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Just How Special are the Physical Activity Cognitions in Diseased Populations? Preliminary Evidence for Integrated Content in Chronic Disease Prevention and Rehabilitation

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Abstract

Background: The extant literature is building on subdividing physical activity (PA) correlates and interventions by health condition (e.g., diabetes, cancer, etc.).

Purpose: The purpose of this study was to compare the mean values and correlations of a population sample divided by mutually exclusive health condition status (“nondiseased”, cardiovascular disease and risk factors, cancer, diabetes, and arthritis) on theory of planned behaviour beliefs and physical activity after adjusting for sociodemographic factors. The relationship between compounding health conditions/comorbidities and these beliefs with PA was also evaluated.

Methods: Participants were a U.S. sample of 6,739 adults (M age = 49.65, SD = 16.04) who completed relevant social and medical demographics, measures of behavioural, normative, and control beliefs, and self-reported PA.

Results: Mean analyses identified greater health barriers to PA for the arthritis population compared to the other groups ($\eta^2 > .025$), while physician norms and health barriers were higher for compounding health condition populations compared to the nondiseased group ($\eta^2 > .025$). Belief-behaviour correlations, however, were not different across health conditions ($q < .19$) and nondiseased and single disease populations had larger control belief-behaviour correlations than those populations with compounding health conditions ($q > .19$).

Conclusions: Thus, these data generally provide preliminary evidence for an integrated approach to PA promotion content in primary prevention and health rehabilitation with some possible tailoring in the areas of health barriers. This area of research will benefit from future studies that build off of the present data.

The health benefits of regular physical activity (PA) are well established for both primary prevention of a majority of chronic diseases (1, 2) and the recovery and rehabilitation from these health conditions (3, 4). Unfortunately, a majority of adults do not engage in sufficient PA (5, 6). Thus, there is a need for effective PA interventions from primary prevention to tertiary rehabilitation and care. Although PA interventions have shown some effectiveness, the use of theory-guided programs (7, 8) and continued tailoring for particular populations (9) is advocated. Following biomedical research and given the research link between PA and certain chronic diseases, there is a current tendency to focus theory-based studies and interventions on these particular populations. For example, theory work on the correlates of PA in cardiac rehabilitation (10, 11), cancer (12, 13), and diabetes (14, 15) is abundant in the extant literature. Intervention studies focused on these populations are also increasing (16-19).

Almost no research, however, has compared PA findings across diseased populations or to a "nondiseased" (i.e., an absence of reported health conditions) population despite narrative remarks or parallel analyses (10, 14, 20-23). Interventions can be tailored by content or execution strategy (24, 25). Tailoring PA intervention content for various populations is largely based on the premise that unique barriers and circumstances are present due to the complications of treatment or daily living. Thus, focusing on these aspects in interventions should be more efficacious than PA interventions created for primary prevention. This theorizing is sound (25-27), but our literature search on this topic yielded only three studies that have made a direct comparison between potential PA antecedents. Plotnikoff, Brez and Brunet (28) compared the means of PA-related social cognitive constructs between diabetic and non-diabetic populations and found that self-efficacy/perceived control was significantly higher in the non-diabetics, while fear/perceived vulnerability were significantly higher among diabetics. Still, it should be noted that no differences

were present when comparing pros, cons, self-concept, social support, environmental support, perceived severity, or any measure of actual PA behaviour. Similarly, Prapavessis et al. (29) found no mean differences between a sample of heart disease patients and a non heart disease sample on exercise attitudes, subjective norms, perceptions of control, intentions, or behaviour. Finally, Nelson (30) identified significantly higher perceived benefits and barriers to PA in a matched group without cancer compared to breast cancer survivors, but no difference in actual behaviour. Clearly, the results are mixed at present.

Convincing counter arguments to tailoring PA intervention content by health status can also be posited. First, many major health conditions (e.g., cardiovascular disease, diabetes, some cancers, arthritis) include physical inactivity as a risk factor and are defined through biomedical criteria. Thus, it may be that motivational antecedents to PA are largely stable far before the diagnosis of disease state and even helped produce its onset. Second, many health conditions exist as comorbidities. For example, the American Diabetes Association (31) indicates that more than 65% of diabetics die from heart disease or stroke. Although this factor still allows for differences between "non-diseased" and particular health condition populations, it creates some confounds, and thus limitations toward the argument for specific tailoring of PA content by health condition. Finally, evidence outside of health status generally supports the robustness of PA-related correlates across many sociodemographic factors. For example, constructs in the theory of planned behaviour (TPB) are not moderated by age (32) and demographics are relatively invariant in self-efficacy and PA correlations (33). It may be that many PA correlates are somewhat universal or fundamental.

