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Citation

Mattei, Josiemer, Martha Tamez, Carlos F. Ríos-Bedoya, Rui S. Xiao, Katherine L. Tucker, José F. Rodríguez-Orengo. "Health conditions and lifestyle risk factors of adults living in Puerto Rico: a cross-sectional study." BMC Public Health 18, no. 1 (2018). DOI: 10.1186/s12889-018-5359-z

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Health conditions and lifestyle risk factors of adults living in Puerto Rico: a cross-sectional study

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1 **ABSTRACT**

2 **Background**: Puerto Rico is experiencing an economic and healthcare crisis, yet there are scarce

3 recent and comprehensive reports on the population's health profile. We aimed to describe

4 prevalent risk factors and health conditions of adults living in Puerto Rico and assess their

5 interrelationship.

6 **Methods**: Participants (n=380) aged 30-75y recruited from a 2015 convenience sample in

7 primary care clinics in the San Juan, Puerto Rico metropolitan area answered cross-sectional

8 interviewer-administered questionnaires on sociodemographic characteristics, lifestyle behaviors,

9 self-reported medically-diagnosed diseases, health services, and psychosocial factors.

10 Anthropometric measures were obtained. Logistic regression models assessed factors associated

11 with having ≥ 2 cardiometabolic conditions or ≥ 2 chronic diseases.

12 **Results**: Most participants had completed $\geq$college education (57%), had household income

13 <$10,000/y (60%), received government-assisted food benefits (51%), and had health insurance

14 (93%). Nearly 20% reported smoking, 27% alcohol use, 74% light/sedentary physical activity,

15 51% sleeping difficulties, and 36% self-rated fair/poor diet. Social support was moderate, and

16 53% screened positive for depressive symptomatology. Abdominal obesity was observed in 33%

17 of men and 76% of women (p<0.0001). Self-reported medically-diagnosed conditions included

18 hypertension (39%), anxiety (30%), obesity (28%), arthritis (26%), hypercholesterolemia (24%),

19 depression (22%), respiratory problems (21%), and diabetes (21%). Higher odds of having ≥ 2

20 cardiometabolic conditions (37%) was observed among participants aged ≥ 50y, with sedentary

21 physical activity, and self-rated fair/poor diet. Odds of having ≥ 2 chronic diseases (62%) were

22 higher among ≥ 50y, sleeping difficulties, >2 hours/day television, and self-rated fair/poor diet.

23 Participants obtained (79%) and trusted (92%) health information from physicians. While most

24   participants with a cardiometabolic condition reported receiving medical recommendations on

25   diet (>73%) and physical activity (>67%), fewer followed them (<67% and <53%, respectively),

26   yet most adhered to medication treatments (>73%). Participants following medical

27   recommendations were more likely to report healthy vs. poor behaviors (90% vs. 75%, self-rated

28   diet); (73% vs. 56%, physical activity).

29   **Conclusions**: Adults living in Puerto Rico have multiple lifestyles risk factors and high

30   prevalence of chronic diseases, namely cardiometabolic and psychological conditions.

31   Comprehensive epidemiological studies are needed to identify contributors to chronic disease,

32   including lifestyle behaviors. Concerted multi-level public health and clinical programs should

33   be prioritized to help this population improve their health.

34

BACKGROUND

Multiple studies have documented that Puerto Ricans living in the mainland United States (U.S.) have poor health behaviors and chronic conditions, compared to other Hispanic/Latino backgrounds, as well to the general U.S. population. Unhealthy lifestyle behaviors include smoking, low physical activity, and poor diet quality [1-3]. Similarly, high prevalence of obesity, diabetes, hypertension, arthritis, cardiovascular diseases, and depression has been reported for this group [1, 2]. Conversely, Puerto Ricans on the U.S. mainland tend to have higher household income and higher rates of health insurance coverage, employment, and educational attainment than other Hispanics/Latinos, yet these remain lower than the general U.S. population [1, 4].

Despite studies reporting health-related data for Puerto Ricans on the U.S. mainland, less is known about the health behaviors and conditions presented by adults living on the island of Puerto Rico, a U.S. territory. The Behavioral Risk Factors Surveillance System (BRFSS) tracks some – but not comprehensive – statistics, and these may be limited by sampling methods and response bias [5]. Still, results indicate social and health disadvantages. For example, median household income is under $20,000, and unemployment is high, despite relatively high levels of educational attainment [6]. Self-reported consumption of fruit (44%) and vegetables (76%), and of meeting physical activity guidelines (8%) suggest unhealthy lifestyle behaviors [7]. In comparison, in the U.S. states, 48% of households earn >$50,000 annually, and self-reported consumption of fruit (60%) and vegetables (80%), and meeting physical activity guidelines (20%) are higher than in the island [7]. Disparities in common chronic conditions also exist, with prevalence of 42% in Puerto Rico vs. 31% in U.S. for hypertension; 39% vs. 36% for high cholesterol, 16% vs. 10% for diabetes; and 9% vs. 6% for coronary heart disease or myocardial infarction; additionally, 66% of island residents have self-reported body mass index (BMI)

60 consistent with overweight or obesity [7]. High prevalence of cardiometabolic conditions and

61 behavioral risk factors were shown in a 2005 probabilistic cross-sectional study of Puerto Ricans

62 aged 21-79y that used questionnaires and physical and laboratory measures [8, 9].

63 Aside from the aforesaid study, there is a dearth of comprehensive epidemiological

64 studies assessing risk factors and chronic conditions among adults in Puerto Rico. The island is

65 experiencing an economic crisis and a shift in sociodemographic structure [10] which have

66 intensified in the aftermath of hurricane María in 2017, making it crucial to report recent and

67 valid data on multi-level contributors to chronic diseases that would depict the situation in the

68 island before such events. Such information would help identify public health priorities and

69 potential solutions, as well as help promote further research studies on the contributors to chronic

70 diseases within the island's context, especially before-after the natural disaster. Descriptive data

71 are necessary to help set the appropriate indications and contra-indications for clinically-relevant

72 action [11]. Thus, we aimed to describe the prevalence of sociodemographic, lifestyle,

73 psychosocial, and healthcare risk factors, as well as prevalent chronic health conditions, along

74 with their interrelationships, in a convenience sample of adult men and women living in Puerto

75 Rico.

76

77 **METHODS**

78 **Study population, setting, and design**

79 The Puerto Rico Assessment of Diet, Lifestyle, and Diseases (PRADLAD) study is a

80 cross-sectional survey of a convenience sample of 380 adults living in Puerto Rico, conducted in

81 2015 with the goal of assessing lifestyle risk factors and health conditions among adults in the

82 island. Study design and methodology have been described in detail previously [12]. Participants

83   were patients waiting for a medical appointment, or visitors, recruited from three primary care

84   clinics (a community clinic (n=206); a research-based clinic (n=101); and a city hospital clinic

85   (n=73), selected for their strategic locations, facilities, and wide patient representation) in the San

86   Juan metropolitan area. Eligible individuals had to be living in Puerto Rico at the time of the

87   study and for at least 10 months of the previous year, aged 30-75y, and able to answer questions

88   without assistance. All participants provided written informed consent. The Institutional Review

89   Board at Harvard T.H. Chan School of Public Health, Ponce Health Sciences University,

90   University of Massachusetts Lowell, and Northeastern University, approved the study.

91   **Data collection**

92   Questionnaires were administered by trained, Spanish-speaking interviewers in a private

93   room in the clinic. Data were collected and managed using the secure, web-based electronic data

94   capture tool 'Research Electronic Data Capture' (REDCap).

