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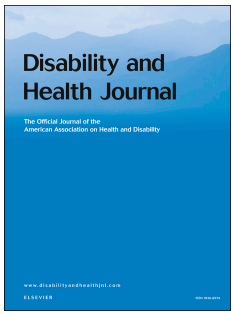

The relationship between unmet need for home and community-based services and health and community living outcomes

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Title: The Relationship between Unmet Need for Home and Community-Based Services and Health and Community Living Outcomes

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Title: The Relationship between Unmet Need for Home and Community-Based Services and Health and Community Living Outcomes

Abstract:

Background: Few studies have examined user-reported perspectives about the quality and sufficiency of home and community-based services (HCBS) and their relationship to key health and community living outcomes.

Objective: To examine the association between unmet need for HCBS and health and community living outcomes in a multi-state, multi-program sample of Medicaid HCBS users.

Methods: We used data from the 2017-2018 National Core Indicators-Aging and Disability (NCI-AD) survey, collected among older adults and adults with physical disabilities who were receiving Medicaid HCBS across 13 states (N = 10,263). We conducted descriptive analysis on the demographic, functional, and health characteristics of the sample, and examined the prevalence of unmet need for HCBS across five domains: 1) assistance with daily activities, 2) assistive technology, 3) home modifications, 4) transportation, and 5) sufficiency of services for meeting user needs and goals. We used logistic regressions to estimate adjusted odds ratios for the association between unmet need for HCBS and health care utilization (ED visits, hospital/rehab stays, preventative care) and community living outcomes (active in the community, interacting with family/friends, satisfaction, control).

Results: Across the five domains, prevalence of unmet need ranged from 21% (unmet need for assistance with self-care or other daily activities) to 54% (unmet need for assistive technology). Individuals who experienced unmet need had consistently worse health and community living outcomes than those who reported no unmet need, after adjusting for key user demographic, functional, and social characteristics ($p<0.05$).

Conclusions: Unmet need for HCBS is consistently and significantly associated with poor health and community living outcomes among Medicaid users.

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Introduction

Long-term services and supports (LTSS) refer to a wide range of health and social services provided to individuals with disabilities and older adults who need assistance with daily living (i.e. eating, bathing, dressing, medication management, meal preparation, mobility). In the U.S., LTSS is primarily financed through the Medicaid program, which accounts for over half of national LTSS spending.[1] An estimated 12 million individuals need LTSS and most prefer to receive supports at home versus in institutional settings, such as nursing homes.[2, 3] Medicaid Home and Community-Based Services (HCBS) provide an alternative to institutional care, allowing users to receive LTSS in their own homes and communities.

The Americans with Disabilities Act of 1990 (ADA), as reaffirmed by the landmark U.S. Supreme Court *Olmstead* decision, established that individuals have a right to live in the most integrated setting appropriate to their needs.[4] Access to HCBS is essential to ensuring this right. High-quality HCBS provides a tailored set of services to meet users' care and support needs under their own direction, according to their personal preferences and goals.[5] Services can include in-home personal care, adult day, employment supports, and assistance with meals, transportation, assistive devices, and home modifications. While HCBS is not medical care, services support users' health and well-being by ensuring a safe living environment, assisting with management of chronic health conditions, and coordinating health care services. HCBS allow individuals with disabilities to live independently, participate in the community, and age with dignity and respect. This includes facilitating participation in valued activities and relationships, as well as employment. Access to HCBS may also reduce unnecessary placements in more costly nursing homes and other institutional settings.[6-9]

Access to Medicaid HCBS is limited. The Medicaid program has a longstanding institutional bias in which nursing home care is a mandatory benefit, while HCBS are optional for states to provide.[10-11] Over the past few decades, access to Medicaid HCBS has significantly expanded. Enforcement of the ADA, coupled with state and federal policies have shifted the balance of LTSS from institutional to community-based settings.[1, 12-13] Broader access to Medicaid HCBS is significant because it expands services to individuals who were previously ineligible for Medicaid LTSS. For example, state Medicaid waivers may extend HCBS services to certain target populations (e.g., individuals with physical disabilities and older adults) at higher income thresholds than standard Medicaid rules allow.