Therefore, the purpose of this study was to compare the mean values and correlations of a population sample, divided by health condition, on behavioural, normative, and control beliefs and PA controlling for sociodemographic factors. The theoretical framework chosen for this analysis was Ajzen's (34) TPB based on its efficacy in explaining PA (32) and recent support for its use in

health behaviour (35-37) and PA interventions (38-41). Further, the TPB bares considerable content overlap with other popular social cognitive theories (42, 43). TPB beliefs have also been collectively organized for relative content across populations in the PA domain (44). This allows for the majority of key beliefs inclusive of diseased populations to be included in the study. The foundation of intervention content, as proposed by the TPB, resides within behavioural (e.g., PA is good for my health), normative (e.g., my friends would approve of me being active), and control (e.g., limited time will make it difficult for me to be active) beliefs associated with a behaviour. These beliefs, in turn, are hypothesized to comprise attitudes (i.e., evaluation of a behaviour), subjective norms (i.e., perceived approval from others), and perceptions of control (i.e., perception of ability to perform the behaviour) respectively, which influence behaviour primarily via intention (27, 34). TPB theory suggests that 1) a belief-behaviour relationship is necessary to establish a marker for intervention content, and 2) that enough variability needs to be present in mean belief levels to conceivably allow for change in the belief to affect behaviour in an intervention (25, 45).

For our demarcation of health conditions, we selected four major chronic diseases in North America (46, 47): heart disease, cancer, diabetes, and arthritis. Because health conditions for many people are not mutually exclusive, we also evaluated the relationship between compounding health conditions and the TPB beliefs with PA. It may be that increasing comorbidities are a better grouping variable than each particular disease state. Indeed, evidence suggests that quality of life is more compromised as health conditions compound (48). Based on the concurrent argumentation for and against exclusive PA content by health condition, we considered the assessment as exploratory. Still, we did expect that mean differences in control beliefs, particularly related to health, would be higher for our “nondiseased” sample based on prior work (22, 28).

Method

Participants and Procedure

A national U.S. cross-sectional mail out panel survey was conducted via a hired vendor, MarketFacts throughout a 3-month period in 2001. MarketFacts has a consumer mail panel database of approximately 500,000 people who agree to answer surveys in return for small gifts, such as a 30-minute phone card and/or a chance to win a drawing of $250 (both used in the present study). For the present study, Marketfacts randomly selected 12,000 respondents stratified by region, income, household size, age of respondent, and population density. Furthermore, they over-sampled minority and low-income households to obtain a more representative sample. Of the 12,000 surveys that were mailed, 6,739 completed surveys were returned yielding a response rate of 56%. The current study reflects a component of data analyses from a larger, parent study (49). For a more detailed discussion of these procedures, please see Blanchard et al. (49).

The mean age of participants was 49.65 (SD = 16.04) years, 55.7% were female, 30% were visible minorities, 63.9% were married/common-law, and 28.5% had a college education or higher (91.5% reported graduating from high school). Further, 63.7% of respondents were employed and 50.8% had an annual family income < $40,000 USD. For relevant health indicators in this study, 39.3% (n = 2648) reported having cardiovascular disease or associated risk factors (i.e., high blood pressure, high cholesterol, heart attack), 10.6% (n = 714) reported having diabetes, 3.3% (n = 223) reported having cancer at present or in the past, and 28% (n = 1887) reported having arthritis. These rates are a reasonable match of U.S. adult prevalence for cancer (3.6%) (50), CVD (41%) (51), diabetes (9.6%) (52), and arthritis (21%) (53).

Measures

Theory of Planned Behaviour Beliefs were chosen based on the results of a systematic review by Symons Downs and Hausenblas (44). Specifically, behavioural, normative, and control beliefs that had been elicited in nondiseased and diseased populations across at least 20% of past

studies were considered important enough to include in this study. Beliefs were framed similar to the suggested protocol by Ajzen (27). Only expectancy type beliefs were included in the study for the sake of questionnaire brevity and results demonstrating limited additional utility of including the value component across all beliefs (54). PA was defined using the moderate intensity, frequency, and duration criteria advocated by the CDC position stand on recommended PA (55). Specifically, participants were asked to consider activity of moderate intensity or higher, accumulating at least 30 minutes in duration per day, on five or more days per week. Participants were asked to keep this definition in mind when answering PA-related questions.

For the behavioural beliefs, the questions asked participants to tell us “how likely you are to experience each result if you engage in physical activity.” The beliefs included were: 1) have more energy, 2) feel more relaxed (stress relief), 3) have more control over your daily life (daily functioning), 4) have a good quality of life, 5) have fun, 6) lose or maintain weight, 7) look better (appearance), 8) feel good about yourself, 9) get to be with people/socialize, 10) improve your overall fitness level, and 11) decrease the risk of chronic disease. All beliefs were asked using a five-point Likert type scale from 1 (not at all likely) to 5 (very likely). Internal consistency of the behavioural beliefs aggregate was acceptable ($\alpha = .90$).

