Relationships between illness representations, physical activity and depression in Chronic Kidney Disease

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Conflict of Interest Statement

None of the authors of this manuscript have any conflicts of interest to declare. The results presented in this paper have not been published previously in whole or part, except in abstract format.

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Abstract

Background: Chronic Kidney Disease (CKD) is exacerbated by depression and confers significant healthcare costs. Whilst adverse impacts may be mitigated by physical activity, many patients with CKD remain physically inactive, with this physical inactivity potentially influenced by how CKD is appraised.

Objectives: The study aims to explore the relationship between physical activity, depression and illness representations in CKD.

Methods: Non-dialysing patients with CKD 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. Moderation and mediation analyses were performed to investigate the role of depression in any relationship between illness representations and physical activity levels.

Results: Seventy respondents, with a mean age of 60 ± 16 years, the majority being male (60%), took part in the study. Of illness representation dimensions, 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 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. Future research concerning the development and validation of psychological interventions based on an illness representations framework for patients with CKD not on renal-replacement therapy is proposed. The efficacy of such interventions could be then evaluated using a randomised controlled method.

Introduction

Chronic Kidney Disease (CKD) is an irreversible long-term condition often undiagnosed until an advanced stage where costs can be significant for the individual and society (NICE 2015a). Adverse impacts of CKD appear exacerbated by co-morbid mental health problems (Tonelli *et al.* 2015). Depression is prevalent in individuals with CKD (EMPO 2010; NICE 2015b), where 20 to 30 per cent of patients meet diagnostic criteria (Cukor *et al*. 2007) compared to point prevalence of 2 to 4 per cent in the general community and 5 to 10 per cent in primary care settings (Hedayati *et al*. 2009). As CKD and depression have negative repercussions (Cruz *et al.* 2010, Farrokhi *et al.* 2014, Teles *et al.* 2014), and depression is a significant co-morbidity magnifying adverse impact, increased attention has been drawn to possible interventions that might mitigate the impact of both CKD and depression.

Studies have found that engagement in physical activity and exercise accrues significant physiological benefits such as improved cardiovascular reactivity, eGFR and physical functioning and a reduction of inflammation for individuals with CKD (Kosmadakis *et al* 2012, Smith & Burton 2012, Gould *et al* 2014, Wilkinson *et al* 2018). A Cochrane review reported evidence demonstrating beneficial effects of physical activity on CKD and mood (Heiwe & Jacobson 2011).

Although activity and exercise have scope to mitigate the impact of CKD and alleviate depression in patients with CKD, many individuals do not undertake sufficient physical activity (Zamojska *et al*. 2006; Beddhu *et al*. 2009; Avesani *et al*. 2012; Hayhurst & Ahmed 2015). Explanatory theories were developed to understand such phenomena and inform health behavioural change interventions (Nigg *et al*. 2002). Notable amongst these self-regulation models is Leventhal and Cleary's Common Sense Model (CSM) of illness representations (Leventhal & Cleary 1980). The CSM hypothesises that individuals with illnesses construct illness beliefs about their health conditions, which influence health-related behaviours such as the undertaking of physical activity.

Extensive research investigating how illness representations influence health behaviours in chronic illnesses, notably rheumatoid arthritis, chronic obstructive pulmonary disease (COPD) and multiple sclerosis (Hale *et al*. 2007) has been conducted. However, there is a paucity of research exploring the relationship between illness representations and health behaviour in CKD. No known studies have examined the roles of illness representations in influencing the undertaking of physical activity for patients with CKD particularly those not receiving renal replacement therapy (also termed as patients with CKD-ND in this paper). Furthermore, illness representations were found to differ between dialysing and non-dialysing patients (Jansen *et al.* 2010; Jansen *et al.* 2013).

Hence, the current study aimed to determine if facets of illness representations are associated and predictive of levels of physical activity in patients with CKD-ND. This is of clinical importance as illness representations were found to be modifiable (Hale *et al.* 2007), potentially increasing physical activity, which mitigates the impact of CKD and depression. Besides that, depression was found to be associated with physical activity (Jekau & Brand 2017) and illness representations (Muscat *et al.* 2018). Thus, the secondary study aim was to investigate if the severity of depression has a moderating or mediating effect between illness representations and levels of physical activity.

