



Published in final edited form as:

Health Educ Behav. 2014 December ; 41(6): 642–650. doi:10.1177/1090198114532289.

Does Concern Motivate Behavior Change? Exploring the Relationship Between Physical Activity and Body Mass Index Among Low-Income Housing Residents

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INTRODUCTION

National health priorities are focused on the obesity epidemic now more than ever before. Increasing rates of physical inactivity and overweight/obesity are associated with increased morbidity and mortality, resultant from elevated rates of chronic diseases such as cardiovascular disease, cancer, and diabetes. (Centers for Disease Control and Prevention 2011; Centers for Disease Control and Prevention 2012) Evidence suggests that individuals may be more likely to engage in physical activity and maintain a healthy weight if they feel at-risk for diseases associated with leading a sedentary lifestyle and being overweight/obese. (Renner, Spivak, Kwon and Schwarzer 2007) Level of concern or worry about such susceptibility is fundamentally important and highly related to an individual's perceived risk (Loewenstein and Mather 1990; Lipkus, Iden, Terrenoire and Feaganes 1999; Beebe-Dimmer, Wood, Gruber et al. 2004).

Affect or emotions (i.e., concern, worry) may play a similar role to cognitions (i.e., perceived risk) in fostering health behavior change (Janis 1967; Weinstein 1982; Weinstein 1987). Concern, which may be even more powerful than belief about one's risk (Lipkus, Iden et al. 1999), may cyclically influence perceived susceptibility, which in turn impacts health-protective actions (Stephan, Boiche, Trouilloud, Deroche and Sarrazin 2011) that help stave off poor health by playing a role in intention formation (Renner, Spivak et al. 2007; Schwarzer 2008)—motivating healthy behavior adoption/change. (Rosenstock 1974; Rogers 1975; Witte 1992; Schwarzer 2008) Several health behavior models and theories are implicit (i.e., Health Belief Model, Protection Motivation Theory, and the Precaution Adoption Model). (Lipkus, Iden et al. 1999) Informed by these, the conceptual model for this investigation largely combines constructs from the Theory of Reasoned Action (Ajzen and Fishbein 1980), which suggests that behavioral intention is dependent upon an

individual's attitudes about the behavior and norms, and the Transtheoretical stages of change model (Prochaska and DiClemente 1983), which submits that change is a process that involves progress via a series of stages. These stages include pre-contemplation (no intention to change in the foreseeable future and unaware of problematic behavior); contemplation (recognition of problematic behavior and decisional balance occurs); preparation (intention to take action in immediate future and small steps may already be taken); action (overt behavioral changes made); and maintenance (sustained healthy behavior and relapse prevention). (Norcross, Krebs and Prochaska 2010) Taken together, these theories suggest that those who feel confident in their ability to enact behavior change (self-efficacy) and express intention to do so by taking actions (such as participating in behavioral counseling or wellness programs) may be more worried about their perceived vulnerability to illness (concern).

Studies on the role and strength of the relationship between concern and health behaviors have generated inconsistent results. Disparate findings suggest that associations differ depending on the type of health behavior or risk status (acquisition/cessation); individual perceptions about the ability to change said behavior; and/or other external influences specific to each risk factor. (Brewer, Chapman, Gibbons et al. 2007) Further, a majority of studies examining such relationships have focused on White populations of higher socio-economic status (SES). (Beebe-Dimmer, Wood et al. 2004; Jones, Roche and Appel 2009) Lower SES groups face an undue number of economic, environmental, and social constraints that can hinder the adoption and maintenance of a healthy lifestyle. (Eyler, Matson-Koffman, Vest et al. 2002; McIntyre, Glanville, Raine et al. 2003; Eikenberry and Smith 2004; Parker and Keim 2004; Chang, Nitzke, Guilford, Adair and Hazard 2008) Furthermore, minority racial/ethnic groups may hold distinct cultural attitudes and norms that influence body mass index (BMI) and weight-control behaviors such as physical activity, differently. (Thompson and Sargent 2000; Bennett and Wolin 2006) As such, further examination of the relationship between concern and health behaviors/states among less advantaged populations is warranted.

The goal of this study was to explore the relationship between levels of concern and physical activity and BMI, among a racially/ethnically diverse low SES population. Specifically, we hypothesized that concern would be associated with more physical activity and lower BMI. We further hypothesized that concern would be associated with intent-to-change, and higher self-efficacy and likelihood of participation in behavioral counseling and wellness programs. Understanding these relationships will help inform more successful health promotion interventions tailored to meet the needs of low-income individuals at varying stages of readiness for behavior change.