Normative beliefs were asked in terms “how much encouragement do you get from the following people to be physically active?” The beliefs included were: 1) your spouse or partner, 2) your family, 3) your close friends, 4) people you work with (work colleagues), 5) Your doctor or health care provider (physician), and 6) your employer. These beliefs were asked using a seven-point Likert type scale from 1 (none) to 7 (a lot). Internal consistency of the normative beliefs aggregate was acceptable ($\alpha = .80$).

Control beliefs were asked as “a list of possible things that keep people from being physically active.” Participants were asked “for each one, please tell me how much each influences

your own activity level." Beliefs included: 1) health problems, 2) lack of energy/too tired, 3) lack of time, 4) Costs too much (clothes, equipment, etc.), 5) no facilities (parks, gyms) near me, 6) no one to do physical activity with, and 7) I don't know how to be active. All beliefs were asked using a seven-point Likert type scale from 1 (doesn't influence me at all) to 7 (influences me a lot). Internal consistency of the control beliefs aggregate was acceptable (α = .73).

Physical activity was measured using items modified from the behavioural risk factor surveillance survey (56). These items resemble the leisure score index of the Godin Leisure Time Exercise Questionnaire (57, 58) and ask participants to report their frequency of days performing moderate and vigorous activities 30 min or more per day. Moderate and Strenuous intensity categories were then aggregated to produce a total frequency score to resemble CDC recommendations (55) and create basic correspondence with the phrasing of the other questions.

Analysis

Self-reported health conditions of 1) cardiovasular disease and related risk factors (CVD & risk), 2) diabetes, 3) cancer, and 4) arthritis were coded 1 = presence and 0 = absence. These health conditions were aggregated to create a compounding health condition variable. This variable was subsequently used as a grouping factor for the compounding health conditions analyses. In contrast, participants with a compounding health conditions score of < 2 were included in the analyses across mutually exclusive health condition because this represents the absence of multiple conditions. To compare means across both of these grouping variables, we used univariate analyses of covariance (covariates = age, gender, education, employment status, income, and marital status).

Differences among correlations in the mutually exclusive health conditions and across compounding health conditions were evaluated using the χ^2 test for independent correlations (59). Correlations included were actually partial correlations after controlling for sociodemographic covariates (covariates = age, gender, education, employment status, income, and marital status).

P levels for all tests were set at $p < .01$. Still, the large groups in the sample necessitated an additional criterion for meaningfulness in differences beyond standard Fisherian probability levels. For the mean comparisons, we chose effect size $\eta^2 > 0.024$, based on Cohen's (60) effect size estimates. Specifically, $\eta^2 = 0.025$ is an intermediate between small and medium effect sizes and we considered this an acceptable cut-off for meaningfulness in public health (61). Post-hoc evaluations were based on similar logic. We considered an effect size $d > .34$ as meaningful. For the comparisons of belief-behaviour correlations, we chose effect size $q > .19$ as the criterion of meaningfulness during post-hoc evaluation.

The treatment of TPB beliefs included both an evaluation of the respective (behavioural, normative, control) aggregate, a multivariate R of these aggregates, and each individual belief. The aggregate has a tendency to account for 80% or more of the common variance with PA, but unique variance of specific beliefs is still often present (62). Furthermore, it may be unique beliefs that distinguish populations from each other because of this increased specificity in measurement (25, 27). This could be lost with the inclusion of only the aggregate or multivariate R. We also did not include intention as a dependent variable in this analysis. Intention is considered a proximal behaviour mediator in the TPB (34), but belief-behaviour relations are the key consideration when preparing for tailored interventions (25, 45).

Results

Sample sizes by exclusive health condition were as follows: "nondiseased" n = 3153, cancer n = 51, diabetes n = 117, CVD and related risk factors n = 1215, and arthritis n = 668. Descriptives and mean difference analyses comparing these groups can be found in Table 1. Overall, no meaningful differences ($\eta^2 < 0.25$) across groups were found for any of the behavioural or normative beliefs. In contrast, the aggregate control beliefs differed across groups ($\eta^2 > 0.24$). Specifically, the arthritis population reported less overall control over PA than the nondiseased

population ($d > .34$). Only one specific control belief, however, differed across population samples ($\eta^2 > 0.24$). That is, perceived control over ones health when participating in PA was more of a barrier for the arthritis population than all other groups, but the diabetes and cancer populations also reported this as more of a barrier than the "nondiseased" population.