Materials and Methods

Design, setting and participants

Participants were recruited through convenience sampling in a UK renal outpatient clinic from August 2016 to January 2017. A face-to-face approach was adopted whereby patients were approached randomly and introduced to the study. Eligible patients met the following inclusion criteria: (i) diagnosis of CKD and not on dialysis, (ii) male or female aged 18 years or above, (iii) were willing and able to give informed consent for study participation, and (iv) were able to complete the measures in English. Participants were given a study survey booklet to be taken away, completed, and returned within 10 days. Medical records were accessed after completed surveys were returned to extract relevant clinical details. All participants in the study provided informed consent. The study was sponsored by the University Hospitals of Leicester NHS Trust and approved by the London Queen Square Research Ethics Committee (ref 16/LO/0980).

Measures

The International Physical Activity Questionnaire Short Form (IPAQ-SF), a seven-item self-report questionnaire was used to assess participants' levels of physical activity, which are categorised into four intensity levels: vigorous-intensity activity; moderate-intensity activity; walking and; sitting (Craig *et al*. 2003). The IPAQ-SF can be calculated as a continuous score by multiplying activities' metabolic equivalent (MET) with the time spent

(minutes) and the number of days engaged in those activities. 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' (IPAQ 2004).

The Beck Depression Inventory (BDI)-II, a 21-item self-report questionnaire was used to assess participants' severity of cognitive and somatic depressive symptoms in the past two weeks (Beck *et al*. 1988). Each item is rated on a four-point Likert scale ranging from 0 to 3, with higher overall scores reflecting greater severity of depression (Whisman & Richardson 2015). 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) (Beck *et al*. 1996). The BDI-II clinical cut off score of ≥ 11 was established as having the best diagnostic accuracy for depressive disorder in patients with CKD-ND (Hedayati *et al*. 2012).

Facets of illness representations were assessed by the Illness Perceptions Questionnaire-Revised (IPQ-R). The IPQ-R is an 84-item self-report questionnaire that measures the five components of CSM (Moss-Morris *et al*. 2002). The current study utilised the second section of the IPQ-R, which consists of seven subscales: consequences, timeline acute/chronic and cyclical, personal and treatment control/cure, illness coherence, and emotional representations (Hill 2010). Each item is rated on a five-point Likert-style scale (Hill 2010). Higher subscale scores reflect greater

endorsement of the given construct (Zoeckler *et al*. 2014). High scores on consequences, timeline acute/chronic, cyclical and emotional representation subscales represent negative illness beliefs that an illness has adverse impacts, is chronic, cyclical in nature and generates a negative emotional response respectively. Whereas high scores on illness coherence and personal and treatment control indicate positive illness beliefs where individuals understood their condition, felt in control over their condition and the treatment received controls/cures the illness.

Statistical methods

Data analyses were performed using IBM SPSS statistics for Windows, version 24 (Armonk, NY: IBM Corp). 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, 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 facets of illness representations and levels of physical activity. Hierarchical multiple regression analyses were used to model the relationships between facets of illness representations, levels of physical activity, and participant characteristics. As the study sample size is underpowered, Adjusted R

square values are reported (Pallant 2007). A post-hoc regression analysis was conducted with only the predictors that made a statistically significant contribution to the main regression analysis to address the small sample size issue. Mediation and moderation analyses were performed using Hayes' PROCESS macro for SPSS (Hayes 2012) to investigate the role of depression in the hypothesised relationship between dimensions of illness representations and level of physical activities.

For missing data, cases were excluded from the calculation of overall BDI score if there were more than one missing datum. On the IPQ-R, cases were excluded if more than two items are missing per subscale with the exception of subscales with less than six items where a maximum of one missing item is allowed. 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 (Little 1988). 'Treatment Control' subscale was excluded from regression analyses as the sample consisted of non-dialysing participants with conservative 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. All statistical analyses adopted a pairwise exclusion method.

