Published in final edited form as:

Am J Prev Med. 2018 January ; 54(1): 103–112. doi:10.1016/j.amepre.2017.10.011.

Reducing Preventable Hospitalization and Disparity: Association With Local Health Department Mental Health Promotion Activities

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Abstract

Introduction—Serving as the center of community-engaged health programs, local health departments can play a critical role in promoting community mental health. The objectives of this study were to explore the association between local health department activities and (1) preventable hospitalizations for individuals with mental disorders, and (2) associated racial disparities in preventable hospitalizations.

Method—Employing the linked data sets of the 2012–2013 Healthcare Cost and Utilization Project state inpatient discharge file of the State of Maryland, the National Association of County and City Health Officials Profiles Survey, the Area Resource File, and U.S. Census data, the authors estimated the association between local health department activities (i.e., provision of mental health preventive care and community mental health promotion) and the reduction of the preventable hospitalizations for ambulatory care sensitive conditions and co-existing mental disorders. All the data analyses were conducted during September 2016–August 2017.

Results—Multilevel regression showed that local health departments' provision of mental health preventive care (OR=0.76, 95% CI=0.63, 0.92) and mental health promotion activities (OR=0.77, 95% CI=0.62, 0.94) were significantly associated with lower rates of preventable hospitalizations

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for individuals with ambulatory care sensitive conditions and co-existing mental disorders. Decomposition results suggested that local health departments' direct provision of mental health preventive care could reduce 9% of the racial disparities.

Conclusions—Improving care coordination and integration are essential to meeting the growing demands for healthcare access, while controlling costs and improving quality of service delivery. These results suggest that it will be effective to engage local health departments in the integrated behavioral health system.

INTRODUCTION

The cost of mental illness reached \$201 billion in the U.S. in 2013, topping the list of the most costly conditions.¹ Nearly 34 million adults—17% of all American adults—had co-occurring mental and physical conditions.² Racial and ethnic minority patients experience disproportionate burdens of common physical health conditions associated with mental illness, largely as a result of lack of healthcare access and social stigma.^{3,4} Effectively treating mental illness and associated conditions depends on a culturally tailored and comprehensive infrastructure that crosses health systems.^{5,6} However, the current mental health care system works in a silo.⁷

Integration of physical and mental health care has been considered as an effective approach to improving care for individuals with coexisting mental disorders and other physical health conditions.^{8,9} Most of the care integration models focus on primary care settings, behavioral health settings, and health homes.^{8–10} Examples of successful integration of mental and physical care include the PROSPECT Trial, which has effectively reduced depressive symptoms,¹¹ and Behavioral Health Associates, operated as part of UCLA Health, which has led to reduction in emergency department use.¹²

Recent research suggests that provision of evidence-based mental health care could be expanded beyond primary care to local health departments (LHDs).^{13–17} LHDs function within the Centers for Disease Control's Public Health Model of Practice, and are called upon to serve in central roles of public health assessment, policy development, and assurance of service delivery.^{13,18,19} Emerging evidence has shown that LHDs have been actively providing healthcare services and population-based interventions to address mental health issue.^{13,18} To the authors' knowledge, there is still a lack of evidence directly linking LHDs' activities with community mental health.^{20,21}

This study constructed (Figure 1) an ecologic multilevel model to delineate the roles of LHDs to promote mental health and reduce racial and ethnic health disparities.^{9,22–25} As the center of community-engaged health programs, and the major source of health care for vulnerable populations, LHDs can promote mental health by providing critical healthcare resources, especially for people with limited healthcare access.^{20,21,26} LHDs are well established organizations within their communities, and this gives them an advantage in terms of cultivating trusting relationships with minorities and low-income residents to improve engagement in health care.²⁷ Lastly, because assessment of community needs forms the basis for public health practice, LHDs' activities are more likely to reflect community

health needs and values, and thereby provide needed education to target barriers such as stigmatization and negative beliefs about mental health conditions.^{28,29}