Nationally, approximately 56% of total Medicaid LTSS spending is now devoted to HCBS.[12] However, access varies widely between states and across populations that need HCBS. Moreover, states have significant flexibility in designing their Medicaid HCBS systems, which contributes to variation in program eligibility and the types and amount of services and supports provided.[14] Most states cap enrollment in their Medicaid HCBS programs and maintain wait lists. Nationally, over 820,000 individuals are on wait lists for services covered under 1915 (c) HCBS waivers (which is the primary Medicaid authority states use to provide HCBS) and 1115 waivers, and the average wait time exceeds three years.[15-16]

Because unmet need for LTSS is not routinely assessed in any national population survey that includes adults of all ages, unmet need for LTSS is not well understood.[2] In the mid-1990s, 21% of LTSS users in the U.S. were found to have unmet need.[17] Using a broader definition of LTSS, a 2007 survey among the working-age population in Massachusetts found that unmet need was as high as 70%.[18] In a 2011 national survey among older adults, 32% of those 65 and older who had difficulty or received help with self-care or household activities reported experiencing an adverse consequence related to unmet need.[19] Among participants in Medicaid HCBS programs, studies across various states have found unmet need ranges from 24% to 58%.[20-22]

Previous studies have found that unmet need for HCBS is associated with multiple adverse outcomes including mortality, hospitalization, and institutionalization.[23-26] Among those living in community settings, adverse outcomes of unmet LTSS need include the inability to get out of bed or out into the community, medication mistakes, falls, inadequate nutrition, missed healthcare appointments, discomfort due to infrequent bathing or changing clothes, and inability to reach the toilet in time.[17, 27-30]

Relatively few studies have examined self-reported perspectives about the quality and sufficiency of HCBS programs and their relationship to key health outcomes. Moreover, few studies have examined the impact of unmet needs on community living outcomes, such as the ability to participate in the community and maintain desired relationships with family and friends. Prior studies have been limited to data sources focused on older adults receiving Medicare, but not younger adults with disabilities receiving Medicaid HCBS.[19] Other studies have been limited to data from single states and/or individuals with disabilities but who are not necessarily Medicaid HCBS users. Our study builds on previous research by 1) assessing the prevalence of unmet need for HCBS in a multi-state sample of Medicaid HCBS users and 2)

examining the association between unmet need for HCBS and key health and community living outcomes.

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Methods

Conceptual Framework

Figure 1 presents the conceptual framework for the relationship between unmet need for HCBS and health and community living outcomes. In this model, individual characteristics and HCBS system-level factors determine the scope and level of services accessed by users. Individual characteristics include demographics, health characteristics, level of assistance needed for daily activities, type of residence, and personal preferences and goals. System-level factors include the design, administration, and quality of Medicaid HCBS program(s) and infrastructure (note: these characteristics are not directly measured in our study). Across a range of service domains, users may experience unmet need for HCBS when the level, quality, and/or scope of services they receive are insufficient for meeting their needs. Users may receive some but not enough of the supports and services they need in each HCBS domain or report receiving no services at all. Unmet need for HCBS may put individuals who rely on these services to support their health, well-being, and community integration at greater risk for poor health and community outcomes.

Data

We used secondary data from the 2017-2018 wave of the National Core Indicators Aging and Disability (NCI-AD) survey. NCI-AD is coordinated by participating states, ADvancing States (formerly the National Association of States United for Aging and Disabilities [NASUAD]), and Human Services Research Institute (HSRI). States volunteer to participate in NCI-AD and choose the publicly funded program(s) to include in their survey sample. Each state must have at least 400 total respondents to participate. State health agencies conduct the survey among a sample of older adults and individuals with physical disabilities who access LTSS through the selected programs in their state.[31] The survey collects a wide range of respondent-reported information on quality of services and outcomes. Data is collected through in-person interviews and a subset of questions allow for proxy responses from family, friends, or hired caregivers (e.g. questions on health care events). Several items are derived from state administrative records and linked to the survey data, including the primary source of funding for services.

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Although the target populations for NCI-AD are older adults and adults with physical disabilities who use publicly funded LTSS, it is important to note that the individuals sampled differ across states. While NCI-AD sets general parameters for sampling, individual state agencies are responsible for administering the NCI-AD. Therefore, sampling and recruitment procedures may vary by state. States sample respondents from their own set of LTSS programs, each with varying eligibility criteria. For example, states can choose to draw their samples from among Medicaid HCBS recipients, Older Americans Act program participants, nursing home residents, and/or state-funded HCBS program participants.