METHODS

Data source and setting

We used data from the resident survey portion of the Health in Common (HIC) study (2005-2009), conducted between February 2007 and June 2009, to examine the relationship between concerns and physical activity and BMI. The HIC study examined cancer risks for low-income residents living in publicly and privately managed housing in the greater Boston

area. To be eligible for the study, housing sites needed to be considered low-income based on Department of Housing and Urban Development guidelines and consist of family units with a minimum of 40 households per site. At the individual level, participants were required to be residents of one of the housing developments assessed; over 18 years of age; and speak English, Haitian Creole, or Spanish. Households were randomly selected within housing developments; residents were randomly selected within households. Bilingual interviewers conducted face-to-face interviews with residents about social and physical determinants of risk-related behaviors. A total of 1,937 households were randomly selected of which 258 were ineligible. Of the 1,679 eligible households, surveys were completed in 828 (49%). The HIC study was approved by the Dana-Farber Cancer Institute Institutional Review Board. Additional details regarding study methodology are available elsewhere. (Tamers, Okechukwu, Allen et al. 2012)

Measures

Concern—Residents' level of concern regarding specific health behaviors and risk status was assessed by asking if they were “very concerned”, “moderately concerned”, “a little concerned”, or “not at all concerned” about their 1) amount of daily exercise, and 2) weight. Response categories were further combined into “very/moderately concerned” versus “a little/not at all concerned.” These questions were specifically developed and tested for the HIC study.

Physical activity—Participants were asked to report daily average vigorous and moderate physical activity that lasted at least 10 minutes at a time, over the course of the previous week. (Craig, Marshall, Sjostrom et al. 2003) This measure combined occupational, home, and leisure-time activity and assessed both frequency and intensity. We captured daily total physical activity by summing the hours of both vigorous and moderate activity.

Body mass index—BMI was calculated as weight (kg) divided by height squared (m^2); height and weight were measured by self-report.

Behavioral intention—Participants were asked about their intention to increase their physical activity and lose weight. (University of Rhode Island Stages of Change algorithm as used in Pinto 2002) Those who did not intend to do so in the next 30 days but rather in the next six months were coded in “contemplation”; those who indicated that they did not intend to improve in either 30 days or six months were considered in the “pre-contemplation” stage. Those who indicated that they intended to do so in the next 30 days were categorized as being in the “preparation” stage of behavior change. Individuals who were already at a healthy BMI ($BMI < 25 \text{ kg}/m^2$) or who met the physical activity guidelines were classified in the “action/maintenance” stage. Categories were further dichotomized into “pre-contemplation/contemplation” versus “preparation/action” stage, as has been done in previous work (Sorensen, Allen, Adamkiewicz et al. 2013).

Self-efficacy—Respondents were asked if they were “very sure”, “somewhat sure”, or “not at all sure” that they could: 1) lose weight and 2) do 30 minutes of moderate/vigorous

physical activity at least 5 days a week, in the next 30 days if they needed to do so. (University of Rhode Island Stages of Change algorithm as used in Pinto 2002)

Behavioral counseling—Participants were asked if they were told by a doctor or healthcare professional in the previous year to: 1) control/lose weight and 2) increase physical activity. These questions were specifically developed and tested for the HIC study.

Wellness programs—Residents were asked about prior participation and future willingness to participate in health promotion programs specific to physical activity and weight loss (yes, no, or maybe). Due to a limited number of participants responding “maybe”, these were grouped with the “yes” category, as this response indicates potential willingness to participate. These questions were specifically developed and tested for the HIC study.

Statistical Procedures

Bivariate analyses were conducted to examine the effects of each covariate and socio-demographic characteristic separately with the outcomes using linear/logistic regressions. The following covariates were examined at the bivariate stage: education, age, gender, race/ethnicity, income, poverty level, and marital status.

Multivariable logistic regression analyses were conducted for each of the two concerns, where the probability of being “very/moderately” concerned was compared to being “a little/not at all” concerned. The clustering of subjects within sites was taken into account by including site as a random effect. In all multivariable regression models, we adjusted for socio-demographic characteristics that were found to be significant at the bivariate stage. Initial models tested each concern with its behavior/status counterpart (e.g., if concerns about physical activity was significantly associated with physical activity). Analyses were run in 2012 using SAS version 9.2 (SAS Institute, Cary, NC).

RESULTS

Details on the HIC sample characteristics have been previously described. (Tamers, Okechukwu et al. 2012) Briefly, the majority of the sample was female, married, of Hispanic or non-Hispanic Black race/ethnicity, with a mean age of 44 years; most residents had a high school diploma or less and were living below the poverty limit (results not shown).