Results

Patient characteristics

164 patients were approached, of these, 64 declined to take part in the study. 100 patients consented to participate, but 30 did not return the survey booklet and were withdrawn from the study. The final sample comprised 70 patients with CKD-ND (43% participation rate). The majority of these were male (60%), identified as 'White British' (80%), with a mean age of 60 ± 16 years. Demographics and clinical data are reported in Table 1.

[Table 1]

Levels of physical activity

Approximately a third of the participants (35%) were sedentary, meeting the criteria of low/inactive level of physical activity, and thus considered insufficiently active. Whereas 39% individuals met the criteria of 'Minimally Active', achieving the recommended minimum level of activity for adults, 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'.

Depression severity

Participants generally reported 'Minimal Depression' with 63.2% of participants' scores in this category, 17.6% for 'Mild Depression, 11.8% for 'Moderate Depression' and 7.4% for 'Severe Depression' (Table 2). The mean BDI-II score for the sample was 12.0 ± 9.6 with a range of 0-45. Half (50%) of the participants had a BDI-II cut-off score of ≥ 11.

[Table 2]

Association of illness representations with levels of physical activity

There was a small positive correlation between personal control and level of physical activity (r=.288, p=.034), 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. Findings are presented in Table 3.

[Table 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 effects of age and eGFR were removed

(Table 4). Of 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.

[Table 4]

Post-hoc regression analysis

A post-hoc hierarchical multiple regression analysis (Table 5) was conducted with the significant predictors from the main analysis, age and timeline cyclical, as variables. Timeline cyclical accounted for 8.1% of the variance in IPAQ-SF scores after controlling for age ($\Delta R^2_{Adjusted}$=.081, *p*=.009) while Model 2 as a whole explains 21.1% of the variance ($R^2_{Adjusted}$=.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).

[Table 5]

313

314 *Moderation and mediation analyses*

315 Moderation analysis was conducted with levels of physical activity (IPAQ-
316 SF) as the dependent variable, timeline cyclical as the independent variable
317 and severity of depression (BDI-II) as the moderator variable (Table 6).
318 Findings suggest that the relationship between timeline cyclical and levels
319 of physical activity is not moderated by severity of depression as the
320 interaction effect is not significant (*b*= .023, 95% CI [-.015, .061], *t*=1.201,
321 *p*=.23).

322

323 [Table 6]

324

325 Similarly, mediation analysis (Figure 1) was conducted with levels of
326 physical activity (IPAQ-SF) as the dependent variable, timeline cyclical as
327 the independent variable and severity of depression (BDI-II) as the mediator
328 variable. Results indicated that severity of depression was not a mediator
329 as there is no significant indirect effect of timeline cyclical on levels of
330 physical activity through severity of depression (*b*=-.021, BCa CI [-.082,
331 .008], *p*=.33).

332

333 [Figure 1]

334

Discussion

The present study is the first to examine the relationship between illness representations and levels of physical activity in patients with CKD-ND. Findings of this study suggest that illness representation elements are associated with, and predictive of, levels of physical activity in accordance with the CSM model assumptions, in which perceptions of a condition such as CKD influence coping and the utilisation of health behaviours (Leventhal *et al*. 1984). Regarding the secondary aim, depression was not found to mediate or moderate the predictive relationship between timeline cyclical and levels of physical activity.

Almost three-quarter of the sample (74%) undertook insufficient levels of physical activity. This is expected as CKD has been found to be associated with impaired physical activity (Beddhu *et al*. 2009). Half of the sample had a BDI-II cut-off score of ≥ 11, which is indicative of a depressive presentation. This rate is more than twice reported in a systematic review on the prevalence of depression in CKD (Palmer et al. 2013). The reason for this discrepancy is unclear. Our study sample comprised only patients with CKD-ND, thus excluding those receiving renal replacement therapy or had kidney transplants.