95   Questionnaires were based on instruments used by the Boston Puerto Rican Health Study

96   [2] and the National Health and Nutrition Examination Survey [13]. General demographic and

97   socioeconomic questions included household composition, educational attainment, marital status,

98   work history, household income, food security and food assistance, and use of communications

99   technology. Participants were asked whether a physician or health professional had ever

100 diagnosed a list of chronic conditions. If so, we obtained information on medications, time of

101 diagnosis, and current status of the disease. Participants with a diagnosis of any of five main

102 cardiometabolic conditions (hypertension, diabetes, obesity, high cholesterol, or heart disease)

103 were asked if they had received and/or followed medical advice on diet, physical activity, or

104 medication use for each condition. Additional medical questions included menopausal status (for

105 women), family history of main chronic diseases, health services, health insurance, and self-rated

106 health status.

107   We assessed detailed information on history, frequency, amount, and type of smoking

108 and alcohol use with questionnaires previously used in this population [2]. A physical activity

109 score was calculated as the sum of hours spent on typical 24-hour activities, captured using a

110 modified Paffenbarger questionnaire, multiplied by weighing factors for each activity level. We

111 asked for total hours of sleep over a 24-hr period and difficulty falling asleep.

112   The 14-item Perceived Stress Scale was used to measure perception of life as stressful

113 [14, 15]. We used the Center for Epidemiology Studies - Depression Scale to assess depressive

114 symptomatology; high depressive symptomatology was defined as a score ≥16 [15, 16].

115 Perceived social support was assessed with the 12-item Interpersonal Support Evaluation List

116 [17, 18], including three subscales: appraisal, belonging, and tangible support. Participants who

117 reported a diagnosis of diabetes were asked the Diabetes Social Support Questionnaire-Family

118 Version [19] to assess perceived family support for diabetes management.

119   Self-reported weight, height, and systolic and diastolic blood pressure were recorded.

120 BMI was calculated by dividing self-reported weight by height squared. Waist and hip

121 circumference measures were available for 316 participants using standardized protocols [20] in

122 duplicate or thrice if there was more than 1cm of difference between measurements. We used the

123 average of the measurements as the final value. Abdominal obesity was defined according to

124 U.S. guidelines (≥102cm men, ≥88cm women), with a second cutoff (≥94cm men, ≥80cm

125 women) suggested by the International Diabetes Federation (IDF) for populations of European or

126 Sub-Sahara African heritages [20]. We calculated waist-to-hip ratio by dividing the waist by hip

127 measurement; a waist-to-hip ratio of ≥0.90 in men or ≥0.85 in women was deemed as high [20].

128 Weight status classifications by BMI were: underweight (15.0 to 18.4 kg/m^2) [43, 44],

129 recommended weight (18.5 to 24.9 kg/m^2), overweight (25.0 to 29.9 kg/m^2), or obesity ($\geq$30

130 kg/m^2) [20].

Statistical analysis

132 Descriptive characteristics for all participants and by sex were assessed. Differences by

133 sex were tested using chi-square for categorical variables or t-test for continuous variables. We

134 created a combined variable for participants who reported 'ever receiving' medical advice on

135 diet for any of the conditions probed, similarly for medical advice on physical activity or

136 medication use. We also created a variable for 'currently following' medical advice on diet,

137 physical activity, or medication use for any of the conditions combined. Differences by 'ever

138 receiving' or 'currently following' medical recommendations for diet, physical activity, or

139 medication use by self-rated diet quality, physical activity status, or actual medication use,

140 respectively, were tested using chi-square.

141 Multivariable logistic regression models were used to determine sociodemographic and

142 lifestyle factors correlating to the likelihood of having two or more cardiometabolic conditions or

143 two or more chronic diseases, given that risk of mortality hand quality of life increases for

144 individuals with multiple prevalent conditions [21-23]. Cardiometabolic conditions were defined

145 as the sum of current self-reported medically-diagnosed hypertension, obesity, high cholesterol,

146 high triglycerides, pre-diabetes, diabetes, and heart disease or stroke. Chronic diseases were

147 defined as the sum of current self-reported medically-diagnosed cardiometabolic conditions plus

148 thyroid disease, arthritis, osteoporosis, anxiety, depression, cancer, bladder or kidney disease,

149 gastrointestinal disease (including liver), eye-related diseases, sleep apnea, respiratory diseases,

150 and physical disabilities. Definitions were based on WHO [24]. The reference categories were

151 having none or one condition. Odds ratio (95% confidence interval) were obtained by categories

152 of age, sex, marital status, educational attainment, household income, monthly food

153 insufficiency, smoking status, drinking status, sleep hours, sleep difficulties, physical activity

154 level, hours spent watching television, self-rated diet quality, and clinic site.

155 All analyses were done using SAS software version 9.4 (SAS Institute Inc; Cary, NC).

156 Significant differences were considered at a two-tailed p<0.05.

157 **RESULTS**

158 Mean (SD) age was 51.5y (11.2), and 66% of the sample was female (**Table 1**). The

159 sample was mostly comprised of self-identified Puerto Ricans, with a subgroup of Dominicans or

160 people from the U.S. or other Latin American countries. More women than men were not

161 married or living with a partner, and had higher educational attainment. There were no other

162 significant differences by sex in other sociodemographic characteristics. Most participants

163 reported a household income under $10,000, were retired or stay-at-home, and had health

164 insurance. Nearly a quarter of the sample reported living alone. Frequent food insufficiency was

165 reported by nearly 15% of the sample; more than half reported receiving benefits from the

166 Supplemental Nutrition Assistance Program. While nearly all participants reported having a cell

167 phone, fewer reported texting or using the internet. Most participants reported living on the

168 island most for their lives, yet more than a quarter reported living in the mainland U.S. for at

169 least one continuous year, and nearly 1 in 5 reported planning to move from the island

170 permanently, mostly to the mainland U.S. (92%). Main reasons for planning to move were to

171 improve quality of life (82.3%), to seek employment or for professional and financial reasons

172 (72.6%), for personal reasons (69.4%), or to seek health services (54.8%).