This present study focuses on the roles of LHDs in reducing preventable hospitalizations for individuals with mental disorders and co-existing chronic conditions. The concept of ambulatory care sensitive conditions (ACSCs) was used to define preventable hospitalizations.³⁰ ACSCs are medical problems, such as diabetes and hypertension that can be well managed through routine, ongoing care in an office-based setting. More than 40% of preventable hospitalizations for ACSC's are linked to mental disorders (such as mood, anxiety, schizophrenia, and psychotic disorders).³¹ This study hypothesizes that LHD's involvement in the provision of mental health preventive care and health promotion could reduce preventable hospitalizations and reduce associated racial disparities for individuals with co-existing mental and physical conditions.

METHODS

Study Sample

Data from the State of Maryland were used to test hypotheses. Specifically, this study employed the linked data sets of the 2012–2013 Healthcare Cost and Utilization Project State Inpatient Databases of the State of Maryland, the National Association of County and City Health Officials Profiles Survey,³² the American Hospital Directory, the Area Health Resource File, and U.S. Census data. All the data sets are public data files. The analytic sample includes hospital discharges in 2012–2013 for adults aged 18–64 years (N=296,917). All hospitals in this analysis are short-term acute care, voluntary, non-profit hospitals. The American Hospital Directory was used to verify hospital characteristics.

Maryland has 24 LHDs, and the communities they serve vary widely in terms of SES, ethnic and racial characteristics, and behavioral health disorder prevalence. The jurisdiction areas of LHDs are at the county level. The State of Maryland is advancing the State Innovation Model to promote the efficiency and equity of its healthcare delivery system³³ and LHDs play leadership roles in this model. In addition, care coordination is critically important under the Maryland Global Budget Revenue Program, which pushes hospitals to target population health.³⁴ Maryland stands at a critical juncture in its understanding of how to involve LHDs in integrated healthcare delivery models, in order to achieve the state's goal of improved population health, especially for the most vulnerable, within the fixed economic resources the state can allocate to health care.

Measures

The outcome variable of interest was the probability of having a preventable hospitalization for co-existing ACSCs and mental illness. ACSCs were measured using the Agency for Healthcare Research and Quality's Prevention Quality Indicators™, Version 5.0.³⁵ This study used the Agency for Healthcare Research and Quality's report on mental disorders as the reference to define patients with mental disorders.³⁶ Broad patient populations with mental and substance use disorders (such as miscellaneous mental conditions, alcohol-related disorders, drug abuse disorders, etc.) were first examined. Research suggests that

mental disorders, such as depression and anxiety disorders, can be effectively treated and prevented.^{37,38} Hence, this study also focused on developing effect estimators of LHDs' activities among patients with depression and anxiety disorders (i.e., a subset of mental disorders) in particular. Appendix Table 1 lists specified ICD-9 codes for each of the mental disorders.³⁶

Derived from the ecologic multilevel model presented in Figure 1, LHDs can improve community mental health and reduce racial disparities by providing timely health care and culturally designed patient education programs.^{39,40} This study examined the role of LHDs from two perspectives: (1) LHDs' active provision of mental health preventive care (i.e., LHDs directly performed preventive care for mental disorders versus LHDs that had no direct involvement). Preventive care includes initial screening and case detection, identifying, and tracking those at high risk for relapse and those not adhering to treatment, structuring follow-up, monitoring outcomes, and providing targeted services for treatment resistant or more complex cases; and (2) LHDs' active health promotion. LHDs' health promotion was considered active if LHDs had been involved in policy or advocacy activities focused on mental health, tobacco, alcohol, or other drugs, chronic conditions, education, and affordable housing. Both measures were provided in the National Association of County and City Health Officials Profiles Survey data set.

