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Racial Disparities in Health Service Utilization Among Medicare Fee-for-Service Beneficiaries Adjusting for Multiple Chronic Conditions

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Abstract

Objective—To examine racial disparities in health services utilization in Hawaii among Medicare fee-for-service beneficiaries aged 65 years and above.

Method—All-cause utilization of inpatient, outpatient, emergency, home health agency, and skilled nursing facility admissions were investigated using 2012 Medicare data. For each type of service, multivariable logistic regression model was used to investigate racial disparities adjusting for sociodemographic factors and multiple chronic conditions.

Results—Of the 84,212 beneficiaries, 27.8% were White, 27.4% were Asian, 27.3% were Pacific Islanders; 70.3% had two or more chronic conditions and 10.5% had six or more. Compared with Whites, all racial groups experienced underutilization across all types of services. As the number of chronic conditions increased, the utilization of inpatient, home health care, and skilled nursing facility dramatically increased.

Discussion—Disparities persist among Asians and Pacific Islanders who encounter the problem of underutilization of various health services compared with Whites.

Keywords

utilization; health disparities; multiple chronic conditions; Medicare; race

Introduction

The high prevalence of chronic conditions in the United States is one of the most important challenges to the health care system. With the increasing improvement in medical care and advances in public health, there has been a rapid increase in the population of older adults living with multiple coexisting chronic conditions (Fried, Bernstein, & Bush, 2012; Ward, Schiller, & Goodman, 2014). Multiple chronic conditions (MCC) are usually defined as the

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presence of two or more chronic conditions in the same individual (Mercer, Smith, Wyke, O'Dowd, & Watt, 2009). MCC are associated with poor functional status (Laan et al., 2013; Marventano et al., 2014), disability (Garin et al., 2014; St. John, Tyas, Menec, & Tate, 2014), psychological distress (Fortin et al., 2006), poor quality of life (Chen, Baumgardner, & Rice, 2011; Garin et al., 2014), and a higher risk of mortality (St. John et al., 2014). People with MCC also have greater health needs and therefore have significantly higher utilization of health services (Centers for Medicare and Medicaid Services [CMS], 2012; Harris et al., 2016; Lochner, Goodman, Posner, & Parekh, 2013; Skinner, Coffey, Jones, Heslin, & Moy, 2016; Steiner, Barrett, Weiss, & Andrews, 2014; Steiner & Friedman, 2013).

Racial disparities are common not only in the prevalence of MCC (Fried et al., 2012; Lim, Gandhi, Davis, & Chen, 2016; Rocca et al., 2014; St. Sauver et al., 2015; Ward et al., 2014) but also in the utilization of health services, a concern that has primarily been studied among Whites, Blacks, and Hispanics (Copeland, 2005; Lo, Cheng, & Howell, 2014). These studies have largely focused on specific chronic conditions (Fitch, Pelizzari, & Pyenson, 2016; Singh & Yu, 2016; Zhao, Kuo, Weir, Kramer, & Ash, 2008; Zhu et al., 2015), a variety of treatments (Ibrahim, Kwoh, Harper, & Baker, 2000; Lee, Gehlbach, Hosmer Reti, & Baker, 1997), certain lifesaving technologies (Cromwell, McCall, Burton, & Urato, 2005), the provision of necessary care (Asch, Sloss, Hogan, Brook, & Kravitz, 2000; Kaiser Family Foundation Report, 2016; Liu et al., 2006), and some cancer screening procedures (Shih, Zhao, & Elting, 2006).

The few studies that have explored health service utilization among Asian populations have reported a considerable underutilization of health resources compared with Whites. For example, Asians were less likely to utilize inpatient and outpatient mental health services (Augsberger, Yeung, Dougher, & Hahm, 2015; Leong, 1994; J. K. Shin, 2009), and emergency room and inpatient services for cardiovascular disease and hypertension (Tran, Do, & Baccaglini, 2016). Asians also had lower rates of psychiatric hospitalizations (Sentell et al., 2013) and of hospice use (Ngo-Metzger, Phillips, & McCarthy, 2008). Studies have also found that Asians experience differences in perceptions of inpatient care (Goldstein, Elliott, Lehrman, Hambarsoomian, & Giordano, 2010) and were significantly less likely to receive care for complex surgical procedures at high-volume hospitals (Liu et al., 2006). However, these studies have focused on specific chronic conditions or procedures in the overall adult Asian population. A study of elderly Korean American adults found a significant underutilization of ambulatory health facilities and difficulty receiving care when needed (Shin, Kim, Juon, Kim, & Kim, 2000).