Regarding associative relationship, only personal control had a statistically significant positive correlation with levels of physical activity, suggesting that patients with CKD-ND who perceived themselves as having more control

over their illness were more likely to engage and undertake higher levels of physical activity. This is consistent with Hagger and Orbell (2003) meta-analysis examining the relationship between illness representations and health behaviours and illness outcomes. They found that CSM cure/control dimension, equivalent to personal control, was positively correlated with specific problem-focused coping strategies such as exercise (Hagger & Orbell 2003). Perception of personal control over illness was related to active coping strategies, which was reflected in our results. In the context of CKD, where the main goal of physical activity is to improve disease management as opposed to cure, it could define an important coping strategy. Similarly, the French *et al*. (2006) systematic review with meta-analysis reported patients with cardiovascular disease (CVD) disclosing greater CSM cure/control appraisals were more likely to attend cardiac rehabilitation, 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 (Reges *et al*. 2013; Mosleh & Almalik 2016).

Timeline cyclical dimension predicted levels of physical activity and remained statistically significant for the post-hoc regression analysis. Patients with CKD-ND who considered their illness and symptoms as unpredictable and cyclical undertook lower levels of physical activity. This finding parallels Sniehotta *et al*. (2010) who similarly concluded that timeline cyclical predicted levels of physical activity in patients with CVD. It is possible that patients with CKD-ND who perceived their condition as cyclical

may adopt an avoidant coping style by not employing health behaviours for the fear of aggravating their symptoms (Sniehotta *et al*. 2010). Such explanation is congruent with Hagger and Orbell (2003) who found that the timeline dimension, which consists of both acute/chronic and cyclical components, were positively associated with avoidance and denial.

The predictive relationship between timeline cyclical and levels of physical activity were neither moderated nor mediated by the severity of depression. This is expected as severity of depression was not significantly associated with levels of physical activity. 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.

Limitations

There are several limitations in the current study. Whilst our findings have shown a relationship between illness representations and physical activity, only two of the seven domains of the CSM were statistically significant, indicating a limitation of the CSM as an explanatory model for physical activity behaviour. Results emerged from a within group cross-sectional survey design, which precluded causal examination and comparisons across groups. Additionally, the self-report measures (IPAQ-SF and BDI-II)

are prone to recall bias, which threatens the validity of the data (Raphael 1987). We acknowledge the small sample size and made stringent attempts to address power: a post-hoc regression analysis with two predictor variables was conducted, which met the 15 cases per predictor variable requirement for social sciences research (Stevens 1996). Future studies could address the power issue by recruiting a larger sample and refining data collection method, such as using online survey systems. With participant characteristics of the sample indicating more males than the prevalence model (Roth *et al*. 2010), and the sample reporting more depression compared to other studies (Palmer *et al*. 2013), results are not entirely generalisable to the CKD population, and are restricted to patients with CKD-ND. Our study population also had a higher percentage of White British participants (80%) than the local CKD population (70%). These differences possibly could be due to the sampling method adopted, which results in selection bias (Acharya *et al.* 2013). Moreover, individuals who declined to take part in the study may differ from those who volunteered for the study, resulting in non-response bias (Sedgwick 2014).

Implications for clinical practice

Our study results suggest a predictive relationship between timeline cyclical and levels of physical activity, which are neither moderated nor mediated by the severity of depression. This demonstrates that timeline cyclical is an important predictor and on its own has a direct effect on levels of physical activity. This is a key finding, with important clinical implications given the substantial evidence that patients with CKD undertake insufficient physical

activity (Zamojska *et al*. 2006; Beddhu *et al*. 2009; Avesani *et al*. 2012; Hayhurst & Ahmed 2015), with potential adverse consequences (Beddhu *et al*. 2009; Zelle *et al*. 2017). Furthermore, research has found that exercise is beneficial for patients with CKD (Heiwe 2011) and associated with better outcomes (Tentori *et al*. 2010), including non-dialysing patients (Gould *et al*. 2014).

