeared to underpin and direct the motivation to engage in physical activity, better understanding and targeting of patient appraisals in this population appears warranted. Clinical resources could be invested for routine psychological assessment and screening for CKD patients not on renal replacement therapy, to assess their illness representations, and consideration given to development of psychological interventions specific to address unhelpful representations in non-dialysing CKD patients via CBT [48]. For instance, psychoeducation and information about CKD could be provided to increase patients' understanding and knowledge of the condition, which could potentially empower them and increase personal control. With enhanced knowledge, individuals could identify early warning signs of their symptoms, which facilitates better management of the condition and prevent the aggravation of symptoms. Being more competent in identifying and managing their illness could potentially reduce the patients' perception that their illness is cyclical and unpredictable and reduce the severity of depression. Research has established the

efficacy of illness representations-based interventions in increasing physical activity in myocardial infarction patients [101] and improving clinical and psychological outcomes in diabetic patients [102]. Similarly, such focused interventions should be timely provided for non-dialysing patients with CKD to enhance and sustain uptake of physical activity and mitigate the effects of depression.

4.5 Directions for future research

The current study has established the relationship of illness representations with levels of physical activity and severity of depression. Further research can be conducted to address the limitations described above. Notably, recruitment of a larger sample may increase the validity of the findings, while employing a longitudinal study allows the inferring of temporal association between illness representations and levels of physical activity [92]. A mixed method design, specifically a sequential explanatory model, utilising collection and analysis of qualitative data after employing quantitative methods [103], might lend further credence and strengthen the findings and also overcome some of the disadvantages of self-report measures.

Due to the scale of the study, only age and eGFR levels were selected as participant characteristics to be controlled for as these variables were found to influence physical activity [104, 105]. Further studies could include more participant characteristic variables known to influence levels of physical activity, particularly gender, to improve the robustness of the results. Most importantly, research concerning the development and validation of psychological interventions specific to the modification of illness representations in non-dialysing CKD patients is encouraged. Following that, randomised controlled trials could be carried out to verify the efficacy of such treatments and also establish causal links between illness representations and levels of physical activity.

References

1. National Kidney Foundation. *About Chronic Kidney Disease*. 2017.
<https://www.kidney.org/atoz/content/about-chronic-kidney-disease#ckd> (15 February 2017, date last accessed)
2. National Institute for Health and Care Excellence (NICE). *Chronic kidney disease in adults: assessment and management. Introduction*. 2015.
<https://www.nice.org.uk/guidance/cg182/chapter/Introduction> (15 February 2017, date last accessed)
3. Department of Health England. *The National Service Framework for Renal Services – Part Two: Chronic Kidney Disease, Acute Renal Failure and End of Life Care*. 2005
4. The Renal Association. *CKD stages*. <http://www.renal.org/information-resources/the-uk-eckd-guide/ckd-stages#sthash.95o4PVDn.teZtzh5X.dpbs> (15 February 2017, date last accessed)
5. Kidney Research UK. *Stages of kidney disease*.
<https://www.kidneyresearchuk.org/health-information/stages-of-kidney-disease> (15 February 2017, date last accessed)
6. National Health Service. *Chronic Kidney Disease*. 2016.
<http://www.nhs.uk/conditions/kidney-disease-chronic/pages/introduction.aspx> (15 February 2017, date last accessed)
7. Zhang Q, Rothenbacher D. Prevalence of chronic kidney disease in population- based studies: Systematic review. *BMC Public Health* 2008; 8: 117-117
8. East Midlands Public Health Observatory. *Kidney disease: key facts and figures*. 2010. <http://www.boltonshealthmatters.org/sites/default/files/Kidney-Disease-Key-Facts.pdf> (15 February 2017, date last accessed)
9. Cracknell R. *Key Issues for the New Parliament 2010. The ageing population*.
<http://www.parliament.uk/business/publications/research/key-issues-for-the-new-parliament/value-for-money-in-public-services/the-ageing-population/> (15 February 2017, date last accessed)
10. British Kidney Patient Association. *Chronic Kidney Disease*. 2014.
<http://www.britishkidney->

pa.co.uk/images/downloads/patient_information_leaflets/BKPA_Chronic_Kidney_Disease.pdf (15 February 2017, date last accessed)

11. Kerr M, Bray B, Medcalf J, O'Donoghue DJ, Matthews B. Estimating the financial cost of chronic kidney disease to the NHS in England. *Nephrol Dial Transplant* 2012; 27 Suppl 3: 73-80
12. National Institute for Health and Care Excellence (NICE). *Chronic kidney disease in adults: assessment and management. Research recommendations*. 2015. <https://www.nice.org.uk/guidance/cg182/chapter/3-Research-recommendations> (15 February 2017, date last accessed)
13. Cukor D, Coplan J, Brown C, *et al.* Depression and anxiety in urban hemodialysis patients. *Clin J Am Soc Nephrol* 2007; 2: 484
14. Hedayati SS, Minhajuddin AT, Toto RD, Morris DW, Rush AJ. Prevalence of major depressive episode in CKD. *Am J Kidney Dis* 2009; 54: 424-432
15. Bautovich A, Katz I, Smith M, Loo CK, Harvey SB. Depression and chronic kidney disease: A review for clinicians. *Aust N Z J Psychiatry* 2014; 48: 530-541
16. Peng YS, Chiang CK, Hung KY, *et al.* The association of higher depressive symptoms and sexual dysfunction in male haemodialysis patients. *Nephrol Dial Transplant* 2007; 22: 857-861
17. Theofilou PA. Sexual functioning in chronic kidney disease: the association with depression and anxiety. *Hemodial Int* 2012; 16: 76-81
18. Yazici R, Altintepe L, Guney I, *et al.* Female sexual dysfunction in peritoneal dialysis and hemodialysis patients. *Ren Fail* 2009; 31: 360-364
19. Khaira A, Mahajan S, Khatri P, Bhowmik D, Gupta S, Agarwal SK. Depression and marital dissatisfaction among Indian hemodialysis patients and their spouses: a cross-sectional Study. *Ren Fail* 2012; 34: 316-322
20. Pruchno R, Wilson-Genderson M, Cartwright FP. Depressive symptoms and marital satisfaction in the context of chronic disease: a longitudinal dyadic analysis. *J Fam Psychol* 2009; 23: 573
21. Jung S, Lee Y, Choi SR, Hwang S, Noh J. Relationship between cognitive impairment and depression in dialysis patients. *Yonsei Med J* 2013; 54: 1447-1453

22. Cruz LN, de Almeida Fleck, Marcelo Pio, Polanczyk CA. Depression as a determinant of quality of life in patients with chronic disease: data from Brazil. *Soc Psychiatry Psychiatr Epidemiol* 2010; 45: 953-961
23. Kao T, Lai M, Tsai T, Jan C, Chie W, Chen W. Economic, Social, and Psychological Factors Associated With Health-Related Quality of Life of Chronic Hemodialysis Patients in Northern Taiwan: A Multicenter Study. *Artif Organs* 2009; 33: 61-68
24. Berlim MT, Mattevi BS, Duarte APG, Thomé FS, Barros EJ, Fleck MP. Quality of life and depressive symptoms in patients with major depression and end-stage renal disease: a matched-pair study. *J Psychosom Res* 2006; 61: 731-734
25. Farrokhi F, Abedi N, Beyene J, Kurdyak P, Jassal SV. Association between depression and mortality in patients receiving long-term dialysis: a systematic review and meta-analysis. *Am J Kidney Dis* 2014; 63: 623-635
26. Akman B, Uyar M, Afsar B, Sezer S, Nurhan Ozdemir F, Haberal M. Adherence, depression and quality of life in patients on a renal transplantation waiting list. *Transplant Int* 2007; 20: 682-687
27. Cukor D, Rosenthal DS, Jindal RM, Brown CD, Kimmel PL. Depression is an important contributor to low medication adherence in hemodialyzed patients and transplant recipients. *Kidney Int* 2009; 75: 1223-1229
28. Khalil AA, Frazier SK, Lennie TA, Sawaya BP. Depressive Symptoms and Dietary Adherence in Patients with End-Stage Renal Disease. *J Ren Care* 2011; 37: 30-39
29. McDade-Montez EA, Christensen AJ, Cvengros JA, Lawton WJ. The role of depression symptoms in dialysis withdrawal. *Health Psychol* 2006; 25: 198
30. Teles F, Azevedo VFDD, Miranda CTD, Miranda MPDM, Teixeira MDC, Elias RM. Depression in hemodialysis patients: the role of dialysis shift. *Clinics* 2014; 69: 198-202
31. So BH, Methven S, Hair MD, Jardine AG, MacGregor MS. Socio-economic status influences chronic kidney disease prevalence in primary care: a community-based cross-sectional analysis. *Nephrol Dial Transplant* 2015; 30: 1010-1017

32. British Medical Association, NHS Employers. *Revisions to the GMS contract 2006/07. Delivering investment in general practice*. 2006.
<http://www.nhsemployers.org/~media/Employers/Documents/Primary%20care%20contracts/QOF/2006-07/Revisions%20to%20the%20GMS%20contract%20200607%20-%20Delivering%20investments%20in%20general%20practice.pdf> (15 February 2017, date last accessed)
33. Clapp EL, Bevington A, Smith AC. Exercise for children with chronic kidney disease and end-stage renal disease. *Pediatr Nephrol* 2012; 27: 165-172
34. Gould DW, Graham-Brown MP, Watson EL, Viana JL, Smith AC. Physiological benefits of exercise in pre-dialysis chronic kidney disease. *APSN* 2014; 19: 519-527
35. Hedayati SS, Yalamanchili V, Finkelstein FO. A practical approach to the treatment of depression in patients with chronic kidney disease and end-stage renal disease. *Kidney Int* 2012; 81: 247-255
36. Heiwe S, Jacobson SH. Exercise training for adults with chronic kidney disease. *Cochrane Database Syst Rev* 2011
37. Kidney Research UK. *Exercising*. <https://www.kidneyresearchuk.org/health-information/exercising> (19 February 2017, date last accessed)
38. National Health Service. *Preventing Chronic Kidney Disease*. 2016.
<http://www.nhs.uk/Conditions/Kidney-disease-chronic/Pages/Prevention.aspx> (19 February 2017, date last accessed)
39. Goodman ED, Ballou MB. Perceived barriers and motivators to exercise in hemodialysis patients. *Nephrol Nurs J* 2004; 31: 23
40. Delgado C, Johansen KL. Barriers to exercise participation among dialysis patients. *Nephrol Dial Transplant* 2012; 27: 1152-1157
41. Booth ML, Owen N, Bauman A, Clavisi O, Leslie E. Social–cognitive and perceived environment influences associated with physical activity in older Australians. *Prev Med* 2000; 31: 15-22
42. Johnston M. Means and meanings in health psychology. *European Health Psychologist* 2005; 1: 6-8

43. Nigg CR, Allegrante JP, Ory M. Theory-comparison and multiple-behavior research: common themes advancing health behavior research. *Health Educ Res* 2002; 17: 670-679
44. De Ridder DT, De Wit JB. Self-regulation in health behavior: Concepts, theories, and central issues. *Self-regulation in health behavior* 2006; 1-23
45. Hagger MS. Self-regulation: an important construct in health psychology research and practice. *Health Psychol Rev* 2010; 4: 57-65
46. Teixeira PJ. A primer on self-regulation and health behavior change. *Archives of Exercise in Health and Disease* 2015; 5: 326-337
47. Leventhal H, Cleary PD. The smoking problem: a review of the research and theory in behavioral risk modification. *Psychol Bull* 1980; 88: 370
48. Hale ED, Treharne GJ, Kitas GD. The common-sense model of self-regulation of health and illness: how can we use it to understand and respond to our patients' needs? *Rheumatology (Oxford)* 2007; 46: 904-906
49. Maes S, Karoly P. Self-Regulation assessment and intervention in physical health and illness: A review. *Appl Psychol* 2005; 54: 267-299
50. Hagger MS, Orbell S. A meta-analytic review of the common-sense model of illness representations. *Psychol Health* 2003; 18: 141-184
51. Cohen J. A power primer. *Psychol Bull* 1992; 112: 155
52. Moss-Morris R, Weinman J, Petrie K, Horne R, Cameron L, Buick D. The revised illness perception questionnaire (IPQ-R). *Psychol Health* 2002; 17: 1-16
53. Hill S. The illness perceptions questionnaire-revised (IPQ-R). *J Physiother* 2010; 56: 280
54. Zoeckler N, Kenn K, Kuehl K, Stenzel N, Rief W. Illness perceptions predict exercise capacity and psychological well-being after pulmonary rehabilitation in COPD patients. *J Psychosom Res* 2014; 76: 146-151
55. Beck AT, Steer RA, Carbin MG. Psychometric properties of the Beck Depression Inventory: Twenty-five years of evaluation. *Clin Psychol Rev* 1988; 8: 77-100
56. Whisman MA, Richardson ED. Normative data on the Beck Depression Inventory—second edition (BDI-II) in college students. *J Clin Psychol* 2015; 71: 898-907

57. Beck AT, Steer RA, Brown GK. Manual for the Beck Depression Inventory-II. San Antonio, TX: 1996
58. Wang Y, Gorenstein C. Psychometric properties of the Beck Depression Inventory-II: a comprehensive review. *Rev Bras Psiquiatr* 2013; 35: 416-431
59. Hedayati SS, Yalamanchili V, Finkelstein FO. A practical approach to the treatment of depression in patients with chronic kidney disease and end-stage renal disease. *Kidney Int* 2012; 81: 247-255
60. Craig CL, Marshall AL, Sjostrom M, *et al.* International physical activity questionnaire: 12-country reliability and validity. *Med Sci Sports Exerc* 2003; 35: 1381-1395
61. Lee PH, Macfarlane DJ, Lam T, Stewart SM. Validity of the international physical activity questionnaire short form (IPAQ-SF): A systematic review. *Int J Behav Nutr Phys Act* 2011; 8: 115
62. IPAQ Research Committee. *Guidelines for data processing and analysis of the International Physical Activity Questionnaire (IPAQ)–short forms*. 2004. <https://sites.google.com/site/theipaq/scoring-protocol> (15 February 2017, date last accessed)
63. Brown WJ, Trost SG, Bauman A, Mummery K, Owen N. Test-retest reliability of four physical activity measures used in population surveys. *J Sci Med Sport* 2004; 7: 205-215
64. Field Andy. *Discovering statistics using IBM SPSS statistics*. Sage, 2013
65. Hayes AF. *Process: a versatile computational tool for observed variable mediation, moderation and conditional process modeling*. 2012. <http://www.afhayes.com/public/process2012.pdf>. (28 August 2017, date last accessed)
66. Little RJ. A test of missing completely at random for multivariate data with missing values. *J Am Stat Assoc* 1988; 83: 1198-1202
67. Cohen J. *Statistical power analysis for the behavioural sciences*. Hillside, NJ: 1988
68. Roth M, Roderick P, Mindell J. *Kidney disease and renal function. Health survey for England 2010*; 1
69. Public Health England. *Chronic kidney disease prevalence model*. 2014. <http://www.yhpho.org.uk//resource/view.aspx?RID=204692> (17 April 2017, date last accessed)