Table 1 shows bivariate associations between concern about weight and covariates. Women, residents with higher BMIs, those in “preparation/action” compared to “pre-contemplation/contemplation” stage, and those who had received behavioral counseling and participated (or would) in a weight management program were “very/moderately” concerned about their weight compared to those reporting “little/no” concern.

When we included these variables in a multivariable model (Table 2), we found that BMI, intention to lose weight (“preparation/action” stage), behavioral counseling, and prior and

future willingness to participate in a weight management program all remained statistically significant.

Table 3 shows bivariate associations between concern about physical activity and covariates. Residents with higher BMIs, and those who had received behavioral counseling and were interested in participating in a physical activity program in the future were “very/moderately” concerned about physical activity compared to those reporting “little/no” concern.

When we included these variables in a multivariable model (Table 4), we found that BMI, behavioral counseling, and prior program participation were statistically significant.

DISCUSSION

In this study, we examined the relationship between levels of concern and physical activity and BMI among racially/ethnically diverse residents of low-income housing. We also studied factors that might influence these associations, specifically intention-to-change, self-efficacy, and participation in behavioral counseling and wellness programs.

Our findings are generally in line with our hypotheses. With respect to both BMI and physical activity, residents with higher BMIs, and those who had received behavioral counseling and had participated in a wellness program were more concerned about their weight and physical activity. Additionally, those in “preparation/action” compared to “pre-contemplation/contemplation” stage and those who indicated willingness to participate in a weight management program in the future were more concerned about their weight. These results suggest that those more concerned about overweight/obesity (by nature of their BMI or physical inactivity) recognize that they are at-risk, intend to change, and many have made prior efforts in that regard through participation in behavioral counseling or wellness interventions. While our conceptual model suggests that these factors might have been mediated by self-efficacy, we did not find this to be the case. This may be due to the relatively high levels of self-efficacy for behavior change across the HIC sample overall.

A number of studies have examined concern in relation to different health-related indicators or outcomes (e.g., genetic testing, cancer, smoking cessation) and in varied population subgroups (e.g., children and adolescents, university students, pregnant women), with inconsistent findings. Many fewer have explored such relationships as examined in this study and population. Still, our results chiefly complement several other more akin and recent study findings. In a multi-national (U.S.A. France, UK, Canada), longitudinal study of smokers, Aubin et al., 2009 found that high baseline BMI was associated with higher weight concerns; however, the authors uncovered that weight gain at follow-up was not associated with baseline weight concerns or self-efficacy in preventing weight gain. (Aubin, Berlin, Smadja and West 2009) A cross-sectional study among adults living with rheumatoid arthritis found that stronger beliefs that physical activity was beneficial for their illness and increased motivation to participate in physical activity were related to higher levels of physical activity participation, while concerns about physical activity participation were not. (Ehrlich-Jones, Lee, Semanik et al. 2011) In a sample of romantic partners, further evidence

showed that individuals' weight concerns were associated with their weight status and that those who had higher BMI were most likely to report weight concerns. (Markey and Markey 2011)

There are several plausible reasons for our findings of a positive association between concern and intention-to-change. First, those with an unhealthier BMI or lower levels of physical activity may be in the process of trying to change. As with the abundant literature on smoking cessation, health behaviors are often highly entrenched and difficult to change (Prochaska and DiClemente 1983), requiring ongoing and multiple 'attempts' to reach goals. This is supported by the finding that more concerned individuals had previously participated in intervention programs. Another possible explanation is that concern might prompt attempts at change, but is not sufficient to accomplish behavior change in-and-of itself, particularly among vulnerable populations who face challenging social/contextual factors. For example, factors not measured in this study, such as diminished access to healthy foods, absence of safe locations or time for physical activity, negative socio-cultural norms or attitudes, or competing priorities, may thwart efforts for goal attainment among those with the best of intentions to change. In either case, these findings suggest that interventions in this high-risk, yet motivated population would be well-received; hence, interventions designed to reach groups with behavioral risks should gauge levels of concern, and ensure accurate risk perceptions and tailored messaging.

Limitations and Strengths

These cross-sectional survey data cannot elucidate a possible temporal relationship between concern and subsequent outcomes or conversely between risk behaviors/states and subsequent levels of concern. (Brewer, Weinstein, Cuite and Herrington 2004; Brewer, Chapman et al. 2007) The self-reported measures of physical activity and BMI used may be subject to reporting bias due to social desirability or other factors. (Slootmaker, Schuit, Chinapaw, Seidell and van Mechelen 2009) Still, this study includes a number of important strengths. One such strength is the measurement of concern and health behaviors in an understudied population of racially/ethnically diverse lower SES individuals. What's more, we were able to capture often overlooked measures informing these associations, such as behavioral counseling (Kim, McEwen, Kerr et al. 2007) and wellness intervention participation.