Considering the increasing Asian population (Hoeffel, Rastogi, Kim, & Shahid, 2012) and Hawaii's older population (Administration on Aging, 2012), the Medicare population is likely to grow, and studies are therefore needed to explore the disparities in health service utilization among these older Medicare beneficiaries. Prior studies show Asian immigrants were less likely to have routine care access, talk to general doctors or specialists, and receive emergency services. Possible explanations are language barriers, health literacy, and specific ethnicity-related cultures and beliefs (Kim & Keefe, 2010; Tran et al., 2016; Ye, Mack, Fry-Johnson, & Parker, 2012). Pacific Islanders (PIs) have lower rates of cancer screening procedures (e.g., fecal occult blood testing, sigmoidoscopy, and mammography) and lower

utilization of hospice care (Goel et al., 2003; Ngo-Metzger et al., 2008). Barriers to health care among Asians and PIs have been discussed in previous studies, as different cultural values influence their health care decision making, and these studies have recommended that further research will benefit all minority groups with respect to health care utilization.

To our knowledge, there are no studies that comprehensively address disparities across different types of health care utilization among older Asians and PIs. To fill this gap, we examined racial disparities in the utilization of different types of health care services among Medicare fee-for-service (FFS) beneficiaries aged 65 years and older in Hawaii, focusing on the understudied older Asian and PI population and examined their use of services adjusting for sociodemographic factors and number of chronic conditions. Identifying older vulnerable groups living with MCC will be useful to health care practitioners seeking service use profiles, which can be used to develop culturally tailored interventions and health services to reduce persistent disparities.

Method

Data Source and Study Population

The data source for this study was Hawaii Medicare 2012 data. Medicare is the U.S. federal health insurance program for people aged 65 years or older, younger people with certain disabilities, and people with end-stage renal disease (ESRD). The 46% of the beneficiaries ($n = 107,080$) with Medicare Part C (Medicare Advantage or health maintenance organizations [HMOs]) were excluded from the analysis as their claims data, which were needed to define chronic conditions, were not available in the Medicare database. Beneficiaries were excluded if they had been enrolled for less than 11 months ($n = 31,000$), were aged less than 65 years ($n = 12,046$) or were non-Hawaii residents ($n = 1,247$). After exclusions, there were 84,212 Medicare FFS beneficiaries eligible for analysis with Medicare Part A (hospital insurance) and Part B (medical insurance) who had been enrolled for at least 11 months in 2012 or until death. This study was approved by the University of Hawaii Institutional Review Board.

Variables

Dependent variables—The main outcome variables were all-cause utilization of inpatient (IP) admissions, outpatient (OP) visits, emergency department (ED) visits, home health agency (HHA) admissions, and skilled nursing facility (SNF) admissions. All-cause utilization was defined as having one or more claims for a type of service at any given time in 2012. Utilization of ED services included ED claims from IP (i.e., admitted to ED as anIP) as well as OP (i.e., discharged from OP) settings. Utilization was coded as a dichotomous indicator (yes/no).

Independent variables—The primary independent variable was race, which was coded as White, Asian, PI, and other racial group (Black, American Indian/Alaska Native, Hispanic, Other, and unknown). Age was coded as 65 to 74, 75 to 84, and 85 years or older. Medicare beneficiaries were considered dual eligible if they received full or partial Medicaid benefits in any month in 2012 along with traditional Medicare. Dual eligibility was coded as

a dichotomous variable (yes/no) and could be considered a potential indicator of socioeconomic status. Residential area was categorized as living on the island of Oahu or on a neighbor island based on the beneficiary's residential zip code and could indicate accessibility of medical or health care resources, as most acute care hospitals in Hawaii are on the island of Oahu.