173   Nearly two-thirds of participants had measurement-based abdominal obesity, as defined

174   by current U.S. guidelines; the prevalence was 75.6% when using ethnic-specific IDF criteria,

175   similar to the prevalence of high waist-to-hip ratio (**Table 2**). Self-reported data showed a lower

176   percent of BMI-based overweight and obesity, relative to central obesity. More women than men

177   were significantly classified with abdominal obesity or BMI-based obesity. Women were also

178   more likely than men to be non-smokers and to not drink alcohol. Other lifestyle factors were

179   similar for men and women. Overall, the prevalence of unhealthy lifestyles included sedentary

180   habits, short (<7 h) or long (>8 h) sleeping hours, sleep difficulties, and current smoking. Only

181   25% of participants had a yearly flu shot. Health and diet quality were self-rated as fair or poor

182   by 40.1% and 35.6% of participants, respectively. Finally, the main sources of health information

183   included physicians, TV/radio, health professionals, and newspapers/magazines. Physicians and

184   health professionals were highly trusted. Women were more likely to seek and trust health

185   information on the internet than men. Nearly 53% of participants screened positive to depressive

186   symptomatology. Scores for perceived stress, social support, and diabetes emotional support

187   were moderate; with the social support subscale for 'appraisal' (i.e.: receiving advice or

188   guidance) having the highest mean score. There were no differences by sex in any of the

189   psychosocial measures.

190   The main medically-diagnosed chronic conditions reported by participants were

191   hypertension, anxiety, obesity, arthritis, hypercholesterolemia, depression, respiratory problems,

192   and diabetes, all of which were reported by at least 20% of participants (**Table 3**). Women had

193   significantly higher prevalence of obesity, arthritis, hypercholesterolemia, thyroid diseases, and

194   osteoporosis, but lower prevalence of hepatitis than men. The majority of those diagnosed with

195   hypertension, diabetes, or thyroid diseases used medication for the condition; medication use was

196 lower for the other conditions. The majority of participants who reported ever being diagnosed

197 with a condition reported still having the condition at the time of the study, except for

198 hypertension and cancer. Family history of hypertension, diabetes, and heart disease were

199 commonly reported; there were no significant differences by sex.

200   Two or more self-reported current cardiometabolic conditions were noted in 37% of the

201 sample; 25% had one cardiometabolic condition and 38% had none. For chronic diseases, 62%

202 had two or more, 17% had one, and 21% had none. Logistic regression models were used to

203 determine sociodemographic and lifestyle factors associated with having two or more

204 cardiometabolic conditions or chronic diseases (**Table 4**). Higher odds ratio (95% CI) of having

205 ≥2 cardiometabolic conditions (vs. >2) were observed among participants age ≥50y vs. age

206 <50y), with sedentary physical activity (vs. light/moderate activity), and self-rated fair/poor diet

207 (vs. excellent/very good). Participants with ≥2 chronic diseases (vs. >2) were more likely to be

208 aged ≥50y, watch television >2 hours/day (vs. ≤2 hours/day), had sleeping difficulties (vs.

209 rarely), and self-rated fair/poor diet. Sensitivity analysis excluding sleep apnea or physical

210 disabilities showed identical results. No other sociodemographic or lifestyle factors were

211 observed to be significantly associated with multiple conditions.

212   Diet and physical activity recommendations, as given by their physician, were most

213 frequently reported by participants with hypertension, diabetes, and obesity, while use of

214 medication was most frequently noted by participants with hypertension (**Figure 1**). While most

215 participants had received advice on diet and physical activity for each condition, fewer had

216 followed or were currently following this advice, especially for diabetes, obesity, and

217 hypertension; yet most adhered to medication treatments. Self-rated excellent/very good diet

218 quality (vs. poor/fair) was more often reported among participants who were currently following

219   medical recommendations on diet for any of the five chronic conditions probed (90% vs. 75%,

220   p=0.013); similar results were observed for light/moderately physical activity vs. sedentary (73%

221   vs. 56%, p=0.029) among participants currently following medical recommendations on physical

222   activity, and for actual medication use (96% vs. 73%, p<0.0001) among currently following

223   medication recommendations. Ever receiving medical recommendations was more often reported

224   among participants using medications (98% vs. 54%, p<0.0001), but there was no difference by

225   self-rated diet quality (p=0.89) or physical activity status (p=0.87).

226

227   **DISCUSSION**

228   Participants from a cross-sectional study of adults, aged 30-75y from the San Juan,

229   Puerto Rico metropolitan area, had poor socioeconomic and lifestyle factors as well as high

230   prevalence of multiple chronic conditions, with differences by sex in several characteristics.

231   Paradoxically, most adults had attained some college education or higher, yet reported low

232   annual household income. Low income may have been observed because most participants were

233   retired or stay-at-home, with an additional 15% unemployed. More than half of the sample

234   received food assistance and most had government-assisted health insurance. Our observations

235   agree with recent statistics from the island [6], and relate to the current economic crisis that has

236   stalled employment and wages [10]. The education and income disparity was notable for women,

237   who had significantly higher education than men, yet tended to report lower household incomes

238   despite reporting the same employment rate.

239   The most striking differences by sex were observed for anthropometric measures; more

240   than twice the percent of women (76%) than men (33%) had abdominal obesity. Our results are

241   comparable for men, but higher for women as observed in a probabilistic cross-sectional study

242 from 2005 (51% for women, 37% for men) [8]. We observed higher prevalence of abdominal

243 obesity for men when using IDF-based criteria (55%), which use a lower waist circumference

244 cutoff based on differential fat distribution of people with European and Sub-Saharan African

245 heritages. Waist-to-hip ratio was similarly high for both sexes. Both anthropometric measures

246 denote elevated accumulation of abdominal fat, which is a strong predictor of multiple chronic

247 diseases particularly diabetes [25], and thus merits urgent attention in this population.

248   When obesity was classified based on self-reported weight and height, women also

249 showed higher prevalence of overweight (26%) and obesity (27%) compared to men (15 and 8%,

250 respectively). Self-reported medically-diagnosed presence of obesity tended to agree with these

251 numbers. However, a study that used measurement-based BMI reported higher prevalence of

252 overweight and obesity among both women (33% and 44%, respectively), and men aged 21-79

253 years (40% and 38%) [9]. Self-reported 2014 BRFSS data showed similar results as the aforesaid

254 study except for women with obesity, which was lower (30%) [7]. This suggests that participants

255 in our study may have underreported their weight. Notably, men in our study were more likely to

256 be underweight or have normal weight, and the only condition that was reportedly higher in men

257 than women was hepatitis, for which treatment could lead to weight loss [26].

258   The majority of participants self-rated their health as fair/poor, and we observed high

259 prevalence of sedentary behaviors and tobacco use, and low vaccination for influenza. These

260 observed frequencies are similar to those reported in BRFFS except for current smoking, which

261 was higher in our study (11% vs. 18%) [7]. From among all U.S. states and territories, Puerto

262 Rico had the lowest percent of people reporting good/excellent health and of adults 65y or older

263 receiving a flu shot, and the highest percent of adults reporting no leisure-time physical activity

264 in the BRFSS [27]. Additionally, nearly half of participants reported short or long sleep time and

265 some sleeping difficulties, and the majority rated their diet as fair or poor, suggesting that

266 lifestyle and health-related behaviors tend to be poor in this sample.