The 2017-2018 NCI-AD represents data collected in one survey cycle (June 1, 2017 – May 31, 2018) and the data in this study includes responses from 13 states (CO, IN, KS, MN, MS, NE, NJ, NV, OR, TN, TX, VT and WI). The data was de-identified at the state level to protect state and respondent identities. See ***Table 1*** in the supplemental materials for further details on the Medicaid HCBS program sampled in each state and corresponding sample sizes.

Study sample

Of the 15,789 respondents to the NCI-AD, we limited our sample to the 10,284 identified as participating in Medicaid HCBS programs. Of those, 21 were removed because of missing data on all of the outcomes of interest, leaving a final sample size of 10,263 community-dwelling Medicaid HCBS recipients.

Measures

Outcome Variables – Health Care Utilization & Community Living Outcomes. Health care utilization and community living outcomes were measured as binary variables (yes/no). The health care utilization outcomes included measures of whether respondents reported 1) one or more emergency room visit(s), 2) one or more overnight stay(s) in a hospital or rehabilitation facility, 3) at least one physical exam or wellness visit, and 4) at least one dental visit over the prior year. Community living outcomes included measures of whether respondents reported being 1) as active in the community as they would like to be, 2) able to see or talk to friends and family when they wanted to, 3) satisfied with how they spend their time during the day, and if they 4) felt in control of their life. Of note, NCI-AD allows proxy responses for survey items used to construct the health care utilization outcomes but not the community living outcomes.

Independent Variables – Unmet Need. The key independent variables were binary (yes/no) indicators of unmet need for HCBS. Unmet need was assessed across five domains: 1) assistance with self-care or other daily activities, 2) assistive technology, 3) home modifications, 4) transportation, and 5) services that fully meet user needs and goals. Respondents had 1) unmet need for assistance with self-care or other daily activities if they did not always receive enough help with self-care activities (e.g., bathing, dressing, eating) or other daily activities (e.g., preparing meals, shopping, taking medications) when needed. Respondents had 2) unmet need for assistive technology if they needed but did not have any of the following items: walker, scooter, wheelchair, hearing aids, glasses, or CPAP machine. Similarly, respondents had 3) unmet need for home modifications if they needed but did not have any of the following items: bathroom grab bars, other bathroom modifications, specialized bed, ramp or chairlift, remote monitoring system, or emergency response system. For transportation, respondents had 4) unmet need if they reported not always having transportation to medical appointments or activities outside of the home. Finally, respondents had 5) unmet need for services that met their needs and goals if they reported that their long-term care services did not fully meet all of their needs and goals.

Covariates. We examined several demographic and health characteristics of the sample and included these as covariates in our multivariate analyses. Demographic characteristics included age, gender, race/ethnicity (white, Black, and other non-Hispanic, Hispanic, unknown), and location (rural or urban area based on respondent zip codes). This information was derived from state administrative records, and where missing, was asked during the interview. We also included two variables on living arrangements: whether the respondent lived alone and residence type (home or senior living, congregate setting [e.g., group home or assisted living], other). Health characteristics included self-reported health status (excellent, very good, or good; fair; poor; only included as a covariate in models for community living outcomes) and functional status based on reported level of need (none, some, a lot) for assistance with self-care and other daily activities.

Analysis

We conducted descriptive analysis to describe the demographic, functional, and health characteristics of the sample overall and by unmet need status (i.e., any unmet need vs. no unmet

need) to examine how individual characteristics might be associated with unmet need. We also performed bivariate analyses to determine the observed prevalence of each outcome by unmet need status. We used logistic regressions to estimate the adjusted odds ratios (with 95% confidence intervals) for the association between unmet need indicators and the health care utilization and community living outcomes, as hypothesized in our conceptual framework. Multivariable models adjusted for the person-level characteristics described above, as these factors may also influence health and community living outcomes. We performed all analyses in Stata version 16 MP and a p-value of <0.05 was the accepted level of significance. This study was reviewed and approved by the authors' Institutional Review Board.