The CMS developed algorithms to identify 27 chronic conditions using the International Classification of Diseases, 9th Revision (ICD-9), Clinical Modification (Chronic Conditions Data Warehouse, 2016). Of these, we included the following 15 most common chronic conditions, which correspond to the list of chronic conditions used to define MCC by the U.S. Department of Health and Human Services (DHHS): Alzheimer's disease or dementia, asthma, atrial fibrillation, cancer, chronic kidney disease (CKD), chronic obstructive pulmonary disease (COPD), depression, diabetes, heart failure, high cholesterol, high blood pressure, ischemic heart disease, osteoporosis, arthritis, and stroke (Goodman, Posner, Huang, Parekh, & Koh, 2013). The number of chronic conditions were counted and grouped for the study analyses as 0 to 1, 2 to 3, 4 to 5, and 6 or more chronic conditions.

Statistical Analyses

The characteristics of the beneficiaries by race were summarized as frequencies and percentages. Racial differences in the characteristics were investigated by conducting bivariate associations using chi-square tests. Multivariable logistic regression models controlling for age, gender, dual eligibility, residential area, and number of chronic conditions were performed to evaluate racial disparity in different types of utilization. The results are presented as odds ratios (ORs) and 95% confidence intervals (CIs). *C*-statistics were used to measure the goodness of fit of the models. A *c*-statistic value of 0.5 indicates the model is no better than random chance, a value higher than 0.7 indicates moderately accurate whereas 0.8 indicates strong accuracy. A *p* value < .05 was considered statistically significant. All analyses were conducted using SAS version 9.4 (SAS Institute Inc., Cary, NC).

Results

Table 1 presents the beneficiaries' characteristics. The study included 84,212 beneficiaries from 2012. Of these, 27.8% were White, 27.4% were Asian, 27.3% were PI, and 17.6% were other racial group (Black: 0.2%, American Indian/Alaska Native: 0.7%, Hispanic: 11.4%, Other: 5.2%, and unknown: 0.1% combined); in addition, 18.3% were age 85 years or older, 45.6% were male, 69.1% lived in Oahu, and 9.7% had dual eligibility. The prevalence of MCC was high with 70.3% having two or more chronic conditions and 10.5% having six or more chronic conditions. All of the characteristics showed significant racial differences. Compared with the other ethnicities, Asians were more often 85 years or older, female, living on Oahu, and dual eligible. White beneficiaries lived on the neighbor islands more often, while PIs lived more on Oahu. More than 40% of Whites had none or one chronic condition, while 40% of Asians had four or more chronic conditions.

Table 2 compares the utilization of racial groups by type of health care service within each MCC category. As the number of chronic conditions increased, the utilization of all types of

health care services rapidly increased. Regardless of the number of chronic conditions, Whites utilized more IP, ED, and HHA services than the other racial groups. OP utilization was similar among Whites and PI beneficiaries with six or more chronic conditions; Asians had the lowest OP utilization in all MCC categories. Among beneficiaries with six or more chronic conditions, SNF utilization was greatest among Asians. PIs and other racial group had a lower utilization of almost all types of health care services.

Based on the multivariable logistic regression analyses (Table 3), Whites were more likely to utilize all types of services than any of the other racial groups. For instance, IP utilization was lower among all minorities (Asians: OR = 0.71; PIs: OR = 0.66; Other: OR = 0.74). Compared with beneficiaries who were 65 to 74 years old, those aged 85 years and older were less likely to utilize OP services (OR = 0.77) but more likely to use other health services, especially HHA (OR = 3.41) and SNF (OR = 4.20). Females were more likely to utilize all services except for IP admissions (OR = 0.87). Beneficiaries living on Oahu were less likely to use ED (OR = 0.77) but more likely to use other services. Dual eligible beneficiaries were less likely to utilize OP services (OR = 0.91); however, they were more likely to utilize SNF (OR = 2.21) and other types of services. As the number of chronic conditions increased, the odds of utilizing services of all types increased; however, the increase was dramatic for IP (OR = 68.8), HHA (OR = 43.9), and SNF (OR = 83.5) admissions. The interaction between race and MCC was tested for each type of utilization with no statistically significant differences found (results not shown).

