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Multivitamin Use among Multi-ethnic, Low-income Adults

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Abstract

There has been growing interest in the protective health benefits of multivitamin use (MVU). Relatively little research has investigated factors associated with MVU among adults across a broad age range, particularly among lower-income, racially/ethnically diverse adults. In light of standing MVU recommendations and documented health benefits for certain groups, as well as ongoing studies evaluating the potential health benefits of multivitamins, vitamin D, and calcium, research among this understudied population is warranted. The aims of this paper were to assess the association between MVU and 1) sociodemographic, 2) preventive/health, and 3) patient/provider factors among a racially and ethnically diverse adult sample of over 1500 low-income housing residents living in Boston, Massachusetts (USA). Bivariate and multivariable logistic regression models were the primary analytic strategy for investigating these associations. In multivariable analyses, sociodemographic factors (female gender, older age, and White or Other race/ethnicity) were significantly associated with regular MVU ($p \leq .05$). Preventive/health variables (health status, physical activity, and body mass index) and characteristics of patient/provider relationships (having a regular provider, last provider visit, decision-autonomy, and quality of relationship) were not significantly associated with MVU. While more evidence is needed to understand the benefits of MVU, future studies should address low use of MVU among lower income, multi-ethnic populations, particularly in light of health disparities.

Keywords

Health disparities; multivitamins; cancer prevention

INTRODUCTION

Daily multivitamins, typically comprised of at least 10 vitamins and 10 minerals and the U.S. Recommended Daily Allowances of vitamins C, D, and E, represent an important source of essential nutrients.¹ There has been growing interest in the potential role of multivitamins in reducing risk for chronic diseases, including cancer, cardiovascular disease (CVD), hypertension, cataracts, and age-related macular degeneration.¹ The U.S. Preventive Services

Task Force and authors of recent clinical reviews have concluded that there is insufficient evidence at this time to determine whether multivitamin use (MVU) reduces risk for chronic diseases such as cancer and CVD. While the epidemiological evidence from recent trials also calls into question the protective effects of regular MVU for cancer and cardiovascular disease, there continues to be work in this area. For example, several recent studies indicate that there may be protective effects of Vitamin D and calcium for breast and colorectal cancer (CRC), areas in which socioeconomic and racial/ethnic disparities are striking.²⁻⁷ It has also been posited that other major chronic diseases (e.g. type-2 diabetes, end-stage renal disease, osteoarthritis) share common risk factors and pathologic mechanisms that may be modified by nutrients,⁸ though more research is needed to understand the role that MVU plays in this area.

Despite the inconclusive evidence with respect to multivitamins and chronic disease prevention, there are several recommendations and potential benefits for different subgroups of people regarding MVU, including women of childbearing age and populations where nutrient deficiencies might be more prevalent, such as elderly adults and low income populations.^{1-9,10} Unfortunately, little is known about MVU among lower-income, racially/ethnically diverse populations. Because of standing recommendations, continued epidemiological evaluations, the potential of vitamin D and calcium, and other documented benefits of multivitamins (e.g. in terms of improved nutritional status, immune response, reduced risk of birth defects),¹⁰⁻¹⁴ it is important to understand patterns and predictors of MVU among this understudied population. Furthermore, if clinical or public health recommendations are made that advocate multivitamin or supplement use in the future, this population will certainly be a priority for educational interventions.

While multivitamins and mineral supplements are the most common dietary supplements in the U.S.,¹⁵ regular MVU is still not widespread in the general U.S. population. The INTERMAP study (1997-99) among adults 40-59 in U.S. found that 56% of women and 46% of men used a daily vitamin or other supplement.¹⁶ The nationally representative National Health and Nutrition Examination Survey (1999-2000) found that 52% of adults reported taking any kind of dietary supplement in the past month (57% of women and 47% of men), while 35% reported regular use of a multivitamin in the previous month (38% of women and 32% of men).¹⁵

Much of the research on multivitamin use has been conducted among women of child-bearing age and has focused on understanding and increasing use of multivitamins (as a source of folic acid) to decrease risk of birth-related defects.¹⁷⁻²⁰ Less research has focused on examining factors associated with MVU among male and female adults across a wide age range. The limited available evidence suggests that regular multivitamin users are more likely to be non-Hispanic White, female, older, more educated, more physically active, non-smokers, and have a lower body mass index (BMI).^{15,16,21-28} There are also a few studies that suggest that providers may play an important role in promoting multivitamin use,^{17, 29} although these studies have focused on women of childbearing age. There have been mixed findings with respect to health status, medical conditions, and multivitamin use.^{15,26,30,31}

The aims of this paper are to examine sociodemographic, preventive/health, and patient/provider-related factors associated with multivitamin use in a multiethnic, low-income population. The sample for this paper is a large multiethnic sample of over 1500 residents living in lower-income housing in metropolitan Boston, Massachusetts (USA).