267   Psychosocial questionnaires suggest that adults in Puerto Rico have moderate perceived

268 stress and social support, as well as emotional support for those with diabetes. Similar scores

269 using the same scales have been reported for perceived stress among Puerto Rican middle-aged

270 and older adults living in Boston, MA [15], and for social support for Puerto Rican adults in the

271 U.S. [18]. However, more than half of the sample presented with depressive symptomatology.

272 Using the same scale, Puerto Rican men in Boston had a similar mean depression score as in our

273 study, but women in Boston had higher mean score than women in our study (22 vs. 18); the

274 results were significantly different by sex in the Boston study [15]. Puerto Ricans in the U.S.

275 were observed to have the highest percent of depressive symptomatology (38%; lower than

276 observed in our study) among Hispanics/Latinos; these higher odds of having high depressive

277 symptoms persisted after adjusting for demographic, lifestyle, and co-morbid conditions [28].

278   The self-reported prevalence of the assessed clinical diagnoses in our study were

279 generally similar to those reported by BRFSS [6, 7]. Only 40% of individuals with diagnosed

280 hypertension reported currently having it; medication use was high for these individuals and our

281 data suggest that they tend to adhere to it. It is possible that their blood pressure has been

282 regulated by medication and they perceive their hypertension to have resolved. The high

283 prevalence of diagnosed diabetes in the island agrees with previous reports [7, 29, 30]. Puerto

284 Rico has the highest percentage of people with diabetes among all U.S. states and territories [27].

285 Notably, an additional 13.2% of adults in Puerto Rico have been estimated to have undiagnosed

286 diabetes as detected by laboratory measurements [30], indicating that diabetes screening,

287 prevention, and control must be prioritized in the island. Family history of hypertension and

288 diabetes were frequently reported. We have previously shown that Puerto Rican adults carry risk

289 alleles in higher frequency and protective alleles in lower frequency than non-Hispanic whites, as

290 assessed from variants involved in major metabolic and disease-relevant pathways [31].

291 We identified several lifestyle behavioral contributors to multiple cardiometabolic

292 conditions and multiple chronic diseases, including poor sleep, sedentary behaviors, and poor

293 self-rated diet. However, no sociodemographic factors were significantly correlated. While the

294 limited sample size, or reverse causality, may be a factor in the inability to detect significant

295 social determinants, the results suggest that unhealthy lifestyle behaviors may play a larger role

296 in shaping chronic conditions in this population. A study among women from San Juan, PR

297 showed that physical activity was associated with lower odds of metabolic syndrome, but not

298 social determinants such as marital status [32], and in a cross-sectional study of adults in San

299 Juan, PR, lower educational status, no alcohol intake, and low physical activity were associated

300 with metabolic syndrome, but these associations attenuated after controlling for biomarkers [33].

301 Despite the collapsing health care system in Puerto Rico that has left the island with low

302 availability and quality of services [34, 35], 76% of adults still seek yearly checkups and 70%

303 have a personal health care provider to manage their health [7]. Our study shows that participants

304 sought – and trusted – health information from a physician or health professional. This was also

305 denoted by the generally high percentage of participants with a cardiometabolic condition that

306 reported ever or currently following treatment recommendations given by their physician. While

307 the recommendations were mostly followed for medication use, adherence to diet and physical

308 activity advice was lower. Notably, 'currently following' but not 'ever receiving' medical advice

309 for diet and physical activity was more likely noted among those reporting doing such healthy

310 behaviors in the questionnaires (excellent self-rated diet or light/moderate physical activity),

311   suggesting that delivering medical advice may not be sufficient for patients to adopt healthy

312   behaviors and continued guidance, as well as other tangible or motivational support, may be

313   needed. Bidirectional relationships may also be operating, as those with poorer healthy habits

314   may be more likely to receive medical advice to improve behaviors [36]. Still, these observations

315   provide an important opportunity for primary and secondary prevention of chronic conditions

316   through health care providers. Adapted lifestyle interventions that have proven more effective for

317   diabetes prevention than medication have been successfully implemented among Latinos in the

318   U.S. in both clinical and community settings [37, 38]. Other sources of health information

319   included media, internet, and advice from family or friends; however trust in these sources was

320   lower. Use and trust on the internet was particularly low in men, which agrees with previous

321   reports [7, 39].

322   In general, the poor lifestyle behaviors and high prevalence of chronic disease persist for

323   Puerto Ricans on the island as well as the U.S. mainland. However, direct comparisons between

324   the groups show marked differences in some factors, such as higher health care coverage and

325   educational attainment but lower income in the island [29]. Previous studies have reported lower

326   prevalence of diabetes, smoking, influenza vaccination [29], and incidence of cancer [40] in the

327   island, as well as substantial variability in causes of death [41]. Additionally, Puerto Ricans

328   living in the U.S. but born on the island have been reported to have similar rates of mood and

329   anxiety disorders but higher overall mortality rates than their U.S.-born counterparts [42].

330   Importantly, the distinctive pattern of circular migration for Puerto Ricans needs to be taken into

331   account as it may be related to social, economic, behavioral, and health-related dynamics [43].

332   Our study showed that 28% of participants had lived on the mainland U.S. for at least one year

333   and nearly 1 in 5 planned to move away permanently, mainly seeking better jobs, quality of life,

334   and health services.

335   The cross-sectional design of this study serves to depict participants' characteristics as of

336   2015, yet it limits inferences on causality. The convenience sampling in primary clinics from the

337   San Juan metropolitan area reduces the generalizability of our results, and it is possible that those

338   seeking primary care services were either more health-conscious or needed clinical care due to

339   pre-existing conditions. However, health insurance coverage in Puerto Rico is high, thus most

340   people had access to care in the recruitment clinics, and their diverse locations improved the

341   sociodemographic representation of our sample [12]. The prevalence of chronic conditions

342   reported in our study were similar to those reported by BRFSS and previous studies, suggesting

343   that we captured accurate occurrence of disease among adults. Using assessment instruments that

344   were previously validated in this population also improved the accuracy of data. Nonetheless,

345   generalizability of results should be considered cautiously.

346

347   **CONCLUSIONS**

348   We illustrate the current social, lifestyle, and health conditions of adults in a convenience

349   sample of adults attending three clinic locations in San Juan, in Puerto Rico, which will be

350   instrumental in identifying priorities for public health programs and policies to help this

351   population reduce substantial health needs. Priority should be given to improving socioeconomic

352   status, promoting healthy lifestyle behaviors, and addressing cardiometabolic conditions namely

353   hypertension, obesity, and diabetes, as well as mental health. The identified contributing factors

354   to some of these conditions suggest a larger influence from unhealthy lifestyle behaviors than

355   from social determinants. Concerted multi-factorial efforts across the socio-ecological model are

356   needed to address the health disparities present in the island – from interventions at the

357   individual level to community- and population-based programs. Engaging policy-makers and

358   government officials will be instrumental, as the multiple socioeconomic disadvantages and high

359   dependence on government-assisted services may impact behaviors and health outcomes. Health

360   care officials should also be on board, as individuals seek, trust, and follow their health

361   recommendations. Our study provides timely and recent data to inform preventive efforts that

362   may positively impact the health status of Puerto Rico residents, which is relevant and crucial

363   given the financial and health care crisis affecting the island.

