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Healthcare Coverage, Access, and Utilization in the Unincorporated US Territories of Guam, Puerto Rico, and the Virgin Islands

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Abstract

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An abstract of

A thesis submitted to the Faculty of the
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Abstract

Introduction: National healthcare reforms such as the 2010 Patient Protection and Affordable Care Act rarely extend to the unincorporated US territories, where healthcare disparities may be masked by nationwide statistics. This study investigates whether healthcare coverage predicts access and utilization in Guam, Puerto Rico (PR), and the Virgin Islands (VI) relative to the US states (DC inclusive). Further, we examined factors associated with access/utilization to inform community-based healthcare interventions in the unincorporated territories.

Methods: We analyzed the 2010 BRFSS data for access to and utilization of healthcare across five factor domains: socio-demographics, lifestyle/behavior, social and emotional support, self-reported health, and history of diagnosed conditions. Multiple logistic models estimated weighted odds of healthcare access/utilization outcomes attributed to lack of coverage across the four subpopulations, adjusting for each factor domain.

Results: Compared to the US states, residents in Guam and VI were more likely to be uninsured and lack a usual source of healthcare, whereas reverse associations were found in PR. Cost barriers were more prevalent in unincorporated territories than in the states, even for the highly-insured PR population (92% coverage). Controlling for factor domains had varying effects across each territory's healthcare access/utilization outcomes. After adjusting for all five factor domains, health insurance was a significant predictor of all access/utilization outcomes in PR, VI, and the states, and was also a significant predictor of having a usual healthcare provider in Guam. The fully adjusted cost barrier OR among those lacking coverage (95% CI): 1.15 in Guam (0.53-2.47), 5.51 in PR (3.20-9.49), 3.95 in VI (2.27-6.87), and 5.41 in the states (5.06-5.79).

Discussion: Having healthcare coverage strongly improves the likelihood of access/utilization, even in the unincorporated territories. This relationship was partially accounted for by poor social and emotional support and mental health in Guam, mental health coverage and physical limitations in PR, and socio-demographic disparities in VI, highlighting the need for interventions with cultural and social relevance. To fully address national healthcare disparities, the unincorporated territories should be included in future reform efforts and discussions.

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Acronyms

ARRA	American Recovery and Reinvestment Act
BRFSS	Behavioral Risk Factor Surveillance System
FMAP	Federal Medical Assistance Percentage
HCC	Healthcare coverage
PR	Puerto Rico
PPACA	Patient Protection and Affordable Care Act
VI	US Virgin Islands

CHAPTER I: BACKGROUND / LITERATURE REVIEW

Underlying the argument for federal healthcare reform is the common perception that improved insurance coverage, access, and utilization predict healthier outcomes. While numerous studies have justified health policy reforms that intervene on these pathways, they have also demonstrated that the connections between health systems and health outcomes are often complex, indirect, and unobservable.[1,2]

Frameworks that revolve around the access and utilization of health services consider a variety of factors that include socio-demographics, behavioral characteristics, and health needs. The most frequently cited of these frameworks is the Andersen Behavioral Model, initially developed in the late 1960s to "define and measure equitable access to health care; to assist in developing policies to promote equitable access."[3] The Model proposes three main components that predict or explain health services utilization: predisposing characteristics (which include demographics, social structure, and health beliefs), enabling resources (personal/family and community factors), and need (perceived and evaluated). Revisions made to the initial Model in subsequent years have given additional attention to the role of cultural, organizational, psychological, and social determinants of healthcare access and utilization.

The current study contributes to these research directions by investigating the question of expanded healthcare coverage for a population commonly neglected in the healthcare reform debate: the unincorporated US territories comprised of Commonwealth of Puerto Rico, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, and the US Virgin Islands. We aim to present a novel investigation of the healthcare systems for these under-represented areas, as well as filling in some crucial knowledge gaps regarding healthcare coverage, access, and utilization. We aim to explore healthcare at a unique intersection of policy and culture – to test familiar wisdom concerning health insurance in a largely under-explored context.

Healthcare coverage, access, and utilization

We start with an examination of four commonly assessed indicators of healthcare systems: healthcare insurance coverage, the experience of medical cost barriers, having a usual provider/source, and receiving routine checkups. These four indicators comprise the primary variables of interest in our study, with healthcare insurance coverage as the primary factor and the latter three indicators as outcome measures of healthcare access and utilization.

Healthcare insurance coverage

It is generally believed that increased insurance coverage tends to predict improved health outcomes, primarily by intervening on pathways of healthcare access and utilization. Lack of insurance has been associated with fewer screening tests, delayed diagnoses, irregular access to medications, and greater barriers to receiving treatment.[4] Providing insurance to the previously uninsured has been associated with improvements in self-reported health across both physical and mental indicators, particularly among those with chronic conditions such as cardiovascular disease or diabetes.[5-7]

Medical cost barriers

Affordability is the primary barrier of medical services for both the insured and uninsured in the US.[8] Despite the inverse relationship between insurance coverage and the experience of cost barriers, necessary services may not be covered by insurance plans, or co-payments and deductibles may remain too high for the patient to afford. Cost barriers may be especially prevalent among those who require specialty services, such as chronic disease management or mental healthcare.[9,10]

Having a usual provider

Having a usual source of healthcare can improve quality of care by facilitating ongoing patient-provider relationships, which in turn aids the physician's ability to conduct long-term patient monitoring and perform the appropriate follow-up treatments.[11,12] Those with a usual source of care tend to be more likely to conduct routine checkups, to have less difficulty obtaining care when needed, and to purchase necessary prescription medicines.[13] There is also evidence that continuity of care is associated with increased patient satisfaction, decreased hospitalizations and emergency department visits, and improved receipt of preventive services.[14,15]

Annual routine checkup

Annual physical examinations (or routine checkups) are an established medical practice designed for the early detection and prevention of chronic conditions. The importance of annual physical examinations has been called into question in recent years, with many providers advocating for a more selective case-finding format.[16-18] However, public desire for annual routine checkups remains high, and it remains a widely used indicator of healthcare utilization at the population level.[19]

Links between coverage, access, utilization and other factors

Although health insurance is a strong predictor of health care access, it does not guarantee access and utilization. Affordability, physician trust, health history, geographic and transportation difficulties, language and cultural differences, and discriminatory attitudes all represent potential barriers that complicate the role of health insurance.[20,21] Having insurance does not assure that it will be used, nor does it guarantee that the terms of the provision will be sufficient to meet all health needs. As such, it is necessary to investigate the factors that explain the relationships between healthcare coverage, access, and utilization.

The associations between healthcare and socio-demographics that include age, race, sex, household income, and education level are well documented.[22-29] The role of social and emotional ties in facilitating use of healthcare services has also been extensively investigated, with evidence of a positive association between social/emotional support and healthcare access/utilization.[30] Also predictably, higher levels of healthcare utilization are found among individuals with chronic conditions such as diabetes, heart disease, and asthma, but with evidence of higher risk of barriers to access.[31-35]

The predictive value of behavioral/lifestyle factors (such as smoking, alcohol consumption, exercise) on use of health services tends to be less straightforward. There is evidence suggesting that smokers, heavy drinkers, and those with limited physical activity are more likely to seek healthcare services to compensate for their risky behaviors, but it has also been proposed that these behaviors create barriers to healthcare in the form of poorer health-seeking motivation, provider scrutiny, and depleted resources.[36-41]

It is worth noting the difficulty in establishing a temporal order between health insurance, access, utilization, and health outcomes because most studies are observational by nature. It is highly likely that these mechanisms work in multiple directions, with health outcomes influencing access/utilization and vice versa.[1,3] We also acknowledge the reverse causal role that differential healthcare access plays in maintaining the same socio-demographic disparities that act as risk factors for poor healthcare outcomes.[3] This complex web of relationships suggests that expanded insurance coverage is only one option to improve access, utilization, and health outcomes - and that intervention opportunities exist at multiple levels.

US healthcare reform

About 50 million US adult residents had no health insurance for at least part of 2010. The Patient Protection and Affordable Care Act (PPACA) has been a source of ongoing debate on the federal government's role in healthcare. In addition to provisions for administration cost controls,

funding for medical research, market reform, and revisions of employer coverage guidelines, one of the central aims of the PPACA is to expand insurance coverage for a projected 32 million Americans by 2019. An estimated 49.9 million US residents reported not having health insurance in 2010.[42]

The PPACA represents the latest expansion of the federal government's efforts to reduce health disparities through insurance coverage. The enactment of Medicare in 1965, the expansions of Medicaid eligibility in the 1980s and 1990s, and the inception of the Children's Health Insurance Program in 1997 tend to demonstrate a positive effect of insurance coverage on both utilization and health outcomes.[1,43,44] Early findings suggest that the PPACA has already had an effect in expanding coverage, primarily for young adults and minorities.[45]

Despite some promising preliminary results, questions remain on the Act's ability to address some long-standing structural issues found in the US healthcare system. These include: the capacity of medical infrastructure to support the reform, remaining complexities left unaddressed in the healthcare market, and the estimated 23 million US residents who will remain uninsured. Largely ignored in national discussions on healthcare reform are the unincorporated US territories, which include the Commonwealth of Puerto Rico, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, and the US Virgin Islands.

Often referred to as the US insular areas, these islands under US jurisdiction receive disproportionate healthcare benefits from the federal government relative to the US states. Further conflating the problem are nationwide statistics that often mask – or ignore entirely – the unique health burdens found in these territories.

The argument for healthcare reform in the territories

Comparisons of health care and health outcomes between the states and the unincorporated territories have been rare, partly due to the relative lack of data available for the

territories. However, there is enough evidence to suggest that the attention paid thus far to healthcare reform in the territories has not been adequate to address several alarming disparities.

Evidence of poorer access to quality care

There is just one hospital serving the entire population of the US Virgin Islands, and two major hospitals serving Guam (only one of which accommodates its civilian population, the other is a military naval hospital).[46] Puerto Rico has just one level I trauma center for its population of over 3.7 million.[42,47] Within these hospitals is a relative shortage of the healthcare workforce; the proportion of registered nurses per 100,000 for each territory is lower than for any US state.[47-48] Patients with pneumonia, heart attack, and heart failure in the territories are at higher risk of hospital mortality and hospital readmissions than patients with the same conditions in the states.[49]

Epidemiologic transition in the territories

As the territories progress on the epidemiologic transition, early reform of the healthcare systems will be crucial to mitigate future costs. Preventive services and behavioral change efforts have targeted these trends with varying levels of success. Smoking prevalence in Guam is higher than in any state.[50] The prevalence of obesity continues to rise in each of the territories, with decreasing reports of physical activity in Puerto Rico.[51] There is some evidence that diabetes mortality is significantly higher in the territories than in the states.[46]

Differences in Federal Health Spending

Differential Medicaid terms apply to the unincorporated territories that restrict the federal funding for health needs. Whereas there is no limit to the total amount of Medicaid funding allotted to the states, federal funding caps for Medicaid are applied to the territories that restrict the amount that the federal government pays for Medicaid reimbursements. A report from the US Government Accountability Office found that in 2003 an average of $6,800 was spent per

Medicaid enrollee in the states, compared to an average of $2,800 per enrollee in the territories.[52] The same report found that despite receiving disproportionate Medicaid funding, the territories receive slightly more in grants per person ($60 in the territories vs. $48 in the states) from the Centers for Disease Control and Prevention, the Health Resources and Services Administration and Substance Abuse, and the Mental Health Services Administration.

The Federal Medical Assistance Percentage (FMAP) reflects the federal reimbursement rate that matches state/territory Medicaid costs. The American Recovery and Reinvestment Act (ARRA) of 2009 increased the FMAP in each state by a flat 6.2% increase from 2009 to FY quarter 1 of 2011, along with additional increases based on state unemployment percentages to yield an average FMAP increase of 29.6% across the 50 states. In contrast, the territories did not receive this benefit from the ARRA, and instead received only its usual annual FMAP increase of 2.8%.[53]

Provisions for the territories have been included on recent federal healthcare reform efforts, but have limited benefits relative to state-level changes. The federal funding caps in the territories were raised by the ARRA by 30% from 2009-2011, and were further increased by the PPACA in 2011. PPACA grants have also been extended to the territories for research on health insurance market practices, additional support to create new community health centers, and home visiting programs[54]. It remains to be seen whether these benefits will be deemed satisfactory by territory residents and officials, or if attention will remain on the widening funding disparities relative to the states.

Cultural and ethnic considerations

The cultural and social context of healthcare varies markedly in the unincorporated territories. Conventional wisdom on healthcare disparities in the US may not apply in the territories, particularly in regards to ethnic/racial disparities. Whereas Hispanics, African-Americans, Asians, and Pacific Islanders make up the minority in the general US population,

Whites do not comprise the majority in the territories, thus requiring a separate perspective on ethnic/racial determinants of health and healthcare. Culture is likely to play a large role in behavioral/lifestyle factors, health perceptions, and social organization patterns that influence the access and utilization of health services. Although findings in the territories may not necessarily be generalizable to corresponding ethnic/racial groups in the US, lessons learned in the reform of territory healthcare delivery systems have implications on shaping a more socially and culturally sensitive approach to meeting health needs of the US population.