Discussion

Our study showed substantial disparities in the utilization of all types of health services across all racial groups even after adjusting for sociodemographic factors and number of chronic conditions. The existing literature explaining racial disparities focuses on Asians and PIs separately in comparison with Whites for specific chronic conditions in specific type of health service utilization. Because Hawaii is a state with diverse races and ethnicities, this study provides a unique opportunity to examine disparities among Asian and PI Medicare beneficiaries altogether across different types of utilization accounting for MCC. This study extends the existing knowledge on underutilization of health care services among elderly Asians and PIs and describes the possible factors contributing to the underlying differences in the health care behaviors and health-related decision-making process.

Asians were found to underutilize all types of health services compared with Whites. Cultural and familial values for Asians have a dramatic impact on their health behaviors and health care decision-making process. Asian families may value group consensus on health care matters that can delay important medical decisions as family consultation can be time-consuming. The degree of utilization may be dependent on factors such as mistrust or unresponsive medical services, family responsibilities, family and cultural stigma that can damage family's status in the community, or lack of culturally appropriate interventions (Augsberger et al., 2015; Leong, 1994). According to McLaughlin and Braun (1998), religious influences could create conflict with informed consent procedures that are required for diagnosis and prognosis in Western medicine among Japanese populations, traditional medicine is still practiced among Chinese and Vietnamese cultures, and Filipinos may delay

seeking treatment until there is an emergency. This mind-set may result in accepting their illnesses and indicate unwillingness to see doctors and seek treatment on time. Another study suggests that perceptions of health have different impacts on the extent of ambulatory care use among Korean elderly in the United States, which may underlie some of the differences observed. These perceptions, such as their current activity levels and worrying about their health, have control over their health, and interference due to health problems could possibly be based on their cultural attitudes and beliefs (Pourat, Lubben, Yu, & Wallace, 2000).

Based on the access to care measures used by Agency for Healthcare Research and Quality (AHRQ) National Healthcare Disparities Report, Asians had worse access to care for one third of the measures. The access to care measures include access to health care system (e.g., not having usual source of care and unmet health needs), structural barriers within the system (e.g., transportation issues and longer waiting times), and inability of providers to address patient's needs (e.g., patient–physician communication and relationship, cultural competency, and inability to understand health information) (National Healthcare Quality and Disparities Report, 2016). The findings of this study underscore the need for further research, education, and practical solutions involving long-term care planning and access to health care services among the elderly Asians. The families of Asians in the United States need to be educated on aging and the importance of continuum of medical care. Elderly Asians should be encouraged to better plan for their health and financial well-being, to be able to communicate with their physician regarding their health needs and preferences to achieve a better quality of life.

Lower utilization rates across all types of health services have also been observed among PIs. Based on earlier studies, PIs are more likely to delay seeking needed medical care (Panapasa et al., 2012), tend to accept their medical conditions, and are more likely to adjust to symptoms without complaint, and to have a lack of regard for preventive health care (McLaughlin & Braun, 1998). For PIs, health is often synonymous to social well-being where familial and societal obligations are given a priority. Besides lack of health prioritization, economic deprivation in terms of basic needs—such as lack of access to basic household obligations, lack of opportunity to participate in socioeconomic communities, and living in medically underserved areas to receive basic health services—could be a major contributor to inadequate health care access and management (Hawley & McGarvey, 2015). Another major factor among PIs is the lack of trust in physician's care; poor patient–physician relationship where past negative experiences with health personnel (e.g., discrimination on health needs and disrespectful care and services) could create barrier to health care (Browne et al., 2014; Hughes, 2004; Kaholokula, Saito, Mau, Latimer, & Seto, 2008). The providers should be willing to establish a personal connection and have an open interaction with elderly beneficiaries to establish a trustworthy relationship. These findings support the need for accessible and acceptable culturally tailored programs and policies that can address the growing health care needs among the elderly PIs.

