**European Journal of Physical Education and Sport Science**
ISSN: 2501 - 1235
ISSN-L: 2501 - 1235
Available on-line at: www.oapub.org/edu

doi: 10.5281/zenodo.3451272 Volume 5 | Issue 12 | 2019

# DO HEALTH BELIEFS PREDICT EXERCISE BEHAVIOR? EXPLORING THE CONSTRUCTS OF THE HEALTH BELIEF MODEL

**Oloo Micky Olutende[1i],**
**Maximilla N. Wanzala[2],**
**Edwin K. Wamukoya[1]**
[1]Department of Health Promotion and Sports Science,
Masinde Muliro University of Science and Technology,
Kakamega, Kenya
[2]Dr., Department of Public Health,
Masinde Muliro University of Science and Technology,
Kakamega, Kenya

**Abstract:**
**Objective:** To determine if the tenets of the health belief model explain exercise behavior among residents of Kakamega county. **Design:** The study design was a cross-sectional analytical, that utilized quantitative methods. **Setting:** The study was conducted in Kakamega County, located in Western Kenya. Kakamega County has twelve sub-counties; Kakamega North (Malava), Kakamega Central (Lurambi), Kakamega South (Ikolomani), Kakamega East (Shinyalu) and Butere/Mumias. **Sample:** Simple random sampling was used to sample respondents. The formula that was used for calculating the sample size was Cochran with an attrition rate of 10% ($n$ = 221). The sample consisted of participants from five sub-counties of Kakamega: Kakamega central (23.1%), Kakamega south (22.6%), Kakamega east (22.2%), Butere (17.5%) and Kakamega north (14.5%) **Analysis:** Data were analyzed through structural equation modeling (SEM). The alpha level for all the computations was considered significant at an $\alpha$ <0.05. **Main outcome measures:** Perceived susceptibility, modifying factors, perceived threat, perceived severity, cues to action and exercise behavior **Results:** The measurement model included six latent constructs measured by 22 indicator variables. All of the completely standardized parameter estimates obtained were significantly different from zero (t > 1.96) and loaded satisfactorily onto their corresponding latent variable. In the structural model, the estimation of this hypothesized structural model yielded an acceptable fit to the data, $\chi2$ =1434.7, $df$ = 680; $\chi^2/df$ *ratio* =2.453(good), CFI = .822; RMSEA = .059, with 90% C.I. = .045 - .075, SRMR = .058. The perceived threat was a direct predictor of exercise behavior ($\beta$ = .294, $p$ < .001), the variable formed by perceived benefits minus perceived barriers was a direct predictor of exercise behavior ($\beta$ = .017, $p$ <.001). All variables explained 57% of the variance in exercise behavior.

[i] Correspondence: email micky.oloo.mf@gmail.com

**Conclusion:** The health belief model provided useful insight in explaining exercise behavior of the respondents. Other theories should be investigated (e.g. Social Cognitive Theory, Health Action Process Approach) to determine which theory better explains behavior in the context and population of interest.

**Keywords:** health belief model, structural equation modeling, physical activity evidence-based health promotion, non-communicable diseases, Kakamega, Kenya

## 1. Background

Physical activity (PA) improves quality of life and health in clinical and non-clinical populations, including prevention and management of non-communicable diseases (NCDs) (Tero, Samppa, Ari & Urho, 2017; Lee *et al*., 2012) like diabetes (Thent, Das, & Henry, 2013), lowers blood pressure and reduces the risk of coronary heart disease, hypertension and stroke (Soares-Miranda, Siscovick, Psaty, Longstreth, & Mozaffarian, 2016; Green, Spence, Halliwill, Cable & Thijssen, 2011), reduces risk of developing breast and colon cancer (Kimmel, Haas, & Hermanns, 2014) and has beneficial effects on body weight, fat mass and central obesity (Wiklund, 2016). Regular PA can achieve parallel or greater effects on NCDs' risk factors than those achieved with drugs at a lower cost and with minimal adverse effects (Fiuza-Luces, Garatachea, Berger, & Lucia, 2013). In a landmark British Medical Journal paper examining the head-to-head effects of medication versus PA/exercise in chronic disease, Naci and Ioannidis (2013) from Stanford University made a strong case for equivalent or superior effect of the health benefits of PA. In particular, PA interventions were more effective than drug treatment among patients with stroke and were as effective as medications for the prevention of diabetes and secondary treatment of NCDs (Naci & Ioannidis, 2013).

Despite the public's knowledge that PA leads to a range of health benefits, physical inactivity is the fourth leading cause of death worldwide after blood pressure, smoking and high blood glucose (World Health Organization [WHO], 2017; Khan, Weiler & Blair, 2011). According to Shaw, Sicree, and Zimmet (2010), 6.4% of adults in 2010 were estimated to have diabetes mellitus. On average, diabetes mellitus is affecting 285 million people in the world and the disease is predicted to affect 439 million adults (7.7% rise in prevalence) by 2030 (Shaw, Sicree & Zimmet, 2010). In developing countries, studies have projected a 67% increase in the prevalence of diabetes from 2014 to 2030 (Animaw & Seyoum, 2017; Checkley *et al*., 2014).