364   Our study opens the door to multiple lines of public health research, including the need to

365   assess additional health risk factors in Puerto Rico, analyze the association of the observed risk

366   factors and health outcomes within the context of the island, and expand assessment to the rest of

367   the island, especially as geographical variance in prevalence of diabetes has been shown [44].

368   Importantly, our study builds on the evidence that the profile of health behaviors and outcomes

369   of Puerto Ricans may differ between their place of origin and the mainland U.S. Public health

370   officials and researchers must take these nuances into consideration to better target interventions

371   and programs that account for the specific context and needs of this population.

372

373   **List of abbreviations**

374   BRFSS – Behavioral Risk Factors Surveillance System

375   BMI – Body mass index

376   IDF – International Diabetes Federation

377   REDCap – Research Electronic Data Capturing

378   US – United States

379

Declarations

Ethics approval and consent to participate

Consent for publication

Not applicable

Availability of data and material

PRADLAD data and materials are available upon request to the corresponding author.

Competing interests

Funding

Authors' contributions

JM was principal investigator on the study and conceptualized the study, supervised conduct and management of the study and data quality control, conducted data analysis and interpretation, and wrote the manuscript. MT and RSX were responsible for data entry and cleaning, data analysis and depiction of results. MT additionally helped write portions of the

402   manuscript. CFRB, KLT, and JFRO contributed to study design, management and

403   implementation, data quality control, and interpretation of results. All authors have read, edited,

404   and approved the final version of the manuscript.

405   *Acknowledgements*

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425   **REFERENCES**

426

427   1. Daviglus M.L., Talavera G.A., Aviles-Santa M.L., et al. Prevalence of major cardiovascular

428   risk factors and cardiovascular diseases among Hispanic/Latino individuals of diverse

429   backgrounds in the United States. JAMA. 2012; 308(17), 1775-1784.

430   2. Tucker K.L., Mattei J., Noel S.E., et al. The Boston Puerto Rican Health Study, a longitudinal

431   cohort study on health disparities in Puerto Rican adults: challenges and opportunities.

432   BMC Public Health. 2010;10:107.

433   3. Mattei J., Sotres-Alvarez D., Daviglus M.L., et al. Diet Quality and Its Association with

434   Cardiometabolic Risk Factors Vary by Hispanic and Latino Ethnic Background in the

435   Hispanic Community Health Study/Study of Latinos. J Nutr. 2016; 146(10), 2035-2044.

436   4. Lopez G., & Patten E. Hispanics of Puerto Rican Origin in the United States, 2013. Statistical

437   Profile. Pew Research Center. Washington, D.C. 2015.

438   http://www.pewhispanic.org/2015/09/15/hispanics-of-puerto-rican-origin-in-the-united-

439   states-2013/. Accessed 21 Dec 2016.

440   5. Boslaugh S.Behavioral Risk Factor Surveillance System. Encyclopedia of Epidemiology.

441   2008. (pp. 75-76). Thousand Oaks, CA. USA.: SAGE Publications, Inc.

442   6. Rodríguez Ayuso I.R., Geerman K., & Pesante F. Puerto Rico Community Health Assessment:

443   Secondary Data Profile. Department of Health, Commonwealth of Puerto Rico, 2012.

444   http://www.salud.gov.pr/Estadisticas-Registros-y-

445   Publicaciones/Publicaciones/Evaluacion%20de%20la%20Salud%20de%20la%20Comuni

446   dad%20Puertorrique%C3%B1a%20Perfil%20de%20Datos%20Secundarios%20(Ingl%C

447   3%A9s).pdf. Accessed 21 Dec 2016.

448   7. Centers for Disease Control and Prevention - National Center for Chronic Disease Prevention

449   and Health Promotion - Division of Population Health. BRFSS Prevalence & Trends

450   Data. 2015. http://www.cdc.gov/brfss/brfssprevalence/. Accessed 21 Dec 2016.

451   8. Perez C.M., Guzman M., Ortiz A.P., et al. Prevalence of the metabolic syndrome in San Juan,

452   Puerto Rico. Ethn Dis. 2008; 18(4), 434-441.

453   9. Perez C.M., Sanchez H., & Ortiz A.P. Prevalence of overweight and obesity and their

454   cardiometabolic comorbidities in Hispanic adults living in Puerto Rico. J Community

455   Health. 2013; 38(6), 1140-1146.

456   10. Cohn D., Patten E., Lopez M.H. Puerto Rican Population Declines on Island, Grows on U.S.

457   Mainland. Pew Research Center. Washington, D.C. 2014.

458   http://www.pewhispanic.org/2014/08/11/puerto-rican-population-declines-on-island-

459   grows-on-u-s-mainland/. Accessed 21 Dec 2016.

460   11. Grobbee D.E. Epidemiology in the right direction: the importance of descriptive research.

461   European journal of epidemiology. 2004; 19(8), 741-744.

462   12. Mattei J., Rodríguez-Orengo J.F., Tamez M., et al. Challenges and opportunities in

463   establishing a collaborative multisite observational study of chronic diseases and lifestyle

464   factors among adults in Puerto Rico. BMC Public Health. 2017;17:136.

465   13. Centers for Disease Control and Prevention - National Center for Health Statistics. 2015-

466   2016 National Health and Nutrition Examination Survey (NHANES). 2016.

467   http://wwwn.cdc.gov/Nchs/Nhanes/Search/nhanes15_16.aspx. Accessed 21 Dec 2016.

468   14. Cohen S., Kamarck T., & Mermelstein R. A global measure of perceived stress. J Health Soc

469   Behav. 1983; 24(4), 385-396.

470   15. Falcon L.M., Todorova I., & Tucker K. Social support, life events, and psychological distress

471   among the Puerto Rican population in the Boston area of the United States. Aging Ment

472   Health. 2009; 13(6), 863-873.

473   16. Radloff L.S. The CES-D scale: a self-report depression scale for research in the general

474   population. Appl Psychol Meas. 1977; 1, 385-401.

475   17. Cohen S., Mermelstein R., Kamarck T., et al. Measuring the functional components of social

476   support. Social Support: Theory, Research and Applications. 1985. (pp. 73-94). The

477   Hague, Holland: Springer Netherlands: Martinus Nijhoff Publishers, Dordrecht.

478   18. Merz E.L., Roesch S.C., Malcarne V.L., et al. Validation of interpersonal support evaluation

479   list-12 (ISEL-12) scores among English- and Spanish-speaking Hispanics/Latinos from

480   the HCHS/SOL Sociocultural Ancillary Study. Psychol Assess. 2014; 26(2), 384-394.