Consistent with our findings, previous studies have also found significant differences among minorities. For instance, disparities in quality of care indicators (e.g., 52% of Asians and PIs, 95% of Hispanics, and 75% of Blacks did not receive quality care for prevention and

treatment of chronic conditions; Hebb, Fitzgerald, & Fan, 2003), disparities in the utilization of lifesaving technologies despite having Medicare insurance (Cromwell et al., 2005), differences in the use of hospital services (Dunlop, Manheim, Song, & Chang, 2002; Song, Chang, Manheim, & Dunlop, 2006), and lower use of SNF and rehabilitation services (Li, Glance, Yin, & Mukamel, 2011; Yeboah-Korang, Kleppinger, & Fortinsky, 2011) have been reported. These findings suggest that Medicare eligibility may not promote appropriate levels of health care service utilization among minorities, although it may improve health care access and utilization. Our study provides a foundation for further research on how and why disparities in utilization exist and underscores the need to develop culturally tailored interventions to address these disparities among beneficiaries with different racial backgrounds.

As noted in previous studies, beneficiaries with MCC had a higher utilization of all types of health services compared with those who had no or one chronic condition (CMS, 2012; Harris et al., 2016; Lochner et al., 2013; Skinner et al., 2016; Steiner et al., 2014; Steiner & Friedman, 2013). The increase in utilization was rather dramatic for IP, HHA, and SNF admissions as the number of chronic conditions increased. With increasing numbers of chronic conditions, beneficiaries are likely to have more complications, have longer stays in the hospital (Skinner et al., 2016), require more diverse and intensive care (Boyd et al., 2005), and experience end-of-life crises that lead to higher utilization of health care resource. Beneficiaries with MCC are often considered as “super-utilizers” due to their continued high utilization of health care, and therefore, identification of this subgroup of patients should receive closer attention, as they are thought to be responsive to interventions that are designed to help elderly patients, and their caregivers play an effective role in their own health care (Harris et al., 2016). Continuity of care in terms of greater primary care and specialty care could lower the risk of IP admissions and ED visits among those with MCC (Bayliss et al., 2015). Although beneficiaries with MCC are presumed to have a higher risk of complications and greater health care needs, the presence of a single serious chronic condition in a lifetime, especially among older Medicare beneficiaries, can also be critical. Future studies are needed to investigate health care utilization patterns among older beneficiaries with serious conditions.

Consistent with prior studies (Cameron, Song, Manheim, & Dunlop, 2010; Dunlop et al., 2002; Song et al., 2006), women were less likely to utilize IP services, but more likely to use HHA (Cameron et al., 2010; Song et al., 2006; Yeboah-Korang et al., 2011) and SNF (Bird, Shugarman, & Lynn, 2002). However, unlike previous studies (Dunlop et al., 2002; Song et al., 2006), women in our study were more likely to utilize OP services. Medicare beneficiaries aged 85 years and older were most likely to utilize supportive services such as IP, HHA, and SNF admissions, possibly due to lack of independence and self-sufficiency in activities of daily living (eating, bathing, dressing, and moving around), need for help in medication change and monitoring associated side effects, need for rehabilitative services from an injury or illness, nursing services for wound care, injections, physical therapy, or monitoring of vital signs and medical equipment. In addition, previous studies reported depression, urinary incontinence, or cognitive impairment among the elderly to be associated with higher service utilization (Bird et al., 2002; Yeboah-Korang et al., 2011).

Dual eligible beneficiaries were less likely to utilize OP services and more likely to receive IP (Sloss, Dhanani, O’Leary, Lopez, & Melnick, 2004), ED, HHA, and SNF care even after controlling for MCC (Moon & Shin, 2005; Moon & Shin, 2006; Rahman, Tyler, Thomas, Grabowski, & Mor, 2015). This could be due to other complex health conditions or complications not accounted for in this study or due to a delayed realization of their unmet health care needs rather than overutilization as a result of the expanded benefits of the dual eligibility program (Moon & Shin, 2005; Moon & Shin, 2006; Rahman et al., 2015). In addition, the higher utilization of IP, HHA, and SNF services among the dual eligible beneficiaries could possibly be due to lack of care coordination between the two separately managed insurance programs, as providers may have an incentive to shift costs from one program to the other (The SCAN Foundation, 2011). Further research is recommended to elucidate the reason for this discrepancy. Beneficiaries living in Oahu showed higher utilization of IP admissions, OP visits, and HHA and SNF services, while those living on neighbor islands showed higher rates of ED visits. The difference in service utilization could be due to urban–rural divides, with Oahu having all major hospitals and a greater capacity than neighbor islands (Remler et al., 2011).