These integrated data from multiple data sources enabled an examination of the impact of LHDs, while considering complex patient demographic and socioeconomic factors, cultural background, health needs,^{3,41} and contextual factors^{42,43} that might relate to health care and health disparities for patients with mental disorders. Specifically, this study used the Andersen Behavioral Model of Health Services Use⁴⁴ to control for predisposing factors (age, gender, and race), need factors (Elixhauser comorbidity index), and enabling factors (insurance coverage, income in patients' residential ZIP code). Contextual factors included urban or rural area, the percentage of the county population that report African American ancestry, the percentage of county population without high school degrees, and the percentage of county population with insurance. Measures indicating availability of mental healthcare resources were also included^{43,45}: the number of community mental health centers, the number of federally qualified health centers, the number of primary care doctors, and physicians specializing in mental health care. LHDs' characteristics, such as whether an LHD had one or more local boards of health, the total full-time equivalents workforce at an LHD, and an LHD's total expenditures per capita were also controlled in the model.^{26,46}

Statistical Analysis

A multilevel/hierarchical model was used to examine whether LHDs' active provision of mental health preventive care and health promotion could reduce the rates of preventable hospitalizations. Multilevel models were used to measure variability across individuals within a hospital and an LHD, across hospitals within an LHD, and across LHDs and account for the non-independence of individuals living in the same area.⁴⁷

$$\begin{aligned}
 E(Y_{ihl}) &= \beta_0 + \beta_X X_i + \beta_H H_i + \beta_L L_i + d_{hl} + e_{ihl} \\
 d_{hl} &\sim N(\beta_h H_h + c_l, \delta_h^2), \\
 c_l &\sim N(\beta_L LHD_l, \delta_l^2),
 \end{aligned}$$

where Y is the outcome variable, X is a vector of individual characteristics, H are measures of hospital characteristics, LHD are measures of service provision or health promotion.

The Blinder–Oaxaca regression decomposition method was used to identify and quantify specific LHD practices affecting racial disparities (white versus African American) in the likelihood of having a preventable hospitalization.^{48,49} The decomposition method approach is a regression-based method.⁴⁸ To decompose the difference in the probability of having preventable hospitalizations between whites and African Americans, $\bar{Y}^W - \bar{Y}^{AA}$, multivariable logistic regressions $Y = F(X\hat{\beta})$ for these two groups were first estimated separately. The decomposition for these nonlinear equations was written as:

$$\bar{Y}^W - \bar{Y}^{AA} = \left[\sum_{i=1}^{N^W} \frac{F(X_i^W \hat{\beta}^W)}{N^W} - \sum_{i=1}^{N^{AA}} \frac{F(X_i^{AA} \hat{\beta}^W)}{N^{AA}} \right] + \left[\sum_{i=1}^{N^{AA}} \frac{F(X_i^{AA} \hat{\beta}^W)}{N^{AA}} - \sum_{i=1}^{N^{AA}} \frac{F(X_i^{AA} \hat{\beta}^{AA})}{N^{AA}} \right]$$

where W stands for whites and AA stands for African Americans. The first term on the right-hand side measures the portion of the difference because of observed population characteristics (i.e., all of the control variables), and the second term measures the portion of the difference because of unobserved heterogeneities, such as cultural background and stigma. Among the observed population characteristics, disparities associated with each specific factor, such as LHD activities, can also be quantified. This method has been widely adopted to examine racial and ethnic disparities in health care.^{43,50,51}

A variety of sensitivity analyses, such as different model specifications, were conducted to evaluate the robustness of the model, and found similar results. Stata, version 14, was used for the analyses.

RESULTS

Table 1 presents the rates of preventable hospitalizations and LHDs' activities for patients with mental disorders. The rate of preventable hospitalizations was double among African American patients (10% vs 5%), compared with white patients. Among those with preventable hospitalizations, 51% of African Americans and 65% of whites were diagnosed with any mental health disorder.