481   19. La Greca A.M., & Bearman K.J. The diabetes social support questionnaire-family version:

482   evaluating adolescents' diabetes-specific support from family members. J Pediatr

483   Psychol.2002; 27(8), 665-676.

484   20. World Health Organization. Waist Circumference and Waist-Hip Ratio: Report of a WHO

485   Expert Consultation. Geneva, Switzerland. 2008.

486   http://apps.who.int/iris/bitstream/10665/44583/1/9789241501491_eng.pdf. Accessed 21

487   Dec 2016.

488   21. Vogeli C., Shields A.E., Lee T.A, et al. Multiple Chronic Conditions: Prevalence, Health

489   Consequences, and Implications for Quality, Care Management, and Costs. J Gen Intern

490   Med. 2007; 22(Suppl 3): 391–395.

491   22. Salive M.E. Multimorbidity in Older Adults. Epidemiol Rev. 2013; 35(1): 75–83.

492   23. The Emerging Risk Factors Collaboration. Association of Cardiometabolic Multimorbidity

493   With Mortality. JAMA. 2015; 314(1): 52–60.

494   24. World Health Organization. Global action plan for the prevention and control of NCDs 2013-

495   2020. Geneva, Switzerland. 2013. http://www.who.int/nmh/publications/ncd-action-

496   plan/en/. Accessed 14 Feb 2018.

497   25.Huxley R., Mendis S., Zheleznyakov E.,et al. Body mass index, waist circumference and

498   waist:hip ratio as predictors of cardiovascular risk--a review of the literature. Eur J Clin

499   Nutr. 2010; 64(1), 16-22.

500   26. Fioravante M., Alegre S.M., Marin D.M., et al. Weight loss and resting energy expenditure in

501   patients with chronic hepatitis C before and during standard treatment. Nutrition. 2012;

502   28(6), 630-634.

503   27. Chowdhury P.P., Mawokomatanda T., Xu F., et al. Surveillance for Certain Health

504   Behaviors, Chronic Diseases, and Conditions, Access to Health Care, and Use of

505   Preventive Health Services Among States and Selected Local Areas- Behavioral Risk

506   Factor Surveillance System, United States, 2012. MMWR CDC Surveill Summ. 2016;

507   65(4), 1-142.

508   28. Wassertheil-Smoller S., Arredondo E.M., Cai J., et al. Depression, anxiety, antidepressant

509   use, and cardiovascular disease among Hispanic men and women of different national

510   backgrounds: results from the Hispanic Community Health Study/Study of Latinos. Ann

511   Epidemiol. 2014; 24(11), 822-830.

512   29. Ho G.Y., Qian H., Kim M.Y., et al. Health disparities between island and mainland Puerto

513   Ricans. Rev Panam Salud Publica. 2016; 19(5), 331-339.

514 30. Perez C.M., Soto-Salgado M., Suarez E., et al. High Prevalence of Diabetes and Prediabetes

515   and Their Coexistence with Cardiovascular Risk Factors in a Hispanic Community. J

516   Immigr Minor Health. 2015; 17(4),1002-1009.

517 31. Mattei J., Parnell L.D., Lai C.Q., et al. Disparities in allele frequencies and population

518   differentiation for 101 disease-associated single nucleotide polymorphisms between

519   Puerto Ricans and non-Hispanic whites. BMC Genet. 2009; 10:45.

520 32. Ortiz A.P., Suarez E., Beauchamp G., et al. Correlates of the Metabolic Syndrome Among a

521   Sample of Women in the San Juan Metropolitan Area of Puerto Rico. Metab Syndr Relat

522   Disord. 2010; 8(3): 235–242.

523 33. Pérez C.M., Ortiz A.P., Guzmán M., et al. Distribution and Correlates of the Metabolic

524   Syndrome in Adults Living in the San Juan Metropolitan Area of Puerto Rico. P R Health

525   Sci J. 2012; 31(3): 114-122.

526 34. Roman J. The Puerto Rico Healthcare Crisis. Ann Am Thorac Soc. 2015; 12(12), 1760-1763.

527 35. Colon H.M., & Sanchez-Cesareo M. Disparities in Health Care in Puerto Rico Compared

528   With the United States. JAMA Intern Med. 2016; 176(6), 794-795.

529 36. Forjuoh S.N., Lee C., Won J., et al. Correlates of Receiving a Recommendation for More

530   Physical Activity From a Primary Care Provider. Am J Prev Med. 2017;52(2):207-214.

531 37. Hall D.L., Lattie E.G., McCalla J.R., et al. Translation of the Diabetes Prevention Program to

532   Ethnic Communities in the United States. J Immigr Minor Health. 2016; 18(2), 479-489.

533 38. Ockene I.S., Tellez T.L., Rosal M.C., et al. Outcomes of a Latino community-based

534   intervention for the prevention of diabetes: the Lawrence Latino Diabetes Prevention

535   Project. Am J Public Health. 2012; 102(2), 336-342.

536   39. Finney Rutten L.J., Hesse B.W., Moser R.P., et al. Socioeconomic and geographic disparities

537   in health information seeking and Internet use in Puerto Rico. J Med Internet Res. 2012;

538   14(4), e104.

539   40. Ho G.Y., Figueroa-Valles N.R., De La Torre-Feliciano T., et al. Cancer disparities between

540   mainland and island Puerto Ricans. Rev Panam Salud Publica. 2009; 25(5), 394-400.

541   41. Colon-Ramos U., Rodriguez-Ayuso I., Gebrekristos H.T., et al. Transnational Mortality

542   Comparisons Between Archipelago and Mainland Puerto Ricans. J Immigr Minor Health.

543   2016. doi: 10.1007/s10903-016-0448-5

544   42. Argeseanu Cunningham S., Ruben J.D., & Narayan K.M. Health of foreign-born people in

545   the United States: a review. Health & place. 2008; 14(4), 623-635.

546   43. Arevalo S.P., Tucker K.L., & Falcon L.M. Life events trajectories, allostatic load, and the

547   moderating role of age at arrival from Puerto Rico to the US mainland. Soc Sci Med.

548   2014; 120, 301-310.