The similar analysis by compounding health condition was based on aggregating all health conditions to form the grouping variable. The result yielded n = 2051 participants with one health condition, n = 1208 with two conditions, n = 296 with three conditions, and n = 31 with all four of these conditions. Due to the small sample in the four condition group, we aggregated these people with those who reported three conditions in order to form a "3+" group. Descriptives and mean differences analyses comparing these groups can be found in Table 2. Overall, results were quite similar to the mutually exclusive health conditions analyses. Specifically, behavioural beliefs did not differ across groups ($\eta^2 < 0.25$). Only the physician normative belief differed across groups ($\eta^2 > 0.24$) with compounding health condition groups reporting higher normative support from physicians than the "nondiseased" population ($d > .34$). Furthermore, those individuals who reported having "3+" compounding health conditions reported more normative physician support than those with only one condition. Finally, the aggregate control beliefs differed by group as did control beliefs about health and fatigue ($\eta^2 > 0.24$). For the aggregate control beliefs, those reporting 1 condition or more had less control over PA than those who reported none of the health conditions, while those who reported "3+" conditions were also less than those who reported only one condition ($d > .34$). Poor health as a barrier showed a linear pattern in differences from "nondiseased" to "3+" and fatigue as a barrier to PA was higher for "3+" in comparison to those who were "nondiseased" or who reported one health condition ($d > .34$).

Comparisons of belief-behaviour correlations across mutually exclusive health conditions are presented in Table 3. Despite a majority of correlations falling within the small-borderline

medium effect size range (60), no differences among correlations were found across the groups ($p < .01$; $q > .19$). Relatively similar results were also found for the comparison of belief-behaviour correlations across compounding health conditions in Table 4. In these analyses, however, some differences were identified among the perceived control aggregate and two specific control beliefs ($p < .01$; $q > .19$). Specifically, the aggregate of control beliefs correlated more with behaviour for "nondiseased" participants and people with one health condition than those who reported "3+" health conditions and similar findings for perceptions about PA cost and social support were found between "nondiseased" and "3+" samples ($q > .19$).

Discussion

The purpose of this study was to compare the mean values and correlations of a population sample divided by health condition status ("nondiseased", cardiovascular disease and risk factors, cancer, diabetes, and arthritis) on TPB beliefs and PA after adjusting for sociodemographic factors. Based on concurrent argumentation and prior literature for and against differences, we considered the assessment as exploratory. Because health conditions for many people are not mutually exclusive, we also evaluated the relationship between compounding health conditions and social cognitive beliefs with PA.

Results generally provided evidence for the notion that health condition does not affect PA and its behavioural, normative, and control belief antecedents with some notable exceptions. In terms of mean differences, none of the behavioural beliefs differed across any of the groups. This suggests that the expected outcomes associated with PA are stable regardless of health condition. For subjective norm, only the belief about physician encouragement differed across compounding health conditions, with those who had health conditions generally reporting more encouragement than the "nondiseased" sample. This makes sense because it seems unlikely that both time spent in the health care system and physician concerns would be experienced by the "nondiseased" group.

Similarly, control beliefs were different across mutually exclusive health condition and compounding health condition. These specific beliefs focused on barriers regarding health for both analyses and fatigue in the compounding health conditions analysis. Interestingly, our results complimented the prior work in this domain. Specifically, "nondiseased" individuals reported less barriers than diabetics and cancer survivors (28, 30), but were not different from the cardiovascular disease and related risk factors population (29). The arthritis sample, however, reported the highest barriers compared to all groups. This compliments prior research demonstrating that physical functioning is most compromised among arthritis populations when compared to other health populations (48). It appears that the chronic debilitation and pain associated with arthritis is even more pressing to PA than the other health conditions. This mean difference may also have some implications for intervention effectiveness. Based on TPB theory (25), the results suggest that the arthritis population may have more range for improvement (i.e., reduction of health problems as a barrier) on health barriers because these initial mean levels are higher. In terms of compounding health conditions, the results also suggest that health and fatigue barriers to PA may have more range for improvement with compounding disease populations than healthier populations.

We believe the findings for mean differences in the health control belief and even the normative physician belief help validate the measurement in this study. Specifically, it would seem strange if self-reported health as a barrier to PA or physician support were not different in groups organized by health condition because the debilitating aspects of many of these conditions are well-validated (48). Still, it is important to note that differences in belief-behaviour correlations are required to justify health condition as a moderator of potential intervention content (25, 45). Our analyses did not support this conjecture. Indeed, no differences across health conditions were evident for behavioural, normative, or control beliefs. This supports the rationale for similarity in belief-content. As mentioned previously, many belief antecedents to PA may be fundamental or

basic. These populations were, of course, “nondiseased” before their biomedical diagnosis and the new label may be completely independent of PA issues. This contrasts more stable moderators that have also gained attention for PA tailoring such as gender (63), the environment (64, 65), ethnicity/culture (66), and personality (67). In these cases, the populations have presumably had a continuous influence of these factors across the life span.