In Kenya, research shows that NCDs have been a growing problem over the years (WHO, 2017; Machio, 2012). In 2012 NCDs accounted for more than 50% of total hospital admissions and over 55% of hospital deaths in Kenya (Kenya Health Management Information System [HMIS], 2012). According to Kenya Demographic and Health Survey [KDHS] report (2014), over 61% of the population in Kenya did not engage in exercise that caused an increase in their heart rate for at least 10 minutes continuously at work or during other activities. In the Western region of Kenya, results showed that 39.1% of women and 45.4% of men did not engage in PA at all (Grimstvedt *et al*., 2013). This corroborates with studies done in other parts of the world that showed most adults worldwide did not engage in PA at levels with the potential to yield benefits (Ding *et al*., 2016; Das & Horton, 2016).

The HBM has been used to predict health behaviors in various populations. The literature includes several examples of the HBM as it relates to exercise behaviours (Schmiege, Aiken, Sander & Gerend (2007). Swif et al 1995, Godin & Shephard, 1990). Von and colleagues (Von, Ebert, Ngamvitroj, Park & Kang, 2003) reported that perceived barriers have the most significant negative impact on people's health behaviors and that self-efficacy and perceived barriers are the two most significant factors that predict health behaviors. The HBM has been widely used to explain change and maintenance of health-related behaviors for individuals and it has been used as a framework for health interventions (Champion & Skinner, 2013). Most studies done to assess constructs of health belief model were done among college students and findings revealed that physical activity behaviors appeared to be influenced mostly by HBM factors (Von, Ebert, Ngamvitroj, Park & Kang, 2003, Bridges, Guan, Keating & Pinero 2005, Bray, Brittain & Gyurscik, 2004). Therefore, research is needed to determine the specific benefits, barriers and perceived cues to students' involvement in vigorous physical activity (Brown, 2005). Therefore, the purpose of this study was to determine if the tenets of the health belief model explain exercise behavior among residents of Kakamega county.

## 2. The Health Belief Model

The HBM has four factors which serve as the key constructs of the model are perceptions of: (1) susceptibility; refers to an individual's perception that one will experience the dangers associated with the behavior or exposure in question (2) severity/seriousness; refers to an individual's perception of the dangers a particular action or exposure can inflict. (3) barriers; perceived obstacles to engaging in a healthy behavior or forgoing an unhealthy one, and (4) benefits; refer to the perception of the rewards of healthy behavior or avoiding an unhealthy one. An additional two constructs were added as also influencing behavior: (5) cues to action; strategies to activate readiness and (6) self – efficacy; which is confidence in one's ability to act (Rosenstock, Strecher and Becker, 1988).