African Americans, both overall and among those with mental illness who had preventable hospitalizations, were less likely than whites to live in the counties with LHDs that were active in the provision of mental health preventive care. Among adults who experienced hospitalizations, $\approx 55\%$ of whites and 38% of African Americans lived in counties with direct LHDs preventive care provision. Among patients with mental illness who had

preventable hospitalizations, 49% of whites and 29% of African Americans were from counties with direct LHDs preventive care provision. The large majority of LHDs in the state of Maryland had actively promoted policies and activities that can improve mental health (covering 96% of whites and 99% of African Americans).

Results of multilevel regressions (Table 2) suggested that preventable hospitalizations rates for individuals with mental illness were significantly lower if LHDs directly provided mental health preventive care (OR=0.76, 95% CI=0.63, 0.92 and OR=0.77, 95% CI=0.62, 0.94 for individuals with co-occurring ACSCs and mental and substance use disorders, and depressive and anxiety disorders, respectively). Rates of preventable hospitalizations for individuals with mental illness were also significantly lower if LHDs were actively involved in health promotion (OR=0.76, 95% CI=0.56, 1.02 and OR=0.75, 95% CI=0.57, 0.99, respectively). Results also showed that the likelihood of mental illness related preventable hospitalizations were significantly higher among African Americans when compared with whites. The estimates are robust to different model specifications. Marginal estimates showed that direct provision of mental health preventive care by LHDs can reduce $\cong 5$ admissions per 1,000 hospital admissions in total (which is $\cong 7\%$ of preventable hospitalizations); and active provision of health promotion programs can also reduce 4–5 admissions per 1,000 hospital admissions in total (results not shown but are available upon request).

Decomposition results (Table 3) estimate that the rates of having a preventable ACSC with coexisting mental disorders ranged from 3.24% among whites, to 4.98% among African Americans; the rates of having a preventable ACSC with co-existing depression and anxiety was 2.87% among whites, and 4.43% among African Americans. The model explained 69%–72% of the differences across races. LHDs' mental health preventive care explained 9% of the observed differences in rates of having a preventable ACSC with co-existing mental disorders among white and African American patients.

DISCUSSION

This study showed that LHDs' provision of mental health preventive care and health promotion activities were significantly associated with lower rates of inpatient admissions for individuals with ACSCs and co-existing mental disorders. African Americans, however, were less likely than whites to live in the counties with LHDs' that were active in the provision of mental health preventive care. By removing this disparity in access, LHDs' provision of mental health preventive care can potentially reduce approximately 9% of the observed racial disparities in hospitalization for ACSCs for individuals with mental illness and existing chronic diseases, such as heart disease and diabetes.

These findings suggest that LHDs' provision of mental health preventive care is expected to be effective, especially for vulnerable populations. Ongoing financial support for LHDs is warranted to maintain or expand activities in order to reduce disparities.³⁹ Minority patients face substantial barriers to receiving mental health care because of lack of access and stigma. Although this study did not examine stigma specifically, the authors speculated that the LHDs can serve as a mechanism to provide mental health care and health promotion and

engage residents in wellness and treatment, especially for racial and ethnic minority populations. Recent research suggests that partnerships between hospital systems and public health departments can address some of the root causes of poor health by improving healthcare access, reducing social stigma, and reducing health disparities.^{52,53} Because LHDs assume more responsibilities in underserved areas and provide a major source of health care for vulnerable populations, racial minority patients with mental disorders may gain more benefit from the effective LHD strategies identified by this study.

Awareness of mental health as a community health issue has emerged across public health leaders' agendas. The National Institutes of Mental Health identified strengthening the public health impact of their research and population approaches to treatment as priorities within their strategic plan.⁵⁴ The Robert Wood Johnson Foundation, through their Culture of Health Initiative, has implemented an approach to healthy communities that encompasses the full spectrum of physical, mental, and social wellness. As advocated by the Substance Abuse and Mental Health Services Administration, integration of care not only improves access to mental health, but also improves general health care access for people with mental disorders.⁸ Findings of this study are consistent with the literature on mental health integration models proposed by Substance Abuse Mental Health Services Administration and the strategic objective of the National Institute of Mental Health, to strengthen the public health impact.⁵⁴ Results of this study can guide policy decision makers in federal, state, and local governments with critical information to evaluate LHDs' roles as essential components of care integration to improve mental health.