Of note, in the analysis of compounding health conditions, only perceived barriers (i.e., the aggregate, cost, and social support) differed in belief-behaviour correlations. Contrary to what one might expect, however, the larger correlations were present for the groups with less compounding health conditions. Moreover, the group with three or more compounding health conditions did not show significant barrier-PA correlations and health barriers did not differ across groups. Belief-differences about the cost of PA and social support suggest that populations without health conditions may perceive being neglected in terms of PA needs. This is possible. A health care focus on tertiary rehabilitation over primary prevention is noticeable. The results suggest that some tailoring to primary prevention populations or populations with less compounding health conditions, on PA barriers may be warranted.

The results of this study provide important preliminary evidence to support an integrated approach to PA promotion content at least in the form of generalized beliefs with some small exceptions. This is suggestive of integrated intervention content, but in no way supports or refutes the tailoring of content execution. Specialized execution, or messaging with multiple behaviours and self-management strategies tailored by relevant disease/health condition, may be very useful during persuasive appeals towards behaviour change. Indeed, prior experimental work has demonstrated that generalized interventions can be transferred across health conditions but tailored execution may be even more effective (68, 69).

Limitations of this current study necessitate future research before any definitive conclusions can be drawn. Indeed, we hope that these results spark future work. First, our population sample was large, but group size was dramatically un-equivalent. Homogeneity of variance and equality of slopes was supported in the covariance analyses ($\eta^2 < .01$), but group representation, particularly for cancer and diabetes, was small. Thus, the results from these groups in particular should be interpreted with caution. This was similar to Plotnikoff et al. (28) and may be a limitation when using population samples because disease prevalence rates differ. Future research comparing specific diseases will likely benefit from case-control or cohort sampling. Second, the study has measurement and design limits. Our measurement of health conditions was crude and the cross-sectional design limits any causal inferences. It would be prudent for future research to employ more detailed measures of these health conditions (e.g., different types of cancer, diabetes), more objective measures of PA, and longitudinal change studies (both in terms of health condition and belief-behaviour relations). Third, our choice of beliefs was based on a review of TPB elicitation studies, but it is entirely possible that different correlates not included in this study may discriminate across health conditions. Future work expanding beyond the TPB or even including post-intentional constructs (e.g., planning, implementation intentions) is warranted. Moreover, our belief measures may lack specificity of belief-level targets produced for each disease. Obviously, we needed to address broad beliefs (e.g., health, fatigue) over highly specific beliefs (e.g., chemotherapy treatment) in order to compare across conditions, but additional studies that focus on comparisons across within-disease groups (e.g., types of cancer) may also be very informative. Type one experimentwise error may also be a limitation to these multiple belief analyses. Replication is desirable. Finally, although a response rate of 56% is considered adequate in survey research (70), external validity in this study may have been compromised if non-responders differed from survey respondents on some relevant characteristics. Still, the sample was quite representative

of national disease prevalence rates. Further, 70.2% reported not meeting CDC PA guidelines which is similar to national PA prevalence rates of 73% (71).

In summary, the extant literature is building on subdividing PA correlates and interventions by disease state. This follows biomedical research, but may not be necessary in the psychosocial PA literature. This study provided preliminary evidence that health condition does not moderate PA or its presumed generalized belief-based antecedents derived from the TPB, with some exceptions. Mean analyses identified greater health barriers to activity for the arthritis population compared to the other groups, while physician norms and health barriers were higher for all compounding health condition populations compared to the nondiseased group. Belief-behaviour correlations, however, were not different across health condition, and nondiseased and single disease populations had larger control belief-behaviour correlations than those populations with compounding health conditions. Thus, these data generally provide preliminary evidence for an integrated approach to PA promotion content in primary prevention and health rehabilitation with some possible tailoring in the areas of health barriers and physician support. This area of research will benefit from future studies that build off of these present data.

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Table 1

Mean[A] differences among Mutually Exclusive Health Condition Populations for Theory of Planned Behaviour Beliefs and Physical Activity