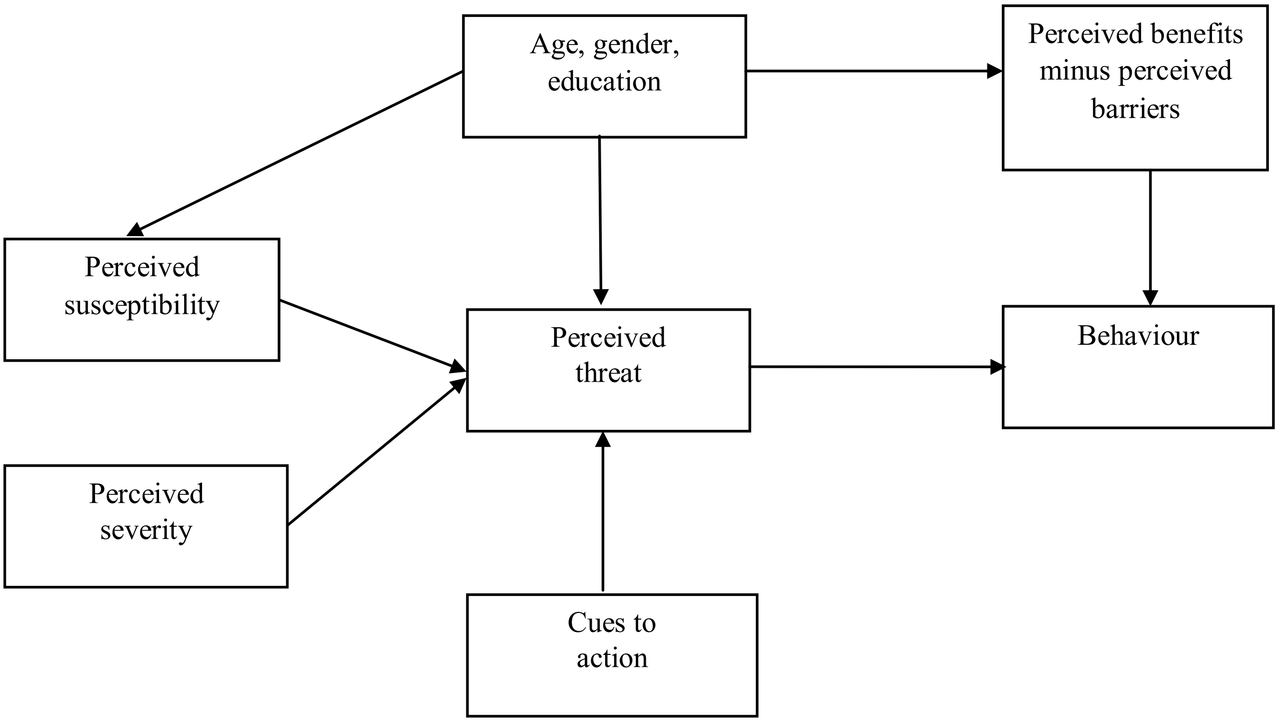


**Figure 1:** The variables in the Health Belief Model.
(Adapted from Rosenstock, Strecher and Becker, 1988)

## 3. Methods

### 3.1 Study Setting

This was a cross-sectional study; surveys were conducted between February and May 2019. The study was conducted in Kakamega County, located in Western Kenya. Kakamega County has twelve sub-counties; Kakamega North (Malava), Kakamega Central (Lurambi), Kakamega South (Ikolomani), Kakamega East (Shinyalu) and Butere/Mumias. First, some explanations about the study were given to the participants. Written consent was obtained from all subjects.

### 3.2 Participants and Recruitment

The study population was community-dwelling adults in Kakamega County. A power and sample size analysis was conducted with alpha acceptance criteria of $p<0.05$. It calculated that a sample size of 230 would be sufficient to detect an effect size of 0.183 (between small and medium) at a level of statistical power of 0.8. The sample consisted of participants from five sub-counties of Kakamega: Kakamega central (23.1%), Kakamega south (22.6%), Kakamega east (22.2%), Butere (17.5%) and Kakamega north (14.5%). The mean age for the total sample was 28.02 years (SD = 9.13) and 65.2% reported being female and 34.8% male. With respect to marital status, 60% reported being single, 34% married and 6% widowed. Demographic information is described in Table 1.

### 3.3 Procedures

Two hundred and twenty-one respondents completed the questionnaires and tests; 9 questionnaires were excluded for not being complete. The study was conducted in Kakamega county and ethics approval was obtained from the Kakamega county commissioner. No further approval was needed since the project did not require access to patients or personal data. All participants were informed of the complete confidentiality of the data and were notified of the subsequent handling of the data following analysis.

### 3.4 Data Collection Instruments

The data was collected using a pre-coded self-administered questionnaire. Demographic information including gender, age and the highest level of education was collected. Respondents PA participation was measured using two items which assessed the self-reported participation in moderate and vigorous activity in hours /per week. The health belief model questionnaire was adapted and modified to measure the psychosocial constructs hypothesized to influence respondents' PA participation behavior. The instrument was a questionnaire from previous study (Villar et al., 2017) that was adapted for this study; in fact, they designed the instrument based on Health Belief Model. Based on literature review and discussion with experts, some changes had been made to the questionnaire such as organizing items in factors, deleting and adding few items to have current questionnaire. To increase the validity and reliability of the instruments, after adapting the questionnaires were evaluated by experts. A panel of experts (n = 5) was used to establish face and content validity. The panel offered suggested revisions that were subsequently incorporated into the final instrument. Scoring system of HBM: Possible responses were measured using a 5-point Likert scale for each variable were “strongly disagree”, “disagree”,” “not sure”, “agree”, and “strongly agree”. A score was given for each response from 1 to 4, whereby higher scores indicated a stronger feeling of each variable.