Limitations

The findings of our study should be interpreted within the context of its limitations. First, our study sample was limited to Medicare FFS beneficiaries in Hawaii who were enrolled for at least 11 months in 2012. Beneficiaries with Medicare Advantage plans had no available claims data to identify chronic conditions and were thus excluded from the analysis. The inclusion of only FFS beneficiaries could produce a selection bias, as it is believed that Medicare Advantage plans tend to attract healthier individuals and to select patients with favorable clinical risks (McWilliams, Hsu, & Newhouse, 2012). Our findings, therefore, may not be generalizable to the entire geriatric population in Hawaii. Second, racial disparities were investigated based on the available racial groups coded in Medicare data, in which multiple ethnic groups were collapsed under broad categories of Asians and PIs. Hawaii is a state with diverse races and ethnicities, and more detailed racial/ethnic categories would allow for more meaningful comparisons. In addition, the characteristics of Asians and PIs in Hawaii may differ from the characteristics of these groups in mainland United States. As a result, health care service utilization patterns may vary between Hawaii and mainland communities and our findings may not be generalizable to other locations. Third, our study was descriptive in nature and could not ascertain the causes of the observed racial differences. Fourth, the number of chronic conditions was calculated based on the identification of chronic conditions by ICD-9 codes, which are subject to disease misclassification due to physician coding or data entry errors. Fifth, our investigation was restricted to the use of the type of health care services and did not explore the reasons for the use (i.e., type/severity of the condition(s)) or whether differences existed in health-related outcomes (i.e., improvement in condition(s)) as a result of the utilization. In addition, analyzing the number of chronic conditions, rather than specific disease profiles, restricted us from identifying which combinations of diseases had strong associations with a specific type of service utilization. However, using the number of chronic conditions did allow for a general understanding of the burden of MCC that would not have been possible when

considering specific diseases or disease combinations. Our study was also aligned with the DHHS objective of addressing disparities in MCC populations (Parekh, Goodman, Gordon, & Koh, 2011). Sixth, using the White utilization rate as the standard assumes that this group has an appropriate level of use, but it is possible that there is under- or overutilization by this group as well. Nevertheless, this is the approach used in the AHRQ National Healthcare Quality and Disparities Report as an appropriate way to identify disparities between groups. Finally, some variables that could be potential indicators of social support such as marital status were not available in the Medicare data.

Regardless of these limitations, we believe that the current study provides valuable insight into the health service utilization patterns among older Asian and PI Medicare beneficiaries compared with Whites. Although Medicare ensures coverage of all adults aged 65 years and older, we found significant racial disparities even after adjusting for the number of chronic conditions. The utilization patterns therefore indicate that insurance alone does not guarantee equal use of services among Medicare beneficiaries. Further emphasis should be placed on developing culture-specific targeted interventions, for example, initiatives for culturally and linguistically appropriate hospital services such as bilingual providers, interpreter services, and appropriate physician and nurse communications (Goldstein et al., 2010), and on encouraging “cultural leverage” (Fisher, Burnet, Huang, Chin, & Cagney, 2007) by using race-specific cultural practices and philosophies (e.g., hula dance programs for hypertension management; Kaholokula et al., 2015, or culturally tailored diabetes education interventions; Nam, Janson, Stotts, Chesla, & Kroon, 2012) as mediators to increase the utilization of necessary health services to better manage and treat older Medicare beneficiaries living with MCC.

Conclusion

The present study demonstrated substantial disparities in health care service utilization among older Asians, PIs, and other races compared with Whites, even after accounting for sociodemographic factors and number of chronic conditions. Underutilization of health care persists among older Asians and PIs who experience a lack of necessary care. The findings underscore the need to develop culturally tailored intervention programs and health services to reduce these persistent disparities.

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Table 1

Characteristics of the Beneficiaries in the Study Population.