Purpose of the study

With restricted federal assistance, the unincorporated US territories are often left at a disadvantage relative to the states in ensuring the healthcare needs of its residents. The complexity of this issue stems from the somewhat ambiguous political, economic, and social relationships that bind the territories to the federal US government. Signs of differential regulations for the territories can be seen across these spectrums. Territories are required to file federal taxes with the notable exception of the federal income tax. Territories are allowed to elect their own officials and to participate in primary elections, but are not allowed to vote in congressional or presidential elections. Similarly, the territories are included in federal healthcare funding, but only partially.

The primary goal of this current study is to examine whether healthcare disparities exist in the unincorporated territories relative to the rest of the US population, with particular attention focused on Guam, Puerto Rico, and the US Virgin Islands. A secondary goal of the study is to determine the role that health insurance can play in increasing access and utilization in the territories. Finally, in the absence of fully expanded healthcare coverage in the territories, we explore pathways in the relationship between insurance and access/utilization within the unique cultural contexts of each territory to guide territory- and community-level interventions.

CHAPTER II: MANUSCRIPT

Introduction

Despite a combined population of almost 5 million across the Commonwealth of Puerto Rico, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, and the US Virgin Islands, the unincorporated US territories are commonly excluded from national reports and studies of healthcare equity.[22,23,42] The ongoing healthcare reform debate in the United States has focused on issues of access and utilization in the 50 US states and the District of Colombia, while largely ignoring similar issues in these insular US areas.

In spite of the lack of research conducted on US healthcare provision outside the 50 states, there is evidence that healthcare systems of the unincorporated territories may also be in need of reform. There is evidence of poorer quality of care in the territories than in the states, with higher hospital mortality and readmission rates[55]. Funding streams from the federal government are applied differently to the territories than in the states, with lower reimbursement percentages and without special consideration of patient per capita income[55]. In 2003, US Medicare spending averaged $6,800 per enrolled patient in the states compared with $2,800 for residents in the five territories[52]. These gaps persist despite well-documented evidence of differential household income, access to services, and disease burden in the territories relative to the states[23-29,46,49,56-60].

As policymakers become increasingly aware of the need to reduce health disparities, an opportunity exists for national healthcare reform efforts (such as the 2010 Patient Protection and Affordable Care Act) to identify healthcare gaps found in these often-neglected populations.[61] Although the debate is complicated by the unique diplomatic and economic relationships between the US and its territories, improvements to these insular healthcare systems can provide meaningful boosts to nationwide health statistics. A deeper investigation can also provide

valuable lessons to be applied in the US healthcare system by finding where these islands have succeeded in spite of limited resources and disconnect from the national health system.

The current study examines issues of healthcare coverage, access, and utilization in Guam, Puerto Rico, and the US Virgin Islands in relation to the 50 US states. These three territories have the largest 2010 populations of the inhabited insular areas (Puerto Rico: 3,725,789, Guam: 159,358 US Virgin Islands: 106,405).[42] In light of recent federal and state-level efforts to expand healthcare coverage, this study focuses on the relationship between healthcare coverage and healthcare access and utilization, examining whether expanded insurance coverage can potentially reduce disparities in the delivery of health services found in the unincorporated territories.

This study has three primary aims:

1) To investigate disparities in healthcare access, barriers, and utilization in the unincorporated US territories relative to the 50 US states and D.C.
2) To explore whether increased insurance coverage (one of the principal aims of the 2010 Patient Protection and Affordable Care Act) can improve healthcare access and utilization outcomes within each territory.
3) To examine territory-specific factors that explain the association between healthcare coverage and healthcare access/utilization outcomes.

These aims contribute to both national and territory-specific healthcare reform efforts. We will consider the unique cultural and social contexts of Guam, Puerto Rico, and the Virgin Islands and how territory-specific factors shape local healthcare gaps. It is the researchers' hope that novel contributions can be made to the national healthcare debate, while shining a light on the need to include the unincorporated territories in this discussion.

Methods

Data Source

Data were analyzed from the 2010 Behavioral Risk Factor Surveillance System (BRFSS), which is publicly available, de-identified data. Hence, this analysis was deemed exempt from review by the Institutional Review Board of Emory.

Overview of the BRFSS Study Design

The BRFSS is an ongoing, state-based, random-digit dialed household telephone survey of the non-institutionalized US civilian population aged ≥ 18 years. BRFSS data are collected monthly in all 50 states, the District of Colombia, US Virgin Islands, Puerto Rico, and Guam. At the end of the survey year, CDC edits and aggregates the monthly data files to create a yearly sample for each state. Each sample is weighted to the respondent's probability of selection and to the age- and sex-specific population or age-, sex-, and race-specific population using the yearly census projections reported by the census bureau for each state.

The standard BRFSS questionnaire consists of three parts: 1) core questions; 2) optional supplemental modules, which are sets of questions on specific topics; and 3) state-added questions. All 50 states, the District of Colombia, and three territories ask the same core questions. Optional modules and state-added questions are included at the discretion of each state/territory. The 2010 core questions address demographics, general health status, number of healthy days, health-related quality of life, health-care access, sleep habits, exercise or leisure time physical activity, prevalence of: cardiovascular diseases, asthma, and diabetes, oral health, disability, tobacco/cigarette use, alcohol consumption, immunization including flu and pneumonia vaccination among adults, falls, seatbelt use, drinking and driving, women's health, prostate and colorectal cancer screening, HIV/AIDS, and emotional support and life satisfaction.

We used the core dataset of the 2010 BRFSS data to evaluate healthcare coverage, other outcomes in healthcare access and utilization, and selected covariates for residents in Guam, Puerto Rico, and the Virgin Islands compared to residents living in the 50 US states and the District of Colombia. The final sample included 784 residents in Guam, 3,542 residents in Puerto Rico, 1,822 residents in the Virgin Islands, and 444,927 residents in the US states.

Measures

Primary Measures

Healthcare outcome measures included in this analysis were: 1) whether the respondent experienced a healthcare cost barrier in the past 12 months, 2) whether they had a usual source/provider of healthcare (defined as having at least one person they considered a personal doctor), and 3)whether the respondent visited a doctor for a routine checkup in the past year. The primary factor of interest was whether the respondent had healthcare coverage in the form of either health insurance, prepaid plans, or government plans such as Medicare.

Factor Domains

Covariates were grouped into five factor domains and compared across the four subpopulations:

1) Socio-demographic variables included gender, marital status (currently married, never married, divorced, separated, or widowed), employment status (employed, unemployed, retired, unable to work, student or homemaker), age (as a 6-level category variable), education level (did not graduate from high school, high school graduate, attended college/technical school, graduated from college/technical school), and household income (as a 5-level category variable). These factors were conceptualized as a broad set of social determinants of health and healthcare.

2) Lifestyle and behavioral factors assessed physical activity in the past 30 days, smoking status (never, former, or current smoking), alcohol consumption in the past 30 days (none, moderate, or

heavy), and body mass index (measured in kg/m^2 and categorized as normal, overweight, or obese). This domain represents lifestyle risk factors that may affect individual beliefs, behaviors, and needs associated with healthcare.

3) Social and emotional support was measured by a single question asking respondents how often they received the support needed, reclassified as a dichotomous variable ("never", "rarely", or "sometimes" receiving social and emotional support were categorized as insufficient support, while "usually" or "always" were categorized as sufficient support). This variable also represents a broad social determinant of health and healthcare, but was conceptualized differently from demographics because it captures familial and social ties that may influence one's need and/or ability to access healthcare.

4) Self-reported health measures included general health status, number of physically unhealthy days in the past month, number of mentally unhealthy days in the past month, life satisfaction, and reported activity limitations due to physical, mental, or emotional problems. These were conceptualized as perceived health need factors that underlie health seeking behaviors[3].

5) History of diagnosed conditions included whether the respondent had ever been told by a doctor, nurse, or other health professional that they had diabetes, heart attacks, angina or coronary heart disease, stroke, or asthma (assessed also for current prevalence). These factors represent physician-evaluated health-need factors that may influence one's access and utilization of healthcare in ways that are different from perceived health need factors[3].

Statistical Analysis

To investigate the first study aim, χ^2 tests compared each territory with the US states by evaluating the proportion of each population that lacked health insurance, experienced cost barriers, lacked a usual source/provider, and failed to perform a routine checkup.

The three territories and the general US state population were stratified to explore the second and third aims. Logistic regression assessed the unadjusted odds of poor healthcare access and utilization outcomes that could be attributed to lack of healthcare coverage within each of the four subpopulations. Unadjusted odds of the outcomes were also obtained for each variable in the factor domains, again stratified by the four subpopulations.

Multiple logistic regressions were carried out to determine the adjusted effects of healthcare coverage and each factor domain on the access and utilization outcomes, also stratified by the four subpopulations. Each factor domain was separately controlled for to determine which of the domains most strongly accounted for the relationship between healthcare coverage and access/utilization outcomes. A meaningful adjustment effect was defined as a $\geq 10\%$ difference in the estimated odds ratio following domain adjustment. A final model controlling for all 5 domains obtained the fully adjusted measures of association between healthcare coverage and the outcomes within each territory.

All statistical analyses were performed using SAS version 9.2 (Cary, NC) and accounted for complex survey design. All statistical tests were evaluated for significance at the 0.05 level.

Results

Factor Domains by Subpopulation

Table 1 presents socio-demographic characteristics across four subpopulations: residents in Guam, Puerto Rico, US Virgin Islands, and the 50 states. There was no significant difference in distribution of sex across the four subpopulations. Residents in the three unincorporated territories were significantly less likely to be married at the time of survey (Guam: 55.3%, Puerto Rico: 50.2%, Virgin Islands: 47.0%) than residents in the states (61.6%). Residents in Guam were significantly more likely to be unemployed than residents in the states (13.4% vs. 8.6%), while residents in Puerto Rico were significantly more likely to be unable to work than residents in the

states (7.7% vs. 5.5%). Age distributions varied by region. The Guam sample was predominantly Asian (33.7%) and Native Hawaiian or Other Pacific Islander (42.0%), the Puerto Rico sample was predominantly Hispanic (98.6%), the Virgin Islands sample was mostly black or African American (68.0%), and the US states sample was mostly White (69.7%). Each of the three unincorporated territories had a significantly higher proportion of residents who did not graduate high school (Guam: 13.4%, Puerto Rico: 19.4%, Virgin Islands: 17.1%) compared to the states (10.1%). Guam and Puerto Rico also had a significantly higher proportion of households with an annual income less than $15,000 compared to the states (Guam: 12.1%, Puerto Rico: 30.6%, US states: 9.1%).

Table 2 summarizes lifestyle and behavior factors, social or emotional support, self-reported health measures, and history of diagnosed conditions in each of the four subpopulations.

Residents in Puerto Rico and the Virgin Islands were significantly more likely to report an absence of exercise in the past 30 days (Puerto Rico: 42.3%, Virgin Islands: 31.8%) than residents in the states (24.2%). Guam had a significantly higher prevalence of reported current smoking (25.8%) while Puerto Rico (11.9%) and the Virgin Islands (5.8%) had a significantly lower prevalence compared to US states (17.2%). The three unincorporated territories had a lower prevalence of moderate alcohol consumption in the past 30 days (Guam: 34.7%, Puerto Rico: 24.7%, Virgin Islands: 36.9%) compared to US states (46.6%), but the subpopulations did not significantly differ in regards to prevalence of heavy alcohol consumption. There was no difference in the distribution of body mass index categories between the four subpopulations.

Residents in Guam and the Virgin Islands were significantly more likely to be report insufficient social and emotional support (Guam: 39.5%, Virgin Islands: 31.0%) while Puerto Rico residents were significantly less likely (15.1%) compared to the state population (19.6%).

Residents in Puerto Rico were significantly more likely to report poor or fair general health (32.1%) compared to state residents (16.1%). Residents in Puerto Rico were also less likely to be dissatisfied with life (3.6%) compared to residents in the 50 states (5.4%). Residents in all three unincorporated territories were less likely to report activity limitations due to health problems (Guam: 10.8%, Puerto Rico: 15.6%, Virgin Islands 11.4%) than state residents (20.7%). Compared to the 50 states, having 14 or more physically unhealthy days in the past month was less prevalent in Guam (7.4%) and the Virgin Islands (7.9%) while it was more prevalent in Puerto Rico (14.4%). Similarly, frequent mental distress was less prevalent in Guam (6.2%) and the Virgin Islands (7.5) than in the US states (10.8%).

History of diabetes was significantly more prevalent in Puerto Rico (12.8%) than in the states (9.3%). Compared to US states (4.3%), history of angina or coronary heart disease was more prevalent in Puerto Rico (8.2%) and significantly less prevalent in Guam (2.2%) and the Virgin Islands (1.6%). History of a heart attack was significantly less prevalent in Guam (2.7%) and the Virgin Islands (2.0%) compared to US states (4.3%). History of stroke was significantly less prevalent in Puerto Rico (2.0%) and the Virgin Islands (1.6%) compared to US states (2.8%). Finally, the prevalence of ever (10.4%) and currently (5.9%) diagnosed asthma in the Virgin Islands were significantly lower than that in states (13.2% and 8.6%) respectively). Currently diagnosed asthma in Guam (5.2%) was less prevalent than that in the states, but ever diagnosed asthma did not differ.