70. VanVoorhis CW, Morgan BL. Understanding power and rules of thumb for determining sample sizes. *Tutorials in Quantitative Methods for Psychology* 2007; 3: 43-50
71. Pallant Julie. SPSS survival manual. McGraw-Hill Education, UK: 2007
72. Greenwood SA, Lindup H, Taylor K, *et al.* Evaluation of a pragmatic exercise rehabilitation programme in chronic kidney disease. *Nephrol Dial Transplant* 2012; 27 Suppl 3: iii126-34
73. Kosmadakis GC, John SG, Clapp EL, *et al.* Benefits of regular walking exercise in advanced pre-dialysis chronic kidney disease. *Nephrol Dial Transplant* 2012; 27: 997-1004
74. Vickery S, Webb MC, Price CP, John RI, Abbas NA, Lamb EJ. Prognostic value of cardiac biomarkers for death in a non-dialysis chronic kidney disease population. *Nephrol Dial Transplant* 2008; 23: 3546-3553
75. Jameson K, Jick S, Hagberg K, Ambegaonkar B, Giles A, O'donoghue D. Prevalence and management of chronic kidney disease in primary care patients in the UK. *Int J Clin Pract* 2014; 68: 1110-1121
76. Palmer S, Vecchio M, Jonathan CC, *et al.* Prevalence of depression in chronic kidney disease: systematic review and meta- analysis of observational studies. *Kidney Int* 2013; 84: 179-191
77. French DP, Cooper A, Weinman J. Illness perceptions predict attendance at cardiac rehabilitation following acute myocardial infarction: a systematic review with meta-analysis. *J Psychosom Res* 2006; 61: 757-767
78. Mosleh SM, Almalik MM. Illness perception and adherence to healthy behaviour in Jordanian coronary heart disease patients. *Eur J Cardiovasc Nurs* 2016; 15: 223-230
79. Reges O, Vilchinsky N, Leibowitz M, Khaskia A, Mosseri M, Kark JD. Illness cognition as a predictor of exercise habits and participation in cardiac prevention and rehabilitation programs after acute coronary syndrome. *BMC Public Health* 2013; 13: 956
80. Sniehotta FF, Gorski C, Araújo-Soares V. Adoption of community-based cardiac rehabilitation programs and physical activity following phase III cardiac rehabilitation in Scotland: A prospective and predictive study. *Psychol Health* 2010; 25: 839-854

81. Schwarzer R, Fuchs R. Self-efficacy and health behaviours. *Predicting health behavior: Research and practice with social cognition models* 1996; 163-196.
82. Harvey J, Lawson V. The importance of health belief models in determining self-care behaviour in diabetes. *Diabetic Med* 2009; 26: 5-13.
83. Greenland S. Quantifying biases in causal models: classical confounding vs collider-stratification bias. *Epidemiology* 2003; 14: 300-306.
84. MacKinnon DP, Krull JL, Lockwood CM. Equivalence of the mediation, confounding and suppression effect. *Prev Sci* 2000; 1: 173-181.
85. Almutary H, Bonner A, Douglas C. Which patients with chronic kidney disease have the greatest symptom burden? A comparative study of advanced CKD stage and dialysis modality. *J Ren Care* 2016; 42: 73-82.
86. Knowles S, Swan L, Salzberg M, Castle D, Langham R. Exploring the relationships between health status, illness perceptions, coping strategies and psychological morbidity in a chronic kidney disease cohort. *Am J Med Sci* 2014; 348: 271-276
87. Chilcot J, Norton S, Wellsted D, Davenport A, Firth J, Farrington K. Distinct depression symptom trajectories over the first year of dialysis: associations with illness perceptions. *Ann Behav Med* 2013; 45: 78-88
88. Foxwell R, Morley C, Frizelle D. Illness perceptions, mood and quality of life: A systematic review of coronary heart disease patients. *J Psychosom Res* 2013; 75: 211-222
89. Covic A, Seica A, Gusbeth-Tatomir P, Gavrilovici O, Goldsmith DJ. Illness representations and quality of life scores in haemodialysis patients. *Nephrol Dial Transplant* 2004; 19: 2078-2083
90. Raphael K. Recall bias: a proposal for assessment and control. *Int J Epidemiol* 1987; 16: 167
91. Stevens James P. Applied multivariate statistics for the social sciences. Houghton Mifflin, Boston: 1996
92. Sedgwick P. Cross sectional studies: advantages and disadvantages. *BMJ* 2014; 348
93. Leventhal H, Nerenz D, Steele D. Illness representations and coping with health threats. In: Baum A, Singer J, eds. *A Handbook of Psychology and Health*, Lawrence Erlbaum Associates, Hillsdale, NJ; 1984: 219-252

94. Beddhu S, Baird BC, Zitterkoph J, Neilson J, Greene T. Physical activity and mortality in chronic kidney disease (NHANES III). *Clin J Am Soc Nephrol* 2009; 4: 1901-1906
95. Zamojska S, Szklarek M, Niewodniczy M, Nowicki M. Correlates of habitual physical activity in chronic haemodialysis patients. *Nephrol Dial Transplant* 2006; 21: 1323-1327
96. Avesani CM, Trolonge S, Deleaval P, *et al.* Physical activity and energy expenditure in haemodialysis patients: an international survey. *Nephrol Dial Transplant* 2012; 27: 2430-2434
97. Hayhurst WS, Ahmed A. Assessment of physical activity in patients with chronic kidney disease and renal replacement therapy. *SpringerPlus* 2015; 4: 536
98. Zelle DM, Klaassen G, van Adrichem E, Bakker SJ, Corpeleijn E, Navis G. Physical inactivity: a risk factor and target for intervention in renal care. *Nat Rev Nephrol* 2017; 13: 152-168.
99. Tentori F, Elder SJ, Thumma J, *et al.* Physical exercise among participants in the Dialysis Outcomes and Practice Patterns Study (DOPPS): correlates and associated outcomes. *Nephrol Dial Transplant* 2010; 25: 3050-3062
100. Johansen KL, Painter P. Exercise in individuals with CKD. *Am J Kidney Dis* 2012; 59: 126-134
101. Broadbent E, Ellis CJ, Thomas J, Gamble G, Petrie KJ. Further development of an illness perception intervention for myocardial infarction patients: a randomized controlled trial. *J Psychosom Res* 2009; 67: 17-23
102. Keogh KM, Smith SM, White P, *et al.* Psychological family intervention for poorly controlled type 2 diabetes. *Am J Manag Care* 2011; 17: 105-113
103. Creswell John W. Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications, 2013
104. Shaw BA, Spokane LS. Examining the association between education level and physical activity changes during early old age. *J Aging Health* 2008; 20: 767-787
105. Robinson-Cohen C, Littman AJ, Duncan GE, *et al.* Physical activity and change in estimated GFR among persons with CKD. *J Am Soc Nephrol* 2014; 25: 399-406

PART 3: Critical Appraisal

1 Introduction

This section of the thesis comprised of my personal reflections and critical appraisal of the entire research process. I have also provided a critique of the research methodology and elaborated further on the research limitations and potential future research opportunities. Furthermore, challenges and obstacles encountered and the steps taken to resolve these issues were discussed. Finally, I offered how the research project has impacted on my personal and professional development.

1.1 Research process

Throughout my research endeavour, I was provided with formal and informal support and guidance. I had recourse to formal assistance and research expertise under the tutelage of my research and field supervisors. Besides that, I kept a research diary and attended regular research supervision meetings, which allowed me to review, revisit and reflect on my research journey. My research was further enhanced by my clinical training as I was exposed to many valuable concepts to which I have embraced and utilised. For instance, Praxis, the act of constant action and reflection (Freire, 1998), is one of the many concepts that I have subscribed to, which encourages me to think critically and better my research through constant learning, adjusting and refining. Regarding informal support, I had the opportunity to have insightful discussions with my fellow peers and professional colleagues about my research topic and experiences. I also worked alongside with other researchers and consulted them when the need arises.

1.1.1 Choice of topic

Selecting the current topic was not an easy decision as I had the opportunity to conduct research in another topic that I was also keen in – help-seeking behaviour of the Chinese community and their access to psychological therapies in the UK. I was interested in this topic because I had prior experience in conducting qualitative research on help-seeking behaviour in a predominantly Chinese country. I wondered if there would be any differences in the help-seeking behaviour of the same ethnic group but being a minority in a different country. Furthermore, I realised that there was a paucity of research on the Chinese ethnic group in the UK

after doing a literature search for a critical appraisal assignment on differential access to psychological therapies for BME clients.

At the same time, I have always been very interested in the impact of exercising on mental health difficulties as I have consistently felt better not just physically but also mentally after engaging in strenuous physical activities. I wondered if there are also beneficial differences in the type of exercise engaged, specifically, aerobic and anaerobic exercises. Furthermore, having taken Health Psychology during my undergraduate studies, I was also curious about the psychological underpinnings and mechanisms behind the engagement of health behaviours, such as exercising. After further contemplation, I decided to embark on something different and to expand my breadth of knowledge instead of depth.

With the help and suggestions from my research supervisor, I began to examine the literature to understand some of the theoretical models that are hypothesised to influence health behaviour specifically, in individuals with Chronic Kidney Disease, which was my field supervisor's area of research expertise. Reading through the literature, I identified the locus of control and the Common-Sense Model (CSM) of illness representations as two possible theoretical models to utilise in my research. Following several research meetings with my research and field supervisors and other researchers, the topic and research question was further developed and refined. I was convinced that the CSM of illness representations was the most appropriate model as it theorises the psychological processes that underpin and direct the motivation of health behaviours for individuals with a chronic illness, which was directly relevant to my target sample and thus, worthy of investigation.

1.1.2 Choice of methodology

One of the personal development goals I have set for myself during the entire research journey was to commit to something new in order to widen my research knowledge and expertise. As I have some experience in qualitative research methods but no significant quantitative research experience, I was leaning towards and was more inclined to utilise a quantitative research design. My initial intention prior to the refinement of my research question was to conduct a between-group experimental research by having three separate groups and providing aerobic

exercise intervention to the first group, anaerobic exercise interventions to the second and the final group being the control group. However, due to the limited time frame given to complete the research study, it was advised that this research design was not feasible.

Factoring the time constraints in the context of clinical training and the large sample size required for quantitative research, it was decided that a within-group cross-sectional survey design study was the most viable option. Besides that, a convenience sampling method was employed as my field supervisor has links to a renal outpatient clinic. The research method adopted has limitations such as those mentioned in the main empirical report. On top of that, despite being a quicker and easier method, convenience sampling also results in variability and bias, which limits the generalisability of the findings (Acharya *et al.*, 2013). Furthermore, the quantitative method employed in the current study is a nomothetic approach that relies on the science of general law (Gelo *et al.*, 2008). While this approach is helpful to understand and explain a general phenomenon, but it does not provide an in-depth understanding of the psychological thought processes of an individual as with an idiographic/qualitative approach. As such, as suggested in the section 'directions for future research', a mixed method design is desirable to capitalise on the benefits of both quantitative and qualitative research.

Pertaining to the management of potential biases due to the violation of assumptions, I have employed two primary methods, transformation and bootstrapping, to ensure methodological robustness. I decided to adopt the traditional approach of transformation first to correct for distributional problems in non-normal data. However, two independent variables, eGFR and Timeline Acute/Chronic, did not achieve normality despite transformation. As such, the decision was made to run bootstrapping, a relatively new approach in the field of statistics, in all analyses to resolve issues regarding the violation of assumptions. Even though bootstrapping has been evidenced as a robust method to overcome issues where assumptions are violated (Field, 2013), many researchers still prefer to adopt traditional statistical methods. Similarly, in a methodical manner, my instinctual response was to utilise traditional statistics of transformation first before adopting new techniques such as bootstrapping to ensure optimal robustness in my

data. However, on hindsight, it seems like I could have just utilised the bootstrapping method as this approach does not assume normality and addresses similar issues that transformation is able to resolve (Field, 2016).

1.2 Ethical approval and ethical considerations

The ethical approval process proved to be challenging and time-consuming. As I had to conduct recruitment in a different Trust, I was informed that a Letter of Access (LoA) was required. It was advised that I had to complete an NHS-to-NHS proforma in order to obtain the LoA. However, I was subsequently notified that I was not recognised as an official employee because I am an honorary contract holder and thus, was ineligible to apply for the NHS-to-NHS proforma. As a result, I had to take an alternative route and applied for a Research Passport from the University. The whole process to obtain the LoA took around nine months, which was a difficult process as I was being redirected to several people who were unable to provide the proper guidance to obtain the LoA.

Besides that, the whole ethical approval process was complicated by newly implemented processes. Specifically, research protocols had to be submitted for Health Research Authority (HRA) approval other than seeking the usual approvals from NHS Research Ethics Committee (REC) and the Research and Development (R&D). The entire process felt a little repetitive and confusing as the new process was not explained thoroughly. As it was a transitional phase for the new process, the R&D research representative was unable to provide comprehensive guidance due to an element of uncertainty. Furthermore, the HRA approval process took more than two months because of a delay in the processing of studies as there was a high volume of submissions.

Despite the challenges encountered, I felt that the application for ethical approval was a learning process. Through this endeavour, I have understood the intricacies and requirements needed to gain ethical approval. I have also gained experience in utilising the different complex online systems. On hindsight, the entire experience made me realised the importance of allowing ample time to navigate through the ethics application process, so as to account for unexpected complications and barriers.

In terms of ethical considerations, study participants were considered as vulnerable adults as they were generally older adults with chronic kidney disease and multiple co-morbidities, including mental health difficulties such as depression. As recruitment was conducted in a clinical setting where participants received clinical treatments and consultations, I had to regularly hold in mind the possibility of undue coercion in research during recruitment. I found myself emphasising on the voluntary nature of the research and ensuring that potential participants understood that their care would be unaffected regardless of their decision to participate in the research. Being an international trainee, I also realised that my accent might not be easy to comprehend, especially for older adults who have hard of hearing. As such, I had to pace the rate of speech, check for participants' understanding and allow participants ample time to ask any questions to ensure that participants fully understood what the research study entails before consenting. Prior to conducting the research, I would have perceived the aforementioned ethical considerations as seemingly trivial, but I have learned that they are actually crucial in maintaining the ethical standards of the research. There was another ethical concern regarding the research procedure and the utilisation of the BDI-II prior to submitting the research protocol to REC. As participants were supposed to take the survey booklet back home to complete and post it back to the research office, there were some concerns that researchers might not be able to respond quickly in the event that participants indicated that they have suicidal thoughts or wishes on the BDI-II. However, there were substantial precedents by other studies for this research procedure and the utilisation of the BDI-II. To exercise caution, all survey booklet returned was checked in the first instance for suicidal ideation to ensure that research participants do not present with risk issues.

1.3 Recruitment and data collection

There was a need to work collaboratively with other researchers, medical doctors and renal clinic coordinators to facilitate recruitment. I have learned that in order to build good working relationships, it was necessary to attend renal clinic meetings to increase the opportunities for communication and rapport building with other staff members. Furthermore, clinical renal meetings offered a platform to promote the current research study and also allowed staff members to be familiarised with

me. Besides that, attending the meetings were helpful as the medical doctors could provide advice on which patients to approach based on the inclusion and exclusion criteria of the current study.