Implications

This study suggests that concern and factors such as behavioral intention and counseling, and wellness program participation play important, if insufficient roles, in improving health behaviors and states in low-income housing residents. Improving awareness of risk is important; however, additional tactics other than those targeting cognitive mediators of change are likely necessary. For instance, motivational strategies, such as coaching, behavioral contracting, and incentives, have been found effective in some settings and populations. (Sutherland, Christianson and Leatherman 2008) Moreover, strategies that assist in overcoming social/contextual barriers to change for low SES groups, such as increased access to (safe) exercise facilities, healthy food choices, and stress reduction, may also be helpful. (Miller, Mushi, Ahmed et al. 2004; Lovasi, Hutson, Guerra and Neckerman

2009) To that endeavor, future like studies should examine additional constructs in these pathways specific to vulnerable populations, including attitudes, social and subjective norms, cultural influences, and other social/contextual factors.

Acknowledgments

Funding

This research was supported by the National Cancer Institute (R01CA111310-01A1), the NIH/NCI Harvard Education Program in Cancer Prevention and Control (R25 CA057713; PI: Glorian Sorensen, PhD, MPH), and the NIH/NCI Reducing Social Disparities in Cancer Risk (K05 CA108663-05 to GS).

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Table 1

Association of HIC participant characteristics with weight concerns (2005-2009), Boston, MA, U.S.A.

Predictors	Weight concerns		p-value
	Very/moderately n=491 (60%)	A little/not at all n=334 (40%)	
Education Grade school Some high school High school graduate > High school	80(18.39%) 70(16.09%) 124(28.51%) 161(37.01%)	71(23.83%) 53(17.79%) 75(25.17%) 99(33.22%)	0.23
Age 18-29 30-39 40-49 50-59 60-70+	90(18.33%) 130(26.48%) 113(23.01%) 87(17.72%) 71(14.46%)	62(18.73%) 87(26.28%) 56(16.92%) 57(17.22%) 69(20.85%)	0.08
Gender Male Female	83(16.9%) 408(83.1%)	85(25.45%) 249(74.55%)	0.003
Race Hispanic Non-Hispanic White Non-Hispanic Black Other	209(42.74%) 55(11.25%) 179(36.61%) 46(9.41%)	131(39.46%) 38(11.45%) 135(40.66%) 28(8.43%)	0.66
Income (weekly) \$0-100 \$101-250 \$251-500 \$501-750 \$751+	41(8.89%) 146(31.67%) 155(33.62%) 63(13.67%) 56(12.15%)	34(11%) 90(29.13%) 103(33.33%) 42(13.59%) 40(12.94%)	0.86
Poverty Index (below) No Yes	192(41.74%) 268(58.26%)	132(42.72%) 177(57.28%)	0.79
Married Yes No	172(35.17%) 317(64.83%)	103(30.84%) 231(69.16%)	0.20
Vigorous and moderate activity hours (daily)	1.9134	1.8886	0.81
BMI (mean)	31.2060	27.8561	<.0001
Intention to lose weight Pre-contemplation/contemplation Preparation/action	168(34.22%) 323(65.78%)	176(52.69%) 158(47.31%)	<.0001
Self-efficacy in losing weight Very sure Somewhat sure Not at all sure	268(56.54%) 138(29.11%) 68(14.35%)	159(56.18%) 78(27.56%) 46(16.25%)	0.75
Behavioral counseling Yes No	219(52.02%) 202(47.98%)	65(23.72%) 209(76.28%)	<.0001
Participated in weight loss program Yes No	125(25.51%) 365(74.49%)	35(10.57%) 296(89.43%)	<.0001
Willing to participate in weight loss program Yes/maybe No	325(66.46%) 164(33.54%)	143(43.2%) 188(56.8%)	<.0001

*Frequencies (%) presented for categorical predictors and mean presented for continuous predictors. Values in **bold** are significant (p .05).

Table 2

Multivariable associations of weight concerns with predictors (2005-2009), Boston, MA, U.S.A.