Healthcare Access, Barriers, and Utilization by Subpopulation

Table 3 and Figures 1-3 summarize healthcare coverage and the three healthcare access and utilization outcomes across the four subpopulations. Residents in Guam and the Virgin Islands were more likely to be uninsured (22.2% and 30.6% respectively, compared to the states: 15.3%), to lack a usual source of healthcare (28.3% and 27.0% respectively, compared to the states:

18.3%) and to have experienced a healthcare cost barrier (18.8% and 19.5% respectively, compared to the states 14.6%). Residents in Guam were also more likely to not have had a routine annual checkup in the past year (39.8% compared to the states: 32.2%).

There was a significantly lower proportion of residents in Puerto Rico who lacked a usual source of healthcare (16.0%) or failed to have an annual routine checkup in the past year (21.2%) compared to state residents. Although the proportion of uninsured residents in Puerto Rico (7.9%) was lower compared to state residents, residents in Puerto Rico were still more likely to experience a healthcare cost barrier (17.5%).

Figures 1-3 also highlight potential discrepancies between healthcare coverage and outcomes in access and utilization. In Guam, the uninsured proportion did not significantly differ from the proportion of those who experienced a healthcare cost barrier or those who lacked a usual healthcare source, but the uninsured proportion was significantly lower than the proportion of those who failed to conduct a routine checkup in the past year. In Puerto Rico, the uninsured proportion was significantly lower than all three proportions for negative access/utilization outcomes. While the uninsured proportion in the Virgin Islands was not significantly different from the proportion that failed to conduct a routine checkup or lacked a usual healthcare provider, there were significantly more residents that were uninsured than those who had experienced a healthcare cost barrier.

Factor Domains and Healthcare Access/Utilization Outcomes Within Each Subpopulation

Appendices A, B, and C present the unadjusted measures of effect for the association between the health access/utilization outcomes and each variable in the five factor domains. The effect of each factor domain on the association between healthcare coverage and the access/utilization outcomes varied by subpopulation (Tables 4-6).

The socio-demographics domain meaningfully reduced the cost barrier OR in the Virgin Islands (-45.5%) and the states (-45.0%). It also meaningfully reduced the healthcare provider OR in Puerto Rico (-19.2%), the Virgin Islands (-28.7%), and the states (-46.3%), as well as the routine checkup OR in Guam (-10.4%), Puerto Rico (-40.2%), and the states (-20.6%).

The behavioral/lifestyle factors domain meaningfully increased the healthcare provider OR in Guam (+16.8%), as well as the routine checkup OR in Puerto Rico (-13.9%). The social/emotional support domain meaningfully reduced the cost barrier OR in Guam (-17.0%). The self-reported health domain meaningfully reduced the cost barrier OR in Guam (-15.8%), while meaningfully increasing the cost barrier OR in Puerto Rico (+26.1%). It also meaningfully decreased the routine checkup OR in Puerto Rico (-14.6%). The domain for history of diagnosed conditions did not meaningfully adjust any of the healthcare coverage ORs.

Healthcare Coverage and Healthcare Access/Utilization Outcomes Within Each Subpopulation

Unadjusted measures of association between healthcare coverage and the healthcare access/utilization outcomes were consistently significant across each of the four subpopulations (Tables 4-6). The unadjusted OR of experiencing a cost barrier among those who lacked healthcare coverage ranged from 1.71 in Guam (95% CI: 1.03 – 2.84) to 8.84 in the states (95% CI: 8.46 – 9.25). The unadjusted OR of lacking a usual healthcare provider among those without coverage ranged from 4.07 in the Virgin Islands (95% CI: 2.93 – 5.64) to 9.28 in the states (95% CI: 8.88 – 9.70). Lastly, the unadjusted OR of failing to perform a routine checkup in the past year among those without coverage ranged from 2.57 in the Virgin Islands (95% CI: 1.89 – 3.51) to 4.45 in Puerto Rico (95% CI: 2.98 – 6.64).

After adjusting for all five factor domains, adjusted measures of the association between healthcare coverage and the outcomes were almost consistently significantly across all four subpopulations as well, with the exception of ORs for experience of a cost barrier and failure to

perform a routine checkup in the past year in Guam (Tables 4-6). The fully adjusted OR of experiencing a cost barrier among those who lacked healthcare coverage ranged from 1.15 in Guam (95% CI: 0.53 – 2.47) to 5.51 in Puerto Rico (3.20 – 9.50). The fully adjusted OR of lacking a usual healthcare provider among those without coverage ranged from 3.09 in the Virgin Islands (95% CI: 1.84 – 5.17) to 7.91 in Puerto Rico (95% CI: 4.65 – 13.45). The fully adjusted OR of failing to perform a routine checkup in the past year among those without coverage ranged from 1.87 in Guam (0.87 – 3.99) to 3.25 in the states (3.07 – 3.44).

Discussion

Crude results suggest that although a high proportion of residents in the Virgin Islands were uninsured, many were finding ways to get past cost barriers. The opposite was true in Puerto Rico; although insurance coverage was relatively high, a large proportion of the population continued to experience healthcare cost barriers.

These findings would appear to support the argument that extensive coverage of health insurance does not necessarily lead to improved healthcare access and utilization. However, measures of association between healthcare coverage and access/utilization outcomes suggest otherwise. In Puerto Rico, the Virgin Islands, and the US states, healthcare insurance was a strong predictor of access and utilization both before and after adjustment for covariates. Although insurance was not a significant predictor of conducting routine checkups or experiencing cost barriers in Guam following adjustment, it was a strong predictor of having a usual healthcare source. Lack of healthcare coverage generally predicted poorer access and utilization outcomes across the four subpopulations even after taking into consideration socio-demographics, behavioral/lifestyle factors, social/emotional support, self-reported health, and a history of diagnosed conditions,

These findings suggest that expanded health insurance can indeed improve healthcare access and utilization across the US states and the territories. However, this association is complicated by the unique cultural and social contexts within each subpopulation. We follow with a region-specific discussion on the factors that appear to influence the link between healthcare coverage and access/utilization.

Guam

Not only was insurance coverage lower in Guam compared to the US states, a higher proportion of Guam's residents had experienced healthcare cost barriers, lacked a usual source of healthcare, and failed to perform a routine checkup in the past year. It was hoped that healthcare coverage would be a strong predictor of all three access/utilization outcomes, but after adjustment, it was only a significant predictor of having a usual healthcare source. This may be partially attributable to a lower sample size in Guam relative to the other subpopulations.

Results of domain adjustment suggest that social/emotional support and self-reported health could explain part of the link between healthcare coverage and cost barriers. Lack of social/emotional support was highest in Guam compared to the four subpopulations was found to be a risk factor for cost barriers in the territory. Among the self-reported health variables, poor general health, life dissatisfaction, physical health, and mental health in particular were significant risk factors for cost barriers, with life dissatisfaction and mental health as particularly strong predictors. These findings suggest that the general mental and psychological well-being of residents in Guam may play a role in the access of healthcare, highlighting a potential pathway for intervention. Reforms and intervention efforts can potentially examine the role that social and emotional ties play in helping Guam's residents access and utilize healthcare, providing resources and community support where needed.

The predictive effect of healthcare coverage on having a usual healthcare source increased after adjusting for behavioral/lifestyle factors, suggesting the importance of insurance among those who report current smoking or heavy alcohol consumption (identified as risk factors for not having a usual provider in Guam). Smoking in Guam has the highest prevalence among all US states and territories; along with alcohol consumption, it carries unique cultural and social connotations for Pacific Islanders and Asians[62]. The role of healthcare coverage appears to greatly improve the likelihood that these substance-users have access to a consistent source of healthcare, which will be crucial in mitigating Guam's chronic disease burden as it continues its epidemiologic transition.

Furthermore, socio-demographics appeared to play a role in the relationship between coverage and routine checkups. Young age and low income were identified as risk factors in Guam for not receiving a yearly checkup from a physician. However, while a household income less than $15,000 was not a significant predictor, residents with a household income falling between $15,000-$25,000 had twice the odds of not conducting a routine checkup relative to those with a household income greater than $50,000. This suggests that federal and/or territorial healthcare benefits extending to low income families were reaching those belonging to the lowest income bracket, while providing little assistance to those who fall just slightly above a certain threshold. To ensure widespread utilization of healthcare, reform and intervention efforts should look to either expand insurance coverage or provide necessary resources to those who live in relative socioeconomic disadvantage who aren't currently receiving benefits.

Because of geographic and demographic similarity, these findings may potentially be generalizable to the Northern Mariana Islands and the American Samoa – the two inhabited unincorporated territories that were not included in this study.

Puerto Rico

In spite of the discrepancy between high insurance coverage and high prevalence of cost barriers, having healthcare coverage in Puerto Rico still significantly reduced the odds that an individual could not afford to see a doctor. A meaningful contributor to this relationship was the self-reported health domain; after self-reported health was controlled for, the predictive value of healthcare coverage increased. Poor general health, life dissatisfaction, poor physical health, and poor mental health were all identified as risk factors for the experience of cost barriers in Puerto Rico. High levels of poor general health and physical health in Puerto Rico reveal the importance of ensuring healthcare affordability among those most in need.

Furthermore, although Puerto Ricans generally indicated high levels of strong social/emotional support and life satisfaction relative to the other subpopulations, an extended duration of poor mental health was still highest in Puerto Rico. There is evidence that attitudes towards mental health in Puerto Rico remain heavily stigmatized, with little belief in treatment and sympathy towards those with psychiatric illnesses[63]. Puerto Rico's privatization of healthcare in the 1990s left the responsibility of providing mental health services to companies specializing in behavioral and mental healthcare, with primary care and other services provided by general insurance carriers[64]. This isolation of mental health into its own sphere, in addition to the elevated costs of mental health care in Medicare programs, reflects a potential cost barrier for Puerto Ricans with psychiatric disorders[65].

Socio-demographics had a meaningful effect on health insurance's predictive value of having a usual source of healthcare. Being male, never being married, and young age were identified as risk factors for not having a consistent health provider. Contrary to intuition, low education, low income, and being unable to work tended to be associated with *lower* odds of lacking a usual provider. These findings, coupled with Puerto Rico's high insurance coverage, suggest that a strong effort has been made to provide insurance and access to physicians among disadvantaged populations.

Finally, socio-demographics, behavioral/lifestyle factors, and self-reported health meaningfully influence the relationship between insurance and conducting routine checkups. Among these specific factors, young age, activity limitations due to health problems, and heavy alcohol consumption were identified as risks for not successfully performing yearly checkups. The debilitating effects of activity limitations and alcohol consumption should be highlighted here; the larger issue may not be provision of health insurance among these groups, but rather the physical difficulty of accessing health services exacerbated by the relative lack of hospitals in areas of Puerto Rico outside the metropolitan area. Use of more local healthcare sources in the form of entities such as federally qualified health centers may reduce these problems and improve utilization.

The findings suggest that healthcare coverage can indeed play an important role in reducing access/utilization disparities within Puerto Rico, contrary to the apparent discrepancy between high coverage and high prevalence of cost barriers. Puerto Rico's healthcare gaps don't appear to be attributed to general insurance coverage, but rather the affordability, availability and accessibility of services.[66] Further examination of Puerto Rico's ongoing healthcare reform effort, particularly in the areas of mental health and rural access, is warranted.

US Virgin Islands

Socio-demographics meaningfully influenced healthcare coverage's predictive value on cost barriers and the lack of usual provider. Young age, lower education, and low income were identified as risk factors for both these access/utilization outcomes. Being unemployed, unable to work, and Hispanic were also significant risk factors for cost barriers, while being male and never married were also significant risk factors for lacking a usual provider.

The racial demographic of the Virgin Islands is unique: with a majority of African Americans, this racial/ethnic group was not at greater risk of experiencing poorer healthcare access/utilization

relative to Whites, in contrast with the disparities found for African Americans in the US state population. However, evidence of poorer access/utilization among a sizable Hispanic population of 13% suggests that racial disparities in health care do still exist in this territory.

Lack of health insurance was highest in the Virgin Islands relative to the other subpopulations and appears to be on a negative trend over time; 24.1% were uninsured in 2003 and 28.7% in 2009, compared with 30.6% in 2010 based on the findings of this study[24]. Despite the high proportion of uninsured residents, cost barriers were not significantly more prevalent relative to the other subpopulations. This may be partially explained by the relatively high levels of income found in the Virgin Islands relative to Guam and Puerto Rico.

However, this does not indicate that health insurance doesn't play a role in improving healthcare access and utilization in the Virgin Islands. Having health insurance consistently reduced the odds of poor healthcare access/utilization outcomes, both before and following adjustment for other factors. Although low income isn't as prevalent in the Virgin Islands compared to the other territories, there still appear to be healthcare disparities that need to be addressed among disadvantaged populations, particularly Hispanics and the unemployed.