I was aware that for quantitative research, the process of recruitment and data collection would be time-consuming and challenging as the current research study required a relatively large number of sample. The process was also pressurising mainly because of two reasons; (1) there was only a small window of opportunity for me to speak to the patients about the research study and take their consent before they were seen by their medical doctors, (2) patients typically do not like to be approached after being seen by their medical doctors. As such, I had to balance between being efficient in introducing the study and ensuring that potential participants understood what the research entails. Most importantly, as I was under time constraints, I had to constantly remind myself that research participants are human beings rather than just research subjects. I took the time to interact with potential participants whom sometimes shared about the negative impact of their medical condition. Clinical training had provided me with the necessary skills to manage situations when potential participants got visibly upset while describing their experiences. At the same time, I was cognizant of the fact that I was conducting a research study and not a therapy session. While I do acknowledge their difficulties and demonstrate empathy, I had to remind myself to maintain the professionalism of a researcher and not a therapist. Several mandatory procedures during recruitment such as photocopying the consent forms immediately after consent taking, filing the copied consent form and pasting consent and research study stickers in the medical notes helped me to understand the importance of being systematic and meticulous.

The data collection process was created with the participants in mind and were advantageous in various ways. Allowing participants to take and complete the study survey booklet at home was mainly to minimise the burden of time, reduce socially desirable responses due to the lesser need for impression management (Randall & Fernandes, 1991) and finally, provide them with more time to consider about their participation in the study. However, during the data collection process, it was realised that such a method has several disadvantages. Firstly, thirty per cent of the

participants who consented to participate in the research study did not send back their study survey booklet. The response rate might be higher if the study survey booklets were completed after consent as participants may be less motivated to complete the survey at home. Besides that, there were significant missing data, which could have been avoided if the survey was completed at the clinic as the missing fields could be pointed out to the participants. Overall, the process of recruiting and data collecting was a learning process, and I feel that such experiences will be helpful for future research endeavours.

2 Personal and professional development

There were a substantial number of difficulties encountered during this research journey. Besides those that were mentioned in the previous sections, I also often felt like I was not in control of my research study when compared to my peers. This is because my research study was subsumed by a larger study and I was unable to have as much autonomy as I would have preferred. However, I was fortunate to have the support from my research supervisor and developmental tutors who offered a safe space for me to reflect on some of these difficulties. Furthermore, maintaining a research diary provided an avenue for me to note down the challenges faced, which I have found to be cathartic. It was also helpful for me to reflect on the challenges and organise my thoughts. As cliché as it might sound, I feel that these challenges encountered during the research journey proved to be a character-building experience. On top of that, my doctoral research undertaking has expanded my breadth of knowledge in many respects; chronic kidney disease, CSM of illness representations, quantitative research methods and various SPSS data analysis techniques just to name a few. Notably, I have learned to write research study protocol, complete ethical approval processes and attend meticulously to the day-to-day running of the research study. Moreover, through reading various statistic books and materials, I have gained a wealth of knowledge in correlation, regression, bootstrapping, expectation maximisation, mediation and moderation.

3 Dissemination

One of the things I have come to realise during my doctorate training is that research is not merely an iterative process. As scientist-practitioner, our responsibility is to

ensure that we disseminate our research findings in the scientific community, so as to facilitate evidence-based practice amongst other clinicians alike. As such, I have authored and co-authored several abstracts from the current research study and submitted them to several research conferences. These abstracts have been accepted as poster presentations and free communication. I have further intention to put forward the empirical research report for publication.

4 Final reflections

I believe that the quest for knowledge is a never-ending endeavour. As the inspiring founder of the Ford Motor Company, Henry Ford once said: “Anyone who stops learning is old, whether at twenty or eighty”. For me, completing my DClinPsy research thesis is not simply a means to an end, but an opportunity to continue my pursuit in scientific inquiry. Research work is quintessential to the profession of clinical psychology. I would definitely like to continue to engage in research work after qualifying and further develop myself as a scientist-practitioner so as to serve the society in both capacities.

References

- Acharya, A. S., Prakash, A., Saxena, P., & Nigam, A. (2013). Sampling: Why and how of it. *Indian Journal of Medical Specialties*, 4(2), 330-333.
- Field, A. (2013). *Discovering statistics using IBM SPSS statistics* Sage.
- Field, A. (2016). *An adventure in statistics: The reality enigma* Sage.
- Freire, P. (1998). *Pedagogy of freedom: Ethics, democracy, and civic courage* Rowman & Littlefield.
- Gelo, O., Braakmann, D., & Benetka, G. (2008). Quantitative and qualitative research: Beyond the debate. *Integrative Psychological and Behavioral Science*, 42(3), 266-290.
- Randall, D. M., & Fernandes, M. F. (1991). The social desirability response bias in ethics research. *Journal of Business Ethics*, 10(11), 805-817.
- Yu, C. H. (2003). Resampling methods: Concepts, applications, and justification. *Practical Assessment, Research & Evaluation*, 8(19), 1-23.

PART 4: Appendices

Non-Mandatory Appendices

Appendix A: Database searches

Database	Terms Used in Search	Records identified through database search	Records screened and selected based on inclusion criteria
PsycInfo*	1) 'Illness Representation' AND 'Physical Activit*'	19	4
	2) 'Illness Representation' AND Exercise	27	7
	3) 'Illness Representation' AND 'Physical Fitness'	1	0
	4) 'Illness Representation' AND 'Health Behaviour'	135	1
	5) 'Illness Representation' AND 'Coping Behaviour'	103	1
	6) 'Illness Representation' AND 'Exercise Training'	1	0
	7) 'Illness Representation' AND 'Aerobic Fitness'	1	0
	8) 'Illness Perception*' AND 'Physical Activit*'	47	5
	9) 'Illness Perception*' AND Exercise	86	14
	10) 'Illness Perception*' AND 'Physical Fitness'	6	0
	11) 'Illness Perception*' AND 'Exercise Training'	1	0
	12) 'Illness Perception*' AND 'Aerobic Fitness'	2	0
	13) 'Common-Sense Model' AND 'Physical Activit*'	8	0
	14) 'Common-Sense Model' AND Exercise	11	1
	15) 'Common-Sense Model' AND 'Physical Fitness'	22	0
	16) 'Common-Sense Model' AND 'Exercise Training'	2	0
	17) 'Common-Sense Model' AND 'Aerobic Fitness'	0	0
	18) 'Illness Perception Questionnaire' AND 'Physical Activit*'	30	0

	19) 'Illness Perception Questionnaire' AND Exercise	44	0
	20) 'Illness Perception Questionnaire' AND 'Physical Fitness'	2	0
	21) 'Illness Perception Questionnaire' AND 'Exercise Training'	29	0
	22) 'Illness Perception Questionnaire' AND 'Aerobic Fitness'	11	0
	23) 'Self-Regulatory Model' AND 'Physical Activit*	1	0
	24) 'Self-Regulatory Model' AND Exercise	2	0
	25) 'Self-Regulatory Model' AND 'Physical Fitness'	15	0
	26) 'Self-Regulatory Model' AND 'Exercise Training'	8	0
	27) 'Self-Regulatory Model' AND 'Aerobic Fitness'	3	0
	28) 'Parallel Process Model' AND 'Physical Activit*	6	0
	29) 'Parallel Process Model' AND Exercise	5	0
	30) 'Parallel Process Model' AND 'Physical Fitness'	1	0
	31) 'Parallel Process Model' AND 'Exercise Training'	2	0
	32) 'Parallel Process Model' AND 'Aerobic Fitness'	0	0
	Total Records	631	33
PubMed	33) 'Illness Representation' AND 'Physical Activit*'	24	1
	34) 'Illness Representation' AND Exercise	16	3
	35) 'Illness Representation' AND 'Physical Fitness'	1	0
	36) 'Illness Representation' AND 'Exercise Training'	2	0
	37) 'Illness Representation' AND 'Aerobic Fitness'	1	0
	38) 'Illness Perception*' AND 'Physical Activit*'	375	6
	39) 'Illness Perception*' AND Exercise	341	4
	40) 'Illness Perception*' AND 'Physical Fitness'	33	0
	41) 'Illness Perception*' AND 'Exercise Training'	91	0

	42) 'Illness Perception*' AND 'Aerobic Fitness'	5	0
	43) 'Common-Sense Model' AND 'Physical Activit*	16	2
	44) 'Common-Sense Model' AND Exercise	18	3
	45) 'Common-Sense Model' AND 'Physical Fitness'	3	0
	46) 'Common-Sense Model' AND 'Exercise Training'	1	0
	47) 'Common-Sense Model' AND 'Aerobic Fitness'	0	0
	48) 'Illness Perception Questionnaire' AND 'Physical Activit*	275	0
	49) 'Illness Perception Questionnaire' AND Exercise	230	0
	50) 'Illness Perception Questionnaire' AND 'Physical Fitness'	22	0
	51) 'Illness Perception Questionnaire' AND 'Exercise Training'	62	0
	52) 'Illness Perception Questionnaire' AND 'Aerobic Fitness'	2	0
	53) 'Self-Regulatory Model' AND 'Physical Activit*	35	0
	54) 'Self-Regulatory Model' AND Exercise	32	1
	55) 'Self-Regulatory Model' AND 'Physical Fitness'	2	0
	56) 'Self-Regulatory Model' AND 'Exercise Training'	5	0
	57) 'Self-Regulatory Model' AND 'Aerobic Fitness'	0	0
	Total Records	1592	20
CINAHL	58) 'Illness Representation' AND 'Physical Activit*'	405	2
	59) 'Illness Representation' AND Exercise	508	4
	60) 'Illness Representation' AND 'Physical Fitness'	270	0
	61) 'Illness Representation' AND 'Exercise Training'	22	0
	62) 'Illness Representation' AND 'Aerobic Fitness'	4	0

63) 'Illness Perception*' AND 'Physical Activit*'	210	2
64) 'Illness Perception*' AND Exercise	330	3
65) 'Illness Perception*' AND 'Physical Fitness'	24	0
66) 'Illness Perception*' AND 'Exercise Training'	26	0
67) 'Illness Perception*' AND 'Aerobic Fitness'	4	0
68) 'Common-Sense Model' AND 'Physical Activit*'	342	1
69) 'Common-Sense Model' AND Exercise	403	2
70) 'Common-Sense Model' AND 'Physical Fitness'	269	0
71) 'Common-Sense Model' AND 'Exercise Training'	14	0
72) 'Common-Sense Model' AND 'Aerobic Fitness'	6	0
73) 'Illness Perception Questionnaire' AND 'Physical Activit*'	95	1
74) 'Illness Perception Questionnaire' AND Exercise	154	2
75) 'Illness Perception Questionnaire' AND 'Physical Fitness'	13	0
76) 'Illness Perception Questionnaire' AND 'Exercise Training'	18	0
77) 'Illness Perception Questionnaire' AND 'Aerobic Fitness'	3	0
78) 'Self-Regulatory Model' AND 'Physical Activit*'	193	0
79) 'Self-Regulatory Model' AND Exercise	208	0
80) 'Self-Regulatory Model' AND 'Physical Fitness'	6	0
81) 'Self-Regulatory Model' AND 'Exercise Training'	159	0
82) 'Self-Regulatory Model' AND 'Aerobic Fitness'	0	0
Total Records	3686	17
Total records identified through all databases	5, 909	

Total records screened on basis of title and abstract	70
Records remained after the removal of duplicates	43

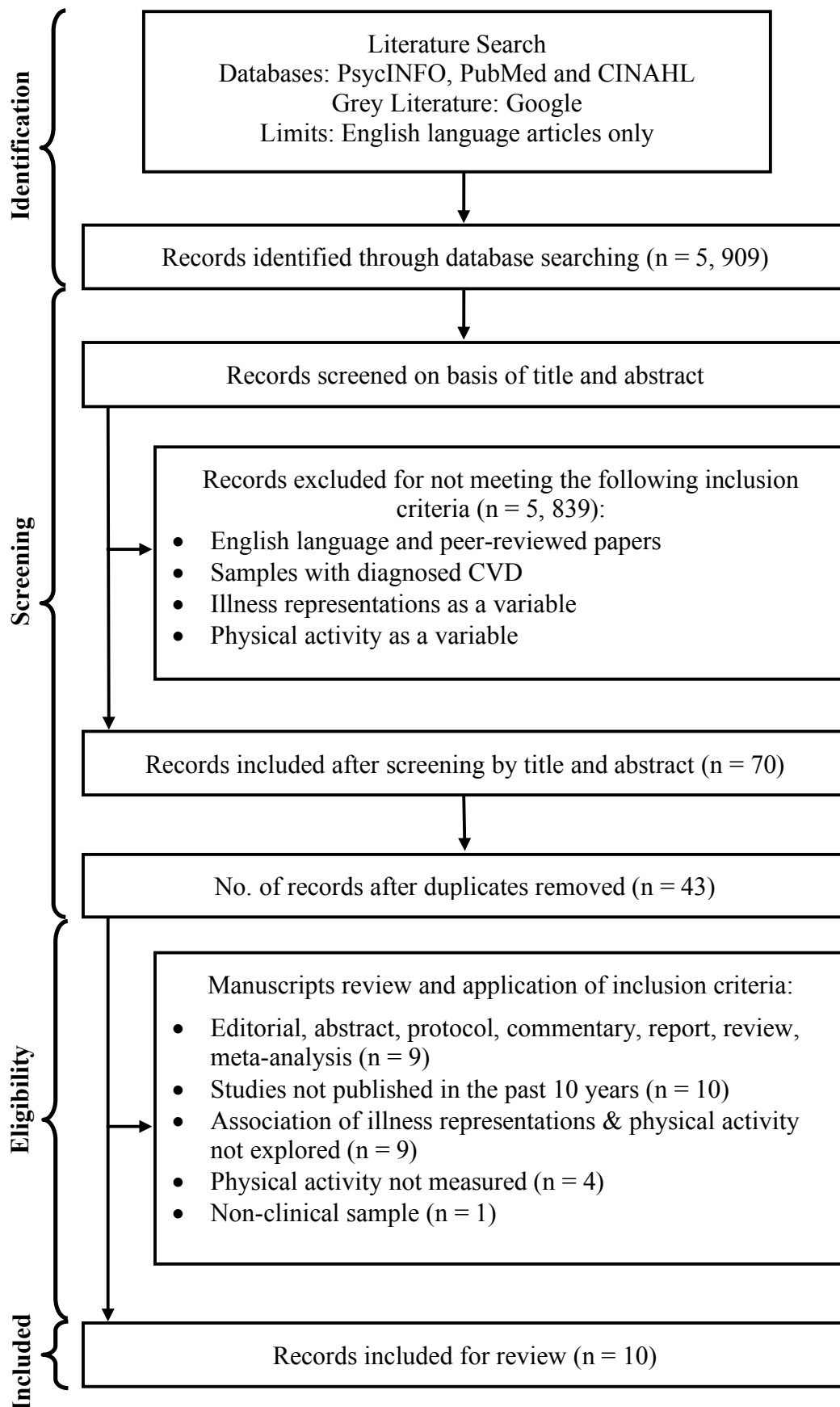
***Note:**

“Parallel Process Model”, “Health Behaviour” and “Coping Behaviour” were initially used as search terms in **PsycINFO**. It was noticed that the search for ‘Parallel Process Model’ returned with articles related to another model, the ‘Extended Parallel Processing Model’. Additionally, most of the articles that returned for “Health Behaviour” and “Coping Behaviour” were irrelevant and unsuitable as they were too broad and had no relevance to “Physical Activity”. Hence, the search terms were removed for **PubMed** and **CINAHL** to refine the search strategy.