Construct	"Nondiseased" (n = 3153)	Cancer (n = 51)	Diabetes (n = 117)	CVD & Risk (n = 1215)	Arthritis (n = 668)	F	η^2	Post-Hoc
Behavioral Beliefs	4.02 (0.68)	3.92 (0.74)	3.87 (0.84)	4.01 (0.70)	3.92 (0.79)	4.06*	.00	
Energy	4.21 (0.92)	4.09 (1.08)	3.99 (1.15)	4.12 (0.99)	4.03 (1.12)	5.66*	.00	
Stress Relief	4.07 (0.97)	3.98 (1.06)	3.82 (1.15)	3.98 (0.99)	3.88 (1.13)	5.88*	.01	
Fun	3.91 (1.06)	3.89 (1.04)	3.70 (1.32)	3.82 (1.12)	3.75 (1.15)	3.74*	.00	
Weight Control	4.18 (0.95)	4.11 (1.11)	3.97 (1.07)	4.23 (0.91)	4.09 (1.07)	4.03*	.00	
Appearance	4.22 (0.92)	4.13 (0.91)	4.02 (1.09)	4.27 (0.89)	4.17 (1.05)	2.80	.00	
Social Interaction	3.16 (1.27)	3.01 (1.20)	2.86 (1.41)	3.17 (1.28)	3.10 (1.31)	2.01	.00	
Fitness	4.24 (0.87)	4.03 (0.98)	4.20 (1.06)	4.24 (0.91)	4.13 (1.03)	2.47	.00	
Reduce Disease Risk	4.26 (0.94)	4.28 (0.88)	4.25 (1.02)	4.26 (0.97)	4.23 (1.00)	0.15	.00	
Daily functioning	3.70 (1.15)	3.60 (1.16)	3.69 (1.25)	3.69 (1.12)	3.61 (1.20)	0.81	.00	
Feel good about yourself	4.24 (0.91)	4.08 (0.96)	4.08 (1.10)	4.24 (0.91)	4.16 (1.02)	2.04	.00	
Quality of life	4.07 (0.91)	3.94 (0.96)	3.96 (1.13)	4.04 (0.95)	3.95 (1.04)	2.41	.00	
Normative Beliefs	3.74 (1.32)	3.54 (1.27)	3.94 (1.37)	3.92 (1.25)	3.77 (1.26)	4.86*	.00	
Spouse/Partner	4.48 (2.00)	4.03 (1.94)	4.68 (2.12)	4.63 (1.92)	4.45 (1.99)	2.44	.00	
Family/Children	4.23 (1.91)	3.94 (1.83)	4.49 (2.08)	4.24 (1.94)	4.14 (1.96)	1.16	.00	
Friends	3.68 (1.88)	3.46 (176)	3.59 (2.00)	3.72 (1.83)	3.64 (1.85)	0.47	.00	
Work Colleagues	3.14 (1.65)	3.21 (1.47)	3.09 (1.51)	3.23 (1.54)	3.16 (1.44)	0.77	.00	
Physician	4.26 (1.96)	4.18 (2.08)	5.03 (2.14)	4.96 (1.80)	4.51 (1.91)	29.81*	.02	
Employer	2.68 (1.54)	2.42 (1.05)	2.75 (1.35)	2.75 (1.44)	2.70 (1.31)	0.96	.00	
Control Beliefs	2.87 (1.19)	3.22 (1.20)	3.16 (1.26)	3.17 (1.19)	3.53 (1.19)	45.16*	.03	arthritis>ND
Poor Health	2.34 (1.90)	3.08 (2.32)	3.18 (2.39)	2.77 (2.11)	4.78 (1.94)	197.31*	.13	arthritis>all; diab/can>ND
Fatigue	4.01 (2.02)	4.97 (1.72)	4.63 (1.93)	4.45 (1.96)	4.79 (1.87)	26.90*	.02	
Lack of Time	3.87 (1.89)	4.02 (1.97)	3.84 (2.02)	3.96 (1.89)	3.93 (1.89)	0.59	.00	
Cost	2.56 (1.94)	2.68 (1.89)	2.83 (2.11)	2.76 (1.87)	3.00 (2.07)	8.03*	.01	
Lack of Access	2.45 (1.83)	2.80 (1.98)	2.48 (1.89)	2.69 (1.87)	2.78 (2.01)	6.18*	.01	
Lack of Social Support	2.92 (2.00)	2.75 (1.87)	3.01 (1.92)	3.32 (2.02)	3.19 (2.05)	9.20*	.01	
Lack of Knowledge	1.96 (1.50)	2.24 (1.89)	2.19 (1.70)	2.20 (1.59)	2.23 (1.73)	7.68*	.01	
Physical Activity Frequency	2.09 (2.90)	1.53 (2.41)	2.02 (3.23)	1.82 (2.74)	1.84 (2.75)	2.62	.00	

*$P<0.01$; Criterion of meaningfulness based on $\eta^2 > 0.024$. Post hocs based on Cohen's (1992) effect size $d > .34$. A = adjusted means based on covariates. Age, gender, education, employment status, income, and marital status included as covariates. ND = Nondiseased.