METHODS

Sample

The data for this study, which was funded by the National Cancer Institute, comes from a cluster randomized controlled trial, the Open Doors to Health study, that targeted physical activity, CRC screening, and multi-vitamin intake. The baseline data used for these analyses were collected in 2004–2005. The primary sampling units were twelve urban public housing sites in Boston, Massachusetts (USA), and the secondary sampling units were individuals within the housing sites. Housing sites varied in size and layout, ranging from high-rise apartments to townhouse-style units. To be eligible, participants had to: 1) reside within the housing site; 2) be at least 18 years old; 3) be fluent in English or Spanish; and 4) not currently undergoing cancer treatment. A random sample of potential participants was drawn in larger housing sites (>300 units) and a census sample was drawn in smaller housing sites (<300 units). Sampling aimed to obtain an approximate 35% sample of the full population of each individual housing site, with at least 250 individuals per each housing site. More detailed information about sampling and recruitment for the study are provided in previous publications.^{32,33} The Human Subjects Committee at the Harvard School of Public Health approved this study protocol.

During baseline data collection, 1,554 participants completed surveys, with an overall response rate of 53% (range: 34% to 92% across sites). For all analyses, based on the cluster design, data are weighted up to the population size within each housing site (with a total weighted size of 2271). Of these, all participants had complete data for our primary outcome, regular multivitamin use. We excluded from our sample residents missing physical activity data (weighted n=536) (as a result of being non-ambulatory or having insufficient amount of observations to provide an accurate measure) and those with incomplete BMI data (weighted n=160), since these were exposures of interest in the analyses for this paper. In addition, due to factors such as scheduling conflicts or limited time, some residents (weighted n=89) were excluded because they were administered a shorter version of the baseline survey that did not include all exposures of interest for this paper. Therefore, the primary sample for these analyses is a weighted sample size of 1,485. For sub-analyses that examined characteristics of provider/patient relationships among those with a regular provider, we also did not include residents who did not have a regular health care provider (weighted n=205) or were missing data for this variable (weighted n=10), leaving us with a weighted sample size of 1,270 for those specific sub-analyses.

Survey and Measures

Participants of the study completed an interview-administered survey in English or Spanish and provided informed consent. All participants who completed the baseline assessment received a \$25 grocery store gift card.

Multivitamin Use—The primary outcome for these analyses was assessed by asking participants how many days a week they take multivitamins, with multivitamins defined as “one pill that contains several different vitamins and minerals, like One-A-Day or Centrum”.³⁴ Response options included: Never; Less than once a week; One day per week; Two days per week; Three days per week; Four days per week; Five days per week; Six days per week; and Seven days per week. For the purposes of these analyses, this variable was dichotomized (yes/no), with regular multivitamin use (yes) defined as taking multivitamins six or more days a week and non-regular multivitamin use (no) defined as taking multivitamins less than six days a week. This categorical analytical approach is consistent with prior research.³⁴

Sociodemographic Variables—Age, education, employment, gender, and language were measured using standard demographic questions. Participants reported their race or ethnicity

as Black, White, Hispanic, Asian, American Indian, Native Hawaiian or Pacific Islander, or Other (which included those reporting multiple race/ethnicities). Due to small sample sizes, race/ethnicity was categorized into Black, Hispanic, and White/Other. Nativity was measured by asking people to report where they were born. This was categorized into 'Born in the U.S.', 'Born in Puerto Rico', or 'Not born in the U.S. or Puerto Rico' for the purposes of analyses, based on the distribution of responses. Based on the 2005 Federal Poverty Guidelines, we determined whether residents were at/below or above poverty level by combining yearly household income and the number of people supported by that income. Insurance status was assessed and categorized into the following four categories: no insurance; public insurance (Medicare/Medicaid/Free Care); private insurance only; and public & private insurance.