Variable	Total (n, %) (n = 84,212)	Race (n, %)				p value
		White (n = 23,392)	Asian (n = 23,048)	PI (n = 22,970)	Other (n = 14,802)	
Age						<.001
65–74 years	40,837 (48.5)	13,029 (55.7)	7,772 (33.7)	11,829 (51.5)	8,207 (55.4)	
75–84 years	28,004 (33.3)	6,798 (29.1)	7,613 (33.0)	8,545 (37.2)	5,048 (34.1)	
85 years	15,371 (18.3)	3,565 (15.2)	7,663 (33.2)	2,596 (11.3)	1,547 (10.5)	
Gender						<.001
Male	38,376 (45.6)	12,020 (51.4)	9,238 (40.1)	10,394 (45.3)	6,724 (45.4)	
Female	45,836 (54.4)	11,372 (48.6)	13,810 (59.9)	12,576 (54.7)	8,078 (54.6)	
Residential area						<.001
Neighbor islands	26,049 (30.9)	11,366 (48.6)	5,270 (22.9)	5,084 (22.1)	4,329 (29.3)	
Oahu	58,122 (69.1)	11,999 (51.4)	17,776 (77.1)	17,884 (77.9)	10,463 (70.7)	
Dual eligibility	8,127 (9.7)	1,879 (8.0)	3,538 (15.4)	1,075 (4.7)	1,635 (11.0)	<.001
No. of chronic conditions						<.001
0–1	25,033 (29.7)	9,473 (40.5)	5,582 (24.2)	5,514 (24.0)	4,464 (30.2)	
2–3	30,578 (36.3)	7,343 (31.4)	8,240 (35.8)	9,691 (42.2)	5,304 (35.8)	
4–5	19,752 (23.5)	4,377 (18.7)	6,237 (27.1)	5,685 (24.7)	3,453 (23.3)	
6	8,849 (10.5)	2,199 (9.4)	2,989 (13.0)	2,080 (9.1)	1,581 (10.7)	

Note. Column percentage. Bivariate association was conducted using chi-square test. PI = Pacific Islander.

Table 2
Bivariate Association of Utilization and Race by Type of Health Care Service Within Each MCC Category.

Type of health care service	MCC (n = 84,212)	Total (n, %)	Race (n, %)				p value
			White	Asian	PI	Other	
IP (12.9%)	0-1	385 (1.5)	173 (1.8)	82 (1.5)	70 (1.3)	60 (1.3)	<.028
	2-3	2,088 (6.8)	705 (9.6)	559 (6.8)	494 (5.1)	330 (6.2)	<.001
	4-5	3,686 (18.7)	999 (22.8)	1,167 (18.7)	898 (15.8)	622 (18.0)	<.001
	6	4,727 (53.4)	1,220 (55.5)	1,633 (54.6)	1,060 (51.0)	814 (51.5)	.005
OP (57.8%)	0-1	8,319 (33.2)	3,358 (35.4)	1,604 (28.7)	2,029 (36.8)	1,328 (29.7)	<.001
	2-3	18,800 (61.5)	4,802 (65.4)	4,745 (57.6)	5,969 (61.6)	3,284 (61.9)	<.001
	4-5	14,185 (71.8)	3,329 (76.1)	4,288 (68.8)	4,076 (71.7)	2,492 (72.2)	<.001
	6	7,374 (83.3)	1,856 (84.4)	2,444 (81.8)	1,750 (84.1)	1,324 (83.7)	.041
ED (17.2%)	0-1	1,795 (7.2)	769 (8.1)	371 (6.6)	360 (6.5)	295 (6.6)	<.001
	2-3	4,437 (14.5)	1,339 (18.2)	1,241 (15.1)	1,118 (11.5)	739 (13.9)	<.001
	4-5	4,632 (23.5)	1,239 (28.3)	1,453 (23.3)	1,102 (19.4)	838 (24.3)	<.001
	6	3,603 (40.7)	1,001 (45.5)	1,210 (40.5)	741 (35.6)	651 (41.2)	<.001
HHA (3.0%)	0-1	75 (0.3)	41 (0.4)	20 (0.4)	6 (0.1)	8 (0.2)	.002
	2-3	407 (1.3)	170 (2.3)	112 (1.4)	74 (0.8)	51 (1.0)	<.001
	4-5	727 (3.7)	254 (5.8)	239 (3.8)	131 (2.3)	103 (3.0)	<.001
	6	1,284 (14.5)	373 (17.0)	444 (14.9)	279 (13.4)	188 (11.9)	<.001
SNF (3.2%)	0-1	44 (0.2)	18 (0.2)	16 (0.3)	3 (0.1)	7 (0.2)	.033
	2-3	301 (1.0)	107 (1.5)	97 (1.2)	69 (0.7)	28 (0.5)	<.001
	4-5	766 (3.9)	206 (4.7)	307 (4.9)	152 (2.7)	101 (2.9)	<.001
	6	1,578 (17.8)	409 (18.6)	607 (20.3)	333 (16.0)	229 (14.5)	<.001