Table 2

Mean[A] differences among Compounding Health Conditions for Theory of Planned Behaviour Beliefs and Physical Activity

Construct	"Nondiseased" (n = 3153)	One (n = 2051)	Two (n = 1208)	Three + (n = 327)	F	η^2	Post-Hoc
<u>Behavioral Beliefs</u>	4.02 (0.68)	3.96 (0.74)	3.94 (0.78)	3.99 (0.80)	3.96*	.00	
Energy	4.19 (0.93)	4.06 (1.05)	4.05 (1.10)	3.97 (1.18)	9.51*	.00	
Stress Relief	4.06 (0.97)	3.93 (1.06)	3.94 (1.06)	3.87 (1.13)	7.92*	.00	
Fun	3.92 (1.06)	3.79 (1.14)	3.72 (1.14)	3.81 (1.15)	8.99*	.00	
Weight Control	4.16 (0.96)	4.15 (0.98)	4.12 (1.05)	4.25 (1.03)	1.55	.00	
Appearance	4.20 (0.92)	4.19 (0.96)	4.20 (1.00)	4.24 (1.02)	0.29	.00	
Social Interaction	3.19 (1.28)	3.14 (1.29)	3.18 (1.30)	3.29 (1.29)	1.53	.00	
Fitness	4.23 (0.87)	4.17 (0.96)	4.15 (1.02)	4.24 (0.98)	2.19	.00	
Reduce Disease Risk	4.26 (0.94)	4.24 (0.98)	4.19 (1.03)	4.24 (1.12)	1.29	.00	
Daily functioning	3.71 (1.15)	3.67 (1.15)	3.65 (1.17)	3.75 (1.16)	1.06	.00	
Feel good about yourself	4.24 (0.91)	4.19 (0.96)	4.18 (1.01)	4.26 (1.00)	2.08	.00	
Quality of life	4.07 (0.91)	4.00 (0.99)	3.99 (1.04)	3.95 (1.10)	2.57	.00	
<u>Normative Beliefs</u>	3.74 (1.32)	3.86 (1.27)	4.01 (1.19)	4.19 (1.23)	16.22*	.01	
Spouse/Partner	4.43 (2.00)	4.50 (1.97)	4.52 (1.94)	4.70 (2.07)	1.75	.00	
Family/Children	4.24 (1.91)	4.23 (1.95)	4.40 (1.98)	4.52 (2.00)	3.56*	.00	
Friends	3.69 (1.88)	3.68 (1.84)	3.87 (1.90)	4.13 (2.00)	6.81*	.00	
Work Colleagues	3.12 (1.65)	3.18 (1.51)	3.25 (1.37)	3.37 (1.49)	2.89	.00	
Physician	4.27 (1.96)	4.86 (1.88)	5.22 (1.80)	5.61 (1.60)	84.31*	.04	3,2>ND; 3>1
Employer	2.68 (1.54)	2.73 (1.39)	2.78 (1.20)	2.79 (1.10)	1.44	.00	
<u>Control Beliefs</u>	2.84 (1.19)	3.26 (1.21)	3.47 (1.20)	3.76 (1.19)	106.50*	.05	all>ND; 3>1
Poor Health	2.41 (1.90)	3.55 (2.31)	4.42 (2.13)	5.08 (1.82)	302.88*	.12	3>2>1>ND
Fatigue	3.93 (2.02)	4.50 (1.93)	4.75 (1.88)	5.31 (1.82)	73.65*	.03	3>1,ND
Lack of Time	3.71 (1.89)	3.76 (1.90)	3.73 (1.87)	3.77 (1.94)	0.37	.00	
Cost	2.54 (1.92)	2.83 (1.96)	2.85 (1.99)	3.01 (2.06)	12.79*	.01	
Lack of Access	2.44 (1.83)	2.72 (1.92)	2.79 (1.95)	3.03 (2.07)	15.74*	.01	
Lack of Social Support	2.87 (2.00)	3.22 (2.02)	3.36 (2.07)	3.54 (2.07)	20.80*	.01	
Lack of Knowledge	1.98 (1.50)	2.25 (1.65)	2.38 (1.80)	2.61 (1.95)	23.99*	.01	
Physical Activity Frequency	2.04 (2.90)	1.74 (2.76)	1.76 (2.62)	1.51 (2.22)	6.20*	.00	

*P<0.01; Criterion of meaningfulness based on $\eta^2 > 0.024$. Post hocs based on Cohen's (1992) effect size $d > .34$. A = adjusted means based on covariates. Age, gender, education, employment status, income, and marital status included as covariates. ND = Nondiseased.