Preventive/Health-related Variables—*Physical activity* was measured by pedometers (Yamax SW200) that were worn by study participants. Keeping their regular daily routine, participants were asked to wear the pedometer for five days and keep a sampling log that recorded information about when the pedometer was worn. Detailed information about the pedometer protocol is provided elsewhere.³⁵ The median number of steps/day (steps/d) for the sample was 4,700. For these analyses, physical activity was dichotomized into taking at least 4,700 steps/day or more or taking below the median of 4,700 steps/day. *Body mass index* (BMI; kg/m²) was numerically calculated from height and weight. Current health status was measured by asking participants if they had “any health problems that make it hard for you to exercise” (yes; no).

Provider-related Variables—Participants were asked if they had a doctor or nurse practitioner that they think of as their regular health care provider (yes; no). If participants had a regular DR/NP, they were asked how long ago they last saw their provider (response option range: Within past month to 5 or more years ago). Almost 95% of the sample had a visit within the last 12 months, so this variable was categorized into 3 categories: Within past month; 1–12 months ago; and more than 12 months ago. We assessed decision autonomy by asking, in reference to their regular DR or NP, if they agreed or disagreed with the statement ‘I leave all decisions about screening tests to my doctor’ (response options: Strongly agree; Somewhat agree; Somewhat disagree; Strongly disagree). This was dichotomized into yes or no for the analyses presented here with Strongly or Somewhat agree categorized as ‘yes’ and Somewhat or Strongly disagree categorized as ‘no’. Quality of relationship with provider was assessed by asking how well their regular doctor or NP knows them related to three areas: a) your responsibilities at work, home or school; b) your worries about your health; and c) you as a person, and your values and beliefs (response options for each: Not at all; A little; Somewhat; Very well). A summary score (range from 0–3) was created to reflect the number of items for which respondents felt their provider knows them somewhat or very well.

Statistical Analyses

All analyses were conducted with SUDAAN Version 9.01 and SAS Version 9.1 statistical software for clustered data, with data weighted up to the population size within each housing site. Resident-level data was used for all analyses, accounting for the cluster design and the correlation between individuals within the same housing community. After examining the distributions of key exposure and outcome variables, we conducted bivariate, age-adjusted models predicting multivitamin use. Multivariable logistic regression models were used for our primary analytic models. The choice of inclusion of variables in the final multivariable model was based on both statistical significance (significant in bivariate analyses at the .15 level) and consideration of factors that the literature would suggest are associated with preventive behaviors (e.g. having health care, better education).

RESULTS

Sample Characteristics

Table 1 provides detailed information about the study sample. Most participants in the study were racial and ethnic minorities, with 49.4% identifying as Black and 42.0% as Hispanic. The mean age of study participants was 48 years old. The sample was predominately female (73.1%), with 35.6% having less than a high school education. About forty-two percent of residents were currently working full or part-time. The majority of the sample had some form of public or private insurance, and only 4.6% of the sample was uninsured; 86% reported having a regular health care provider. Only 26% of the main sample reported regular MVU. In terms of physical activity, 48.8% of the sample was below the median of 4,700 steps/day; 43.4% had a BMI of 30 or higher.

Predicting Multivitamin Use- Sociodemographic Factors

In age-adjusted bivariate analyses, a number of statistically significant differences in MVU were found by sociodemographic factors (see Table 2). Of note, all bivariate models control for age since it was significantly associated with MVU in bivariate analyses ($p<.0001$), with older age associated with regular multivitamin use (OR: 1.04, 1.03–1.05). Females were 1.52 (1.10, 2.10) times more likely to regularly use multivitamins than males. Residents who spoke English as a 1st language were 1.49 (1.10, 2.02) times more likely to regularly take multivitamins than their counterparts. Residents who identified as White/Other race/ethnicity were 1.57 (0.94, 2.61) times more likely to regularly use multivitamins than Blacks, while Hispanics were .66 (0.48, 0.91) times less likely to use multivitamins than Blacks. Residents living above poverty were 1.34 (0.99, 1.81) times more likely to take multivitamins than those living below poverty, although this difference was borderline significant ($p=.06$). There were also differences by nativity that were marginally significant ($p=.06$). Compared to those born in Puerto Rico, residents born in the continental U.S. were 1.61 (1.08, 2.40) times more likely to regularly take multivitamins, as were residents who were not born in the U.S. or Puerto Rico (OR: 1.55, .97–2.47). There was no statistical difference in regular multivitamin use by education ($p=.27$): compared to residents with less than a high school education, residents who had completed high school/vocational school and residents with some college education or more were not significantly more likely to regularly take multivitamins (OR: 1.15, 0.79–1.67 and OR: 1.32, 0.92–1.89 respectively). There was also no statistical difference in MVU by employment status ($p=.57$; OR: 1.09, 0.79–1.49) or by insurance status ($p=.19$) (latter data not shown). In multivariable analyses, the only sociodemographic factors that remained significant ($p\leq .05$) were gender, age, and race/ethnicity, while poverty status remained borderline significant ($p\leq .10$).