### 3.5 Data Analysis

A structural relations model of the relationships between the different constructs was developed using AMOS 22 software. Structural equation modeling (SEM) was employed to test the fit of the health belief model using a covariance matrix and the maximum likelihood (MLR) method without any statistical correction due to the presence of missing data because all the records were complete. Cases with missing data were excluded listwise from the SEM analysis (n = 9). No significant differences were observed between cases with missing data and cases with complete data. The variables that were not normally distributed (skewness > 2 kurtoses > 3) and were transformed using the reciprocal transformation method. The analysis was performed in two steps. In the first step, the study tested a measurement model to establish if chosen relevant measures had been chosen to indicate each of the latent variables. Testing the measurement model involved relating the observed variables to the underlying concepts by means of confirmatory factor analysis. In the second step, our conceptual model/structural model was tested to evaluate the hypothesized links between the latent variables attitude, subjective norms, perceived control, intention and exercise prescription behavior. In both steps, maximum-likelihood estimation was used. In principle, a non-significant chi-square test would signify that the data provided a good fit to the model. This test can explain the sum of differences between observed and expected outcome frequencies. The chi-square interpretations were also followed by an interpretation of the index of the ratio of the $\chi^2$ estimated value and its degrees of freedom. To interpret these indices the following criteria were used: $\chi^2/df$ *ratio* < 2 (excellent); $\chi^2/df < 3$ (good); $\chi^2/df < 5$ (acceptable). However, because the goodness of fit test is problematic with large samples (Hayduk, 1996), the adequacy of the models was described with some additional statistics. The overall model fit was evaluated using the root mean square error of approximation (RMSEA), the standardized root means square residual (SRMR) and the comparative fit index (CFI). The RMSEA and SRMR indices measure the discrepancy between the predicted model and the observed model; values lower than 0.08 are interpreted as acceptable fit, with lower values indicating better fit (Hu & Bentler, 1999). The CFI measures the extent to which the model of interest is better than an alternative model where measured variables are uncorrelated; values closer to 1 are considered acceptable fit (Hu & Bentler, 1999). For this study, RMSEA values lower than 0.06, SRMR values lower than 0.08, CFI values greater than 0.95, normalized fit index (NFI) values above .90; values of incremental fit index (IFI) above .90 were considered as indicative of good model fit. Statistical significance was set at $\alpha$ = 0.05. The analyses were conducted with the Statistical Package for Social Sciences version 25 (IBM, Armonk, NY) and AMOS version 22. To standardize the scale of the parameter estimates, the factor loading of one measured variable for each scale was fixed at 1. The structure model was specified based on the tenets of the health belief model and its influence on activity participation behavior.

## 4. Results

Results from the reliability test showed a Cronbach's $\alpha$ of the perceived susceptibility scale $\alpha$ = 0.796, perceived severity scale $\alpha$ =0.801, perceived benefits scale $\alpha$=0.730, perceived barriers scale $\alpha$=0.725, cues to action scale $\alpha$=0.866, perceived self-efficacy scale $\alpha$=0.843, and physical activity participation scale $\alpha$=0.831. Deleting select items would not increase the alpha in any of the constructs. A structural model was designed to estimate the relationships between the measured constructs. The exogenous variables are the predictor variables, namely: cues to action and modifying factors. The endogenous variables are perceived susceptibility, perceived severity, perceived threats, and exercise participation behavior. The model contains observable variables and latent variables that describe error terms.

### 4.1 Participants Characteristics

The study asked the respondents to indicate their background characteristics based on the position they held at the hospital, gender, highest education level, age bracket, and working experience. The summary of their responses is given in Table 1.

**Table 1:** Background characteristics of respondents

| | | N | % |
|---|---|---|---|
| Age groups | Below 25 | 111 | 50.2% |
| | 26-30 years | 51 | 23.1% |
| | 31-40 years | 38 | 17.2% |
| | Over 41 | 21 | 9.5% |
| Gender | Male | 77 | 34.8% |
| | Female | 144 | 65.2% |
| Educational level | Secondary | 179 | 81.0% |
| | Degree | 39 | 17.6% |
| | Postgraduate | 3 | 1.4% |

Findings in Table 1 reveals that 11 doctors, 187 nurses and 23 clinical officers participated in the research study. With regard to their gender profiles, many were females (n=144, 65.2 %). This implied that the majority of health workers in public institutions in Kakamega county are female as opposed to male. Results on their highest level of education revealed that majority (n=179, 81.0%) were secondary school certificate holders while only a few (n=3, 1.4%) had a postgraduate degree. Distribution of age bracket showed that many (n=111, 50.2%) were aged below 26 years. The mean age for all the respondents was 28 years (28±9). The working experience statistics showed that many of the respondents (n=122, 55.2%) had worked for less than 5 years and the mean working years was 7years for all respondents (7±7)

### 4.2 Measurement Model

The measurement model included six latent constructs measured by 22 indicator variables. All of the completely standardized parameter estimates obtained were significantly different from zero ($t > 1.96$) and loaded satisfactorily onto their corresponding latent variable. Correlations among indicators across constructs (N = 221) ranged from .16 to .87. The overall fit of the measurement model was acceptable based on fit indices ($\chi^2$ (202) = 356.7, $\chi^2/df$ *ratio* =2.766(good), RMSEA = .059, RMSEA 90% CI = [.049,.069], IFI = .820 CFI = .814, SRMR = .056).