549   44. Tierney E.F., Burrows N.R., Barker L.E., et al. Small area variation in diabetes prevalence in

550   Puerto Rico. Rev Panam Salud Publica. 2013; 33(6), 398-406.

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559   **Table 1.** Sociodemographic characteristics of 380 adults 30-75 y/o living in Puerto Rico

Characteristic	All (n=380)	Men (n=131)	Women (n=249)	p-value
Age, years	51.5 (11.2)	51.8 (11.3)	51.3 (11.2)	0.69
Rural area of residence, %	15.9	18.3	14.6	0.34
Ethnicity, %				
Puerto Rican	81.6	81.7	81.5	0.87
Dominican	14.5	13.7	14.9	
United States/Other	4.0	4.6	3.6	
Marital status, %				0.03
Married/living with partner	42.8	52.0	38.0	
Divorced/separated/widowed	20.9	15.8	23.6	
Single	36.3	32.3	38.4	
Education, %				
No schooling or <8th grade	11.9	15.2	10.3	0.008
9th – 11th grade	6.2	7.2	5.7	
12th grade	24.9	33.6	20.5	
Some college or college degree	46.3	34.4	52.5	
Graduate school	10.6	9.6	11.1	
Household income, %				
$0-$10,000	59.9	52.8	63.7	0.18
$10,001-$20,000	21.2	26.9	18.1	
$20,001-$50,000	14.1	13.9	14.2	

>$50,000	4.8	6.5	3.9	
Employment, %				
Currently employed	36.6	36.6	36.6	0.63
Retired/stay-at-home	48.2	45.8	49.4	
Unemployed	15.3	17.6	14.1	
Health insurance, %				0.83
Government-assisted	55.4	53.3	56.6	
Private	37.1	38.3	36.4	
No health insurance	7.6	8.3	7.1	
Living alone, %	24.7	29.8	22.1	0.10
Number of people in household	2.6 (1.8)	2.5 (1.8)	2.6 (1.8)	0.50
Food security and assistance, %				
Frequent food insufficiency	14.5	15.5	14.0	0.93
SNAP food assistance[a]	51.1	44.4	54.5	0.07
WIC food assistance[a]	6.8	3.2	8.6	0.05
Use of technology, %				
Has cellphone	91.3	92.0	90.9	0.73
Uses texting	75.5	75.4	75.5	0.99
Uses Internet	55.2	53.6	56.0	0.66
Migration history, %				
Lived in PR most of their life	88.6	87.2	89.3	0.41
Lived in US at least one year	27.8	32.8	25.1	0.12
Plans to move from PR	17.6	20.7	16.0	0.28

560 Shown as mean (standard deviation) or percent, as assessed from a cross-sectional convenience

561 sample of 380 adults aged 30-75y recruited in 2015 from primary care clinics in the San Juan,

562 Puerto Rico metropolitan area

563 [a]Determined as positive if any member of the household currently received benefits from the

564 Supplemental Nutrition Assistance Program (SNAP) or the Women, Infant and Children

565 program (WIC).

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584   **Table 2.** Lifestyle and health-related risk factors and psychosocial measures of 380 adults 30-75

585   y/o in Puerto Rico

	All	Men	Women	p-value
Abdominal obesity U.S. cutoff, %[a]	61.3	33.0	76.2	<0.0001
Abdominal obesity IDF cutoff, %[a]	75.6	55.1	86.4	<0.0001
High waist-to-hip ratio, %[a]	76.8	77.6	76.4	0.81
BMI, %[b]				
Underweight	11.1	14.6	9.2	<0.0001
Recommended weight	46.7	63.4	38.1	
Overweight	21.8	14.6	25.5	
Obesity	20.4	7.3	27.2	
Physical activity, %[c]				
Sedentary	43.5	40.0	42.2	0.10
Light	30.7	26.7	32.7	
Moderate/Vigorous	25.9	33.3	22.1	
Habitual relaxation exercises, %	7.8	9.8	6.8	0.47
Sleep, hours/day	7.0 (1.7)	6.9 (1.6)	7.0 (1.7)	0.51
Less than 7 hours/day	37.7	39.4	36.8	0.20
7-8 hours/day	50.7	53.3	49.4	
More than 8 hours/day	11.6	7.4	13.9	
Sleep difficulties, %				
Always	22.0	26.2	20.0	0.31
Occasionally	28.7	25.4	30.5	

Rarely	49.3	48.4	49.8	
TV watching, hours/day	3.7 (2.7)	3.8 (3.0)	3.7 (2.6)	0.76
Time seated, hours/day	4.3 (3.2)	4.5 (3.8)	4.1 (2.9)	0.34
Smoking status, %				
Never smoker	66.4	54.8	72.4	0.002
Former smoker	15.2	22.2	11.5	
Current smoker	18.4	23.0	16.1	
Alcohol consumption, %				
Non-drinker	50.8	37.8	57.6	<0.0001
Former drinker	22.4	35.4	15.6	
Current drinker	26.8	26.8	26.8	
Yearly influenza vaccination, %	25.7	25.6	25.7	0.59
Self-rated health, %				
Excellent/Very good	24.5	26.9	23.3	0.40
Good	35.4	37.7	34.1	
Fair/Poor	40.1	35.4	42.6	
Self-rated diet quality, %				
Excellent/Very good	30.6	28.2	31.9	0.31
Good	33.8	35.1	33.1	
Fair/Poor	35.6	36.6	35.1	
Source health information, %				
Physician	79.2	80.9	78.3	0.55
Health professional	62.0	63.1	61.5	0.77

Newspapers/magazines	60.7	56.5	62.9	0.22
TV/Radio	63.7	59.5	65.9	0.22
Internet	55.2	46.6	59.7	0.01
Friends/family	51.7	50.4	52.4	0.71
Trust this source, %				
Physician	91.7	93.1	91.0	0.48
Health professional	77.9	79.4	77.1	0.62
Newspapers/magazines	52.7	52.7	52.6	0.99
TV/Radio	47.5	45.0	48.8	0.49
Internet	46.7	39.2	50.6	0.04
Friends/family	46.0	44.5	46.7	0.69
Perceived stress score[d]	21.7 (7.7)	21.5 (8.0)	21.8 (7.5)	0.71
Depressive symptoms score[d]	17.6 (12.6)	16.4 (11.9)	18.3 (12.9)	0.19
% with depressive symptoms[e]	52.6	51.3	53.2	0.74
Social support score[d]	24.7 (7.1)	24.0 (7.6)	25.0 (6.8)	0.19
(Range 0-36)				
Appraisal	8.4 (2.8)	8.2 (2.9)	8.5 (2.7)	0.22
Belonging	8.2 (2.8)	8.1 (2.9)	8.2 (2.7)	0.64
Tangible	8.0 (2.6)	7.8 (2.7)	8.2 (2.5)	0.19
Diabetes emotional support score[f]	14.1 (7.5)	14.5 (7.7)	13.9 (7.4)	0.71
(Range 0-40)[1]				

586   Shown as mean (standard deviation) or percent, as assessed from a cross-sectional convenience

587   sample of 380 adults aged 30-75y recruited in 2015 from primary care clinics in the San Juan,

588   Puerto Rico metropolitan area

589   [a]n=316; Abdominal obesity defined as waist circumference ≥102cm men or ≥88cm women

590   according to U.S. guidelines, or ≥94cm men or ≥80cm women according to International

591   Diabetes Federation (IDF) criteria. High waist-to-hip ratio defined as >0.90 men; >0.85 women.

592   [b]Classified from self-reported weight and height as underweight (15.0-18.4 kg/m^2),

593   recommended weight (18.5-24.9 kg/m^2), overweight (25.0-29.9 kg/m^2), or obesity (≥30.0 kg/m^2).