Limitations

This study has several limitations. First, this study focused on two domains of LHDs' activities using the binary measures given the data limitations. Possible variation in LHDs' level of effort to promote mental health was not captured in this analysis. To develop more informative policy implications, future studies should further examine the implementation quality of LHDs' activities. Second, the present analyses were limited to Maryland data, limiting the generalizability of the findings. Because LHD activities vary from state to state, more research is needed to understand whether LHDs across the U.S. are able to impact mental health in the same pattern. Any such comparison would need to control for differences in state payment models in addition to the numerous socioeconomic factors that were considered in this model. Third, despite controlling for a wide range of individual and community characteristics, some confounding variables might have been omitted because of data limitations. Lastly, using a cross-sectional design, this study examined the association between LHDs' activities and preventable hospitalizations. This study design and decomposition method do not allow for the investigation of causal mechanisms, for example, through feedback loops in which an increasing hospitalization rate prompts LHD action in response. Future studies should focus on the estimation of causality using longitudinal data sets. Despite these limitations, results of this study provide the first evidence needed to develop a scientifically sound and culturally tailored public health-integrated healthcare model that will improve the efficiency of the healthcare delivery system and eliminate health disparities for individuals with mental disorders.

CONCLUSIONS

Improving care coordination and integration are essential to meet the growing demand for mental healthcare access, while controlling costs and improving quality of service delivery. Results suggest that it will be cost effective, from a societal perspective, to engage LHDs as a component of an integrated behavioral health system. Future studies will be needed to investigate LHDs' roles in other states and to generalize these findings. Such studies will help researchers and policymakers understand the extent to which the resources of LHDs can be used or should be expanded to improve mental health and reduce racial disparities.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

This research project is supported by National Institutes of Mental Health R21MH106813-01. Dr. Jie Chen is the principal investigator of this project. Dr. Charles Reynolds is supported by NIH through grant numbers P60 MD000207, P30 MH090333, UL1RR024153, UL1TR000005; and the UPMC Endowment in Geriatric Psychiatry. Dr. Stephen B. Thomas is supported by NIH-NIMHD 5P20 MD006737.

Ms. Novak was an employee of the Agency for Healthcare Research and Quality at the time this manuscript was prepared. The statements contained in this manuscript are solely those of the authors and do not necessarily reflect the views or policies of the Agency for Healthcare Research and Quality, the U.S. DHHS or the Federal government.

No financial disclosures were reported by the authors of this paper.

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Figure 1.

An ecological perspective on local health departments' role in improving mental health.

Notes: The model is adapted from social ecological model (McLeroy et al. 1988, Stokols 1996), and the CDC Public Health Action Plan 2011.

LHDs, local health departments.

Table 1
Race-related Rates of Preventable Hospitalizations for Individuals With Mental Illness

Variables	Total		White		African American	
	Mean (%)	SD	Mean (%)	SD	Mean (%)	SD
n=296,917 n=148,643 n=119,610						
Hospitalization rates						
Hospitalization rates for any ACSCs	6.71	25.02	4.97***	21.73	9.75***	29.66
Hospitalization rates for any ACSCs and mental and substance use disorder	3.32	17.93	3.24***	17.69	4.98***	21.76
Hospitalization rates for any ACSCs and depressive/anxiety disorder	3.74	18.99	2.87***	16.69	4.43***	20.57
Among individuals with hospitalizations for any ACSCs						
Rates of having a mental and substance use disorder	55.80	49.66	65.09***	47.67	51.15***	49.99
Rates of having depressive/anxiety disorder	49.53	49.99	57.73***	49.40	45.45***	49.79
Local Health Departments (LHD) of the State of Maryland						
LHD direct provision of mental health preventive care	47.27	49.93	55.28***	49.72	37.53***	48.42
LHD active involvement in health promotion	97.44	15.79	96.25***	19.00	98.81***	10.83
Among individuals with hospitalizations for any ACSCs and mental and substance use disorder						
Rates of living in the counties with LHDs' direct provision of mental health preventive care	38.17	48.48	48.83***	49.99	28.98***	45.37
Rates of living in the counties with LHDs' active involvement in health promotion	97.59	15.34	96.48***	18.44	98.60***	11.77