### 4.3 Structural Model

A structural model was designed to estimate the relationships between the measured constructs. The cross-sectional inter-correlations between perceived susceptibility, modifying factors, perceived severity, perceived threat, cues to action and exercise behavior were tested. The estimation of this hypothesized structural model yielded an acceptable fit to the data, $\chi2$ =1434.7, *df* = 680; $\chi^2/df$ *ratio* =2.453(good), CFI = .822;

RMSEA = .059, with 90% C.I. = .045 - .075, SRMR = .058. The conceptual links are displayed in Figure 2. As the figure shows, perceived threat was a direct predictor of perceived susceptibility (β = .152, $p$ = .014) and perceived severity (β = .503, $p$ = .008), perceived threat was a direct predictor of exercise behaviour (β = .294, $p$ < .001), the variable formed by perceived benefits minus perceived barriers was a direct predictor of exercise behaviour (β = .017, $p$ <.001). All variables explained 57% of the variance on exercise behavior. The final model with significant pathways and standardized coefficients is shown in Figure. 2

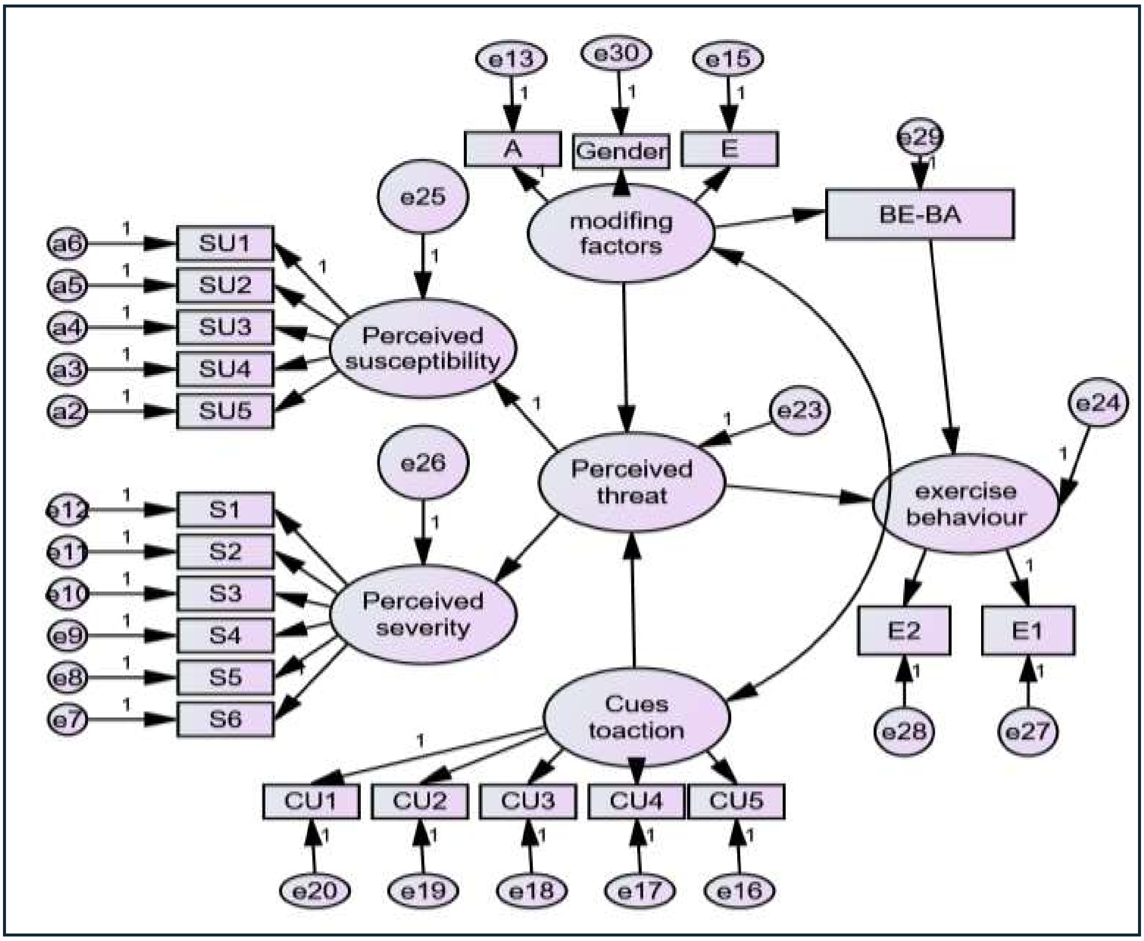


**Figure 2:** Structural equation model for Health belief model (n=221)
(Key: A-age**:** E-education**:** BE-BA-perceived benefits - perceived barriers)