594   [c]Sedentary physical activity defined as a score <30, light activity as 30 to <40, and

595   moderate/vigorous activity as ≥40, as captured using a modified Paffenbarger questionnaire.

596   [d]For all scores, higher values of the score are indicative of higher psychosocial marker. Possible

597   ranges are 0-56 for perceives stress score, 0-60 for depressive symptoms (measured with Center

598   for Epidemiology Studies Depression Scale), 0-36 for social support (measured with12-item

599   Interpersonal Support Evaluation List-12).

600   [e]Depressive symptomatology defined as a score ≥16 in the Center for Epidemiology Studies

601   Depression Scale

602   [f]Diabetes Social Support Questionnaire-Family asked only to those who reported diabetes

603   diagnosis (n=78). Possible range is 0-25; higher score indicates higher diabetes support.

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Table 3. Percent of self-reported medically-diagnosed conditions and family history for 380 adults 30-75 y/o in Puerto Rico

Self-reported medical diagnosis	Ever diagnosed by a physician				If ever-diagnosed, currently uses medication[a]	If ever-diagnosed, currently has the disease[a]
	All	Men	Women	P-value	All	All
Hypertension	39.2	38.6	39.6	0.85	92.4	36.9
Anxiety	29.7	26.2	31.5	0.29	54.1	88.7
Obesity	27.7	14.7	34.8	<0.0001	6.9	90.1
Arthritis	25.6	18.6	29.2	0.03	46.7	95.5
Hypercholesterolemia	23.8	16.1	27.8	0.01	64.4	89.4
Depression	22.1	21.6	22.3	0.88	61.7	82.3
Respiratory problems	20.9	15.9	23.5	0.09	56.0	89.6
Diabetes	20.7	24.2	19.0	0.23	91.0	94.9
Thyroid diseases	17.7	9.7	21.8	0.004	84.6	90.8
Gastrointestinal diseases	17.2	12.0	19.8	0.06	71.4	85.3
Pre-diabetes	15.2	15.1	15.2	0.97	55.4	88.5
Hypertriglyceridemia	14.7	15.7	14.2	0.70	44.2	94.3
Eye diseases	12.7	14.9	11.6	0.37	22.2	89.0
Physical impairment	12.7	16.8	10.6	0.09	66.0	93.5

Hepatitis	12.4	23.4	6.6	<0.0001	42.2	88.1
Sleep apnea	11.3	15.1	9.3	0.10	47.5	92.3
Heart disease	10.0	11.5	9.2	0.49	60.0	76.3
Cancer	4.0	1.6	5.4	0.09	31.3	13.3
Fatty liver disease	7.5	6.7	8.0	0.68	25.9	88.5
Osteoporosis	5.2	1.6	7.1	0.02	42.1	94.7
Family History						
Hypertension	73.3	70.6	74.7	0.40	-	-
Hypercholesterolemia	41.9	39.7	43.0	0.54	-	-
Diabetes	63.9	63.1	64.4	0.80	-	-
Heart diseases	52.9	48.1	55.4	0.17	-	-

612 Shown as percent, as assessed from a cross-sectional convenience sample of 380 adults aged 30-

613 75y recruited in 2015 from primary care clinics in the San Juan, Puerto Rico metropolitan area

614 [a]Calculated for those participants who responded 'yes' to have been ever diagnosed with the

615 disease

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624 **Table 4.** Likelihood of having two or more conditions by risk factors among 380 adults 30-75

625 y/o in Puerto Rico

	≥2 Cardiometabolic conditions	≥2 Chronic diseases
Age ≥50y (vs. <50y)	2.63 (1.55, 4.46)	3.43 (1.99, 5.90)
Female (vs. male)	1.03 (0.60, 1.76)	1.13 (0.65, 1.99)
Single or divorced/widowed (vs. married)	1.37 (0.83, 2.27)	1.06 (0.62, 1.80)
High school or lower education (vs. ≥ college)	1.21 (0.69, 2.10)	1.11 (0.62, 1.98)
≤$10,000 household income (vs. >10,000)	1.02 (0.54, 1.94)	1.00 (0.51, 1.98)
Monthly food insufficiency (vs. never)	1.12 (0.68, 1.86)	1.18 (0.69, 2.02)
Current smoker (vs. never or former)	0.77 (0.40, 1.51)	1.09 (0.54, 2.18)
Current drinker (vs. never or former)	1.27 (0.71, 2.25)	1.56 (0.84, 2.89)
<7 or >8 hours sleep/night (vs. 7-8 hours)	1.12 (0.67, 1.85)	1.21 (0.71, 2.05)
Sleep difficulties always/occasionally (vs. rarely)	1.20 (0.72, 2.10)	2.88 (1.67, 4.98)
Sedentary physical activity (vs. light or moderate/vigorous)	1.91 (1.12, 3.25)	1.44 (0.81, 2.57)
>2 hours/day TV watching (vs. ≤2 hours/day)	1.30 (0.74, 2.28)	1.80 (1.01, 3.21)
Good/fair/poor self-rated diet quality (vs. excellent/very good)	2.01 (1.19, 3.39)	2.34 (1.37, 4.02)

626 [a]Shown as odds ratio (95% confidence interval) obtained from a multivariable logistic regression

627 model adjusted for the variables shown, as assessed from a cross-sectional convenience sample

628 of 380 adults aged 30-75y recruited in 2015 from primary care clinics in the San Juan, Puerto

629 Rico metropolitan area. Two or more cardiometabolic conditions (n=139) was defined as the sum

630   of current self-reported medically-diagnosed hypertension, obesity, high cholesterol, high

631   triglycerides, pre-diabetes, diabetes, and heart disease or stroke. Two or more chronic diseases

632   (n=234) was defined as the sum of current self-reported medically-diagnosed cardiometabolic

633   conditions plus thyroid disease, arthritis, osteoporosis, anxiety, depression, cancer, bladder or

634   kidney disease, gastrointestinal disease (including liver), eye-related diseases, sleep apnea,

635   respiratory diseases, and physical disabilities. The reference categories were having none or one

636   condition/disease.

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653 **Fig 1.** Percent of adults in Puerto Rico who reported receiving and following medical

654 recommendations as treatment for cardiometabolic conditions

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656 Panel 'a' shows recommendations for diet, panel 'b' for physical activity, and panel 'c' for use of

657 medication. Black bars represent the percent of participants reporting if the corresponding

658 recommendation was ever given by a physician; slanted bars represent the percent of participants

659 who ever followed the recommendation (as a percent of those who ever received the

660 recommendation); dotted bars represent the percent of participants who were currently following

661 the recommendation (as a percent of those who ever received the recommendation). Shown as

662 percent for a subsample of 139 adults who responded having at least one cardiometabolic

663 condition, from a cross-sectional convenience sample of 380 adults aged 30-75y recruited in

664 2015 from primary care clinics in the San Juan, Puerto Rico metropolitan area.

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