Among those uninsured in the Virgin Islands in 2009, only about 30% were potentially eligible for employer or public program coverage.[67] While not a panacea for the underlying socio-demographic disparities found in the Virgin Islands, healthcare coverage targeted to disadvantaged groups can go a long way in reducing some of the barriers to health equity.

Limitations

Despite past evidence suggesting that hospital performance in the territories is also lacking, this study does not take into consideration issues of quality of care[49]. Of particular need is a closer examination of how these healthcare systems differ in regards to quality of chronic disease treatment. Although this study showed no evidence of differential access and utilization among

chronic disease patients, past evidence suggests that diabetes patients in the territories are at significantly greater risk of mortality than diabetes patients in the states[46]. There is also evidence of service gaps between the territories and the states in the areas of vaccination, screenings, and specialty services (such as mental healthcare) that aren't addressed by this study[49,68]. Future investigation is needed in specific areas of healthcare quality and services to address some of these territorial gaps.

Limitations of available data made it difficult to examine key issues in the relationship between healthcare coverage and access/utilization. We were unable to investigate potential differences between public vs. private coverage, as well as important factors such as geographic distances and obstacles to healthcare access. The latter is crucial because of unequal geographic distributions of hospitals in Puerto Rico, and the fact that Guam and the Virgin Islands each only have one hospital. We also would have liked to calculate a poverty level indicator as our measure of financial capital rather than a basic income category measure, but the absence of poverty level guidelines by household size in the territories made this impossible. Furthermore, the study was cross-sectional in nature and may have benefitted from consideration of a longer time period.

Implications

The study achieved its aim in demonstrating gaps in healthcare coverage, access, and utilization in the unincorporated US territories relative to the states, as well as highlighting the role that increased coverage can have in increasing access and utilization within each territory.

With limited federal plans to extend healthcare reforms to the insular areas, another goal of this study was to present potential alternate pathways for intervention within the unique contexts of each territory. Key findings in this area included:

1) The role of low social/emotional support and poor mental in preventing healthcare access in Guam, as well as the increased importance of coverage among smokers and low income groups

not receiving healthcare benefits

2) Cost barriers that are posed by mental health coverage gaps in Puerto Rico, in addition to physical limitations that prevent access to services

3) Demographic issues in the Virgin Islands and the need to provide healthcare resources to disadvantaged populations

We believe that these findings can help guide future healthcare reform efforts both at the national and territorial level, and hope that greater attention and participation will be granted to the US territories during further discussions.

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TABLES

Table 1: Socio-demographics by US subpopulation

	Guam (n = 784)		Puerto Rico (n = 3,542)		Virgin Islands (n = 1,822)		States (n = 444,927)	
Demographic	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Females	49.2%	(44.9 - 53.6)	53.1%	(50.8 - 55.3)	53.3%	(50.1 - 56.5)	51.3%	(51.0 - 51.6)
Marital Status								
Currently Married	55.3%	(50.8 - 59.7)	50.2%	(48.0 - 52.5)	47.0%	(43.8 - 50.1)	61.6%	(61.3 - 61.9)
Divorced, Widowed, or Separated	10.9%	(8.8 - 12.9)	18.3%	(16.8 - 19.7)	16.4%	(14.6 - 18.2)	16.9%	(16.7 - 17.1)
Never Married	28.0%	(23.5 - 32.4)	23.7%	(21.5 - 26.0)	33.2%	(30.1 - 36.4)	18.0%	(17.7 - 18.3)
Employment Status								
Employed	60.0%	(55.7 - 64.2)	42.3%	(40.0 - 44.6)	65.6%	(62.6 - 68.6)	57.3%	(57.0 - 57.6)
Unemployed	13.4%	(10.1 - 16.6)	8.9%	(7.4 - 10.4)	9.6%	(7.3 - 11.9)	8.6%	(8.4 - 8.8)
Retired	8.4%	(6.6 - 10.2)	15.1%	(14.0 - 16.3)	13.0%	(11.5 - 14.6)	16.2%	(16.0 - 16.4)
Unable to work	4.4%	(2.6 - 6.2)	7.7%	(6.6 - 8.7)	3.3%	(2.2 - 4.4)	5.5%	(5.4 - 5.6)
Student or Homemaker	13.9%	(10.9 - 16.8)	25.9%	(23.9 - 27.9)	8.4%	(6.6 - 10.3)	12.4%	(12.2 - 12.6)
Age group (years)								
18 - 24	16.2%	(12.4 - 20.0)	14.6%	(12.6 - 16.6)	12.0%	(9.5 - 14.4)	10.0%	(9.7 - 10.2)
25 - 34	23.6%	(19.4 - 27.9)	19.2%	(17.1 - 21.4)	18.3%	(15.4 - 21.2)	16.8%	(16.5 - 17.0)
35 - 44	23.3%	(19.9 - 26.8)	18.5%	(16.7 - 20.3)	21.1%	(18.4 - 23.7)	20.8%	(20.6 - 21.1)
45 - 54	17.1%	(14.2 - 20.1)	16.9%	(15.4 - 18.4)	20.9%	(18.6 - 23.2)	19.9%	(19.6 - 20.1)
55 - 64	10.4%	(8.3 - 12.4)	14.1%	(13.0 - 16.3)	15.5%	(13.7 - 17.3)	15.2%	(15.0 - 15.3)
$\geq$ 65	9.3%	(7.4 - 11.2)	16.7%	(15.6 - 17.8)	12.3%	(10.9 - 13.6)	17.4%	(17.3 - 17.6)

	Guam (n = 784)		Puerto Rico (n = 3,542)		Virgin Islands (n = 1,822)		States (n = 444,927)	
Demographic	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Race/Ethnicity								
White	7.4%	(5.4 - 9.4)	1.0%	(0.6 - 1.4)	15.0%	(12.9 - 17.1)	69.7%	(69.4 - 70.1)
Black or African American	0.7%	(0.1 - 1.4)	0.1%	(0.0 - 0.1)	68.0%	(65.0 - 70.9)	10.0%	(9.8 - 10.2)
Asian	33.7%	(29.4 - 37.9)	0.0%	(0.0 - 0.1)	1.6%	(0.9 - 2.3)	3.6%	(3.4 - 3.7)
Native Hawaiian or Other Pacific Islander	42.0%	(37.5 - 46.6)	-	-	0.8%	(0.0 - 1.8)	0.3%	(0.3 - 0.3)
Other	0.5%	(0.0 - 1.0)	0.2%	(0.0 - 0.3)	0.8%	(0.2 - 1.4)	1.6%	(1.5 - 1.7)
Multi-racial (non-Hispanic)	7.8%	(5.1 - 10.5)	0.0%	(0.0 - 0.1)	1.0%	(0.4 - 1.5)	1.7%	(1.6 - 1.8)
Hispanic	7.9%	(5.7 - 10.1)	98.6%	(98.2 - 99.1)	12.9%	(10.7 - 15.1)	13.1%	(12.9 - 13.4)
Education Level								
Did not graduate high school	13.4%	(10.4 - 16.4)	19.4%	(17.9 - 21.0)	17.1%	(14.8 - 19.3)	10.1%	(9.9 - 10.3)
Graduated high school	40.9%	(36.5 - 45.2)	23.1%	(21.2 - 25.0)	38.6%	(35.4 - 41.7)	27.8%	(27.5 - 28.1)
Attended college or technical school	21.6%	(18.1 - 25.2)	27.7%	(25.6 - 29.9)	18.4%	(16.0 - 20.8)	26.1%	(25.9 - 26.4)
Graduated from college or technical school	24.1%	(20.4 - 27.7)	29.7%	(27.6 - 31.8)	25.9%	(23.2 - 28.6)	36.0%	(35.7 - 36.3)
Household income								
Less than $15,000	12.1%	(9.4 - 14.8)	30.6%	(28.6 - 32.6)	9.9%	(8.1 - 11.8)	9.1%	(8.9 - 9.2)
$15,000 to less than $25,000	18.7%	(15.3 - 22.1)	26.5%	(24.5 - 28.5)	18.0%	(15.5 - 20.4)	13.7%	(13.5 - 13.9)
$25,000 to less than $35,000	13.8%	(10.6 - 16.9)	8.4%	(7.2 - 9.6)	10.5%	(8.5 - 12.4)	9.1%	(8.9 - 9.2)
$35,000 to less than $50,000	13.9%	(11.0 - 16.8)	5.5%	(4.5 - 6.5)	13.8%	(11.7 - 15.8)	11.9%	(11.7 - 12.1)
$50,000 or more	20.5%	(17.1 - 23.9)	6.1%	(5.0 - 7.1)	31.5%	(28.6 - 34.4)	43.0%	(42.7 - 43.3)

Table 2: Lifestyle/behavioral factors, social/emotional support, self-reported health, and chronic conditions by US subpopulation

	Guam (n = 784)		Puerto Rico (n = 3542)		Virgin Islands (n = 1822)		US (n = 444,927)	
Lifestyle and Behavioral Factors	%	95% CI	%	95% CI	%	95% CI	%	95% CI
No exercise in the past 30 days	24.8%	(21.0 - 28.6)	42.3%	(40.1 - 44.6)	31.8%	(28.8 - 34.8)	24.2%	(23.9 - 24.4)
Smoking status								
Never Smoked	57.6%	(53.2 - 62.0)	70.8%	(68.7 - 72.8)	83.7%	(81.5 - 85.8)	57.9%	(57.6 - 58.2)
Former Smoker	16.6%	(13.5 - 19.8)	17.3%	(15.8 - 18.9)	10.5%	(8.9 - 12.2)	25.0%	(24.7 - 25.2)
Current Smoker	25.8%	(21.7 - 29.9)	11.9%	(10.2 - 13.5)	5.8%	(4.4 - 7.2)	17.2%	(16.9 - 17.4)
Alcohol Consumption in past 30 days								
None	60.5%	(56.1 - 64.8)	72.3%	(70.1 - 74.4)	56.6%	(53.4 - 59.8)	48.5%	(48.2 - 48.8)
Moderate Drinking	34.7%	(30.4 - 38.9)	24.7%	(22.6 - 26.8)	36.9%	(33.8 - 40.1)	46.6%	(46.3 - 46.9)
Heavy Drinking	4.9%	(3.1 - 6.7)	3.0%	(2.1 - 4.0)	6.5%	(4.8 - 8.1)	4.9%	(4.8 - 5.0)
Body Mass Index (kg/m^2)								
Neither overweight nor obese	39.7%	(35.4 - 44.0)	34.4%	(32.2 - 36.6)	33.8%	(30.7 - 36.8)	35.9%	(35.6 - 36.2)
Overweight	32.6%	(28.5 - 36.8)	38.1%	(35.9 - 40.3)	36.2%	(33.2 - 39.2)	36.2%	(35.9 - 36.5)
Obese	27.6%	(23.5 - 31.8)	27.5%	(25.4 - 29.5)	30.0%	(27.1 - 33.0)	27.8%	(27.6 - 28.1)
Social/Emotional Support								
Insufficient Support	39.5%	(35.1 - 43.9)	15.1%	(13.5 - 16.7)	31.0%	(28.0 - 33.9)	19.6%	(19.3 - 19.8)

	Guam (n = 784)		Puerto Rico (n = 3542)		Virgin Islands (n = 1822)		US (n = 444,927)	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Self-reported Health Measures								
Poor or Fair General Health Status Rating	18.1%	(14.8 - 21.4)	32.1%	(30.1 - 34.0)	15.0%	(12.9 - 17.1)	16.1%	(15.9 - 16.3)
Dissatisfied with Life	6.2%	(4.2 - 8.3)	3.6%	(2.8 - 4.5)	4.1%	(2.8 - 5.5)	5.4%	(5.3 - 5.6)
Activity limitations due to health problems	10.8%	(8.2 - 13.4)	15.6%	(14.1 - 17.0)	11.4%	(9.4 - 13.3)	20.7%	(20.5 - 20.9)
Physically Unhealthy ≥ 14 Days in Past Month	7.4%	(5.4 - 9.3)	14.4%	(13.0 - 15.9)	7.9%	(6.3 - 9.5)	11.1%	(10.9 - 11.3)
Mentally Unhealthy ≥ 14 Days in Past Month	6.2%	(4.4 - 8.1)	11.7%	(10.3 - 13.1)	7.5%	(5.6 - 9.3)	10.8%	(10.6 - 11.0)
History of Diagnosed Conditions								
Diabetes	11.1%	(8.7 - 13.5)	12.8%	(11.6 - 14.0)	9.1%	(7.7 - 10.6)	9.3%	(9.1 - 9.4)
Heart attack	2.7%	(1.5 - 3.9)	4.2%	(3.5 - 4.8)	2.0%	(1.1 - 2.8)	4.3%	(4.2 - 4.3)
Angina or Coronary Heart Disease	2.7%	(1.4 - 3.9)	8.2%	(7.2 - 9.2)	1.8%	(1.1 - 2.5)	4.3%	(4.2 - 4.4)
Stroke	2.2%	(1.1 - 3.2)	2.0%	(1.5 - 2.6)	1.6%	(0.9 - 2.4)	2.8%	(2.7 - 2.9)
Asthma								
Ever had	10.5%	(7.6 - 13.3)	14.6%	(13.0 - 16.2)	10.4%	(8.4 - 12.4)	13.2%	(13.0 - 13.4)
Currently have	5.2%	(3.1 - 7.3)	7.5%	(6.3 - 8.7)	5.9%	(4.4 - 7.5)	8.6%	(8.5 - 8.8)