## 5. Discussion

This study aimed to explore the physical activity behavior of the community of Kakamega county and the utility of the health belief model in explaining this behavior. Results on highest level of education revealed that majority (n=179, 81.0%) were secondary school certificate holders while only a few (n=3, 1.4%) had a postgraduate degree. Research shows that schooling can directly impact health outcomes through allocative efficiency (Grossman, 1972). Grossman explains that under this mechanism, more educated people produce better health outcomes because they choose different input allocations in comparison to those who are less educated. The current study found that the perceived susceptibility scale had a Cronbach alpha of $\alpha$ = 0.796, perceived severity scale $\alpha$ =0.801, perceived benefits scale $\alpha$=0.730, perceived barriers scale $\alpha$=0.725, cues to action scale $\alpha$=0.866, perceived self-efficacy scale $\alpha$=0.843, and physical activity participation scale $\alpha$=0.831. The current study also found that all variables explained 57% of the variance in exercise behavior. A study was done by Villar et al., (2017) in Mexico found that the factor was named "beliefs that the benefits exceed the costs of exercising" explained 31.48% of the total variance, the second factor "beliefs that exercising can reduce threats" explained 10.52% of the total variance and the third factor "beliefs about the vulnerability of not exercising" explained 5.97% of the total variance

The current study also found that the variable formed by perceived benefits minus perceived barriers was a direct predictor of exercise behavior ($\beta$ = .017, $p$ <.001). Consistent with the findings is a study by Volk & Koopman (2001) that used the health belief model to study condom use in Kisumu. They found that of the sample of 223 individuals who had engaged in intercourse the previous month only 20% of them had used condoms. Perceived barriers were the only aspect of HBM significantly associated with condom use. Kelly, Zyzanski & Alemagno (1991) examined 215 patients in a health promotion trial and found that perceived benefits were a strong predictor of health behavior change, more explicitly in the areas of smoking, stress management, diet, and exercise. Additionally, older adults taking part in a new physical activity program noted many positive benefits, including a strong sense of accomplishment and enjoyment as well as enhancement to physical performance. More specifically, it was noted that there was a correlation between identified positive effects and adherence rates (Bloch, 2004). Furthermore, a study conducted by Ferrini, Edlstein & Barrett-Connor (1994), found that those aged 50 – 69 years who engaged in regular physical activity reported significant benefits to their positive health behavior and were more likely to spend money on healthy items like nutritious food and exercise programs. In studies that isolated perceived barriers and perceived benefits, a study by Niven (1994) found that the negative aspects associated with taking an advised action have shown to significantly impede an individual's rate of engagement. A survey of 409 randomly selected 65 – 84-year old was asked to define barriers to their involvement in any form of physical activity. Although many reported knowing about the benefits of physical activity, those studied specifically identified pain (related to an existing condition), lack of interest, and facility accessibility as major barriers to participation (Crombie, Irvine, Williams, McGinnis, Slane, Alder & McMurdo (2004). Furthermore, Jancey, Clarke, Howat, Maycock & Lee (2009), found that many older adults expressed a need for more individualized program interventions.

The present study also found that perceived threat was a direct predictor of exercise behavior ($\beta$ = .294, $p$ < .001). In agreement with the findings was a study by Vermandere et al. (2016), who studied the use of HBM in predicting HPV uptake, focusing on the importance of promotion and willingness to vaccinate. They found that the perception of oneself as adequately informed was the strongest determinant of vaccine uptake and that susceptibility, self- efficacy, and foreseeing father's refusal as a barrier only influenced willingness to vaccinate which, however was not correlated with vaccination. Also, in agreement was a study by Asare, et al. (2013) who studied condom use among African immigrants using the HBM. Their findings revealed that perceived susceptibility, perceived barriers; cues to action and self-efficacy were significant predictors of condom use in this population. Thus, they noted that this group was at a high risk of HIV/AIDS due to their risky behaviors, but they were inadequately studied.

The current study also found that the perceived threat was a direct predictor of perceived susceptibility ($\beta$ = .152, $p$ = .014). A study by Naomi, Omori, Sugawara, Akishinonomiya & Shimada, (2019) highlighted the importance of perceived vulnerability in the engagement in prevention behavior. These results support those of previous studies involving decision making regarding HIV testing (Mattson, 1999), Similarly, a review of the HBM (Janz & Becker, 1984) showed that perceived susceptibility predicted prevention behavior more effectively relative to sick-role behavior (i.e. actions taken to restore health after diagnosis), while perceived severity produced the lowest overall significance and was more strongly related to sick-role behavior relative to prevention behavior. These results suggest that risk perception should be personal (e.g. 'you are vulnerable to the illness'), rather than threatening (e.g. 'you could die from the illness'), to elicit prevention behavior. However, given the limited statistical power resulting from the low internal consistency of the severity subscale, future research is required to confirm the results

## 6. Conclusion & Recommendation

In conclusion, the results of this study showed that although the Health belief model can explain exercise behavior, socioeconomic factors are interdependent, and need to also be considered. In addition, the effect of interpersonal concerns on HBM constructs suggested that framing prevention behavior as a social practice could be an effective means of health promotion. The limitation of this study was its cross-sectional nature which prevents us from making causal associations between the psychosocial constructs and exercise behavior. Other theories should be investigated (e.g. Social Cognitive Theory, Health Action Process Approach) to determine which theory better explains behavior in the context and population of interest.