Predictors in multivariable models*	Weight concerns	
	OR (95% CI)	p-value
BMI	1.1(1.06-1.13)	<.0001
Total vigorous and moderate activity hours	0.97 (0.87,1.08)	0.61
Intention to lose weight Pre-contemplation/contemplation Preparation/action	0.44(0.32-0.61) 1.00	<.0001
Self-efficacy in losing weight Very sure Somewhat sure Not at all sure	1.07(0.66-1.73) 1.17(0.69-1.98) 1.00	0.82
Behavioral counseling Yes No	4.23(2.86-6.25) 1.00	<.0001
Participated in weight loss program Yes No	3.01(1.92-4.72) 1.00	<.0001
Willing to participate in weight loss program Yes/maybe No	2.66(1.93-3.68) 1.00	<.0001

* Each row represents a multivariable logistic regression analysis where the following demographic characteristics are controlled: education, age, gender, race, marital status. Values in **bold** are statistically significant (p<.05).

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Table 3

Bivariate associations of HIC participant characteristics with daily physical activity concerns (2005-2009), Boston, MA, U.S.A.

Predictors	Daily physical activity concerns		
	Very/moderately n=446 (54%)	A little/not at all n=379 (46%)	p-value
Education Grade school Some high school High school graduate > High school	74(18.73%) 60(15.19%) 104(26.33%) 157(39.75%)	78(23.08%) 62(18.34%) 94(27.81%) 104(30.77%)	0.07
Age 18-29 30-39 40-49 50-59 60-70+	86(19.28%) 116(26.01%) 102(22.87%) 74(16.59%) 68(15.25%)	67(17.82%) 101(26.86%) 67(17.82%) 71(18.88%) 70(18.62%)	0.31
Gender Male Female	81(18.16%) 365(81.84%)	86(22.69%) 293(77.31%)	0.11
Race Hispanic Non-Hispanic White Non-Hispanic Black Other	173(38.96%) 46(10.36%) 177(39.86%) 48(10.81%)	165(43.77%) 47(12.47%) 139(36.87%) 26(6.9%)	0.12
Income (weekly) \$0-100 \$101-250 \$251-500 \$501-750 \$751+	42(10.12%) 122(29.4%) 142(34.22%) 57(13.73%) 52(12.53%)	33(9.3%) 112(31.55%) 116(32.68%) 48(13.52%) 46(12.96%)	0.96
Poverty Index (below) No Yes	185(44.69%) 229(55.31%)	141(39.72%) 214(60.28%)	0.16
Married Yes No	146(32.88%) 298(67.12%)	129(34.04%) 250(65.96%)	0.73
Vigorous and moderate activity hours (daily)	1.9805	1.8222	0.12
BMI (mean)	30.5535	29.0205	0.001
Intention to do 30 minutes physical activity Pre-contemplation/contemplation Preparation/action	187(41.93%) 259(58.07%)	180(47.62%) 198(52.38%)	0.10
Self-efficacy in doing 30 minutes physical activity Very sure Somewhat sure Not at all sure	199(49.5%) 137(34.08%) 66(16.42%)	170(50.9%) 97(29.04%) 67(20.06%)	0.24
Behavioral counseling Yes No	209(55.44%) 168(44.56%)	119(37.3%) 200(62.7%)	<.0001
Participated in physical activity program Yes No	176(39.46%) 270(60.54%)	125(33.16%) 252(66.84%)	0.06
Willing to participate in physical activity program Yes/maybe No	350(78.48%) 96(21.52%)	261(69.23%) 116(30.77%)	0.003

*Frequencies (%) presented for categorical predictors and mean presented for continuous predictors. Values in **bold** are significant (p .05).

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Table 4

Multivariable associations of daily physical activity concerns with predictors (2005-2009), Boston, MA, U.S.A.

Predictors in multivariable models *	Daily physical activity concerns	
	OR (95% CI)	p-value
BMI	1.03(1.01-1.06)	0.009
Total vigorous and moderate activity hours	1.07(0.96-1.19)	0.21
Intention to do 30 minutes physical activity Pre-contemplation/contemplation Preparation/action	0.81(0.6-1.1) 1.00	0.18
Self-efficacy in doing 30 minutes physical activity Very sure Somewhat sure Not at all sure	1.07(0.69-1.67) 1.15(0.71-1.85) 1.00	0.84
Behavioral counseling Yes No	2.23(1.6-3.12) 1.00	<.0001
Participated in physical activity program Yes No	1.38(1.01-1.9) 1.00	0.04
Willing to participate in physical activity program Yes/maybe No	1.37(0.97-1.93) 1.00	0.07

* Each row represents a multivariable logistic regression analysis where the following demographic characteristics are controlled: education, age, gender, race, marital status. Values in **bold** are statistically significant (p<.05).

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