Table 3: Healthcare access and utilization among insured and uninsured, by US subpopulation

		Experience of Cost Barrier	Lack of Usual Provider	No Routine Checkup
Guam	Insured	17.0% (13.6-20.4)	21.2% (16.7-25.6)	33.7% (29.1-38.4)
	Uninsured	25.9% (17.3-34.6)	53.9% (43.7-64.1)	59.5% (49.6-69.3)
Puerto Rico	Insured	15.2% (13.5-16.8)	12.5% (10.8-14.1)	18.7% (16.7-20.6)
	Uninsured	43.8% (34.5-53.2)	56.6% (47.3-65.8)	50.5% (41.0-60.1)
Virgin Islands	Insured	11.5% (9.1-13.8)	18.4% (15.5-21.4)	27.4% (24.0-30.7)
	Uninsured	38.9% (32.3-45.5)	47.9% (41.3-54.4)	49.2% (42.7-55.8)
US states	Insured	8.9% (8.7-9.1)	11.6% (11.4-11.9)	27.0% (26.7-27.3)
	Uninsured	46.4% (45.5-47.3)	55.0% (54.1-55.9)	61.0% (60.1-61.9)

Table 4: Multivariable analysis of the association between health coverage and the experience of a medical cost barrier, by US subpopulation

	Experience of Health Care Cost Barrier			
	Guam	Puerto Rico	Virgin Islands	States
Model 1 - Crude HCC OR	1.71	4.36	4.92	8.84
95% CI	1.03-2.84	2.93-6.48	3.43-7.04	8.46-9.25
Model 2 - HCC OR adjusted for socio-demographics	1.68	4.7	2.68	4.86
95% CI	0.88-3.21	2.89-7.65	1.73-4.16	4.58-5.15
% Difference from Model 1	-1.8%	7.8%	-45.5%	-45.0%
Model 3 - HCC OR adjusted for behavioral/lifestyle factors	1.67	4.73	5.39	8.16
95% CI	0.99-2.81	3.07-7.28	3.66-7.94	7.78-8.57
% Difference from Model 1	-2.3%	8.5%	9.6%	-7.7%
Model 4 - HCC OR adjusted for social/emotional support	1.42	4.36	4.78	8.48
95% CI	0.83-2.43	2.91-6.52	3.24-7.06	8.08-8.89
% Difference from Model 1	-17.0%	0.0%	-2.8%	-4.1%
Model 5 - HCC OR adjusted for self-reported health	1.44	5.5	4.95	9.54
95% CI	0.84-2.46	3.49-8.65	3.30-7.41	9.08-10.02
% Difference from Model 1	-15.8%	26.1%	0.6%	7.9%
Model 6 - HCC OR adjusted for history of diagnosed conditions	1.81	4.7	4.86	9.26
95% CI	1.08-3.03	3.10-7.12	3.37-7.01	8.84-9.70
% Difference from Model 1	5.8%	7.8%	-1.2%	4.8%
Model 7 - Fully Adjusted Model	1.15	5.51	3.95	5.41
95% CI	0.53-2.47	3.20-9.49	2.27-6.87	5.06-5.79
% Difference from Model 1	-32.7%	26.4%	-19.7%	-38.8%

Table 5: Multivariable analysis of the association between health coverage and having a usual health care provider, by US subpopulation

	No Usual Health Care Provider			
	Guam	Puerto Rico	Virgin Islands	States
Model 1 - Crude HCC OR	4.35	9.15	4.07	9.28
95% CI	2.68-7.08	6.12-13.70	2.93-5.64	8.88-9.70
Model 2 - HCC OR adjusted for socio-demographics	4.15	7.39	2.9	4.98
95% CI	2.17-7.97	4.56-11.97	1.88-4.49	4.71-5.26
% Difference from Model 1	-4.6%	-19.2%	-28.7%	-46.3%
Model 3 - HCC OR adjusted for behavioral/lifestyle factors	5.08	9.90	4.13	8.74
95% CI	2.96-8.72	6.42-15.25	2.91-5.87	8.34-9.16
% Difference from Model 1	16.8%	8.2%	1.5%	-5.8%
Model 4 - HCC OR adjusted for social/emotional support	4.17	9.12	4.12	1.37
95% CI	2.53-6.87	6.10-13.65	2.92-5.81	1.31-1.44
% Difference from Model 1	-4.1%	-0.3%	1.2%	-85.2%
Model 5 - HCC OR adjusted for self-reported health	4.57	8.88	3.76	9.00
95% CI	2.70-7.75	5.78-13.66	2.63-5.39	8.59-9.43
% Difference from Model 1	5.1%	-3.0%	-7.6%	-3.0%
Model 6 - HCC OR adjusted for history of diagnosed conditions	3.98	9.18	3.8	9.22
95% CI	2.39-6.62	6.07-13.90	2.72-5.32	8.81-9.64
% Difference from Model 1	-8.5%	0.3%	-6.6%	-0.6%
Model 7 - Fully Adjusted Model	5.92	7.91	3.09	4.88
95% CI	2.68-13.07	4.65-13.45	1.84-5.17	4.58-5.19
% Difference from Model 1	36.1%	-13.6%	-24.1%	-47.4%

Table 6: Multivariable analysis of the association between health coverage and performance of an annual routine checkup, by US subpopulation

	No Routine Checkup			
	Guam	Puerto Rico	Virgin Islands	States
Model 1 - Crude HCC OR	2.88	4.45	2.57	4.22
95% CI	1.83-4.54	2.98-6.64	1.89-3.51	4.06-4.40
Model 2 - HCC OR adjusted for socio-demographics	2.58	2.66	2.71	3.35
95% CI	1.35-4.94	1.65-4.30	1.76-4.19	3.18-3.53
% Difference from Model 1	-10.4%	-40.2%	5.4%	-20.6%
Model 3 - HCC OR adjusted for behavioral/lifestyle factors	2.66	3.83	2.7	4.13
95% CI	1.64-4.30	2.48-5.92	1.92-3.79	3.95-4.31
% Difference from Model 1	-7.6%	-13.9%	5.1%	-2.1%
Model 4 - HCC OR adjusted for social/emotional support	2.75	4.37	2.5	4.15
95% CI	1.72-4.41	2.92-6.55	1.80-3.47	3.98-4.34
% Difference from Model 1	-4.5%	-1.8%	-2.7%	-1.7%
Model 5 - HCC OR adjusted for self-reported health	2.64	3.8	2.46	4.14
95% CI	1.63-4.28	2.45-5.89	1.74-3.47	3.96-4.33
% Difference from Model 1	-8.3%	-14.6%	-4.3%	-1.9%
Model 6 - HCC OR adjusted for history of diagnosed conditions	2.97	4.16	2.57	4.13
95% CI	1.85-4.77	2.77-6.22	1.87-3.53	3.96-4.31
% Difference from Model 1	3.1%	-6.5%	0.0%	-2.1%
Model 7 - Fully Adjusted Model	1.87	2.28	2.94	3.25
95% CI	0.87-3.99	1.34-3.88	1.79-4.84	3.07-3.44
% Difference from Model 1	-35.1%	-48.8%	14.4%	-23.0%

FIGURES

Figure 1: Health coverage and the experience of cost barriers, by US subpopulation

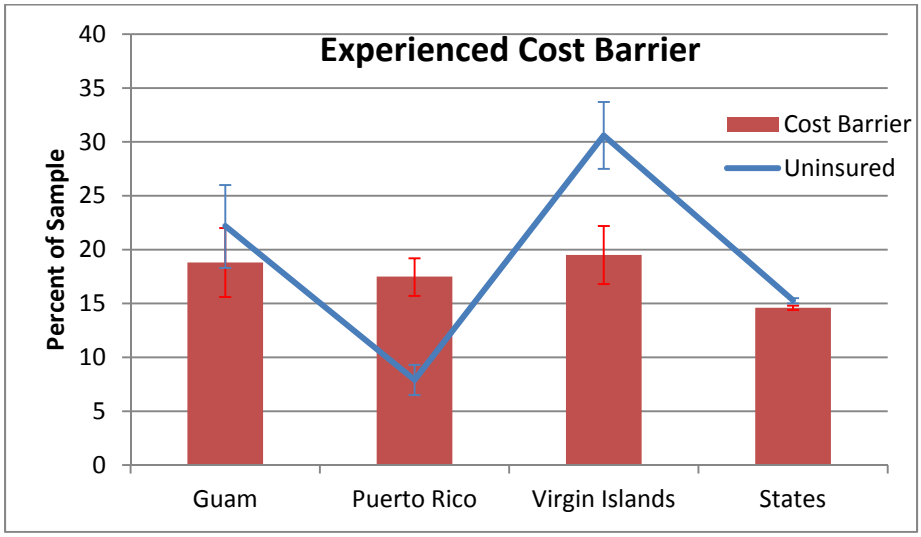


Figure 2: Health coverage and having a usual health care provider, by US subpopulation

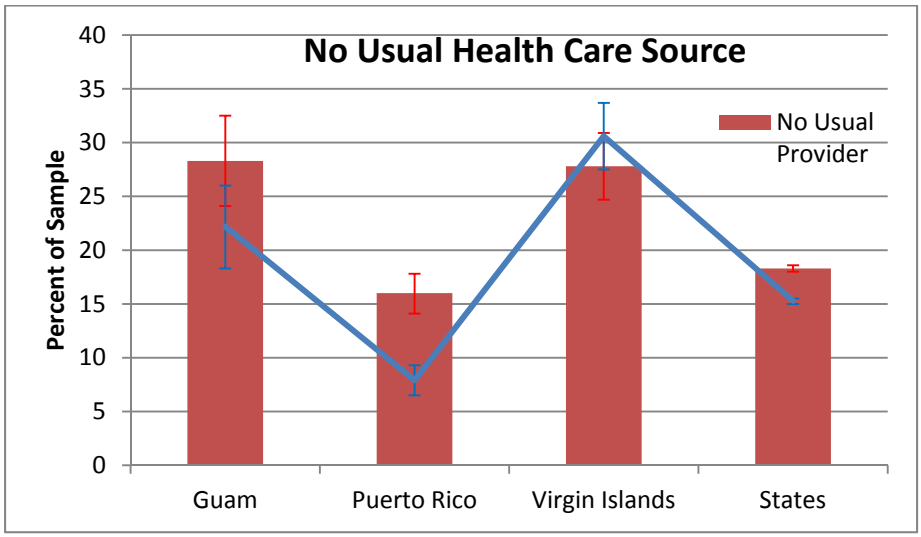


Figure 3: Health coverage and performance of an annual routine checkup, by US subpopulation