## References

Animaw, W. & Seyoum, Y. (2017). Increasing prevalence of diabetes mellitus in a developing country and its related factors. *PLoS ONE*, *12*(11), 1–11. https://doi.org/10.1371/journal.pone.0187670.

Asare, M. & Sharma, M. (2014). Establishing validity and reliability of a Health Belief Model and acculturation for measuring safe sex and sexual communication among African immigrants for protecting against HIV and AIDS. *Journal of immigrant and refugee studies*, *12*, 3, 190-209.

Bloch, M. (2004). *Benefits and Barriers to Motivation for Physical Exercise* (Unpublished doctoral dissertation). University of Brighton, Brighton, England.

Bray, S. R., Brittain, D. R. & Gyurscik, N. C. (2004). Coping with barriers to vigorous physical activity during transition to university. *Fam Community Health, 27*(2):130-142.

Bridges, D. M., Guan, J., Keating, X. D. & Pinero, J. C. (2005). A meta-analysis of college students' physical activity behaviours. *J Amer Coll Health*, *54*(2):116-125.

Brown S. (2005). Measuring perceived benefits and perceived barriers for physical activity. *Am J Health Behav*, *29*(2):107-116.

Champion, V. & Skinner, C. (2013). *The health belief model.*

Checkley, W., Ghannem, H., Irazola, V., Kimaiyo, S., Levitt, N. S., Miranda, J. J., … National Heart & Lung. (2014). Management of NCD in low- And middle-income countries. *Global Heart*, *9*(4), 431–443. https://doi.org/10.1016/j.gheart.2014.11.003

Crombie, I., Irvine, L., Willams, B., McGinnis, A., Slane, P., Alder, E., & McMurdo, M. (2004). Why Older People Do Not Participate in Leisure Time Physical Activity: A Survey of Activity Levels, Beliefs and Deterrents. *Age and Ageing, 33*(3), 287-92.

Ding, D., Lawson, K. D., Kolbe-Alexander, T. L., Finkelstein, E. A., Katzmarzyk, P. T., van Mechelen, W. & Pratt, M. (2016). The economic burden of physical inactivity: a global analysis of major non-communicable diseases. *The Lancet*, *388*(10051), 1311–1324.

Ferrini, R., Edelsteria, S. & Barrett-Connor, E. (1994). The Association between Health Beliefs and Health Behavior Change in Older Adults. *Prevention Medicine,23*(1).

Fiuza-Luces, C., Garatachea, N., Berger, N. A. & Lucia, A. (2013). Exercise is the real polypill. *Physiology*, *28*(5), 330-358.

Godin, G. & Shephard, R.J. (1990). Use of attitude-behaviour models in exercise promotion. *Sports Med, 10*, 103-121.

Green, D. J., Spence, A., Halliwill, J. R., Cable, N. T. & Thijssen, D. H. (2011). Exercise and vascular adaptation in asymptomatic humans. *Experimental physiology*, *96* (2), 57–70

Grimstvedt, M., Der Ananian, C., Pasquariello, C. D., Masambia, F. M., Chevan, J., Haskvitz, E. M., …& Rogers, L. Q. (2013). The role of professional counseling associations in professional counseling practice in Kenya. *Medicine and Science in Sports and Exercise*, *77*(3), 200. https://doi.org/10.2105/AJPH.69.6.591

Grossman, M. (1972). On the Concept of Health Capital and the Demand for Health. *Journal of Political Economy, 80*(2), 223-255.

Hayduk, L. A. (1996). LISREL Issues, Debates, and Strategies. The Johns Hopkins University Press, Baltimore and London.

Hu, L. T. & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct Equation Model*, 6(*1*): 1–55

Jancey, J., Clarke, A., Howat, P., Maycock, B., & Lee, A. (2009). Perceptions of Physical Activity by Older Adults: A Qualitative Study. *Health Education Journal, 68* (3), 196-206. doi: 10.1177/0017896909339531

Janz, N. K. & Becker, M. H. (1984). The health belief model: A decade later. *Health Educ Q*, *11*, 1–47. https://doi.org/10.1177/109019818401100101

Kelly, R., Zyzanski, S., & Alemagno, S. (1991). Prediction of Motivation and Behavior Change Following Health Promotions: Role of Health Beliefs, Social Support, and Self-Efficacy. *Social Science Medicine,32*(3).