The Relationship between Multivitamin Use and Preventive/Health Factors

In bivariate age-adjusted analyses, residents with current health problems were 1.28 (0.95, 1.72) times more likely to use multivitamins regularly than residents without current health problems ($p=.10$). We also examined whether residents with higher levels of physical activity and lower body mass index (BMIs) would be more likely to regularly use multivitamins than those who were less active and had higher BMIs (see Table 2). There was no association between either physical activity level or BMI (as exposures) and multivitamin use in separate age-adjusted bivariate models. These associations remained non-significant in multivariable models, controlling for age, gender, poverty level and race/ethnicity (see Table 2).

The Relationship between Multivitamin Use and Patient/Provider Relationship

No significant association was found between having a regular provider and multivitamin use in bivariate ($p=.13$; OR:1.45, 0.88–2.39) or multivariable analyses ($p=.17$), controlling for

sociodemographics and current health problems (see Table 2). Among participants with a regular provider, no significant bivariate associations were found between multivitamin use and: a) when the provider was last seen; b) decision autonomy; and c) how well your regular health provider knows you (see Table 3). We also ran an overall main effects model (see Table 3) that combined the significant sociodemographic and preventive variables, along with these three main provider variables of interest. We found that when the provider was last seen ($p=.35$), decision autonomy ($p=.81$), and how well your provider knows you ($p=.30$) all remained non-significant in this multivariable model, controlling for age, gender, and race/ethnicity. Age ($p<.001$), gender ($p=.02$), and race/ethnicity ($p=.01$) remained significant in this main effects model.

We also examined how multivitamin use changes with age and whether age modifies the effects of other variables, using Baron & Kenny's tests for modification and mediation.³⁶ There was no moderating effect of age in any of the models but, there was a mediating effect of age for two of the provider variables of interest (for when the provider was last seen and how well your regular provider knows you). As a mediator, age is significantly associated with these provider-related variables, as well as the primary outcome (MVU). Furthermore, age changes the effect of these two provider variables, such that they are no longer significant when age is included in the model, and accounts for the relationship between these two provider variables and MVU (e.g. if your provider knows you well, you are more likely to be older, and older age is associated with greater multivitamin use.)

DISCUSSION

The goal of this paper was to examine factors associated with regular MVU among a multi-ethnic sample of low-income housing residents representing a range of ages. Little research to date has investigated factors associated with MVU among lower-income or racially/ethnic diverse populations. In light of the potential benefits of multivitamins, particularly for groups at higher risk for nutritional deficiencies, and ongoing epidemiological evaluations of the protective effects of multivitamins and specific nutrients (e.g. Vitamin D and calcium) for chronic diseases, research is warranted to understand patterns of use among this population.

Sociodemographic factors found to be significantly associated with MVU were generally consistent with prior findings in the literature among the U.S. population.^{15,16,21-28} Specifically, females, older residents, and those who identified as White/Other had higher rates of rates of regular MVU than their referents. While there were borderline significant findings for poverty level, with residents living above poverty marginally more likely to take multivitamins, there were not any differences by education, employment, or insurance status. This is in contrast to prior research on indicators of socioeconomic position (SEP) and MVU. For example, among a national sample of U.S. adults, 21.4% of people with less than a high school education used multivitamin/multimineral supplements in the previous month compared to 43.9% of people with more than a high school education.¹⁵ Although we had some variability in education in our sample, our findings here may be explained by the fact that our sample is predominately very low income with little variability with respect to income.