Appendix B: Manuscripts reviewed and application of exclusion criteria

Rationale for exclusion	Records excluded
Editorial, abstract, protocol, commentary, report, review, meta-analysis	9
Studies not published in the past 10 years	10
Association of illness representation and physical activity not explored	9
No physical activity measures were used	4
Non-clinical sample	1
Number of records	43
Number of records excluded	33
Number of records included	10

Appendix C: PRISMA flow diagram of included studies



Appendix D: Data extraction pro forma

Title:
Author (1 st only):
Aims:
Country of study:
Sampling Characteristics: <i>(Total number of participants? Age range, who was studied, how was the sample recruited? What type of Cardiovascular Diseases did the participants have?)</i>
Study type: <i>(Is the study prospective, retrospective or cross-sectional? Is the study observational or interventional? Ethical consideration in provision of intervention upon detecting clinical outcomes such as depressive symptoms/depression in prospective cohort studies?)</i>
Measurement and Tool: <i>(What outcomes are being measured? What measurements were used? Are measures validated? At what time points are measures completed? Self-report or clinician rated?)</i>
Analysis: <i>(What statistical methods were used? Were the statistical methods appropriate to the aims of the study?)</i>
Adjustments: <i>(Did the study control for demographics, confounding variables such as other medical conditions?)</i>
Results/Key Findings: <i>(Is illness representation associated with physical activity? Were the results statistically and/or clinically significant?)</i>
Outcomes/Conclusions: <i>(What do the findings mean? Generalisability? Implications and recommendations? For intervention studies, did the change of illness representation lead to a change in levels of physical activity?)</i>
Additional Comments: <i>(Ethical considerations? Clinical implications? Biases?)</i>

Appendix E: Quality appraisal tool

Modified Checklist for Measuring Quality (Downs & Black, 1998)			
Reporting Subscale			
Question	Scoring		
1. Is the hypothesis/aim/objective of the study clearly described?	Yes - 1 Point	No - 0 Point	
2. Are the main outcomes to be measured clearly described in the Introduction or Methods section?	Yes - 1 Point	No - 0 Point	
3. Are the characteristics of the patients included in the study clearly described?	Yes - 1 Point	No - 0 Point	
4.* Are the interventions/ observations of interest clearly described?	Yes - 1 Point	No - 0 Point	
5.* Are the distributions of principal confounders amongst participants or in each group of subjects to be compared clearly described?	Yes - 2 Points	Partially - 1 Point	No - 0 Point
6. Are the main findings of the study clearly described?	Yes - 1 Point	No - 0 Point	
7. Does the study provide estimates of the random variability in the data for the main outcomes?	Yes - 1 Point	No - 0 Point	
8.* Have all important adverse events that may be a consequence of the intervention or being in the study been reported?	Yes - 1 Point	No - 0 Point	
9.* Have the characteristics of patients lost to follow-up or did not respond been described?	Yes - 1 Point	No - 0 Point	
10. Have actual probability values been reported (e.g. 0.035 rather than <0.05) for the main outcomes except where the probability value is less than 0.001?	Yes - 1 Point	No - 0 Point	
External Validity Subscale			
Question	Scoring		

<i>11. Were the subjects asked to participate in the study representative of the entire population from which they were recruited?</i>	Yes - 1 Point	No - 0 Point	Unable to determine - 0 Point
<i>12. Were those subjects who were prepared to participate representative of the entire population from which they were recruited?</i>	Yes - 1 Point	No - 0 Point	Unable to determine - 0 Point
<i>13.* Were the staff, places, and facilities where the patients were treated, representative of the treatment the majority of patients receive? Were the environment/conditions of participants observed representative of the entire population?</i>	Yes - 1 Point	No - 0 Point	Unable to determine - 0 Point
Internal Validity – Bias Subscale			
Question	Scoring		
<i>14.* Was an attempt made to blind study subjects to the intervention they have received? (Score ‘no’, if it’s a non-interventional study)</i>	Yes - 1 Point	No - 0 Point	Unable to determine - 0 Point
<i>15.* Was an attempt made to blind those measuring the main outcomes of the intervention? (Score ‘no’, if it’s a non-interventional study)</i>	Yes - 1 Point	No - 0 Point	Unable to determine - 0 Point
<i>16. If any of the results of the study were based on “data dredging”, was this made clear?</i>	Yes - 1 Point	No - 0 Point	Unable to determine - 0 Point
<i>17.* In trials and cohort studies, do the analyses adjust for different lengths of follow-up of patients, or in case-control studies, is the time period between the intervention and outcome the same for cases and control? (Score ‘yes’, if it’s a cross-sectional study)</i>	Yes - 1 Point	No - 0 Point	Unable to determine - 0 Point
<i>18. Were the statistical tests used to assess the main outcomes appropriate?</i>	Yes - 1 Point	No - 0 Point	Unable to determine - 0 Point
<i>19.* Was compliance with the intervention(s)/observation(s) reliable?</i>	Yes - 1 Point	No - 0 Point	Unable to determine - 0 Point
<i>20. Were the main outcome measures used accurate (valid and reliable)?</i>	Yes - 1 Point	No - 0 Point	Unable to determine - 0 Point
Internal Validity - Confounding (Selection Bias) Subscale			
Question	Scoring		

21.* Were the patients in different intervention (trials and cohort studies)/ observational groups or were the cases and controls (case-control studies) recruited from the same population?	Yes - 1 Point	No - 0 Point	Unable to determine - 0 Point
22.* Were study subjects in different intervention (trials and cohort studies)/ observational groups or were the cases and controls (case-control studies) recruited over the same period of time?	Yes - 1 Point	No - 0 Point	Unable to determine - 0 Point
23.* Were study subjects randomised to intervention groups? (Score 'no', if it's a non-interventional study)	Yes - 1 Point	No - 0 Point	Unable to determine - 0 Point
24.* Was the randomised intervention assignment concealed from both patients and health care staff until recruitment was complete and irrevocable? (Score 'no', if it's a non-interventional study)	Yes - 1 Point	No - 0 Point	Unable to determine - 0 Point
25. Was there adequate adjustment for confounding in the analyses from which the main findings were drawn?	Yes - 1 Point	No - 0 Point	Unable to determine - 0 Point
26. Were losses of patients to follow-up/attrition from study taken into account?	Yes - 1 Point	No - 0 Point	Unable to determine - 0 Point
Power Subscale			
Question	Scoring		
27.* Did the study have sufficient power? (Yes is awarded if there is significant difference or sample size was calculated)	Yes - 1 Point	No - 0 Point	Unable to determine - 0 Point

***Note:**

Items that were modified.

Appendix F: Characteristics summary tables

I. Randomised Controlled Trial Study

Author (Country)	Study Type	Sample Characteristics	Follow-up	Type of Intervention	Measurement and Tool	Adjustment	Results	Results Reported
Broadbent <i>et al.</i> 2009 (New Zealand)	RCT	103 myocardial infarction patients, Control Group: 51 participants, mean age (SD) 54.9 (7.8), 90% male; Intervention Group: 52 participants, mean age (SD) 54.6 (8.3), 87% male	BL, Discharge, 3 and 6-month follow-up	Illness perception based intervention	Brief IPQ, Causal scale of IPQ-R, Health Behaviour Scale (questions on smoking, exercise and diet), Study specific questionnaire covering demographics, work status, attendance at CR classes	Causal perceptions outcome: Admission scores	Significant group-by-time interaction for amount of strenuous exercise performed: [$F(2,157) = 6.74, P < .001$]; Intervention group – admission = 3.40, 3 months = 4.32, 6 months = 4.42; Control group – admission = 4.08, 3 months = 4.02, 6 months = 4.14 Lack of exercise Causal Attribution for: .16 (-.16 to .48) vs. -.39 (-.70 to -.08), $F = 5.99, P = .02$ (Intervention group vs. Control group)	Illness perception intervention group reported increased amount of exercise not control group, statistically significant Lack of exercise Causal attribution score increased for participants in the illness perception intervention group not control group; statistically significant

Abbreviations: BL, Baseline; Brief IPQ, Brief Illness Perception Questionnaire; CR, Cardiac Rehabilitation; IPQ-R, Illness Perception Questionnaire-Revised; RCT, Randomised Controlled Trial; SD, Standard Deviation; vs., versus

II. Cohort Studies

Author (Country)	Study Type	Sample Characteristics	Follow-up	Type of Intervention	Measurement and Tool	Adjustment	Results	Results Reported
Flora <i>et al.</i> 2015 (Canada)	PLCS	49 cardiac rehabilitation patients (unspecified heart disease), mean age 61.82 ± 9.3	BL, 2 weeks and 3-month follow up	Cardiac rehabilitation	IPQ-R, SF-36, study specific self-regulatory efficacy measure, questions on outcome expectations and cardiac rehabilitation participation	None	$F(1,39) = 4.22$, $P = .047$, partial eta squared = .10, observed power = .52 (Strong illness perception group vs. weak illness perception group)	Identity and consequences were related to cardiac rehabilitation exercise adherence; statistically significant
Kidd <i>et al.</i> 2015 (United Kingdom)	PLCS	149 coronary heart disease patients undergoing planned Coronary Artery Bypass Graft surgery, mean age 67.98 ± 8.23 , 89% male	BL, 6-8 weeks and 3-month follow up	Coronary artery bypass graft, cardiac rehabilitation	Brief IPQ, euroSCORE, SF-12, BDI, MoCA, IPAQ, study specific adherence to medication self-report scale	Demographics, clinical factors, measures of socio-economic status, BL depression	Treatment and Personal Control was not significantly associated with physical activity at 3-month follow up ($P > 0.05$). (Specific results not reported)	Personal Control and Treatment Control component of the Brief IPQ was not significantly associated with physical activity.

(Continued)

II. Cohort Studies (Cont'd)

Author (Country)	Study Type	Sample Characteristics	Follow-up	Type of Intervention	Measurement and Tool	Adjustment	Results	Results Reported
Lau-Walker, 2006 (United Kingdom)	PLCS	253 patients diagnosed with myocardial infarction or angina, mean (SD) age 65.3 (10.8), 78.6% male	BL and 9-month follow up	Cardiac rehabilitation	IPQ, GSES, CDSEI, CESEI, study specific DOES, EOES and questions on CR attendance, demographic and illness characteristics	BL cross-sectional DA: predictor variables, demographic and illness characteristic Longitudinal follow-up DA: Predictor variables, attendance of CR	BL DA: Predicting ESE - Timeline (B = 0.247, CI 0.125-0.444, $P = .001$), Control/Cure (B = 0.160, CI 0.005-0.528, $P = .046$) Consequence component: M=3.14, SD=0.65) and M=2.87, SD=0.66; $t=2.85$, $P=.005$ (Attended CR vs. Not attended CR) Longitudinal follow-up DA: Predicting ESE - Identity (B = -0.35, $P = .0005$), Timeline (B = -0.16, $P = .03$), Identity change score (B = -0.24, $P = .0005$)	Timeline, Identity and Control/Cure predicted exercise self-efficacy; statistically significant Patients who attended CR programme had a higher score for 'Consequence' component of illness perception than those who did not attend; statistically significant

(Continued)

II. Cohort Studies (Cont'd)

Author (Country)	Study Type	Sample Characteristics	Follow-up	Type of Intervention	Measurement and Tool	Adjustment	Results	Results Reported
Lau-Walker, 2007 (United Kingdom)	PLCS	253 patients diagnosed with myocardial infarction or angina, mean age (SD) 65.3 (10.8), 78.6% male	BL, 9-month and 3-year follow up	Cardiac rehabilitation	IPQ, GSES, CDSEI, CESEI, study specific Diet and Exercise outcome expectation scale and questions on CR attendance, demographic and illness characteristics	Demographic, illness characteristic and attendance of CR	(Predicting ESE 3 years after discharge) BL: Identity (B = -0.23, CI -0.80 to -0.11, $P = .01$) Timeline (B = 0.25, CI 0.95-0.49, $P = .01$), Control/Cure (B = 0.22, CI 0.05-0.70, $P = .03$) 9-month: Identity (B = -0.33, CI -1.09 to -0.29, $P = .00$), Timeline (B = 0.24, CI 0.07-0.48, $P = .01$)	Timeline, Identity and Control/Cure predicted exercise self-efficacy 3 years after hospital discharge; statistically significant
Leung <i>et al.</i> 2007 (Canada)	PLCS	661 patients with MI, UA or CHF or ACB, mean (SD) age 61.22 (11.30), 76.2% male	Baseline, 9-month and 18-month follow up	Cardiac rehabilitation	IPQ-R, Exercise behaviour subscale of HPLP, DASI, Exercise Benefits and Barriers Scale, HADS and MOSSSS	None	Acute or Chronic ($\chi^2 = 5.67$, $P < 0.05$), Cause-my own behaviour ($\chi^2 = 7.47$, $P < 0.001$); EM vs. IP - OR, 0.505 (95% CI, 0.343-0.742), EM vs. IE - OR, 1.455 (95% CI, 1.045-2.026)	Perception of illness timeline and illness attribution to-self differentiated between EM, IE and IP; statistically significant

(Continued)

II. Cohort Studies (Cont'd)

Author (Country)	Study Type	Sample Characteristics	Follow-up	Type of Intervention	Measurement and Tool	Adjustment	Results	Results Reported
Reges <i>et al.</i> 2013 (Israel)	PLCS	420 patients with acute myocardial infarction or required intervention for ACS, mean age 59.6 ± 10.9 , 84.5% male	Baseline and 6-month follow up	Cardiac prevention and rehabilitation	Personal control and Treatment control of IPQ-R, Modified Minnesota leisure-time physical activity quantitative questionnaire, SEP, study specific health belief model questionnaire and question on CPRP attendance	Age, gender, ethnicity, physical activity, socio-demographic characteristic, medical variables	Association to an active lifestyle 6 months after discharge: Higher perceived PC among Arab – average(SD): 22.89 (3.62) vs. 21.32 (3.35), $P < 0.05$ Participation in CPRP: Higher perceived PC – (Jews) average(SD): 24.21 (3.87) vs. 22.22 (4.54), $P < 0.001$; (Arabs) average(SD): 23.56 (3.46) vs. 21.80 (3.53), $P < 0.05$ PC and exercising 6 months after discharge – OR = 1.09, 95% CI: 1.02-1.17, $P = 0.016$; PC and participation in CPRP – OR = 1.08, 95% CI: 1.01-1.15, $P = 0.017$	PC is associated to an active lifestyle for Arab participants. PC is also associated to exercising 6 months after discharge and participation in CPRP; statistically significant

(Continued)

II. Cohort Studies (Cont'd)

Author (Country)	Study Type	Sample Characteristics	Follow-up	Type of Intervention	Measurement and Tool	Adjustment	Results	Results Reported
Sniehotta, 2009 (United Kingdom)	PLCS	103 patients with coronary heart disease, mean age (SD) 63.0 (10.3), 72.8% male	Baseline and 2-month follow up	Cardiac rehabilitation	IPQ-PS, LSI of the Godin Leisure-Time Exercise Questionnaire, study specific direct predictors of behaviour measures, Theory of Planned Behaviour Questionnaire, Action Planning measure and questions on attendance at phase IV CR programme	Past behaviour	Cyclical timeline with physical activity: $r = -0.26$, $P < 0.05$ Timeline cyclical predicting physical activity controlling for past behaviour (R^2 change = 0.05, $P = .02$; $B = 0.31$, $P = .02$)	Cyclical timeline was negatively associated to physical activity; statistically significant Timeline cyclical predicted physical activity; statistically significant IPQ-PS was not significantly correlated with phase IV CR attendance