Note. Bivariate associations were conducted using chi-square test. MCC = multiple chronic conditions; MCC 0-1: n = 25,033; MCC 2-3: n = 30,578; MCC 4-5: n = 19,752; MCC 6: n = 8,849. PI = Pacific Islander; IP = inpatient; OP = outpatient; ED = emergency department; HHA = home health agency; SNF = skilled nursing facility.

Table 3

Multivariable Logistic Regression for IP, OP, ED, HHA, and SNF Service Utilization.

Variable	Type of health care service (OR [95% CI])				
	IP	OP	ED	HHA	SNF
Race					
Asian vs. White	0.71 [0.67, 0.75]	0.61 [0.59, 0.64]	0.78 [0.74, 0.82]	0.54 [0.49, 0.60]	0.77 [0.69, 0.86]
PI vs. White	0.66 [0.62, 0.70]	0.73 [0.70, 0.76]	0.69 [0.65, 0.72]	0.50 [0.45, 0.57]	0.73 [0.65, 0.82]
Other vs. White	0.74 [0.69, 0.80]	0.70 [0.67, 0.74]	0.83 [0.79, 0.88]	0.57 [0.49, 0.65]	0.67 [0.59, 0.77]
Age					
75–84 years vs. 65–74 years	1.09 [1.03, 1.15]	0.99 [0.95, 1.02]	1.16 [1.11, 1.21]	1.73 [1.54, 1.94]	1.82 [1.61, 2.05]
85 years vs. 65–74 years	1.60 [1.51, 1.70]	0.77 [0.74, 0.81]	1.44 [1.37, 1.52]	3.41 [3.04, 3.83]	4.20 [3.74, 4.72]
Gender					
Female vs. male	0.87 [0.83, 0.91]	1.72 [1.67, 1.77]	1.10 [1.06, 1.14]	1.13 [1.04, 1.23]	1.17 [1.07, 1.27]
Residential area					
Oahu vs. neighbor islands	1.09 [1.04, 1.15]	1.83 [1.77, 1.90]	0.77 [0.74, 0.80]	1.35 [1.23, 1.49]	1.11 [1.01, 1.22]
Dual eligibility					
Yes vs. no	1.45 [1.35, 1.55]	0.91 [0.87, 0.96]	1.21 [1.14, 1.28]	1.14 [1.01, 1.29]	2.21 [1.99, 2.45]
No. of chronic conditions					
2–3 vs. 0–1	4.81 [4.31, 5.37]	3.34 [3.22, 3.47]	2.25 [2.12, 2.39]	4.29 [3.34, 5.51]	4.92 [3.58, 6.76]
4–5 vs. 0–1	14.5 [13.0, 16.1]	5.66 [5.42, 5.91]	3.95 [3.72, 4.19]	10.9 [8.55, 13.9]	17.4 [12.8, 23.6]
6 vs. 0–1	68.8 [61.6, 76.8]	11.9 [11.2, 12.7]	8.43 [7.89, 9.00]	43.9 [34.5, 55.7]	83.5 [61.7, 113.1]

Note. OR = odds ratio; CI = confidence interval; IP = inpatient; OP = outpatient; ED = emergency department; HHA = home health agency; SNF = skilled nursing facility; PI = Pacific Islander. C-Statistic (95% CI): IP = 0.83 (0.82, 0.84); OP = 0.73 (0.72, 0.74); ED = 0.70 (0.69, 0.71); HHA = 0.85 (0.84, 0.86); SNF = 0.88 (0.87, 0.89). Bold indicates significance at $p < .05$.