It is interesting to note that Hispanics had the lowest rates of MVU compared to other racial/ethnic groups. Though research typically suggests that Whites are more likely to regularly use multivitamins than other racial/ethnic groups, most studies examining MVU to date have largely been conducted among predominately White samples, with a few exceptions.^{23,37} Recent data from the Multiethnic Cohort Study (1999–2001) found that regular multivitamin/mineral use (at least one a week over the past year) was reported by 50% participants, ranging from 38% among Native Hawaiians, 43% among African-Americans, 44% among Latinos, 52% among Japanese Americans, and 57% among Whites.³⁷ Data from the National Health

and Nutritional Examination Survey found multivitamin use in the past month to be nearly 40% among non-Hispanic Whites, compared to 23% and 20% respectively among non-Hispanic Blacks and Mexican-Americans.¹⁵ More research among diverse racial and ethnic samples is clearly needed.

With respect to health-related variables, we found a non-significant association between current health status and multivitamin use. There have been mixed findings with respect to health status, medical conditions, and multivitamin use in the literature. One study among a large cohort of men and women in western Washington from the VITAL study (ages 50–76) found that multivitamins were not more likely to be used by cancer survivors than cancer-free controls, with the exception of women with a history of breast cancer having somewhat higher use.³⁰ Other research suggests that supplement and/or multivitamin users are more likely to have been diagnosed with a disease and be on a diet, but are also more likely to rate their health status as excellent or good.^{15,26,31} Since health behaviors and patterns have been found to cluster together,^{38,39} we hypothesized that residents with higher levels of physical activity and lower body mass indexes (BMIs) would be more likely to regularly use multivitamins than those who were less active and had higher BMIs. Interestingly, among this population, we did not find that MVU clustered with other health behaviors or patterns. However, it is important to note that this population tended to have low levels of MVU, low levels of PA, and high rates of obesity; therefore, the limited variability may in part explain these findings.

In examining health care provider/patient relationships, we hypothesized that residents who have a regular health care provider, have seen their health care provider recently (in the last 12 months), perceive that their health care provider knows them well, or leave all screening tests to their provider would be more likely to regularly use multivitamins than their counterparts. Though little research has specifically looked at these specific provider-related characteristics in relation to MVU, research suggests that health care providers may play an influential role in determining whether women of childbearing age take multivitamins.^{17,29,40,41} In contrast to what we hypothesized, this research suggested that there was no difference in MVU by any of the provider-related characteristics. Unfortunately, from this data, we are not able to determine if providers actually recommended taking multivitamins. However, we would speculate that in the context of strong provider/patient relationships, it is probably necessary for the provider to also specifically recommend MVU to ultimately increase intake among this population.

Importantly, while patterns of use are fairly consistent with the literature in terms of who is more likely to take multivitamins, the overall rates of MVU intake found in this study (26%) are much lower than reported in the general U.S. population. It is important to note that the overall evidence available related to the long-term protective effects of multi-vitamins is not conclusive with respect to cardiovascular disease and cancer. While prior observational studies have suggested possible protective benefits for some cancers,^{42,43} as well as cardiovascular disease, osteoporosis, and birth defects,^{44,45} the evidence has been deemed insufficient by the US Clinical Preventive Services Task Force at this time. There are several large randomized clinical trials underway that may provide more definitive evidence in the future. In the meantime, it is critical for future studies to address this issue, particularly from the perspective of disparities. Multivitamins are a relatively simple and low cost ‘intervention’, and if they do have preventive effects and certain population groups are not utilizing them, it could explain persistent disparities at least to some extent.

Study limitations and strengths should be addressed. We achieved a response rate of 53% which ranged from a low of 34% to a high of 92% across the housing sites. Nevertheless, we targeted, recruited and enrolled 1554 participants, which represents a large, ethnically-diverse underserved population. Furthermore, the response rate reported here is consistent with other

response rates that have been reported from community-based studies.^{46,47} However, the low response rates does introduce the possibility of bias in model estimates and associations. While we do not have any information on non-responders in this study, it is well-documented that people who do not respond to surveys have poorer health behaviors than those who do respond, suggesting that if there is any bias, it is likely that we are overestimating the prevalence of MVU. Multivitamin intake was collected by self-report, which may have biased our estimates. However, such biases, which would likely have been due to socially desirable reporting, if anything would have biased our results in terms of over-estimating MVU. Given that the overall use rates were so low (26%), this is unlikely. There may also have been confounding variables that we did not assess. This study has limited generalizability to other populations other than low-income, urban, racial/ethnic minorities living in public housing.