Abbreviations: ACB, Acute Coronary Bypass; ACS, Acute Coronary Syndrome; BDI, Beck Depression Inventory; BL, Baseline; Brief IPQ, Brief Illness Perception Questionnaire; CDSEI, Cardiac Diet Self-Efficacy Instrument; CESEI, Cardiac Exercise Self-Efficacy Instrument; CHF, Congestive Heart Failure; CI, Confidence Interval; CPRP, Cardiac Prevention and Rehabilitation Programme; CR, Cardiac Rehabilitation; DA, Data Analysis; DASL, Duke Activity Status Index; DOES, Diet Outcome Expectation Scale; EM, Exercise Maintainers; EOES, Exercise Outcome Expectation Scale; ESE, Exercise Self-Efficacy; euroSCORE, European System for Cardiac Operative Risk Evaluation; GSES, Generalized Self-Efficacy Scale; HADS, Hospital Anxiety and Depression Scale; HPLP, Health Promoting Lifestyle Profile; IE, Irregular Exercisers; IP, Inactive Participants; IPAQ, International Physical Activity Questionnaire; IPQ, Illness Perception Questionnaire; IPQ-PS, Illness Perception Questionnaire-Psychometrically Shortened; IPQ-R, Illness Perception Questionnaire-Revised; LSI, Leisure Score Index; MI, Myocardial Infarction; MOSSSS, Medical Outcomes Study Social Support Survey; MoCA, Montreal Cognitive Assessment; PC, Personal Control; PCI, Percutaneous Coronary Intervention; PLCS, Prospective Longitudinal Cohort Study; SEP, Subjective Socioeconomic Position; SD, Standard Deviation; SF-12, Short Form health survey – 12 item; SF-36, Short Form 36 Health Survey; UA, Unstable Angina; vs., versus

III. Cross-Sectional Studies

Author (Country)	Study Type	Sample Characteristics	Follow-up	Type of Intervention	Measurement and Tool	Adjustment	Results	Results Reported
Mosleh & Almalik 2014 (Jordan)	CSCS	254 patients with MI, angina, post PCI or post OHS, mean age (SD) 52.0 (15.6), 56.9% male	None	None	Brief IPQ, GLTE questionnaire, MMAS, study specific questionnaire on demographics, adherence to exercise, diet, smoking cessation and secondary preventive medication	None	Illness perception and adherence to exercise ($P<0.05$): Consequences $r_s = -$ 0.16, Timeline $r_s = -$ 0.19, PC $r_s = -0.15$, Concern $r_s = 0.19$, Coherence $r_s = 0.23$ Predictors of PA: Timeline B = -1.855, $P<0.001$; PC B = 2.665, $P<0.001$; Coherence B = - 1.053, $P = 0.019$	Timeline, PC, Concern and Coherence were correlated to exercise adherence; statistically significant Timeline, PC and Coherence were predictors of PA; statistically significant

(Continued)

III. Cross-Sectional Studies (Cont'd)

Author (Country)	Study Type	Sample Characteristics	Follow-up	Type of Intervention	Measurement and Tool	Adjustment	Results	Results Reported
Platt <i>et al.</i> 2013 (Australia)	CSCS	142 CHD patients, 69.7% male Male: mean age (SD) 64.4 (14.1) Female: mean age (SD) 66.4 (14.1)	None	None	IPQ-R, GAS, PANAS, study specific self-efficacy measure and stage of change questionnaire	Transtheoretical Model, Trait affect	Exercise SE: TA $r = -0.32$, $P < 0.001$, Consequences $r = -0.30$, $P < 0.001$, ER $r = -0.26$, $P < 0.01$ Exercise SoC: Consequences $r = -0.20$, $P < 0.05$, ER $r = -0.24$, $P < 0.01$ Exercise Adherence: Consequences $r = -0.30$, $P < 0.001$, ER $r = -0.30$, $P < 0.001$	TA, ER and Consequences were correlated to exercise SE; Consequences and ER to SoC; and Consequences and ER to adherence; statistically significant TC, ER and Consequences were predictive of exercise adherence but was not statistically significant when Transtheoretical Model variables were included in analysis

Abbreviations: Brief IPQ, Brief Illness Perception Questionnaire; CHD, Coronary Heart Disease; CSCS, Cross-Sectional Cohort Study; ER, Emotional Representations; GAS, General Adherence Scale; GLTE, Godin Leisure-Time Exercise; IPQ-R, Illness Perception Questionnaire-Revised; MI, Myocardial Infarction; MMAS, Morisky Medication Adherence Scale; OHS, Open-Heart Surgery; PA, Physical Activity; PANAS, Positive and Negative Affect Scale; PC, Personal Control; PCI, Percutaneous Coronary Intervention; SE, Self-Efficacy; SoC, Stage of Change; TA, Timeline Acute; TC, Timeline Cyclical

Appendix G: Quality appraisal of selected studies

		Broadbent <i>et al.</i> (2009)	Flora <i>et al.</i> (2015)	Kidd <i>et al.</i> (2015)	Lau-Walker (2006)	Lau-Walker (2007)	Leung <i>et al.</i> (2007)	Reges <i>et al.</i> (2013)	Sniehotta <i>et al.</i> (2009)	Mosleh & Almalik (2014)	Platt <i>et al.</i> (2013)
Reporting	1. Is the hypothesis/aim/objective of the study clearly described?	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓
	2. Are the main outcomes to be measured clearly described in the Introduction or Methods section?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	3. Are the characteristics of the patients included in the study clearly described?	✓	✗	✓	✓	✗	✗	✓	✗	✓	✗
	4. Are the interventions/observations of interest clearly described?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	5. Are the distributions of principal confounders amongst participants or in each group of subjects to be compared clearly described?	✗	✓	✓	✓	✓	✓	✓	✓	✗	✗
	6. Are the main findings of the study clearly described?	✓	✓	✓	✗	✓	✗	✓	✓	✓	✓

External Validity	7. Does the study provide estimates of the random variability in the data for the main outcomes?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	8. Have all important adverse events that may be a consequence of the intervention or being in the study been reported?	✗	✗	✓	✗	✗	✗	✗	✗	✗	✗
	9. Have the characteristics of patients lost to follow-up or did not respond been described?	✓	✗	✓	✓	✓	✗	✗	✗	✗	✓
	10. Have actual probability values been reported (e.g., 0.035 rather than <0.05) for the main outcomes except where the probability value is less than 0.001?	✗	✓	✓	✓	✓	✗	✗	✓	✗	✗
	11. Were the participants asked to participate in the study representative of the entire population from which they were recruited?	✗	?	?	?	?	?	?	?	?	?
	12. Were subjects who were prepared to participate representative of the entire population from which they were recruited?	✗	✓	✗	?	?	✗	✗	?	?	?

**Internal
Validity -
Bias**

13. Were the staff, places, and facilities where the patients were treated, representative of the treatment the majority of patients receive? Were the environment/conditions of participants observed representative of the entire population?	✓	✓	✓	?	?	✓	✗	✓	✗	✗
14. Was an attempt made to blind study subjects to the intervention they have received? (Score 'no', if it's a non-interventional study)	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
15. Was an attempt made to blind those measuring the main outcomes of the intervention? (Score 'no', if it's a non-interventional study)	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
16. If any of the results of the study were based on "data dredging", was this made clear?	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓
17. In trials and cohort studies, do the analyses adjust for different lengths of follow-up of patients, or in case-control studies, is the time period between the intervention and	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Internal Validity – Confounding (Selection Bias)	outcome the same for cases and control? (Score ‘yes’, if it’s a cross-sectional study)									
	18. Were the statistical tests used to assess the main outcomes appropriate?	✓	✓	✓	✓	✓	✓	✓	✓	✓
	19. Was compliance with the intervention(s)/observation(s) reliable?	✓	✓	✓	✓	✓	✓	✓	✓	✓
	20. Were the main outcome measures used accurate (valid and reliable)?	✓	✓	✓	✓	✓	✓	✓	✓	✓
	21. Were the patients in different intervention (trials and cohort studies)/observational groups or were the cases and controls (case-control studies) recruited from the same population?	✓	✓	✓	✓	✓	✓	✓	✓	✓
	22. Were study subjects in different intervention (trials and cohort studies)/observational groups or were the cases and controls (case-control studies) recruited over the same period of time?	✓	✓	?	?	?	✓	✓	✓	?
	23. Were study subjects randomised to intervention	✓	✗	✗	✗	✗	✗	✗	✗	✗

Power	groups? (Score 'no', if it's a non-interventional study)										
	24. Was the randomised intervention assignment concealed from both patients and health care staff until recruitment was complete and irrevocable? (Score 'no', if it's a non-interventional study)	✗	✗	✗	✗	✗	✗	✗	✗	✗	
	25. Was there adequate adjustment for confounding in the analyses from which the main findings were drawn?	✗	✗	✓	✓	✓	✗	✓	✗	✗	
	26. Were losses of patients to follow-up/attrition from study taken into account?	✓	?	✓	✓	✓	✗	✗	✗	✓	
	27. Did the study have sufficient power? (Yes is awarded if there is significant difference or sample size was calculated)	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Total Quality Score		19	16	21	17	18	14	16	15	13	14

Note: ✓ = Yes; # = Partially; ✗ = No; ? = unable to determine

Appendix H: Kolmogorov-Smirnov test and Levene's test

	Kolmogorov-Smirnov Test ^a		
	Statistic	df	Sig.
Age	.096	70	.182
Log eGFR	.136	68	.003
Timeline Acute/Chronic	.119	60	.035
Timeline Cyclical	.168	64	.000
Consequences	.092	65	.200*
Personal Control	.098	64	.200*
Treatment Control	.103	64	.092
Illness Coherence	.108	64	.060
Emotional Representations	.125	64	.015
Log No Missing Value IPAQ	.158	70	.000
Overall BDI	.066	68	.200*

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

		Levene's Test			
		Levene Statistic	df1	df2	Sig.
Age	Based on Mean	1.416	1	68	.238
	Based on Median	1.156	1	68	.286
	Based on Median and with adjusted df	1.156	1	63.990	.286
	Based on trimmed mean	1.456	1	68	.232
Log eGFR	Based on Mean	.121	1	66	.729
	Based on Median	.306	1	66	.582
	Based on Median and with adjusted df	.306	1	61.154	.582
	Based on trimmed mean	.129	1	66	.721
Timeline Acute/Chronic	Based on Mean	.009	1	58	.924
	Based on Median	.000	1	58	.997
	Based on Median and with adjusted df	.000	1	57.905	.997
	Based on trimmed mean	.006	1	58	.941

Timeline Cyclical	Based on Mean	.010	1	62	.923
	Based on Median	.072	1	62	.789
	Based on Median and with adjusted df	.072	1	61.929	.789
	Based on trimmed mean	.005	1	62	.944
Consequences	Based on Mean	.489	1	63	.487
	Based on Median	.530	1	63	.469
	Based on Median and with adjusted df	.530	1	62.986	.469
	Based on trimmed mean	.514	1	63	.476
Personal Control	Based on Mean	1.050	1	62	.310
	Based on Median	.863	1	62	.356
	Based on Median and with adjusted df	.863	1	60.524	.357
	Based on trimmed mean	1.015	1	62	.318
Treatment Control	Based on Mean	2.459	1	62	.122
	Based on Median	1.454	1	62	.233
	Based on Median and with adjusted df	1.454	1	60.240	.233
	Based on trimmed mean	2.430	1	62	.124
Illness Coherence	Based on Mean	.092	1	62	.762
	Based on Median	.149	1	62	.701
	Based on Median and with adjusted df	.149	1	60.682	.701
	Based on trimmed mean	.103	1	62	.749
Emotional Representations	Based on Mean	.199	1	62	.657
	Based on Median	.273	1	62	.603
	Based on Median and with adjusted df	.273	1	61.009	.603
	Based on trimmed mean	.163	1	62	.687

Log No Missing Value IPAQ	Based on Mean	.605	1	68	.439
	Based on Median	.578	1	68	.450
	Based on Median and with adjusted df	.578	1	67.515	.450
	Based on trimmed mean	.548	1	68	.462
Overall BDI	Based on Mean	.275	1	66	.602
	Based on Median	.310	1	66	.580
	Based on Median and with adjusted df	.310	1	63.744	.580
	Based on trimmed mean	.265	1	66	.609

Appendix I: Study survey booklet

The current research is part of a larger study that incorporated seven measures. The study survey booklet consisted of the following questionnaires:

1. Revised Illness Perception Questionnaire (IPQ-R)*
2. Beck Depression Inventory (BDI-II)*
3. International Physical Activity Questionnaire Short Form (IPAQ-SF)*
4. Duke Activity Status Index (DASI)
5. Kidney Symptom Questionnaire (KSQ)
6. LKET Fatigue Scale
7. EuroQOL 5 Dimensions (EQ5D)

The questionnaires that were not utilised in the current study are not included in Appendix I.

N.B. For copyright reasons the Beck Depression Inventory (BDI-II) is not included.

* Questionnaires utilised in the current study.

Revised Illness Perception Questionnaire (IPQ-R)

ILLNESS PERCEPTION QUESTIONNAIRE (IPQ-R)

YOUR VIEWS ABOUT YOUR KIDNEY PROBLEM

Listed below are a number of symptoms that you may or may not have experienced since your kidney problem. Please indicate by circling *Yes* or *No*, whether you have experienced any of these symptoms since your kidney problem, and whether you believe that these symptoms are related to your kidney problem.

	I have experienced this symptom <i>since my</i> <i>kidney problem</i>			This symptom is <i>related to my</i> <i>kidney problem</i>	
	Yes	No		Yes	No
Pain					
Sore Throat					
Nausea					
Breathlessness					
Weight Loss					
Fatigue					
Stiff Joints					
Sore Eyes					
Wheeziness					
Headaches					
Upset Stomach					
Sleep Difficulties					
Dizziness					
Loss of Strength					

We are interested in your own personal views of how you now see your current kidney problem.

Please indicate how much you agree or disagree with the following statements about your kidney problem by ticking the appropriate box.

	VIEWS ABOUT YOUR KIDNEY PROBLEM	STRONGLY DISAGREE	DISAGREE	NEITHER AGREE NOR DISAGREE	AGREE	STRONGLY AGREE
IP1	My kidney problem will last a short time					
IP2	My kidney problem is likely to be permanent rather than temporary					
IP3	My kidney problem will last for a long time					
IP4	This kidney problem will pass quickly					
IP5	I expect to have this kidney problem for the rest of my life					
IP6	My kidney problem is a serious condition					

	VIEWS ABOUT YOUR KIDNEY PROBLEM	STRONGLY DISAGREE	DISAGREE	NEITHER AGREE NOR DISAGREE	AGREE	STRONGLY AGREE
IP7	My kidney problem has major consequences on my life					
IP8	My kidney problem does not have much effect on my life					
IP9	My kidney problem strongly affects the way others see me					
IP10	My kidney problem has serious financial consequences					
IP11	My kidney problem causes difficulties for those who are close to me					
IP12	There is a lot which I can do to control my symptoms					
IP13	What I do can determine whether my kidney problem gets better or worse					
IP14	The course of my kidney problem depends on me					
IP15	Nothing I do will affect my kidney problem					
IP16	I have the power to influence my kidney problem					
IP17	My actions will have no affect on the outcome of my kidney problem					
IP18	My kidney problem will improve in time					
IP19	There is very little that can be done to improve my kidney problem					
IP20	My treatment will be effective in curing my kidney problem					
IP21	The negative effects of my kidney problem can be prevented (avoided) by my treatment					
IP22	My treatment can control my kidney problem					
IP23	There is nothing which can help my condition					
IP24	The symptoms of my condition are puzzling to me					
IP25	My kidney problem is a mystery to me					
IP26	I don't understand my kidney problem					
IP27	My kidney problem doesn't make any sense to me					
IP28	I have a clear picture or understanding of my condition					
IP29	The symptoms of my kidney problem change a great deal from day to day					
IP30	My symptoms come and go in cycles					
IP31	My kidney problem is very unpredictable					
IP32	I go through cycles in which my kidney problem gets better and worse.					
IP33	I get depressed when I think about my kidney problem					
IP34	When I think about my kidney problem I get upset					
IP35	My kidney problem makes me feel angry					
IP36	My kidney problem does not worry me					
IP37	Having this kidney problem makes me feel anxious					
IP38	My kidney problem makes me feel afraid					

CAUSES OF MY KIDNEY PROBLEM

We are interested in what you consider may have been the cause of your kidney problem. As people are very different, there is no correct answer for this question. We are most interested in your own views about the factors that caused your kidney problem rather than what others including doctors or family may have suggested to you. Below is a list of possible causes for your kidney problem. Please indicate how much you agree or disagree that they were causes for you by ticking the appropriate box.