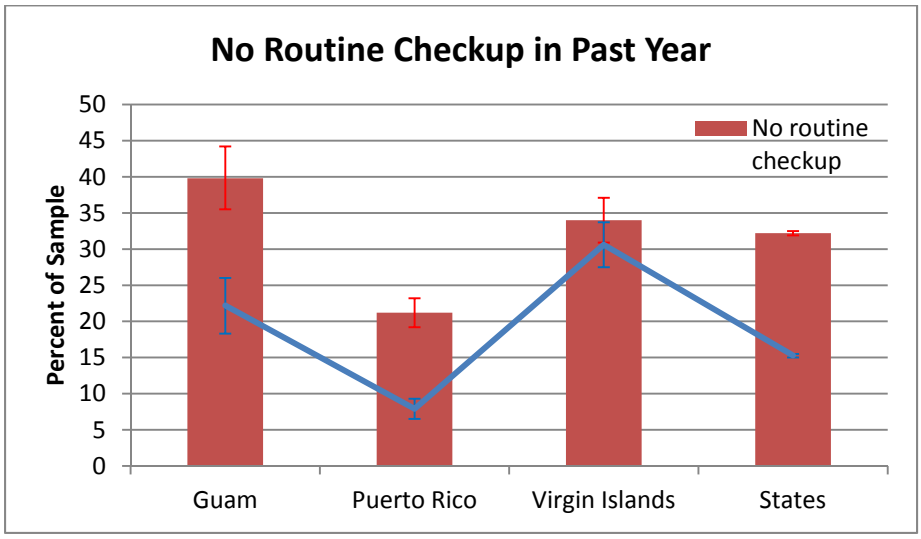
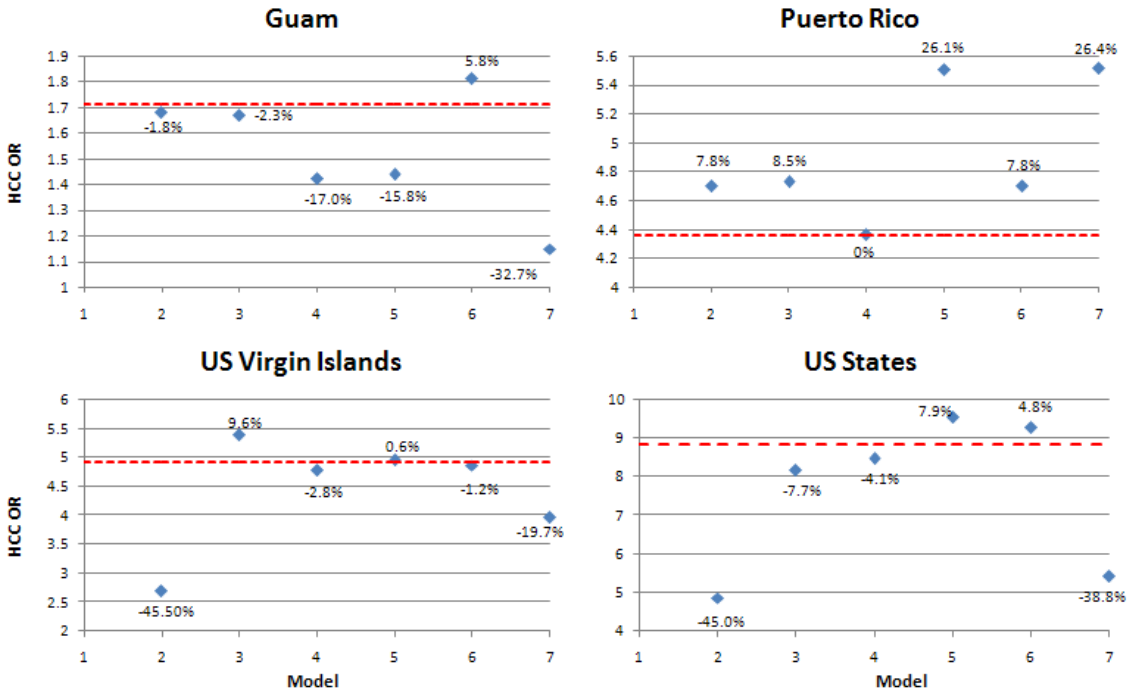
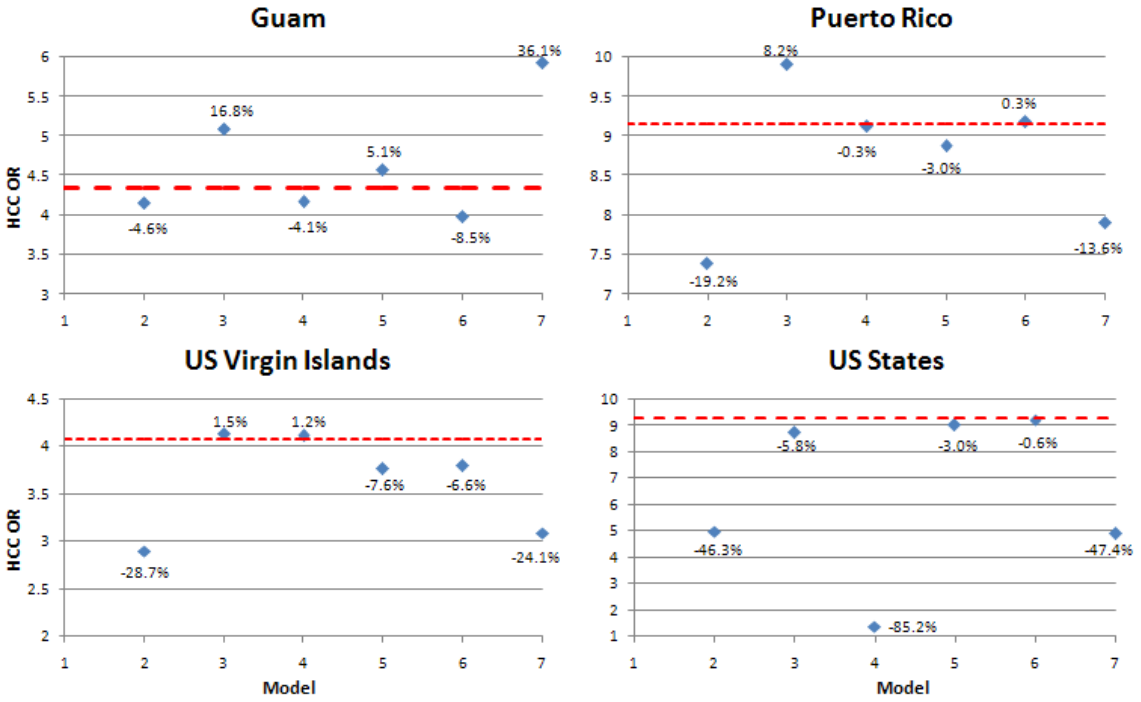


Figure 4: Factor domain adjustment of the association between health coverage and the experience of a medical cost barrier, by US population



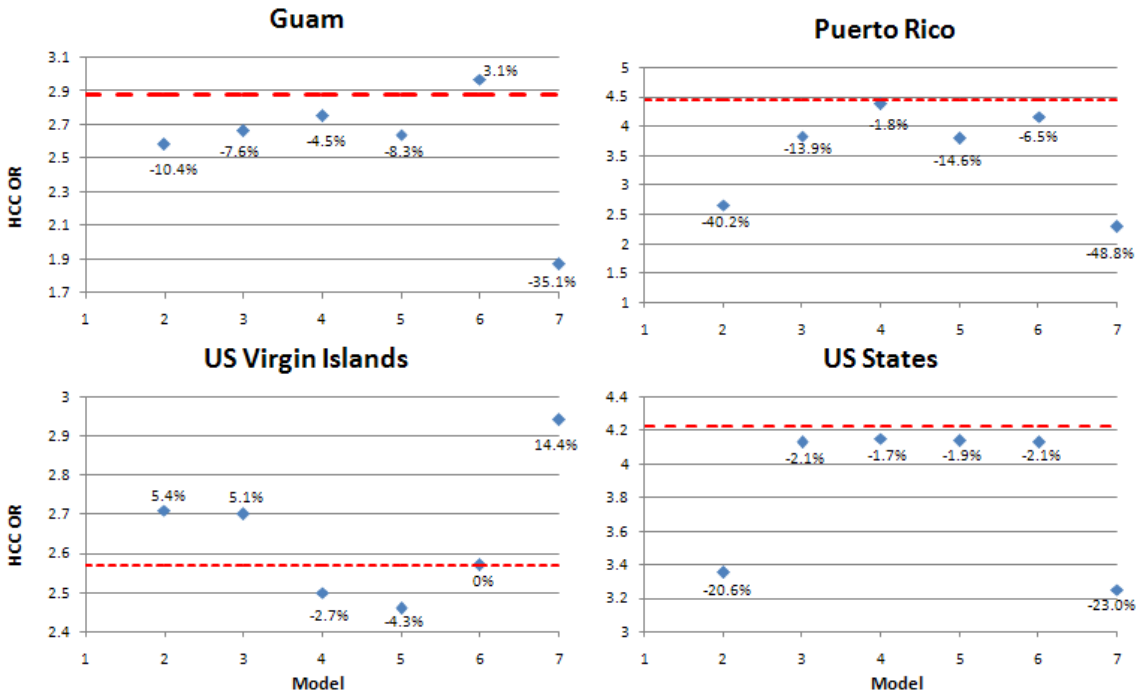
Model 1: Healthcare coverage only (red line reference value)
Model 2: Model 1 adjusted for socio-demographics
Model 3: Model 1 adjusted for lifestyle/behavioral factors
Model 4: Model 1 adjusted for social/emotional support
Model 5: Model 1 adjusted for self-reported health
Model 6: Model 1 adjusted for history of diagnosed conditions
Model 7: Model 1 adjusted for all factor domains

Figure 5: Factor domain adjustment of the association between health coverage and having a usual health care provider, by US population



Model 1: Healthcare coverage only (red line reference value)
Model 2: Model 1 adjusted for socio-demographics
Model 3: Model 1 adjusted for lifestyle/behavioral factors
Model 4: Model 1 adjusted for social/emotional support
Model 5: Model 1 adjusted for self-reported health
Model 6: Model 1 adjusted for history of diagnosed conditions
Model 7: Model 1 adjusted for all factor domains

Figure 6: Factor domain adjustment of the association between health coverage and performance of an annual routine checkup, by US population



Model 1: Healthcare coverage only (red line reference value)
Model 2: Model 1 adjusted for socio-demographics
Model 3: Model 1 adjusted for lifestyle/behavioral factors
Model 4: Model 1 adjusted for social/emotional support
Model 5: Model 1 adjusted for self-reported health
Model 6: Model 1 adjusted for history of diagnosed conditions
Model 7: Model 1 adjusted for all factor domains

CHAPTER III: SUMMARY, PUBLIC HEALTH IMPLICATIONS, POSSIBLE FUTURE DIRECTIONS

In summary, healthcare insurance coverage is found to be a strong positive predictor in the reduction of medical cost barriers, having a usual provider/source of care, and conducting routine checkups and physical examinations. However, the findings also suggest that while health insurance can increase access and utilization of services, expanded coverage alone is likely insufficient. We've demonstrated that alternate interventions can also improve healthcare access and utilization in the territories if expanded insurance is not an option.

One of the key conceptual features of Andersen's Behavioral Model of Health Services is the importance of determining the mutability of a particular model component or intervention strategy in promoting healthcare equity[3]. Factors that fall under the demographic or social structure components (defined as socio-demographics in the current study) are given a low degree of mutability, and thus represent difficult pathways for intervention. Health beliefs (somewhat tied to lifestyle/behavioral factors in this study, but otherwise unmeasured here) are believed to have a medium degree of mutability. For health need (partly encompassed by the slf-reported health and history of diagnosed conditions domains in this study), the mutability is hard to assess because it is often the immediate or proximal cause for seeking health services, although the perception of need can be somewhat mutable.

Enabling factors are considered to be highly mutable in Andersen's Model and represent a more achievable pathway for intervention. Health insurance would be classified as an enabling factor, with expanded coverage probably more likely to be achievable than widespread demographic or social structure changes. Additional enabling factors in this study deserving of further examination include: the role of social and emotional support in facilitating healthcare access and utilization (particularly in Guam), improved access to mental health services (particularly in Guam and Puerto Rico), and additional monetary or social support provided to

those who fall just outside Medicaid eligibility criteria (particularly in Guam and the Virgin Islands). Further investigation is warranted for enabling factors not encompassed by this study, such as transportation to health services and distance to facilities.

The relative lack of public health data for the unincorporated territories reflects another crucial gap to be addressed. The BRFSS does an admirable job of achieving high participation levels in the territories, but few other agencies are taking on the data collection effort. With its existing data collection capacity and infrastructure, greater funding and support should be considered for the BRFSS to expand the number of optional modules implemented in its territory surveys. This can potentially compensate for the lack of public health data by providing additional territory-level statistics on mental health, screening practices, and chronic disease prevalence that are missing elsewhere. Praise should also be directed to the BRFSS for reducing language barriers in its implementation of a Spanish version of the survey.

Greater clarity is needed on the factors underlying differential quality of care and health outcomes in the unincorporated territories, particularly in regards to public vs. private health provision. The complexity of health insurance markets and their relationship with government-provided health systems on these islands is beyond the scope of this study. As is the case in any healthcare reform effort, greater cooperation and partnership between public and private health sectors will greatly aid the cause.

It is not the intention of this current study to make a forthright argument that the territories should unconditionally receive the same terms of the PPACA; political considerations regarding the sovereignty of the territories have been largely sidestepped. However, we do assert that there is indeed room for healthcare reform in the unincorporated territories, and that expanded insurance coverage does appear to be a justifiable intervention strategy to improve access and utilization of health services. Although it is impossible to establish causal relationships in this observational study, we found strong associations across our unadjusted and adjusted

models which support the prevailing notion that health insurance can predict the access and utilization of health services.

Finally, and perhaps most importantly, we hope that the territories will be given a voice in future discussions on healthcare reform, and that the unique cultural and social contexts of these islands will be given due consideration.