A number of strengths should also be noted. Little research to date has explored MVU among low income populations. The ODH sample is particularly interesting, because, despite its low income status, over 95% of participants had health insurance and most had an ongoing relationship with a health care provider. Thus, we are better able to isolate the role of provider-characteristics from access-related issues. This is also a relatively large and diverse sample, in terms of race/ethnicity, gender and age. Finally, this study had significant data related to other health behaviors and provider-patient relationship, which makes it possible to explore relationships not typically evaluated in the literature.

Findings from this study suggest that the prevalence of MVU is comparatively lower among lower-income, multi-ethnic housing residents than among national samples. This is troubling given that low-income populations likely have a higher prevalence of nutrient deficiencies and therefore may receive greater benefits from MVU. Furthermore, our findings indicate that sociodemographic factors primarily drive use among this population. These are valuable data for both the scientific and public health community. First, it could help explain some of the differences in disease prevalence and morbidity seen in low-income and racially/ethnically diverse populations. Furthermore, if clinical or public health recommendations are made that encourage MVU, this population will be made a priority for educational interventions. Thus, the results presented here provide a basis for later research to build upon in understanding factors associated with MVU among underserved populations. Our findings may also have important implications for research on other dietary supplements. For example, if research continues to suggest the roles of Vitamin D and calcium in preventing cancer,²⁻⁷ we may soon see recommendations for daily supplements of these vitamins. Thus, our findings are useful in helping us think about how to effectively meet those recommendations. Future research may want to further explore some of the psychosocial, attitudinal, and cultural factors that may mediate the association between sociodemographic factors and MVU.

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Table 1

Sociodemographic Characteristics of the Sample

	Main analytic sample (weighted N=1485)		Sub-sample (excluding residents without a regular health care provider) (weighted N=1270)	
	Regular MVU n (%)	Not regular MVU n (%)	Regular MVU n (%)	Not regular MVU n (%)
TOTAL	392 (26%)	1093 (74%)	358 (28%)	912 (72%)
Race/Ethnicity				
Black	209 (29%)	524 (71%)	189 (30%)	430 (70%)
White	32 (43%)	43 (57%)	26 (45%)	32 (55%)
Hispanic	129 (21%)	495 (79%)	122 (22%)	429 (78%)
Other	20 (42%)	28 (58%)	19 (53%)	17 (47%)
Gender				
Male	92 (23%)	308 (77%)	78 (25%)	228 (75%)
Female	300 (28%)	785 (72%)	280 (29%)	684 (71%)
Age				
<35	50 (14%)	309 (86%)	38 (15%)	212 (85%)
35–49	72 (18%)	334 (82%)	69 (19%)	289 (81%)
50–64	169 (35%)	312 (65%)	160 (36%)	283 (64%)
65+	100 (42%)	138 (58%)	91 (42%)	128 (58%)
Employment				
Work full time	72 (19%)	306 (81%)	67 (21%)	249 (79%)
Work part time	58 (24%)	184 (76%)	53 (26%)	148 (74%)
Disabled	97 (35%)	181 (65%)	88 (34%)	174 (66%)
Not working	164 (28%)	421 (72%)	150 (30%)	341 (70%)
Poverty level				
Below poverty	182 (26%)	531 (74%)	171 (27%)	456 (73%)
Above poverty	187 (30%)	443 (70%)	167 (31%)	366 (69%)
Education				
Less than HS	154 (29%)	374 (71%)	146 (30%)	333 (70%)
Completed HS/Voc	107 (25%)	326 (75%)	97 (27%)	265 (73%)
Some College +	130 (25%)	393 (75%)	114 (27%)	314 (73%)
Nativity				
Born in US	227 (28%)	594 (72%)	204 (30%)	479 (70%)
Born in PR	77 (23%)	265 (77%)	75 (23%)	243 (77%)
Not born in US, PR	88 (27%)	235 (73%)	79 (29%)	189 (71%)
English 1 st language				
No	148 (22%)	517 (78%)	138 (24%)	445 (76%)
Yes	244 (30%)	577 (70%)	220 (32%)	467 (68%)