Given that 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 nurses to conduct routine psychological assessment and screening for patients with CKD-ND, to assess their illness representations. Development of psychological interventions specifically to address unhelpful representations could also be considered and delivered by trained nursing staff (Hale *et al*. 2007, Hudson *et al.* 2016). For instance, psychoeducation on 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, and work with health providers to better manage their condition to enhance stability and prevent deterioration. Enhanced awareness and active illness management could mitigate perceptions of illness unpredictability and improve perceived controllability. Research has established the efficacy of illness representations-based interventions in increasing physical activity in patients after myocardial infarction (Broadbent *et al*. 2009), and improving

clinical and psychological outcomes in diabetic patients (Keogh *et al*. 2011). Similarly, such focused interventions should be timely provided for patients with CKD-ND to enhance and sustain uptake of physical activity and potentially mitigate the effects of depression.

Conclusion

The current study has established the relationship of illness representations with levels of physical activity. Future research concerning the development and validation of psychological interventions specific to the modification of illness representations in patients with CKD-ND is encouraged. In addition, robust design adopting randomised controlled method could examine efficacy of such treatments and establish causal links between illness representations and levels of physical activity.

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Tables

Table 1: 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%)
Ethnicity (n=67)	
White British	56
Indian	7
White any other background	1
White and Black Carribean	1
White Asian	1
Pakistani	1
Level of Education (n=68) (%)	
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%)
Smoking Status (%)	
Never smoked	37 (52.9%)
Current smoker	5 (7.1%)
Ex-smoker	28 (40%)
Comorbidity Reported (n=66) (%)	
Yes	50 (75.8%)
No	16 (24.2%)
Stage of CKD (%)	
Stage 1	2 (2.9%)

Stage 2	16 (22.9%)
Stage 3	14 (20%)
Stage 4	32 (45.7%)
Stage 5	6 (8.6)
Onset of CKD (n=69)	
Onset of CKD range (in months)	0.5 - 360
Mean onset of CKD in months (SD)	110.6 (100.6)
eGFR (n=68) (ml/min/1.73m^2)	
eGFR range	8 - 90
Mean eGFR (SD)	34.5 (22.3)

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700 **Table 2: BDI-II results summary**

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

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Table 3: 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).

Table 4: 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			
	b	***SE B***	**β**	***p* (2-tailed)**	***B***	***SE B***	**β**	***p* (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 $R^2_{Adjusted}$=.103 for Model 1; ΔR^2=.219 and $\Delta R^2_{Adjusted}$=.142 for Model 2 (*p*s<.05).

Table 5: 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

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

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

Table 6: Moderation analysis for levels of physical activity (IPAQ-SF)

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

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

Figure

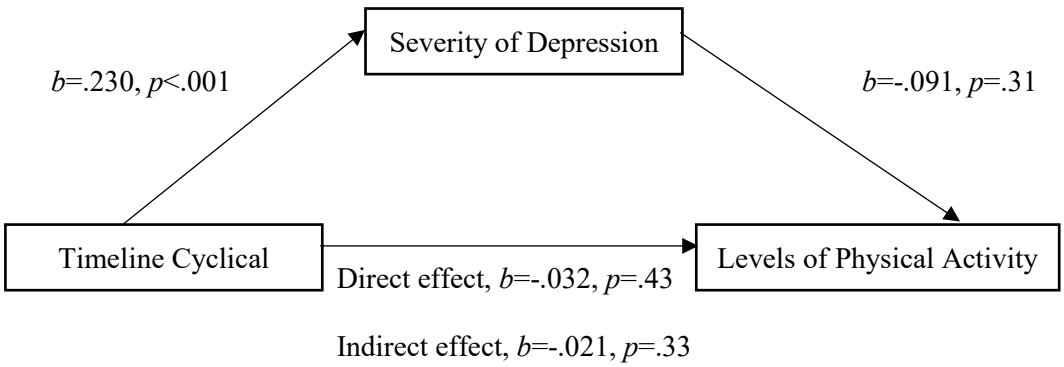

Figure 1. Mediation analysis for levels of physical activity (IPAQ-SF). Severity of depression did not act as a mediator as the indirect effect was statistically insignificant.