Table 3

Correlation differences among Mutually Exclusive Health Condition Populations for Theory of Planned Behaviour Beliefs with Physical Activity

Construct	"Nondiseased" (n = 3144)	Cancer (n = 42)	Diabetes (n = 108)	CVD & Risk (n = 1206)	Arthritis (n = 659)	χ^2	Post-Hoc
Behavioral Beliefs	.19*	.28	.25*	.14*	.19*	3.44	
Energy	.14*	.16	.10	.09*	.13*	2.36	
Stress Relief	.15*	.05	.13	.11*	.15*	1.85	
Fun	.17*	.40*	.30*	.15*	.19*	5.23	
Weight Control	.11*	.15	.19	.08*	.13*	2.11	
Appearance	.11*	.12	.17	.06	.11*	2.89	
Social Interaction	.04	.28	.07	.06	.09	3.68	
Fitness	.16*	.20	.12	.14*	.17*	0.73	
Reduce Disease Risk	.15*	.10	.28*	.12*	.07	6.32	
Daily functioning	.14*	.18	.22	.08*	.15*	4.68	
Feel good about yourself	.14*	.28	.19	.10*	.13*	2.78	
Quality of life	.15*	.27	.27*	.10*	.17*	5.49	
Normative Beliefs	.14*	.40*	.05	.12*	.13*	4.38	
Spouse/Partner	.12*	.23	.00	.11*	.11*	2.08	
Family/Children	.11*	.24	.05	.11*	.09	1.31	
Friends	.14*	.48*	-.04	.13*	.10	9.98	
Work Colleagues	.08*	.30	.09	.09*	.12*	2.80	
Physician	.08*	.32	.04	.04	.10*	4.67	
Employer	.07*	.19	.14	.04	.08	2.21	
Control Beliefs	-.24*	-.12	-.18	-.23*	-.17*	3.64	
Poor Health	-.05*	-.10	-.12	-.07	-.13*	3.92	
Fatigue	-.18*	-.11	-.04	-.19*	-.15*	2.94	
Lack of Time	-.19*	-.17	-.04	-.14*	-.05	13.16*	
Cost	-.15*	.19	-.13	-.11*	-.07	8.25	
Lack of Access	-.14*	-.18	-.15	-.12*	-.05	4.70	
Lack of Social Support	-.19*	-.05	-.16	-.21*	-.10*	6.59	
Lack of Knowledge	-.15*	-.11	-.13	-.17*	-.15*	0.53	
Multivariate Model	.30*	.42	.33*	.28*	.27*	1.84	

*P<0.01. Post hocs based on Cohen's (1992) effect size $q > .19$. Age, gender, education, employment status, income, and marital status included as covariates.

Table 4

Correlation differences among Compounding Health Conditions for Theory of Planned Behaviour Beliefs with Physical Activity

Construct	"Nondiseased" (n = 3144)	One (n = 2042)	Two (n = 1199)	Three + (n = 318)	χ^2	Post-Hoc
Behavioral Beliefs	.19*	.17*	.15*	.18*	1.60	
Energy	.14*	.10*	.11*	.14*	2.35	
Stress Relief	.15*	.12*	.13*	.13	1.24	
Fun	.17*	.18*	.12*	.11	3.99	
Weight Control	.11*	.10*	.09*	.13	0.61	
Appearance	.11*	.08*	.08*	.08	1.53	
Social Interaction	.04	.07*	.06	.14*	3.48	
Fitness	.16*	.15*	.17*	.14*	0.44	
Reduce Disease Risk	.15*	.11*	.09*	.17*	4.61	
Daily functioning	.14*	.12*	.12*	.15*	0.79	
Feel good about yourself	.14*	.12*	.13*	.13	0.52	
Quality of life	.15*	.14*	.14*	.10	0.79	
Normative Beliefs	.14*	.13*	.17*	.17*	1.54	
Spouse/Partner	.12*	.11*	.11*	.11	0.17	
Family/Children	.11*	.10*	.13*	.13	0.82	
Friends	.14*	.11*	.14*	.14*	1.32	
Work Colleagues	.08*	.10*	.08*	.13	1.15	
Physician	.08*	.07*	.14*	.12	4.51	
Employer	.07*	.05	.07	.13	1.91	
Control Beliefs	-.24*	-.20*	-.17*	-.01	18.23*	ND, 1 > 3
Poor Health	-.05*	-.08*	-.12*	-.01	5.66	
Fatigue	-.18*	-.16*	-.18*	-.08	3.31	
Lack of Time	-.19*	-.10*	-.05	-.04	24.18*	
Cost	-.15*	-.09*	-.08*	.05	15.24*	ND > 3
Lack of Access	-.14*	-.10*	-.07*	.04	12.14*	
Lack of Social Support	-.19*	-.17*	-.11*	.01	15.58*	ND > 3
Lack of Knowledge	-.15*	-.16*	-.13*	-.03	5.07	
Multivariate Model	.30*	.26*	.26*	.21*	4.66	

*P<0.01; Post hocs based on Cohen's (1992) effect size $q > .19$. Age, gender, education, employment status, income, and marital status included as covariates. ND = Nondiseased.