	POSSIBLE CAUSES	STRONGLY DISAGREE	DISAGREE	NEITHER AGREE NOR DISAGREE	AGREE	STRONGLY AGREE
C1	Stress or worry					
C2	Hereditary - it runs in my family					
C3	A Germ or virus					
C4	Diet or eating habits					
C5	Chance or bad luck					
C6	Poor medical care in my past					
C7	Pollution in the environment					
C8	My own behaviour					
C9	My mental attitude e.g. thinking about life negatively					
C10	Family problems or worries					
C11	Overwork					
C12	My emotional state e.g. feeling down, lonely, anxious, empty					
C13	Ageing					
C14	Alcohol					
C15	Smoking					
C16	Accident or injury					
C17	My personality					
C18	Altered immunity					

In the table below, please list in rank-order the three most important factors that you now believe caused YOUR kidney problem. You may use any of the items from the box above, or you may have additional ideas of your own.

The most important causes for me:-

1. _____
2. _____
3. _____

International Physical Activity Questionnaire Short Form (IPAQ-SF)

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

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

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

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

_____ **days per week**

☐

No vigorous physical activities → **Skip to question 3**

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

_____ **hours per day**

_____ **minutes per day**

☐

Don't know/Not sure

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

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

_____ **days per week**

☐

No moderate physical activities → **Skip to question 5**

SHORT LAST 7 DAYS SELF-ADMINISTERED version of the IPAQ. Revised August 2002.

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

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

_____ **days per week**

☐ No walking ➔ **Skip to question 7**

6. How much time did you usually spend **walking** on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

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

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

This is the end of the questionnaire, thank you for participating.

Mandatory Appendices

Appendix J: Research and Development approval email

EDGE ID 66366 (ADAPT-CKD)

05/04/2017, 16:57

EDGE ID 66366 (ADAPT-CKD)

Assistant Director, Research & Development

Sent: 22 July 2016 15:22

To:

Cc:

Nah, Ryan Q.R.; Robertson, Noelle

Dear

RE: EDGE ID 66366 - Physical Activity, Depression and Illness Perceptions in Chronic Kidney Disease (ADAPT-CKD)

I am pleased to confirm that the [REDACTED] has the capacity and capability to deliver the above research activity in accordance with the **Protocol** provided. The research must be conducted in line with the Protocol and fulfil any contractual obligations agreed. If you identify any issues during the course of your research that are likely to affect these obligations you must contact the R&I Office as soon as possible. As the [REDACTED] is also the Sponsor of this research, please regard this email as the Sponsor Green Light for the [REDACTED] Sites.

There is an expectation that you will recruit your first patient within 70 days of this site being selected. The date this site was confirmed as selected by the sponsor is **22nd July 2016**. You therefore have **70 days REMAINING** to recruit your first participant. In addition we expect that you will achieve the recruitment target set during the capacity and capability negotiations. Please ensure that your nominated Recruitment Point of Contact uploads recruitment data by the deadlines set.

It is essential that you notify the [REDACTED] Data Management Team as soon as you have recruited your first participant to the study, and ensure that the date is recorded on the [REDACTED] by your [REDACTED]. The [REDACTED] team can be contacted on [REDACTED]

If we have not heard from you within the specified time period we will contact you not only to collect the data, but also to record any issues that may have arisen to prevent you from achieving your targets. It is essential that you get in touch with us if there is likely to be a problem so that we can discuss potential solutions. The Trust is contractually obliged to meet the 70 day target and if an adequate reason acceptable to the NIHR has not been submitted to explain the issues preventing the recruitment of your first participant & targets, the Trust may be financially penalised. In addition, we are required to publish the Title, REC Reference number, local target recruitment and actual recruitment as well as 70 days data for this study on a quarterly basis on the [REDACTED]

Undertaking research in the NHS comes with a range of regulatory responsibilities. Please ensure that you and your research team are familiar with, and understand the roles and responsibilities both collectively and individually.

Documents listing the roles and responsibilities for all individuals involved in research can be found on the R&I pages of the Public Website. It is important that you familiarise yourself with the Standard Operating Procedures, Policies and all other relevant documents which can be located by visiting [REDACTED]

The R&I Office is keen to support and facilitate research where ever possible. If you have any questions regarding this or other research you wish to undertake in the Trust, please contact this

https://email.le.ac.uk/owa/?ae=Item&t=IPM.Note&id=RgAAAABlnuS...bsFEctnpgAAJ9FMSAAAJ&a=Print&pspid=_1491407833499_747715404

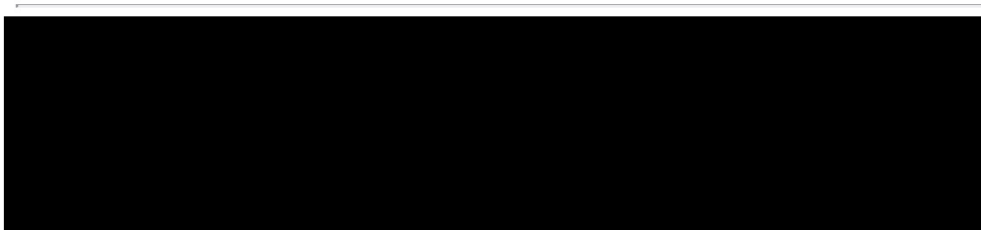
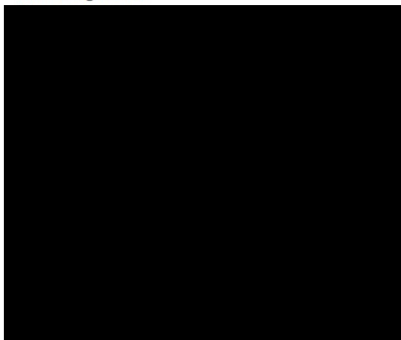
Page 1 of 2

office. Our contact details are provided on the attached sheet.

Please note that a letter confirming authorisation will not be sent. Please retain a copy of this email in your site file.

We wish you every success with your research.

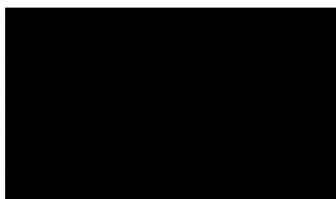
Kind regards,



Appendix K: Research Ethics Committee approval letter



06 June 2016



Dear [REDACTED]

Study title: Physical Activity, Depression And Illness PercepTions in Chronic Kidney Disease (ADAPT CKD)
REC reference: 16/LO/0980
IRAS project ID: 202596

Thank you for your letter of 6 June 2016. I can confirm the REC has received the documents listed below and that these comply with the approval conditions detailed in our letter dated 18 May 2016.

Documents received

The documents received were as follows:

Document	Version	Date
Participant information sheet (PIS)	2	06 June 2016

Approved documents

The final list of approved documentation for the study is therefore as follows:

Document	Version	Date
IRAS Application Form [IRAS_Form_09052016]		09 May 2016
IRAS Application Form XML file [IRAS_Form_09052016]		09 May 2016
IRAS Checklist XML [Checklist_09052016]		09 May 2016
Letters of invitation to participant [ADAPT CKD Patient Invitation Letter]	1	01 February 2016
Participant consent form [ADAPT CKD Patient Consent Form]	1	01 February 2016
Participant information sheet (PIS)	2	06 June 2016

A Research Ethics Committee established by the Health Research Authority

Referee's report or other scientific critique report [ADAPT CKD Peer Review]		
Research protocol or project proposal [ADAPT CKD Protocol]	1	01 February 2016
Summary CV for Chief Investigator (CI) [REDACTED] 2016]		
Summary CV for student [Ryan's Research CV]		
Summary CV for supervisor (student research) [Noelle Robertson CV]		
Validated questionnaire [ADAPT CKD Survey Pack]	1	01 February 2016

You should ensure that the sponsor has a copy of the final documentation for the study. It is the sponsor's responsibility to ensure that the documentation is made available to R&D offices at all participating sites.

16/LO/0980	Please quote this number on all correspondence
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Yours sincerely

[REDACTED]

E-mail: [REDACTED]

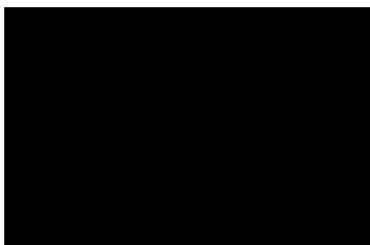
Copy to: [REDACTED]

Appendix L: Health Research Authority approval letter



Health Research Authority

Email: hra.approval@nhs.net



22 July 2016

Dear [REDACTED]

Letter of HRA Approval

Study title: Physical Activity, Depression And Illness PercepTions in Chronic Kidney Disease (ADAPT CKD)
IRAS project ID: 202596
REC reference: 16/LO/0980
Sponsor [REDACTED]

I am pleased to confirm that HRA Approval has been given for the above referenced study, on the basis described in the application form, protocol, supporting documentation and any clarifications noted in this letter.

Participation of NHS Organisations in England

The sponsor should now provide a copy of this letter to all participating NHS organisations in England.

Appendix B provides important information for sponsors and participating NHS organisations in England for arranging and confirming capacity and capability. **Please read *Appendix B* carefully**, in particular the following sections:

- *Participating NHS organisations in England* – this clarifies the types of participating organisations in the study and whether or not all organisations will be undertaking the same activities
- *Confirmation of capacity and capability* - this confirms whether or not each type of participating NHS organisation in England is expected to give formal confirmation of capacity and capability. Where formal confirmation is not expected, the section also provides details on the time limit given to participating organisations to opt out of the study, or request additional time, before their participation is assumed.
- *Allocation of responsibilities and rights are agreed and documented (4.1 of HRA assessment criteria)* - this provides detail on the form of agreement to be used in the study to confirm capacity and capability, where applicable.

Further information on funding, HR processes, and compliance with HRA criteria and standards is also provided.

It is critical that you involve both the research management function (e.g. R&D office) supporting each organisation and the local research team (where there is one) in setting up your study. Contact details and further information about working with the research management function for each organisation can be accessed from www.hra.nhs.uk/hra-approval.

Appendices

The HRA Approval letter contains the following appendices:

- A – List of documents reviewed during HRA assessment
- B – Summary of HRA assessment

After HRA Approval

The document “*After Ethical Review – guidance for sponsors and investigators*”, issued with your REC favourable opinion, gives detailed guidance on reporting expectations for studies, including:

- Registration of research
- Notifying amendments
- Notifying the end of the study

The HRA website also provides guidance on these topics, and is updated in the light of changes in reporting expectations or procedures.

In addition to the guidance in the above, please note the following:

- HRA Approval applies for the duration of your REC favourable opinion, unless otherwise notified in writing by the HRA.
- Substantial amendments should be submitted directly to the Research Ethics Committee, as detailed in the *After Ethical Review* document. Non-substantial amendments should be submitted for review by the HRA using the form provided on the [HRA website](http://www.hra.nhs.uk), and emailed to hra.amendments@nhs.net.
- The HRA will categorise amendments (substantial and non-substantial) and issue confirmation of continued HRA Approval. Further details can be found on the [HRA website](http://www.hra.nhs.uk).

Scope

HRA Approval provides an approval for research involving patients or staff in NHS organisations in England.

If your study involves NHS organisations in other countries in the UK, please contact the relevant national coordinating functions for support and advice. Further information can be found at <http://www.hra.nhs.uk/resources/applying-for-reviews/nhs-hsc-rd-review/>.

If there are participating non-NHS organisations, local agreement should be obtained in accordance with the procedures of the local participating non-NHS organisation.

User Feedback

The Health Research Authority is continually striving to provide a high quality service to all applicants and sponsors. You are invited to give your view of the service you have received and the application

IRAS project ID	202596
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procedure. If you wish to make your views known please email the HRA at hra.approval@nhs.net. Additionally, one of our staff would be happy to call and discuss your experience of HRA Approval.

HRA Training

We are pleased to welcome researchers and research management staff at our training days – see details at <http://www.hra.nhs.uk/hra-training/>

Your IRAS project ID is **202596**. Please quote this on all correspondence.

Yours sincerely



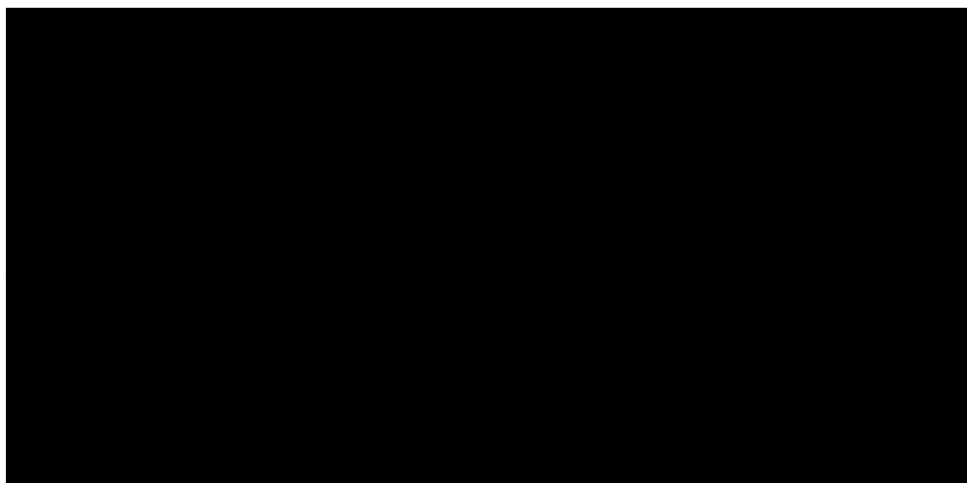
Assessor

Email: hra.approval@nhs.net

Copy to:

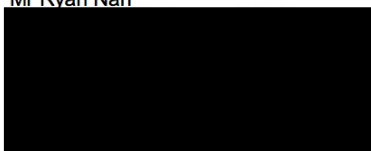


Appendix M: Research passport



Friday, 22 July 2016

Mr Ryan Nah



Dear Mr Nah,

This letter confirms your right of access to conduct research through [redacted] for the purpose and on the terms and conditions set out below. This right of access commences on **22nd July 2015** and ends on **29th September 2017** unless terminated earlier in accordance with the clauses below.

You have a right of access to conduct such research as confirmed in writing in the letter of permission for research from this NHS organisation. Please note that you cannot start the research until the Principal Investigator for the research project has received a letter from us giving permission to conduct the project.

The information supplied about your role in research at [redacted] has been reviewed and you do not require an honorary research contract with this NHS organisation. We are satisfied that such pre-engagement checks as we consider necessary have been carried out.