Kenya Health Management Information system, 2012

Khan, K., Weiler, R. & Blair, S. N. (2011). Prescribing exercise in primary care. *British Medical Journal*, *343*, 10–11

Kimmel, G. T., Haas, B. K. & Hermanns, M. (2014). The Role of Exercise in Cancer Treatment : Bridging the Gap. *Current Sports Medicine Reports,13*(4),246-52. doi: 10.1249/JSR.0000000000000068

Lee, I. M., Shiroma, E. J., Lobelo, F., Puska, P., Blair, S. N. & Katzmarzyk, P. T. (2012). Effect of physical inactivity on the world's major non- communicable diseases. *The Lancet*, *380*(9838), 219–229

Machio, P. M. (2012). "*The Effect of Chronic Illness on Labor Market Outcomes in Kenya*." Center for the Study of Africa Economies. Oxford, UK. https://editorialexpress.com/cgi-bin/conference/download.cgi?db_name=CSAE2012&paper_id=502

Mattson, M. (1999). Toward a reconceptualization of communication cues to action in the health belief model: HIV test counselling. *Commun Monogr*, *66*, 240–65. https://doi.org/10.1080/03637759909376476

Naci, H. & Ioannidis, J.P.A. (2013). Comparative effectiveness of exercise and drug interventions on mortality outcomes: meta-epidemiological study. *BMJ, 347*, f5577. https://doi.org/10.1136/bmj.f5577

Naomi, Y., Mika, O., Masumi, S., Kiko, A. & Sachiko, S. (2019). Do health beliefs, personality traits, and interpersonal concerns predict TB prevention behavior among Japanese adults. *Plos one*,1-10

Niven, N. (1994). *Health Psychology: An Introduction for Nurses and Other Healthcare Professional.* London, England: Churchill-Livingstone

Rosenstock, I. (1974). Historical Origins of the Health Belief Model. *Health Education Monographs,2*, 4.

Schmiege, S. J., Aiken, L. S., Sander, J. L., & Gerend, M. A. (2007). Osteoporosis prevention among young women: Psychosocial models of calcium consumption and weight-bearing exercise. *Health Psychol, 26*(5), 577-587.

Shaw, J. E., Sicree, R. A. & Zimmet, P. Z. (2010). Global estimates of the prevalence of diabetes for 2010 and 2030. *Diabetes Research and Clinical Practice*, *87*(1), 4–14

Soares-Miranda, L., Siscovick, D. S., Psaty, B. M., Longstreth, W. & Mozaffarian, D. (2016). PA and Risk of Coronary Heart Disease and Stroke in Older Adults: The Cardiovascular Health Study HHS Public Access. *Circulation. January*, *12*(1332), 147–155. https://doi.org/10.1161/circulationaha.115.018323

Swift, C. S., Armstrong, J. E., Beerman, K. A., Campbell, R. K. & Pond-Smith, D. (1995). Attitudes and beliefs about exercise among persons with non-insulin-dependent diabetes. *Diabetes Educ, 21*(6), 533-540.

Tero, P., Samppa, T., Ari, H. & Urho, M. K. (2017). Exercise therapy for functional capacity in chronic diseases: an overview of meta-analyses of randomized controlled trials. *British Journal of Sports Medicine*. https://doi:10.1136/bjsports-2016-097132

Thent, Z. C., Das, S. & Henry, L. J. (2013). Role of exercise in the management of diabetes mellitus: The global scenario. *PLoS ONE*, *8*(11), 1–8. https://doi.org/10.1371/journal.pone.0080436

Vermandere, H., Stam, M. A., Naanyu, V., Michielsen, K., Degomme, O. & Oort, F. (2016). Uptake of human papilloma virus vaccine in Kenya: testing the health belief model through pathway modelling on cohort data. *Global Health, 12*, 17,211-217.

Villar, O. A. E., Priscila, M. M., Marisela, G. V., Irene, C. C. S., Gloria, M. G. P., Norma A. R. R., María, D. G. S. & Sergio G. O. A. (2017). Factor structure and internal reliability of an exercise health belief model scale in a Mexican population. *BMC Public Health*, *17*, 229. DOI.10.1186/s12889-017-4150-x

Volk, J. E. & Koopman, C. (2001). Factors associated with condom use in Kenya: a test of the health belief model. *AIDS Education Prevention, 13*, 6, 495-508.

Von Ah, D., Ebert, S., Ngamvitroj, A., Park, N. & Kang, D. (2003). Predictors of health behaviours in college students. *J Adv Nurs*, *48*(5):463-474.

Wiklund, P. (2016). The role of PA and exercise in obesity and weight management: Time for critical appraisal. *Journal of Sport and Health Science*, *5*(2), 151–154. https://doi.org/10.1016/j.jshs.2016.04.001

World Health Organization. (2017). *Preventing Noncommunicable Diseases (NCDs) Reducing Environmental Risk Factors.* Retrieved from http://apps.who.int/iris/bitstream/10665/258796/1/WHO-FWC-EPE-17.01-eng.pdf?ua=1