Note: Boldface indicates statistical significance (* $p<0.05$; ** $p<0.01$; *** $p<0.001$) (white vs. African American). Data source: 2012–2013 Health Cost and Utilization Project State Inpatient Databases of the State of Maryland, the National Association of County and City Health Officials Profiles Survey (NACCHO). The NACCHO data provide a comprehensive description of LHD infrastructure and practice, including LHD resources, and services. The response rate of NACCHO survey was 78%, and the responding agencies cover more than 90% of the U.S. population each survey year. All the 24 counties in the State of Maryland were included in the estimation of LHDs preventive care; 23 counties were included in the estimation of LHDs promotion (Montgomery County Health Department did not report this measure in 2012). Maryland hospital inpatient file 2012 included 303,110 discharges for patients aged 18–64 years with the routine source of admission. There were 6,193 observations (approximately 2% of the total discharges) with missing age, gender, health insurance, and primary diagnosis code. The final sample size was 296,917. LHD measures were derived from the survey questions on “Population-based Primary Prevention Activities on mental health care” and “policy promotions”. Representatives of each responding LHD checked the survey question on “how your LHD and other organizations provided that activity or service in your jurisdiction during the past year” (NACCHO data). Sample includes adults aged 18–64 years with all races and ethnicities (white, African American, Hispanic, Asian, Native, and other). ACSCs are measured using the AHRQ's Prevention Quality Indicators™, Version 5.0. The AHRQ's report on mental disorders was used as reference to define patients with mental disorders. Appendix Table 1 and Appendix Table 2 provide specified ICD-9 codes for ACSCs and mental disorders. Depression/anxiety is a subset of mental and substance use disorder. Specific ICD-9 codes used to measure specific mental illness are included in Appendix Table 2.

ACSCs, ambulatory care sensitive conditions; AHRQ, the Agency for Healthcare Research and Quality.

Table 2

Association Between LHDs' Mental Health Activities With Preventable Hospitalizations for Individuals With Mental Illness