APPENDICES

Appendix A: Associations between experience of a medical cost barrier and factor domain covariates, by US subpopulation

	Guam (n = 784)	Puerto Rico (n = 3,542)	Virgin Islands (n = 1,822)	States (n = 44,927)
Health Insurance				
Yes	reference	reference	reference	reference
No	1.71 (1.03 - 2.84)	4.36 (2.93 - 6.48)	4.92 (3.43 - 7.04)	8.84 (8.46 - 9.25)
Gender				
Males	reference	reference	reference	reference
Females	2.03 (1.31 - 3.13)	1.29 (1.01 - 1.65)	0.97 (0.68 - 1.39)	1.33 (1.28 - 1.38)
Marital Status				
Currently Married	reference	reference	reference	reference
Divorced, Separated, or Widowed	1.46 (0.88 - 2.42)	1.33 (1.02 - 1.73)	0.99 (0.66 - 1.47)	1.75 (1.68 - 1.83)
Never Married	0.93 (0.53 - 1.62)	0.94 (0.66 - 1.35)	1.50 (0.99 - 2.27)	1.91 (1.81 - 2.02)
Employment Status				
Employed	reference	reference	reference	reference
Unemployed	1.49 (0.79 - 2.81)	1.37 (0.86 - 2.18)	2.95 (1.64 - 5.31)	3.60 (3.40 - 3.81)
Retired	0.63 (0.29 - 1.36)	0.50 (0.37 - 0.67)	0.36 (0.23 - 0.58)	0.34 (0.32 - 0.36)
Unable to Work	3.59 (1.44 - 8.92)	1.59 (1.10 - 2.32)	3.30 (1.58 - 6.90)	2.75 (2.60 - 2.91)
Student or Homemaker	0.89 (0.48 - 1.65)	0.91 (0.67 - 1.23)	0.74 (0.39 - 1.38)	1.40 (1.32 - 1.49)
Age group				
18-24	1.58 (0.60 - 4.19)	1.54 (0.95 - 2.48)	2.97 (1.55 - 5.71)	4.86 (4.44 - 5.31)
25-34	1.29 (0.53 - 3.15)	1.83 (1.23 - 2.72)	3.91 (2.22 - 6.90)	5.42 (5.09 - 5.78)
35-44	2.48 (1.12 - 5.47)	2.65 (1.91 - 3.69)	2.63 (1.57 - 4.40)	4.22 (3.97 - 4.48)
45-54	1.93 (0.84 - 4.39)	2.24 (1.65 - 3.04)	1.96 (1.21 - 3.19)	3.98 (3.77 - 4.21)
55-64	2.49 (1.07 - 5.80)	2.44 (1.85 - 3.21)	1.23 (0.75 - 2.02)	3.06 (2.89 - 3.23)
≥ 65	reference	reference	reference	reference

Race				
White	reference	reference	reference	reference
Black or African American	--	--	1.45 (0.92 - 2.28)	2.08 (1.97 - 2.20)
Asian	8.65 (2.24 - 33.37)	--	0.21 (0.03 - 1.43)	1.07 (0.93 - 1.22)
Native Hawaiian or Other Pacific Islander	16.14 (4.28 - 60.87)	--	--	1.92 (1.32 - 2.80)
Other	--	--	--	2.33 (2.04 - 2.67)
Multi-racial (non-Hispanic)	13.40 (2.95 - 60.78)	--	0.80 (0.16 - 3.93)	2.13 (1.90 - 2.39)
Hispanic	9.22 (2.12 - 40.09)	2.34 (0.58 - 9.34)	2.48 (1.38 - 4.46)	2.63 (2.48 - 2.78)
Education Level				
Did not graduate from HS	4.78 (2.36 - 9.69)	1.68 (1.20 - 2.36)	2.60 (1.46 - 4.62)	4.46 (4.19 - 4.75)
HS graduate	2.07 (1.13 - 3.78)	1.36 (0.95 - 1.95)	2.34 (1.37 - 4.00)	2.61 (2.47 - 2.74)
Attended college or technical school	1.75 (0.88 - 3.49)	1.39 (0.97 - 1.98)	1.83 (1.00 - 3.36)	2.21 (2.10 - 2.32)
Graduated from college or technical school	reference	reference	reference	reference
Household income				
Less than $15,000	6.18 (3.06 - 12.48)	6.07 (2.91 - 12.65)	6.79 (3.63 - 12.70)	8.04 (7.55 - 8.56)
$15,000 to less than $25,000	2.70 (1.38 - 5.28)	4.21 (1.98 - 8.92)	7.01 (3.98 - 12.35)	6.79 (6.41 - 7.20)
$25,000 to less than $35,000	2.28 (1.03 - 5.05)	4.18 (1.82 - 9.60)	3.84 (1.93 - 7.64)	4.15 (3.87 - 4.46)
$35,000 to less than $50,000	1.68 (0.77 - 3.68)	1.06 (0.39 - 2.93)	2.22 (1.12 - 4.38)	2.78 (2.60 - 2.98)
$50,000 or more	reference	reference	reference	reference
History of Diagnosed Conditions				
Diabetes	2.49 (1.44 - 4.34)	1.34 (1.00 - 1.80)	0.84 (0.51 - 1.41)	1.18 (1.12 - 1.24)
Heart Attack	1.23 (0.36 - 4.21)	2.18 (1.53 - 3.12)	1.81 (0.58 - 5.65)	1.15 (1.07 - 1.24)
Angina or Coronary Heart Disease	0.75 (0.17 - 3.34)	2.33 (1.70 - 3.19)	0.40 (0.14 - 1.18)	1.01 (0.94 - 1.08)
Stroke	1.81 (0.56 - 5.80)	1.33 (0.75 - 2.35)	1.61 (0.42 - 6.19)	1.33 (1.22 - 1.44)
Ever Asthma	0.92 (0.47 - 1.79)	1.51 (1.12 - 2.03)	1.27 (0.73 - 2.21)	1.63 (1.55 - 1.72)
Current Asthma	1.16 (0.49 - 2.74)	1.84 (1.27 - 2.67)	1.64 (0.83 - 3.27)	1.78 (1.68 - 1.88)
General Self-Reported Health				
Good or Better	reference	reference	reference	reference

Fair or Poor	2.68 (1.65 - 4.37)	2.24 (1.76 - 2.85)	2.59 (1.75 - 3.84)	2.96 (2.85 - 3.09)
Life Satisfaction				
Satisfied	reference	reference	reference	reference
Dissatisfied	3.08 (1.46 - 6.48)	4.71 (2.87 - 7.74)	4.12 (2.03 - 8.33)	4.63 (4.36 - 4.93)
Activity Limitations due to Health problems				
No	reference	reference	reference	reference
Yes	1.06 (0.57 - 1.96)	0.37 (0.29 - 0.48)	0.45 (0.28 - 0.71)	0.46 (0.44 - 0.48)
Physically Unhealthy				
Less than 14 days in past month	reference	reference	reference	reference
More than 14 days in past month	2.69 (1.47 - 4.93)	2.58 (1.97 - 3.38)	2.29 (1.37 - 3.83)	2.66 (2.54 - 2.78)
Mentally Unhealthy				
Less than 14 days in past month	reference	reference	reference	reference
More than 14 days in past month	4.27 (2.20 - 8.29)	3.04 (2.22 - 4.16)	3.64 (2.05 - 6.47)	3.94 (3.76 - 4.13)
Exercise in the past 30 days				
Yes	reference	reference	reference	reference
No	2.04 (1.29 - 3.24)	1.39 (1.09 - 1.77)	1.54 (1.06 - 2.24)	1.63 (1.57 - 1.70)
Smoking status				
Never smoked	reference	reference	reference	reference
Former smoker	0.42 (0.21 - 0.83)	1.00 (0.74 - 1.36)	0.56 (0.33 - 0.96)	0.94 (0.90 - 0.98)
Current smoker	1.27 (0.77 - 2.08)	1.56 (1.08 - 2.27)	2.25 (1.26 - 4.04)	2.60 (2.48 - 2.72)
Alcohol consumption in past 30 days				
None	reference	reference	reference	reference
Moderate	1.12 (0.71 - 1.76)	1.09 (0.81 - 1.48)	1.03 (0.70 - 1.52)	0.66 (0.63 - 0.69)
Heavy	1.35 (0.52 - 3.52)	1.11 (0.46 - 2.70)	0.84 (0.40 - 1.73)	0.97 (0.89 - 1.07)
Body Mass Index				
Normal	reference	reference	reference	reference
Overweight	1.45 (0.87 - 2.39)	1.41 (1.04 - 1.90)	0.96 (0.62 - 1.49)	0.99 (0.94 - 1.03)

Obese	1.47 (0.87 - 2.49)	1.68 (1.22 - 2.30)	1.90 (1.21 - 2.97)	1.43 (1.36 - 1.50)
Emotional Support				
Always or Usually Enough	reference	reference	reference	reference
Never, Rarely, or Sometimes Enough	1.70 (1.10 - 2.64)	2.23 (1.65 - 3.01)	2.08 (1.44 - 3.02)	3.10 (2.98 - 3.24)

Appendix B: Associations between having a usual healthcare provider and factor domain covariates, by US subpopulation

	Guam (n = 784)	Puerto Rico (n = 3,542)	Virgin Islands (n = 1,822)	States (n = 44,927)
Health Insurance				
Yes	reference	reference	reference	reference
No	4.35 (2.68 0 7.08)	9.15 (6.12 - 13.70)	4.07 (2.93 - 5.64)	9.28 (8.88 - 9.70)
Gender				
Males	reference	reference	reference	reference
Females	0.75 (0.50 - 1.13)	0.58 (0.44 - 0.75)	0.46 (0.34 - 0.63)	0.53 (0.51 - 0.55)
Marital Status				
Currently Married	reference	reference	reference	reference
Divorced, Separated, or Widowed	1.20 (0.69 - 2.07)	0.85 (0.60 - 1.21)	1.11 (0.76 - 1.61)	1.13 (1.13 - 1.18)
Never Married	2.25 (1.37 - 3.70)	1.74 (1.24 - 2.45)	2.54 (1.78 - 3.63)	2.93 (2.79 - 3.08)
Employment Status				
Employed	reference	reference	reference	reference
Unemployed	1.61 (0.86 - 3.02)	0.93 (0.62 - 1.60)	1.67 (0.94 - 2.98)	2.47 (2.33 - 2.62)
Retired	0.30 (0.14 - 0.65)	0.30 (0.21 - 0.42)	0.37 (0.24 - 0.57)	0.23 (0.22 - 0.25)
Unable to Work	1.00 (0.37 - 2.71)	0.11 (0.06 - 0.20)	1.54 (0.70 - 3.39)	0.56 (0.51 - 0.61)
Student or Homemaker	1.17 (0.66 - 2.05)	0.52 (0.37 - 0.73)	1.51 (0.89 - 2.58)	1.29 (1.21 - 1.36)
Age group				
18-24	6.05 (2.45 - 14.97)	5.90 (3.84 - 9.06)	5.38 (3.03 - 9.53)	11.61 (10.76 - 12.53)

25-34	4.17 (1.76 - 9.88)	4.89 (3.26 - 7.32)	5.84 (3.50 - 9.74)	9.24 (8.71 - 9.80)
35-44	2.81 (1.24 - 6.37)	3.17 (2.14 - 4.70)	2.26 (1.39 - 3.68)	5.24 (4.94 - 5.55)
45-54	2.09 (0.89 - 4.89)	2.48 (1.69 - 3.66)	2.12 (1.35 - 3.34)	3.51 (3.32 - 3.72)
55-64	2.12 (0.89 - 5.05)	1.86 (1.29 - 2.70)	2.39 (1.52 - 3.76)	2.22 (2.09 - 2.35)
≥ 65	reference	reference	reference	reference
Race				
White	reference	reference	reference	reference
Black or African American	--	--	1.42 (0.93 - 2.17)	1.51 (1.42 - 1.61)
Asian	4.03 (1.64 - 9.91)	--	2.30 (0.84 - 6.35)	1.49 (1.30 - 1.71)
Native Hawaiian or Other PI	4.10 (1.67 - 10.08)	--	--	1.88 (1.33 - 2.67)
Other	--	--	--	2.09 (1.83 - 2.39)
Multi-racial (non-Hispanic)	4.96 (1.48 - 16.57)	--	1.41 (0.40 - 5.00)	1.83 (1.62 - 2.07)
Hispanic	2.33 (0.77 - 6.98)	0.53 (0.19 - 1.53)	1.72 (0.98 - 3.02)	3.61 (3.43 - 3.81)
Education Level				
Did not graduate from HS	1.62 (0.82 - 3.19)	0.61 (0.41 - 0.92)	2.58 (1.61 - 4.13)	3.48 (3.28 - 3.70)
HS graduate	1.26 (0.72 - 2.20)	0.92 (0.65 - 1.32)	2.33 (1.53 - 3.55)	2.02 (1.93 - 2.12)
Attended college or technical school	1.12 (0.60 - 2.09)	1.35 (0.95 - 1.92)	2.03 (1.22 - 3.36)	1.48 (1.41 - 1.56)
Graduated from college or technical school	reference	reference	reference	reference
Household income				
Less than $15,000	3.14 (1.45 - 6.78)	0.62 (0.36 - 1.06)	4.05 (2.40 - 6.83)	3.73 (3.51 - 3.97)
$15,000 to less than $25,000	2.52 (1.20 - 5.26)	0.87 (0.50 - 1.50)	2.12 (1.32 - 3.40)	3.09 (2.93 - 3.27)
$25,000 to less than $35,000	1.35 (0.59 - 3.09)	0.74 (0.38 - 1.43)	1.78 (0.96 - 3.28)	2.11 (1.98 - 2.25)
$35,000 to less than $50,000	0.77 (0.31 - 1.92)	0.90 (0.44 - 1.82)	1.63 (0.99 - 2.68)	1.64 (1.54 - 1.75)
$50,000 or more	reference	reference	reference	reference
Diabetes	0.49 (0.25 - 0.93)	0.20 (0.13 - 0.30)	0.35 (0.20 - 0.62)	0.30 (0.28 - 0.33)
Heart Attack	0.54 (0.14 - 2.04)	0.26 (0.14 - 0.50)	0.40 (0.16 - 0.99)	0.34 (0.30 - 0.38)
Angina or Coronary Heart Disease	0.23 (0.03 - 1.75)	0.21 (0.09 - 0.49)	0.19 (0.05 - 0.65)	0.24 (0.21 - 0.27)