You are considered to be a legal visitor to [redacted] premises. You are not entitled to any form of payment or access to other benefits provided by this NHS organisation to employees and this letter does not give rise to any other relationship between you and this NHS organisation, in particular that of an employee.

While undertaking research through [redacted] you will remain accountable to your Employer **University of Leicester** but you are required to follow the reasonable instructions of [redacted] in this NHS organisation or those given on her/his behalf in relation to the terms of this right of access.

Where any third party claim is made, whether or not legal proceedings are issued, arising out of or in connection with your right of access, you are required to co-operate fully with any investigation by this NHS organisation in connection with any such claim and to give all such assistance as may reasonably be required regarding the conduct of any legal proceedings.

You must act in accordance with [REDACTED] policies and procedures, which are available to you upon request, and the Research Governance Framework.

You are required to co-operate with [REDACTED] in discharging its duties under the Health and Safety at Work etc Act 1974 and other health and safety legislation and to take reasonable care for the health and safety of yourself and others while on [REDACTED] premises. You must observe the same standards of care and propriety in dealing with patients, staff, visitors, equipment and premises as is expected of any other contract holder and you must act appropriately, responsibly and professionally at all times.

You are required to ensure that all information regarding patients or staff remains secure and *strictly confidential* at all times. You must ensure that you understand and comply with the requirements of the NHS Confidentiality Code of Practice (<http://www.dh.gov.uk/assetRoot/04/06/92/54/04069254.pdf>) and the Data Protection Act 1998. Furthermore you should be aware that under the Act, unauthorised disclosure of information is an offence and such disclosures may lead to prosecution.

You should ensure that, where you are issued with an identity or security card, a bleep number, email or library account, keys or protective clothing, these are returned upon termination of this arrangement. Please also ensure that while on the premises you wear your ID badge at all times, or are able to prove your identity if challenged. Please note that this NHS organisation accepts no responsibility for damage to or loss of personal property.

We may terminate your right to attend at any time either by giving seven days' written notice to you or immediately without any notice if you are in breach of any of the terms or conditions described in this letter or if you commit any act that we reasonably consider to amount to serious misconduct or to be disruptive and/or prejudicial to the interests and/or business of this NHS organisation or if you are convicted of any criminal offence. Your substantive employer is responsible for your conduct during this research project and may in the circumstances described above instigate disciplinary action against you.

[REDACTED] will not indemnify you against any liability incurred as a result of any breach of confidentiality or breach of the Data Protection Act 1998. Any breach of the Data Protection Act 1998 may result in legal action against you and/or your substantive employer.

If your current role or involvement in research changes, or any of the information provided in your Research Passport changes, you must inform your employer through their normal procedures. You must also inform your nominated manager in this NHS organisation.

Yours sincerely

A large black rectangular box redacting the signature and name of the sender.

Appendix N: Patient invitation letter

Date:

Dear Patient

Physical Activity, Depression And Illness PercepTions in Chronic Kidney Disease (ADAPT CKD)

I would like you to consider taking part in this research project, which is investigating the relationship between physical activity, depression and perception of having Chronic Kidney Disease. Please read the accompanying Patient Information Sheet (version 1 dated 1st February 2016) which gives you details about the study.

If you decide you would like to take part, please tell the researcher who gave you this letter. If you have taken this letter and Information Sheet away with you, please complete the reply slip below and return it to us so we can contact you about the study.

If you have any queries about this research study, please call [REDACTED] quoting ADAPT-CKD.

Thank you for your co-operation.

Yours faithfully,

[REDACTED]

PLEASE RETURN TO :

[REDACTED]

❖ Yes, I would be willing to take part in the study

☐

Name:

Address:

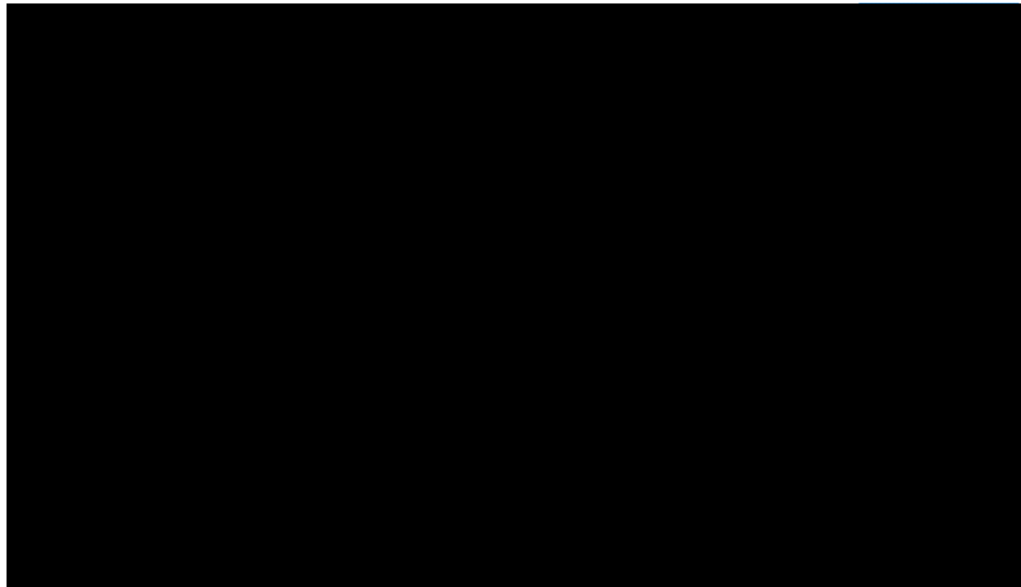
.....

Tel:.....

OR TELEPHONE US ON

[REDACTED]

ADAPT CKD Patient Invitation Letter version 1 1st February 2016

Appendix O: Participa**Physical Activity, Depression And Illness PercepTions in Chronic
Kidney Disease (ADAPT CKD)
Patient Information Sheet**

Version 1 dated 1st February 2016

You are being invited to take part in a research study. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

What is the purpose of the study?

The purpose of this study is to investigate the relationship between physical activity, depression and perception of having Chronic Kidney Disease.

Why have I been chosen?

You have been chosen because you have kidney disease or a kidney transplant. Altogether we will ask up to 44 patients to take part in the study.

Do I have to take part?

It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and asked to sign a consent form. A study participant code will then be allocated to you. If you decide to take part

you are still free to withdraw at any time and without giving a reason. A decision to withdraw, or a decision not to take part, will not affect the standard of care you receive.

What will happen to me if I take part?

We will invite you to complete a survey consisting of 8 sections, each of which is a separate simple questionnaire. A Survey Pack with your allocated study participant code written on it will be given to you to take home for completion in your own time. A stamped addressed envelope will be provided for the return of the completed survey.

The survey consists of the following sections :

Section 1: About You

Some questions about you

Section 2: Illness Perception Questionnaire (IPQ-R)

A questionnaire about how you feel about Chronic Kidney Disease

Section 3: Beck Depression Inventory (BDI-II)

A questionnaire about your mood over the last 2 weeks

Section 4: International Physical Activity Questionnaire Short Form (IPAQ-SF)

A questionnaire about your physical activity over the last 7 days

Section 5: Duke Activity Status Index (DASI)

A questionnaire about your ability to carry out day-to-day activities

Section 6: Kidney Symptom Questionnaire (KSQ)

A questionnaire about the symptoms you experience

Section 7 : LKET Fatigue Scale

A questionnaire about how tired you have felt over the last week

Section 8: EuroQOL 5 Dimensions (EQ5D)

A questionnaire about your quality of life

When you have finished filling in the survey, all you need to do is put it in the stamped addressed envelope provided and return it to us. When we receive your completed survey, a researcher will access your medical records to extract some additional information about you which is relevant to the study. The information we take from your medical records will be your most recent blood and urine test results, the medications you are taking and your past medical history including any other health conditions you have. When we have collected this information, your involvement in the study is finished.

What happens if I forget to return my survey?

We understand that you may forget to fill in the survey or post it back to us. Therefore, we would like to ask your permission to telephone you with a gentle and friendly reminder if we do not receive your completed survey within 10 days of giving it to you. We will only speak to you once, and if you still do not return the survey we will assume that you no longer wish to take part and we will not contact you again, or access your medical records for this research.

If you are happy for us to telephone you, we will ask you to initial a box on the Consent Form and give us the best telephone number to contact you. If you would prefer us not to telephone you, you can indicate this on the Consent Form and you will not receive a reminder.

What happens if I change my mind and decide not to fill the survey in?

We also understand that you may change your mind about taking part when you have had a chance to think about it later. In this case, you do not need to contact us unless you want to. If you do not return a completed survey to us, we will assume that you no longer wish to take part and we will withdraw you from the study. In this case, your medical records will NOT be accessed and we will not store any of your clinical information in the study results.

What are the possible disadvantages and risks of taking part?

You will need to fill in a series of questionnaires, which takes about 30 to 45 minutes to complete. You can do this at home in your own time. Some people may find a few of the questions could make them anxious, but you can miss out any that you prefer not to answer. If you are distressed by filling the survey pack or have indicated on it that you have thoughts of hurting yourself, a referral will be made back to your own consultant.

What are the possible benefits of taking part?

There are no direct benefits to you of taking part in this research. We hope that the results of the study will help us have a better understanding of the relationship amongst illness perception, depression and levels of physical activity.

What happens when the research study stops?

Your usual clinical care will continue unchanged.

What if something goes wrong?

In the very unlikely event of you being harmed by taking part in this research project, there are no special compensation arrangements. If you are harmed due to someone's negligence, then you may have grounds for legal action but you may have to pay for it. Regardless of this, if you wish to complain, or have any concerns about any aspect of the way you have been approached or treated during the course of this study, the normal National Health Service complaints mechanisms would be available to you.

If you wish to make a complaint about the study you can contact the [REDACTED] Patient Information and Liaison Service by post [REDACTED]
[REDACTED]

Will my taking part in this study be kept confidential?

All of the information we collect from or about you will be kept strictly confidential, stored anonymously using a study participant code and will not be identifiable as belonging to you. If you give your permission on the Consent Form, your contact details will be made available to the researchers so that they can contact you to remind you to return the survey form. These details will be stored securely and separately from the research information above.

What will happen to the results of the research study?

We expect the results of the research to become available from 2017. The results will also be published in a medical journal. All information will be anonymised so you will not be identified in any report or publication.

Who is organising and funding the research?

The research is being organised by [REDACTED] is funded by [REDACTED]
[REDACTED]

Who has reviewed the study?

All research that involves NHS patients or staff, information from NHS medical records or uses NHS premises or facilities must be reviewed by an NHS Research Ethics Committee before it goes ahead. This study has been reviewed by the [REDACTED] NHS Research Ethics Committee. A favourable opinion means that the committee is satisfied that your rights will be respected, that any risks have been reduced to a minimum and balanced against possible benefits and that you have been given sufficient information on which to make an informed decision.

Contact for Further Information

If you would like any further information about this study please contact the Chief Investigator [REDACTED]

Alternatively, if you have questions about the study and you would prefer to ask someone not directly involved with the research team, you can contact the [REDACTED]

[REDACTED] phone on [REDACTED] or email [REDACTED]
[REDACTED]

**Thank you for reading this Information Sheet,
and for considering taking part in this study.**

[REDACTED]
Email [REDACTED]

***You will be given a copy of this information sheet and signed consent form
to keep***

Appendix P: Participant consent form

Study Code
ADAPT CKD

PATIENT CONSENT FORM

Physical Activity, Depression And Illness Perceptions in Chronic Kidney Disease (ADAPT CKD)

Please initial each box

1. I confirm that I have read and understand the ADAPT CKD Patient Information Sheet version 1 dated 1st February 2016 for the above study and I have had the opportunity to ask questions. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected. ☐

As explained in the Patient Information Sheet, the researchers would like to be able to telephone you a friendly reminder if you do not return the survey pack within 10 days of taking it home. If you agree to this, the researcher will only speak to you once and if you have changed your mind and no longer wish to take part in the study, we will not contact you again. If you would prefer us not to telephone you, please initial the "NO" box below.

3. I give my permission for a researcher to telephone to remind me to return the survey pack, as explained above

YES NO

If Yes, please give the best telephone number(s) to contact you on,
with your preferred time of day :

--	--

.....

4. After I return the survey pack, I understand that a researcher will access my clinical records to extract information relevant to this research study, and I give permission for the researcher to do so. ☐
5. I understand that relevant sections of my medical notes and/or data may be looked at by responsible individuals from the study team, the Sponsor, Research Ethics Committee, NHS Trust or from regulatory authorities where it is relevant to my taking part in the research. I give permission for these individuals to access my records. ☐
3. I agree to take part in the above study. ☐

Name of Patient

Date

Signature

Name of Researcher

Date

Signature

1 for patient; 1 for researcher; 1 to be kept with hospital notes
ADAPT CKD Patient Consent Form

Version 1 : 1st February 2016

Appendix Q: Epistemological position

The researcher adopted an objective positivist epistemological stance for the current research study, which makes the assumption that objective knowledge can be measured through reliable and valid tools. This position informed my research methods, where psychometric questionnaires were utilised to collect data while quantitative method of statistical analysis was employed to understand the objective truth and meaning. Holding in mind that the researcher is independent of the research outcome in accordance to the positivist approach, the study survey booklet was given to participants to be completed at their own homes to minimise interaction during data collection. The researcher endeavours to disseminate the research findings as defensible scientific knowledge.

Appendix R: Chronology of research process

Chronology of research process	
Thesis proposal peer reviewed	12 th January 2016
Integrated Research Application System (IRAS) submission	9 th May 2016
REC approval gained	6 th June 2016
Health Research Authority (HRA) submission	9 th May 2016
HRA approval gained	22 nd July 2016
Research and Development application initiated	7 th March 2016
Research and Development approval gained	22 nd July 2016
Recruitment and data collection	August 2016 - January 2017
Systematic literature review database searches and write up	July 2016 - April 2017
Data analysis for thesis	February 2017
Write-up and submission of thesis and literature review draft for feedback	January - May 2017
Thesis Submission	May 2017
Research Viva	13 th July 2017
Preparation for trainee research conference and dissemination	July - September 2017

Appendix S: Guidelines for target journal for Literature Review

Guidelines for British Journal of Health Psychology accessed 1st May 2017 from:

[http://onlinelibrary.wiley.com/journal/10.1111/\(ISSN\)2044-8287/homepage/ForAuthors.html](http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)2044-8287/homepage/ForAuthors.html)

Author Guidelines

The aim of the British Journal of Health Psychology is to provide a forum for high quality research relating to health and illness. The scope of the journal includes all areas of health psychology as outlined in the Journal Overview.

The types of paper invited are:

- papers reporting original empirical investigations, using either quantitative or qualitative methods, including reports of interventions in clinical and non-clinical populations;
- theoretical papers which report analyses on established theories in health psychology;
- we particularly welcome review papers, which should aim to provide systematic overviews, evaluations and interpretations of research in a given field of health psychology; and
- methodological papers dealing with methodological issues of particular relevance to health psychology.

Authors who are interested in submitting papers that do not fit into these categories are advised to contact the editors who would be very happy to discuss the potential submission.

All papers published in The British Journal of Health Psychology are eligible for Panel A: Psychology, Psychiatry and Neuroscience in the Research Excellence Framework (REF).

1. Circulation

The circulation of the Journal is worldwide. Papers are invited and encouraged from authors throughout the world.