	ACSCs + mental and substance use disorder	ACSCs + depression/a nxiety	ACSCs + mental and substance use disorder	ACSCs + depression/a nxiety
Variables	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Local Health Departments (LHD)				
No direct LHD mental health preventive care	ref	ref		
Direct provision of mental health preventive care	0.76 (0.63, 0.92)**	0.77 (0.62, 0.94)**		
No active health promotion to improve community mental health			ref	ref
Health promotion to improve community mental health			0.76 (0.56, 1.02)	0.75 (0.57, 0.99)*
Race				
White	ref	ref	ref	ref
African American	1.21 (1.10, 1.32)	1.22 (1.10, 1.34)***	1.22 (1.11, 1.34)***	1.23 (1.10, 1.36)***
Hispanic	0.61 (0.48, 0.78)***	0.60 (0.47, 0.76)***	0.62 , (0.46, 0.83)***	0.59 (0.44, 0.79)***
Asian	0.50 (0.38, 0.65)***	0.49 (0.39, 0.62)***	0.49 (0.36, 0.67)***	0.47 (0.37, 0.61)***
Native	0.86 (0.42, 1.75)	0.70 (0.35, 1.41)	0.87 (0.39, 1.94)	0.66 (0.29, 1.50)
Other	0.45 (0.31, 0.65)***	0.43 (0.29, 0.64)***	0.39 (0.26, 0.57)***	0.36 (0.23, 0.56)***
Age	1.15 (1.12, 1.18)***	1.17 (1.15, 1.20)***	1.15 (1.12, 1.18)***	1.17 (1.15, 1.20)***
Age*Age	1.00 (1.00, 1.00)***	1.00 (1.00, 1.00)***	1.00 (1.00, 1.00)***	1.00 (1.00, 1.00)***
Female	0.97 (0.90, 1.04)	0.99 (0.92, 1.06)	0.98 (0.92, 1.05)	1.00 (0.93, 1.08)
Elixhauser comorbidity score	1.10 (1.08, 1.13)***	1.06 (1.03, 1.09)***	1.10 (1.07, 1.12)***	1.05 (1.02, 1.08)***
Insurance				
Uninsured	ref	ref	ref	ref
Medicare	0.90 (0.81, 1.01)	0.80 (0.72, 0.90)***	0.91 (0.81, 1.02)	0.80 (0.71, 0.90)***
Medicaid	0.96 (0.87, 1.06)	0.91 (0.82, 1.01)	0.95 (0.87, 1.05)	0.90 (0.81, 1.00)*
Private insurance	0.52 (0.46, 0.58)***	0.48 (0.43, 0.54)***	0.52 (0.46, 0.58)***	0.48 (0.43, 0.54)***
Other	0.68 (0.49, 0.94)*	0.64 (0.45, 0.90)**	0.67 (0.48, 0.93)*	0.63 (0.44, 0.90)**
Admission type				
Emergency or urgent	ref	ref	ref	ref
Elective	0.12 (0.09, 0.17)***	0.12 (0.08, 0.17)***	0.12 (0.09, 0.17)***	0.12 (0.08, 0.17)***
Other type	0.08 (0.02, 0.38)***	0.08 (0.02, 0.41)***	0.08 (0.02, 0.38)***	0.08 (0.02, 0.41)***
Staffed beds				
<50	ref	ref	ref	ref
50–99	0.69 (0.45, 1.07)	0.73 (0.49, 1.09)	0.78 (0.49, 1.26)	0.84 (0.54, 1.30)
100–199	0.57 (0.36, 0.91)*	0.58 (0.37, 0.90)*	0.62 (0.37, 1.02)	0.63 (0.38, 1.02)
200–425	0.42 (0.27, 0.65)***	0.43 (0.28, 0.64)***	0.45 (0.28, 0.70)***	0.45 (0.29, 0.70)***
>425	0.27 (0.16, 0.46)***	0.28 (0.16, 0.47)***	0.28 (0.16, 0.48)***	0.29 (0.17, 0.50)***
Median household income of residents in the patient's ZIP code				