Stroke	0.16 (0.02 - 1.25)	0.62 (0.19 - 2.09)	0.25 (0.09 - 0.73)	0.36 (0.32 - 0.41)
Ever Asthma	0.59 (0.28 - 1.24)	0.65 (0.43 - 1.00)	0.88 (0.51 - 1.53)	0.73 (0.69 - 0.77)
Current Asthma	0.55 (0.17 - 1.82)	0.46 (0.24 - 0.87)	0.74 (0.37 - 1.51)	0.61 (0.57 - 0.66)
General Self-Reported Health				
Good or Better	reference	reference	reference	reference
Fair or Poor	0.57 (0.34 - 0.97)	0.32 (0.23 - 0.45)	1.11 (0.75 - 1.67)	0.93 (0.89 - 0.98)
Life Satisfaction				
Satisfied	reference	reference	reference	reference
Dissatisfied	2.82 (1.39 - 5.71)	1.18 (0.58 - 2.43)	1.36 (0.63 - 2.92)	1.77 (1.65 - 1.91)
Activity Limitations due to Health problems				
No	reference	reference	reference	reference
Yes	2.06 (1.06 - 4.02)	2.83 (1.81 - 4.44)	1.11 (0.67 - 1.85)	1.70 (1.62 - 1.79)
Physically Unhealthy				
Less than 14 days in past month	reference	reference	reference	reference
More than 14 days in past month	0.80 (0.40 - 1.60)	0.33 (0.21 - 0.52)	1.08 (0.63 - 1.87)	0.70 (0.65 - 0.74)
Mentally Unhealthy				
Less than 14 days in past month	reference	reference	reference	reference
More than 14 days in past month	0.87 (0.42 - 1.80)	0.78 (0.51 - 1.19)	1.05 (0.58 - 1.89)	1.26 (1.19 - 1.33)
Exercise in the past 30 days				
Yes	reference	reference	reference	reference
No	0.92 (0.58 - 1.47)	0.88 (0.67 - 1.15)	1.46 (1.05 - 2.02)	1.24 (1.19 - 1.29)
Smoking status				
Never smoked	reference	reference	reference	reference
Former smoker	0.77 (0.43 - 1.36)	0.71 (0.48 - 1.05)	0.59 (0.36 - 0.97)	0.64 (0.61 - 0.67)
Current smoker	1.85 (1.14 - 3.00)	1.37 (0.91 - 2.08)	1.62 (0.91 - 2.87)	1.78 (1.70 - 1.86)
Alcohol consumption in past 30 days				

None	reference	reference	reference	reference
Moderate	1.59 (1.02 - 2.48)	1.77 (1.30 - 2.41)	1.18 (0.85 - 1.65)	0.92 (0.89 - 0.96)
Heavy	2.60 (1.15 - 5.87)	2.20 (1.00 - 4.84)	1.57 (0.84 - 2.91)	1.41 (1.30 - 1.54)
Body Mass Index				
Normal	reference	reference	reference	reference
Overweight	0.90 (0.56 - 1.44)	0.75 (0.55 - 1.02)	0.81 (0.56 - 1.18)	0.90 (0.87 - 0.95)
Obese	0.82 (0.47 - 1.42)	0.60 (0.42 - 0.87)	0.80 (0.54 - 1.20)	0.86 (0.81 - 0.90)
Emotional Support				
Always or Usually Enough	reference	reference	reference	reference
Never, Rarely, or Sometimes Enough	1.99 (1.30 - 3.04)	1.34 (0.94 - 1.91)	1.49 (1.08 - 2.07)	1.78 (1.70 - 1.86)

Appendix C: Associations between performance of an annual routine checkup and factor domain covariates, by US subpopulation

	Guam (n = 784)	Puerto Rico (n = 3,542)	Virgin Islands (n = 1,822)	States (n = 44,927)
Health Insurance				
Yes	reference	reference	reference	reference
No	2.88 (1.83 - 4.54)	4.45 (2.98 - 6.64)	2.57 (1.89 - 3.51)	4.22 (4.06 - 4.40)
Gender				
Males	reference	reference	reference	reference
Females	0.70 (0.48 - 1.01)	0.59 (0.46 - 0.74)	0.52 (0.40 - 0.69)	0.64 (0.62 - 0.65)
Marital Status				
Currently Married	reference	reference	reference	reference
Divorced, separated, or widowed	0.64 (0.39 - 1.04)	0.99 (0.73 - 1.33)	1.03 (0.75 - 1.42)	0.84 (0.82 - 0.87)
Never Married	1.65 (1.04 - 2.62)	1.94 (1.42 - 2.66)	1.21 (0.86 - 1.69)	1.59 (1.52 - 1.66)

Employment Status				
Employed	reference	reference	reference	reference
Unemployed	1.39 (0.78 - 2.50)	1.86 (1.23 - 2.83)	1.93 (1.13 - 3.30)	1.60 (1.52 - 1.68)
Retired	0.49 (0.28 - 0.86)	0.20 (0.14 - 0.28)	0.45 (0.32 - 0.63)	0.31 (0.30 - 0.32)
Unable to Work	1.73 (0.74 - 4.08)	0.24 (0.14 - 0.41)	0.89 (0.41 - 1.91)	0.55 (0.52 - 0.58)
Student or Homemaker	1.37 (0.82 - 2.31)	0.60 (0.45 - 0.81)	0.74 (0.43 - 1.27)	0.97 (0.92 - 1.01)
Age group				
18-24	3.27 (1.58 - 6.78)	6.48 (4.24 - 9.91)	2.10 (1.22 - 3.63)	4.46 (4.18 - 4.76)
25-34	2.08 (1.07 - 4.03)	7.73 (5.27 - 11.34)	2.31 (1.44 - 3.71)	4.85 (4.64 - 5.07)
35-44	1.90 (1.04 - 3.49)	5.18 (3.61 - 7.42)	2.20 (1.48 - 3.27)	3.92 (3.77 - 4.08)
45-54	1.98 (1.06 - 3.72)	3.98 (2.81 - 5.64)	1.88 (1.30 - 2.72)	2.93 (2.83 - 3.04)
55-64	1.04 (0.53 - 2.03)	2.68 (1.89 - 3.81)	1.64 (1.13 - 2.38)	2.00 (1.93 - 2.07)
≥ 65	reference	reference	reference	reference
Race				
White	reference	reference	reference	reference
Black or African American	--	--	0.72 (0.50 - 1.02)	0.65 (0.61 - 0.68)
Asian	1.32 (0.68 -2.58)	--	1.82 (0.72 - 4.58)	1.07 (0.97 - 1.19)
Native Hawaiian or Other PI	1.57 (0.81 - 3.02)	--	--	1.03 (0.76 - 1.39)
Other	0.99 (0.09 - 10.47)	--	--	1.21 (1.07 - 1.36)
Multi-racial (non-Hispanic)	2.09 (0.81 - 5.36)	--	0.20 (0.05 - 0.83)	1.19 (1.08 - 1.32)
Hispanic	0.89 (0.37 - 2.11)	0.56 (0.22 - 1.43)	0.86 (0.52 - 1.43)	1.40 (1.33 - 1.47)
Education Level				
Did not graduate from HS	1.26 (0.68 - 2.36)	0.79 (0.56 - 1.13)	1.27 (0.83 - 1.94)	1.42 (1.35 - 1.49)
HS graduate	1.48 (0.92 - 2.38)	1.20 (0.86 - 1.66)	1.79 (1.24 - 2.57)	1.15 (1.11 - 1.19)
Attended college or technical school	1.23 (0.71 - 2.12)	1.19 (0.86 - 1.65)	1.32 (0.85 - 2.05)	1.11 (1.07 - 1.15)
Graduated from college or technical school	reference	reference	reference	reference
Household income				
Less than $15,000	1.74 (0.92 - 3.27)	0.73 (0.45 - 1.20)	1.32 (0.79 - 2.19)	1.44 (1.37 - 1.52)

$15,000 to less than $25,000	2.10 (1.19 - 3.71)	0.73 (0.44 - 1.21)	1.89 (1.26 - 2.83)	1.38 (1.32 - 1.44)
$25,000 to less than $35,000	1.41 (0.73 - 2.73)	0.59 (0.32 - 1.10)	1.32 (0.78 - 2.21)	1.19 (1.13 - 1.25)
$35,000 to less than $50,000	0.84 (0.43 - 1.63)	0.54 (0.27 - 1.05)	1.59 (1.04 - 2.41)	1.11 (1.07 - 1.16)
$50,000 or more	reference	reference	reference	reference
History of Diagnosed Conditions				
Diabetes	0.75 (0.44 - 1.27)	0.16 (0.10 - 0.25)	0.44 (0.28 - 0.71)	0.33 (0.31 - 0.35)
Heart Attack	0.33 (0.11 - 1.01)	0.21 (0.11 - 0.43)	0.73 (0.22 - 0.27)	0.42 (0.40 - 0.45)
Angina or Coronary Heart Disease	0.41 (0.12 - 1.39)	0.39 (0.23 - 0.65)	0.40 (0.15 - 1.07)	0.39 (0.36 - 0.41)
Stroke	0.29 (0.09 - 0.95)	0.58 (0.22 - 1.54)	0.95 (0.29 - 3.12)	0.43 (0.40 - 0.47)
Ever Asthma	1.03 (0.56 - 1.90)	0.59 (0.41 - 0.86)	0.91 (0.56 - 1.48)	0.91 (0.87 - 0.95)
Current Asthma	0.87 (0.37 - 2.07)	0.52 (0.31 - 0.86)	0.78 (0.42 - 1.45)	0.81 (0.77 - 0.85)
General Self-Reported Health				
Good or Better	reference	reference	reference	reference
Fair or Poor	1.36 (0.86 - 2.13)	0.35 (0.26 - 0.47)	0.83 (0.57 - 1.21)	0.79 (0.77 - 0.82)
Life Satisfaction				
Satisfied	reference	reference	reference	reference
Dissatisfied	1.84 (0.92 - 3.69)	1.28 (0.71 - 2.32)	1.65 (0.81 - 3.36)	1.61 (1.62 - 1.71)
Activity Limitations due to Health problems				
No	reference	reference	reference	reference
Yes	1.17 (0.67 - 2.04)	1.86 (1.32 - 2.62)	0.99 (0.64 - 1.53)	1.31 (1.27 - 1.35)
Physically Unhealthy				
Less than 14 days in past month	reference	reference	reference	reference
More than 14 days in past month	1.11 (0.62 - 2.00)	0.38 (0.26 - 0.54)	0.80 (0.48 - 1.33)	0.78 (0.73 - 0.79)
Mentally Unhealthy				
Less than 14 days in past month	reference	reference	reference	reference
More than 14 days in past month	1.19 (0.62 - 2.29)	0.90 (0.61 - 1.33)	1.99 (1.16 - 3.40)	1.27 (1.21 - 1.33)

Exercise in the past 30 days				
Yes	reference	reference	reference	reference
No	1.43 (0.94 - 2.17)	1.01 (0.79 - 1.29)	1.45 (1.08 - 1.96)	1.07 (1.04 - 1.11)
Smoking status				
Never smoked	reference	reference	reference	reference
Former smoker	1.38 (0.85 - 2.25)	0.76 (0.54 - 1.05)	1.13 (0.77 - 1.66)	0.76 (0.74 - 0.79)
Current smoker	1.60 (1.02 - 2.50)	1.44 (0.99 - 2.10)	2.06 (1.22 - 3.50)	1.57 (1.52 - 1.63)
Alcohol consumption in past 30 days				
None	reference	reference	reference	reference
Moderate	1.23 (0.83 - 1.82)	1.51 (1.13 - 2.01)	1.15 (0.85 - 1.56)	1.16 (1.13 - 1.19)
Heavy	1.83 (0.83 - 4.02)	3.13 (1.57 - 6.25)	2.36 (1.35 - 4.12)	1.56 (1.46 - 1.67)
Body Mass Index				
Normal	reference	reference	reference	reference
Overweight	1.20 (0.78 - 1.84)	0.89 (0.67 - 1.18)	0.98 (0.70 - 1.36)	0.93 (0.90 - 0.96)
Obese	1.62 (1.01 - 2.60)	0.74 (0.54 - 1.02)	0.94 (0.66 - 1.36)	0.87 (0.84 - 0.90)
Emotional Support				
Always or Usually Enough	reference	reference	reference	reference
Never, Rarely, or Sometimes Enough	1.30 (0.89 - 1.91)	1.48 (1.07 - 2.03)	1.17 (0.86 - 1.58)	1.31 (1.26 - 1.35)