Table 2

Bivariate and Multivariable Models Predicting Multivitamin Use- Sociodemographic, Preventive and Health-related Factors

(weighted N=1485)	Age-adjusted Bivariate OR (95% CI)	Multivariable- adjusted with PA as exposure OR (95% CI)	Multivariable- adjusted with BMI as exposure OR (95% CI)
Gender			
Male (n=401)	REF	REF	REF
Female (n=1085)	1.52 (1.10, 2.10)**	1.54 (1.09, 2.18)**	1.57 (1.12, 2.22)**
Poverty Level			
Below Poverty (n=713)	REF	REF	REF
Above Poverty (n=630)	1.34 (0.99, 1.81)*	1.29 (0.95, 1.75)*	1.29 (0.95, 1.75)*
Education			
Less than HS (n=528)	REF		
Completed HS/Voc (n=432)	1.15 (0.79, 1.67)		
Some College + (n=523)	1.32 (0.92, 1.89)		
Nativity			
Born in US (n=821)	1.61 (1.08, 2.40)**		
Born in PR (n=342)	REF		
Not born in US, PR (n=323)	1.55 (0.97, 2.47)*		
English 1 st Language			
Yes (n=821)	1.49 (1.10, 2.02)**		
No (n=665)	REF		
Race/ethnicity			
Black (n=733)	REF	REF	REF
Hispanic (n=624)	0.66 (.48, .91)**	0.70 (0.51, 0.97)**	0.70 (0.50, 0.97)**
White/Other (n=122)	1.57 (0.94, 2.61)*	1.65 (0.96, 2.82)*	1.61 (0.94, 2.77)*
Employment Status			
Work full/part time (n=621)	REF		
Disabled/not working (n=864)	1.09 (0.79, 1.49)		
Physical Activity (Steps/day)			
Meets median of 4700 steps/day or above (n=761)	REF	REF	
Below median of 4700 steps/day (n=724)	1.15 (0.86, 1.54)	1.12 (0.82, 1.53)	
Body Mass Index (BMI)			
<25 (n=378)	1.15 (0.78, 1.71)		1.10 (0.73, 1.66)
25–29.9 (n=463)	REF		REF
30+ (n=644)	1.14 (0.81, 1.61)		0.99 (0.70, 1.42)
Age (in 1 year increments)		1.04 (1.03, 1.05)**	1.04 (1.03, 1.05)**
Current Health Problems			

(weighted N=1485)	Age-adjusted Bivariate OR (95% CI)	Multivariable- adjusted with PA as exposure OR (95% CI)	Multivariable- adjusted with BMI as exposure OR (95% CI)
Yes (n=614)	1.28 (0.95, 1.72) *		
No (n=871)	REF		
Have Regular Provider			
Yes (n=1270)	1.45 (0.88, 2.39)		
No (n=205)	REF		

*
p ≤ .10;

**
p ≤ .05

Table 3

Bivariate Models and Multivariable Model Predicting Multivitamin Use: Factors Related to Patient/Provider Relationships among Participants with a Regular Provider

(weighted N=1270)	Age-adjusted Bivariate OR (95% CI)	Multivariable OR (95% CI)
Leave screening test to DR		
Yes (n=1001)	0.87 (0.60, 1.27)	1.05 (0.70, 1.57)
No (n=267)	REF	REF
How well DR/NP knows you		
0 (n=198)	REF	REF
1 (n=201)	0.94 (0.52, 1.70)	0.92 (0.50, 1.69)
2 (n=212)	0.76 (0.43, 1.36)	0.77 (0.43, 1.36)
3 (n=648)	1.19 (0.74, 1.91)	1.14 (0.70, 1.84)
Last see provider		
Within the past month (n=608)	1.59 (0.51, 4.94)	1.38 (.44, 4.31)
1–12 months ago (n=621)	1.25 (0.41, 3.87)	1.12 (.36, 3.48)
More than 12 months ago (n=34)	REF	REF
Gender		
Male (n=401)		REF
Female (n=1085)		1.54 (1.07, 2.21)**
Race/ethnicity		
Black (n=733)		0.51 (0.28, 0.94)**
Hispanic (n=624)		0.36 (0.19, 0.67)**
White/Other (n=122)		REF
Age (in 1 year increments)		1.04 (1.03, 1.05)**

**
p ≤ .05