	ACSCs + mental and substance use disorder	ACSCs + depression/a nxiety	ACSCs + mental and substance use disorder	ACSCs + depression/a nxiety
Variables	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Q1 (1–38,999)	ref	ref	ref	ref
Q2 (39,000–47,999)	0.90 (0.81, 1.01)	0.89 (0.78, 1.00)*	0.90 (0.81, 1.01)	0.88 (0.78, 1.00)*
Q3 (48,000–62,999)	0.77 (0.71, 0.84)***	0.75 (0.69, 0.82)***	0.77 (0.71, 0.85)***	0.75 (0.69, 0.82)***
Q4 (>63,000)	0.64 (0.56, 0.74)***	0.62 (0.54, 0.72)***	0.64 (0.56, 0.74)***	0.62 (0.54, 0.72)***
Urban	1.38 (0.83, 2.27)	1.31 (0.81, 2.13)	0.99 (0.58, 1.70)	0.92 (0.55, 1.53)
County-level characteristics				
Percent of African Americans	2.59 (1.38, 4.87)***	2.79 (1.41, 5.51)***	0.68 (0.25, 1.80)	0.62 (0.23, 1.69)
Percent of foreign-born	0.22 (0.09, 0.54)***	0.18 (0.07, 0.47)***	0.71 (0.17, 2.95)	0.72 (0.16, 3.23)
Number of primary doctors, per 1,000 residents	0.91 (0.45, 1.84)	0.99 (0.47, 2.09)	0.41 (0.17, 0.97)*	0.41 (0.16, 1.02)
Number of mental health specialists, per 1,000 residents	0.98 (0.72, 1.35)	0.95 (0.68, 1.33)	1.71 (1.08, 2.71)*	1.74 (1.09, 2.79)*
LHD per cap expenditure below median	ref	ref	ref	ref
LHD per cap expenditure above median	0.74 (0.60, 0.91)***	0.73 (0.58, 0.92)**	0.69 (0.55, 0.86)***	0.69 (0.54, 0.89)***
LHD per cap expenditure unknown	0.72 (0.47, 1.11)	0.71 (0.42, 1.17)	0.59 (0.38, 0.90)**	0.57 (0.34, 0.96)*
Constant	0.01 (0.00, 0.06)***	0.01 (0.00, 0.06)***	0.00 (0.00, 0.02)***	0.00 (0.00, 0.01)***
Log pseudo likelihood	–38385.21	–41640.072	–36958.578	–40050.668
Wald chi-square	10518.97 ***	9215.92***	6021.20***	7304.72***

Note: Boldface indicates statistical significance (***) $p < 0.001$; ** $p < 0.01$; * $p < 0.05$). A multilevel/hierarchical model was employed to examine whether LHDs' active provision of mental health preventive care and health promotion can reduce the rates of preventable hospitalizations. Source: The linked data sets of the 2012–2013 Health Cost and Utilization Project State Inpatient Databases of the State of Maryland, the National Association of County and City Health Officials Profiles Survey, the American Hospital Directory, the National Directory of Mental Health Treatment Facilities; the Area Health Resource File, and U.S. Census data. Depression/anxiety is a subset of mental and substance use disorder. Specific ICD-9 codes used to measure specific mental illness are included in Appendix Table 2. Contextual factors include income in patients' residential ZIP-code, whether the LHD was in an urban or rural area, the percentage of the population residing in a county that report African American ancestry, the percentage of county population without high school degrees, and percentage of county population with insurance. Also included are measures indicating availability of mental healthcare resources: the number of community mental health centers, the number of federally qualified health centers, the number of primary care doctors and physicians specializing in mental health care, whether LHD had one or more local boards of health, the total full-time equivalents workforce at your LHD, etc. These variables have been identified in the literature as predictors for healthcare utilization for people with mental illness. Contextual factors with significant coefficients are reported above.

ACSC, ambulatory care sensitive conditions.

Table 3

Decomposition Estimation of the Contribution of LHDs to Reduce Racial Disparities in Preventable Hospitalizations

Decomposition results	Individuals with ACSCs + mental and substance use disorder		Individuals with ACSCs + depression/anxiety	
	White	African American	White	African American
Predicted probability of preventable hospitalizations (%)	3.24	4.98	2.87	4.43
Difference		1.75***		1.56***
Explained differences		71.72%		68.90%
Explained by differences in LHDs' mental health preventive care		8.91%***		8.61%***

Note: Boldface indicates statistical significance (* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$). Source: The linked data sets of the 2012–2013 Health Cost and Utilization Project (HCUP) State Inpatient Databases of the State of Maryland, the National Association of County and City Health Officials Profiles Survey (NACCHO), the American Hospital Directory, the National Directory of Mental Health Treatment Facilities; the Area Health Resource File, and U.S. Census data.

^cThe Blinder-Oaxaca decomposition methods are used to estimate the racial disparities.

^dDepression/anxiety is a subset of mental and substance use disorder. Specific ICD-9 codes used to measure specific mental illness are included in Appendix Table 2.

ACSC, ambulatory care sensitive conditions; LHD, Local Health Department.