2. Length

Papers describing quantitative research (including reviews with quantitative analyses) should be no more than 5000 words (excluding the abstract, reference list, tables and figures). Papers describing qualitative research (including reviews with qualitative analyses) should be no more than 6000 words (including quotes but

excluding the abstract, tables, figures and references). The Editors retain discretion to publish papers beyond this length in cases where the clear and concise expression of the scientific content requires greater length.

3. Editorial policy

The Journal receives a large volume of papers to review each year, and in order to make the process as efficient as possible for authors and editors alike, all papers are initially examined by the Editors to ascertain whether the article is suitable for full peer review. In order to qualify for full review, papers must meet the following criteria:

- the content of the paper falls within the scope of the Journal
- the methods and/or sample size are appropriate for the questions being addressed
- research with student populations is appropriately justified
- the word count is within the stated limit for the Journal (i.e. 5000 words, or 6,000 words for qualitative papers)

4. Submission and reviewing

All manuscripts must be submitted via Editorial Manager. The Journal operates a policy of anonymous (double blind) peer review. We also operate a triage process in which submissions that are out of scope or otherwise inappropriate will be rejected by the editors without external peer review to avoid unnecessary delays. Before submitting, please read the terms and conditions of submission and the declaration of competing interests. You may also like to use the Submission Checklist to help you prepare your paper.

5. Manuscript requirements

- Contributions must be typed in double spacing with wide margins. All sheets must be numbered.
- Manuscripts should be preceded by a title page which includes a full list of authors and their affiliations, as well as the corresponding author's contact details. You may like to use this template. When entering the author names into Editorial Manager, the corresponding author will be asked to provide a CRediT contributor role to classify the role that each author played in creating the manuscript. Please see the Project CRediT website for a list of roles.
- For articles containing original scientific research, a structured abstract of up to 250 words should be included with the headings: Objectives, Design,

Methods, Results, Conclusions. Review articles should use these headings: Purpose, Methods, Results, Conclusions. As the abstract is often the most widely visible part of your paper, it is important that it conveys succinctly all the most important features of your study. You can save words by writing short, direct sentences. Helpful hints about writing the conclusions to abstracts can be found [here](#).

- **Statement of Contribution:** All authors are required to provide a clear summary of ‘what is already known on this subject?’ and ‘what does this study add?’. Authors should identify existing research knowledge relating to the specific research question and give a summary of the new knowledge added by your study. Under each of these headings, please provide 2-3 (maximum) clear outcome statements (not process statements of what the paper does); the statements for ‘what does this study add?’ should be presented as bullet points of no more than 100 characters each. The Statement of Contribution should be a separate file.
- **Conflict of interest statement:** We are now including a brief conflict of interest statement at the end of each accepted manuscript. You will be asked to provide information to generate this statement during the submission process.
- **The main document must be anonymous.** Please do not mention the authors’ names or affiliations (including in the Method section) and always refer to any previous work in the third person.
- **Tables** should be typed in double spacing, each on a separate page with a self-explanatory title. Tables should be comprehensible without reference to the text. They should be placed at the end of the manuscript but they must be mentioned in the text.
- **Figures** can be included at the end of the document or attached as separate files, carefully labelled in initial capital/lower case lettering with symbols in a form consistent with text use. Unnecessary background patterns, lines and shading should be avoided. Captions should be listed on a separate sheet. The resolution of digital images must be at least 300 dpi. All figures must be mentioned in the text.
- **For reference citations, please use APA style.** Particular care should be taken to ensure that references are accurate and complete. Give all journal titles in full and provide doi numbers where possible for journal articles. For example:

Author, A., Author, B., & Author, C. (1995). Title of book. City, Country: Publisher.

Author, A. (2013). Title of journal article. Name of journal, 1, 1-16. doi: 10.1111/bjep.12031

- SI units must be used for all measurements, rounded off to practical values if appropriate, with the imperial equivalent in parentheses.
- In normal circumstances, effect size should be incorporated.
- Authors are requested to avoid the use of sexist language.
- Authors are responsible for acquiring written permission to publish lengthy quotations, illustrations, etc. for which they do not own copyright. For guidelines on editorial style, please consult the APA Publication Manual published by the American Psychological Association.
- Manuscripts describing clinical trials are encouraged to submit in accordance with the CONSORT statement on reporting randomised controlled trials.
- Manuscripts reporting systematic reviews and meta-analyses are encouraged to submit in accordance with the PRISMA statement.
- Manuscripts reporting interventions are encouraged to describe them in accordance with the TIDieR checklist.

If you need more information about submitting your manuscript for publication, please email Hannah Wakley, Managing Editor (bjhp@wiley.com) or phone +44 (0) 116 252 9504.

6. Supporting information

We strongly encourage submission of protocol papers or trial registration documents, where these are in the public domain, to allow reviewers to assess deviations from these protocols. This will result in reviewers being unblinded to author identity.

Supporting Information can be a useful way for an author to include important but ancillary information with the online version of an article. Examples of Supporting Information include appendices, additional tables, data sets, figures, movie files, audio clips, and other related nonessential multimedia files. Supporting Information should be cited within the article text, and a descriptive legend should be included. Please indicate clearly on submission which material is for online only publication. It is published as supplied by the author, and a proof is not made available prior to publication; for these reasons, authors should provide any Supporting Information in the desired final format.

For further information on recommended file types and requirements for submission, please visit the Supporting Information page on Author Services.

7. OnlineOpen

OnlineOpen is available to authors of primary research articles who wish to make their article available to non-subscribers on publication, or whose funding agency requires grantees to archive the final version of their article. With OnlineOpen, the author, the author's funding agency, or the author's institution pays a fee to ensure that the article is made available to non-subscribers upon publication via Wiley Online Library, as well as deposited in the funding agency's preferred archive. A full list of terms and conditions is available on Wiley Online Library.

Any authors wishing to send their paper OnlineOpen will be required to complete the payment form.

Prior to acceptance there is no requirement to inform an Editorial Office that you intend to publish your paper OnlineOpen if you do not wish to. All OnlineOpen articles are treated in the same way as any other article. They go through the journal's standard peer-review process and will be accepted or rejected based on their own merit.

8. Author Services

Author Services enables authors to track their article – once it has been accepted – through the production process to publication online and in print. Authors can check the status of their articles online and choose to receive automated e-mails at key stages of production. The author will receive an e-mail with a unique link that enables them to register and have their article automatically added to the system. You can then access Kudos through Author Services, which will help you to increase the impact of your research. Visit Author Services for more details on online production tracking and for a wealth of resources including FAQs and tips on article preparation, submission and more.

9. Copyright and licences

If your paper is accepted, the author identified as the formal corresponding author for the paper will receive an email prompting them to login into Author Services, where via the Wiley Author Licensing Service (WALS) they will be able to complete the licence agreement on behalf of all authors on the paper.

For authors signing the copyright transfer agreement

If the OnlineOpen option is not selected the corresponding author will be presented with the copyright transfer agreement (CTA) to sign. The terms and conditions of the CTA can be previewed in the samples associated with the Copyright FAQs .

For authors choosing OnlineOpen

If the OnlineOpen option is selected the corresponding author will have a choice of the following Creative Commons Licence Open Access Agreements (OAA):

- Creative Commons Attribution Non-Commercial Licence (CC-BY-NC)

- Creative Commons Attribution Non-Commercial -NoDerivs Licence (CC-BY-NC-ND)

To preview the terms and conditions of these open access agreements please visit the Copyright FAQs and you may also like to visit the Wiley Open Access Copyright and Licence page.

If you select the OnlineOpen option and your research is funded by The Wellcome Trust and members of the Research Councils UK (RCUK) or the Austrian Science Fund (FWF) you will be given the opportunity to publish your article under a CC-BY licence supporting you in complying with your Funder requirements. For more information on this policy and the Journal's compliant self-archiving policy please visit our Funder Policy page.

10. Colour illustrations

Colour illustrations can be accepted for publication online. These would be reproduced in greyscale in the print version. If authors would like these figures to be reproduced in colour in print at their expense they should request this by completing a Colour Work Agreement form upon acceptance of the paper.

11. Pre-submission English-language editing

Authors for whom English is a second language may choose to have their manuscript professionally edited before submission to improve the English. A list of independent suppliers of editing services can be found in Author Services. All services are paid for and arranged by the author, and use of one of these services does not guarantee acceptance or preference for publication.

12. The Later Stages

The corresponding author will receive an email alert containing a link to a web site. The proof can be downloaded as a PDF (portable document format) file from this site. Acrobat Reader will be required in order to read this file. This software can be downloaded (free of charge) from Adobe's web site. This will enable the file to be opened, read on screen and annotated direct in the PDF. Corrections can also be supplied by hard copy if preferred. Further instructions will be sent with the proof. Excessive changes made by the author in the proofs, excluding typesetting errors, will be charged separately.

13. Early View

British Journal of Health Psychology is covered by the Early View service on Wiley Online Library. Early View articles are complete full-text articles published online in advance of their publication in a printed issue. Articles are therefore available as soon as they are ready, rather than having to wait for the next scheduled print issue. Early View articles are complete and final. They have been fully reviewed, revised and edited for publication, and the authors' final corrections have been incorporated. Because they are in final form, no changes can be made after online publication. The nature of Early View articles means that they do not yet have

volume, issue or page numbers, so they cannot be cited in the traditional way. They are cited using their Digital Object Identifier (DOI) with no volume and issue or pagination information. Eg Jones, A.B. (2010). Human rights Issues. *Journal of Human Rights*. Advance online publication. doi:10.1111/j.1467-9299.2010.00300.x

Appendix T: Guidelines for target journal for Research Report

1 AIMS AND SCOPE

NDT – Basic and Clinical Science is an official publication of the European Renal Association-European Dialysis and Transplant Association. *NDT* publishes Editorials, Reviews and original research. Rapid communications, exceptional cases and (only) online E-letters to the Editor commenting on papers previously published in the journal are also considered. The journal covers the whole territory of nephrology research including experimental work in animal models and molecular biology studies. In the Clinical Science section we consider clinical trials (RCT have a priority in our journal), observational studies at large and original works on health economy as applied to nephrology. We aim to cover the whole spectrum of kidney disease research, from clinical nephrology to haemodialysis and peritoneal dialysis as well as renal transplantation. Only single patient and small case-series providing novel insights – ranging from cellular or molecular levels to the clinical level – or papers describing novel clinical observations will be accepted for publication in *NDT*. *NDT* may accept high-quality, peer-reviewed supplements. Please contact supplements@oup.com in the first instance for further information. Abstracts from the annual ERA-EDTA congress are published as a supplement to *NDT* each year.

NDT only accepts online submissions. Please visit <http://mc.manuscriptcentral.com/ndt>.

You will also find more complete submission instructions at this site.

2 AUTHORS: ROLES AND RESPONSIBILITIES

The journal takes publication ethics very seriously. If misconduct is found or suspected after the manuscript is published, the journal will investigate the matter and this may result in the article subsequently being retracted.

Authors should observe high standards with respect to publication ethics as set out by the [Commission on Publication Ethics \(COPE\)](#) and [International Committee of Medical Journal Editors \(ICMJE\)](#). Falsification or fabrication of data, plagiarism, including duplicate publication of the author's own work without proper citation, and misappropriation of the work are all unacceptable practices. Any cases of ethical misconduct are treated very seriously and will be dealt with in accordance with the COPE guidelines. If misconduct is found or suspected after the manuscript is published, the journal will investigate the matter and this may result in the article subsequently being retracted.

Each author should have participated sufficiently in the work to take public responsibility for the content. This participation must include:

1. Conception or design, or analysis and interpretation of data, or both.
2. Drafting the article or revising it.
3. Providing intellectual content of critical importance to the work described.
4. Final approval of the version to be published. (See *Br Med J* 1985; 291: 722-723.)

Manuscripts should bear the full name and address, with telephone, fax, and email of the author to whom the proofs and correspondence should be sent

(corresponding author). For all authors, first name and surname should be written in full.

In a covering letter, the individual contribution of each co-author must be detailed. This letter must contain the statement: 'the results presented in this paper have not been published previously in whole or part, except in abstract form'.

Should your manuscript be accepted for publication, you will be required to give signed consent for publication (see copyright section).

On acceptance, the corresponding author will be advised of the approximate date of receipt of proofs. Proofs must be returned by the author within 48 hours of receipt.

To accelerate publication, only one set of PDF proofs is sent to the corresponding author by email. This shows the layout of the paper as it will appear in the Journal. It is, therefore, essential that manuscripts are submitted in their final form, ready for the printer. Proof-reading must be limited to the correction of typographical errors. Any other changes involve time-consuming and expensive work and may not be permitted at this stage. If additions are necessary, these may be made at the end of the paper in a Note in Proof. Major changes may be subject to editorial approval.

Authors are referred to the statement on uniform requirements for manuscripts submitted to biomedical journals prepared by an international committee of medical journal editors. (Br Med J 1982; 284: 1766-1770, Ann Intern Med 1982; 96: 766-771.)

Protection of Human Subjects and Animals in Research

When reporting experiments on animals, authors should indicate whether the institutional and national guide for the care and use of laboratory animals was followed.

In particular, NDT recommends compliance with the [DIRECTIVE 2010/63/EU of the European Parliament](#) for authors submitting from the European area, and compliance with the [Guide for the Care and Use of Laboratory Animals](#) for non-European authors.

When reporting experiments on human subjects, authors should indicate whether the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5). If doubt exists whether the research was conducted in accordance with the Helsinki Declaration, the authors must explain the rationale for their approach and demonstrate that the institutional review body explicitly approved the doubtful aspects of the study.

Patient consent

Authors should state in their paper that informed consent has been obtained from the subjects (or their guardians) as specified in the [ICMJE Recommendations](#)

3 TABLES

All tables must be numbered consecutively and each must have a brief heading describing its contents. Any footnotes to tables should be indicated by superscript

characters. Tables must be referred to in the main text in running order. All tables must be simple and not duplicate information given in the text.

4 FIGURE PREPARATION

Please be aware that the requirements for online submission and for reproduction in the journal are different: (i) for online submission and peer review, please upload your figures either embedded in the word processing file or separately as low-resolution images (.jpg, .tif, .gif or .eps); (ii) for reproduction in the journal, you will be required after acceptance to supply high-resolution .tif files (1200 d.p.i. for line drawings and 300 d.p.i. for colour and half-tone artwork) or high-quality printouts on glossy paper. We advise that you create your high-resolution images first as these can be easily converted into low-resolution images for online submission.

We would encourage authors to generate line figures in colour using the following colour palette:

Blue (CMYK definition - 96/60/2/1 / RGB definition – 0/101/172)

Orange (CMYK definition - 0/71/88/0 / RGB definition – 243/110/53)

Pink (CMYK definition - 0/100/50/0 / RGB definition – 237/20/90)

Yellow (CMYK definition - 1/29/94/0 / RGB definition – 249/185/40)

Green (CMYK definition - 77/10/96/2 / RGB definition – 59/162/75)

Magenta (CMYK definition - 65/98/28/25 / RGB definition – 97/33/94)

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EXAMPLES

1. Madaio MP. Renal biopsy. *Kidney Int* 1990; 38: 529-543

Books:

2. Roberts NK. The cardiac conducting system and the His bundle electrogram. Appleton-Century-Crofts, New York, NY: 1981; 49-56

Chapters:

3. Rycroft RJG, Calnan CD. Facial rashes among visual display unit (VDU) operators. In: Pearce BG, ed. Health hazards of VDUs. Wiley, London, UK: 1984; 13-15

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