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Results

Table 1 presents descriptive statistics on the community-dwelling Medicaid HCBS users in the study sample, overall and by unmet need status. About 80% of users reported unmet need in at least one domain, and unmet need for assistive technology and home modifications were most common. In general, those with any unmet need were younger than those without unmet need. HCBS users who were non-Hispanic white represented a greater proportion of those with no unmet need compared to those with any unmet need, and the inverse relationship was true for all other racial/ethnic groups. Living at home/senior living and living alone was more common among individuals reporting unmet need. Individuals with any unmet need were more likely to report their health status as poor.

Figure 2 compares the observed prevalence of each health and community living outcome among HCBS users with any unmet need to those with no unmet need in any of the five domains. Individuals with at least one type of unmet need had greater prevalence of ER use and overnight hospital or rehab stays (52% vs. 34% and 36% vs. 24%, respectively). Individuals with no unmet need were more likely to receive preventative care services (i.e., a physical or dental exam). With respect to community living, users with no unmet need were consistently more likely to experience each positive outcome than those with any unmet need.

Table 2 presents results from multivariate analysis that examines the association between unmet need and health care utilization outcomes, adjusted for respondent characteristics. In general, unmet need was associated with greater likelihood of an ER visit and a hospital/rehab stay in the past year and reduced likelihood of both types of preventative care in the past year. Among the various types of unmet need, lack of adequate assistive technology was associated with the greatest likelihood of having an ER visit and a hospital/rehab stay, and lowest likelihood of receiving a physical exam in the last year. Unmet need for transportation was associated with the lowest likelihood of receiving a dental exam in the last year.

Table 3 presents the adjusted association between the various types of unmet need and community living outcomes. Unmet need was consistently associated with lower likelihood of experiencing each community living outcome. Comparing across types of unmet need, unmet need for transportation was related to the lowest likelihood of being active in the community and interacting with friends and family. Services that did not fully meet recipient needs and goals

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was associated with the lowest likelihood of user satisfaction with how time is spent and feeling in control of life.

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Discussion

This study examines the prevalence of unmet needs and associated health and community living outcomes in a multi-state, multi-program sample of older adults and individuals with physical disabilities receiving Medicaid HCBS. Using a novel dataset that assesses LTSS outcomes across a standard set of user-reported measures, we found that unmet need for HCBS is common among older adults and adults with physical disabilities who receive Medicaid HCBS. While our study does not focus on the causes for unmet need, our conceptual framework presents HCBS system-level characteristics as a factor in the ability of HCBS programs to meet users' service and support needs. The prevalence of unmet needs for HCBS is unsurprising given the optional nature of most services under state Medicaid programs, enrollment caps, and limits on service allocations. Access to HCBS may also be linked to systemic racial and ethnic barriers, and barriers by geographic location.[32-33] Furthermore, challenges with provider networks and the availability of qualified direct care workers may also impact access to high-quality HCBS. Demographic shifts have increased reliance on direct care workers as the need for LTSS grows and the supply of potential family caregivers falls.[34] At the same time, many direct care workers experience poor job quality, including low wages, limited benefits, and insufficient training, leading to high employee turnover and job vacancies.[35-38] These workforce issues may impact the quality of HCBS and lead to unmet need and other adverse outcomes.[38-39]

Our finding that nearly a third of HCBS users reported that their services did not fully meet their service needs and goals is particularly concerning given that the Centers for Medicaid and Medicare Services requires person-centered planning for all individuals receiving Medicaid HCBS. Person-centered planning is a facilitated, individual-directed, positive approach to planning and coordinating a person's services and supports based on their individual aspirations, needs, preferences, and values.[5, 40] The extent to which person-centered thinking, planning, and practice is implemented effectively varies considerably across HCBS programs and states. Lack of high-quality person-centered planning may impact the degree to which services and supports can be customized to fully meet individual needs. To address this variation, policy makers should adopt and enforce a set of standardized person-centered planning practices and measures to improve the quality of service planning among HCBS users.[5] Future studies should examine the barriers and facilitators of person-centered planning among Medicaid HCBS recipients and

assess the extent to which service plans are implemented and reflected in the supports that users receive.

Our study found that unmet need for HCBS was consistently associated with adverse health and community living outcomes, supporting the relationships hypothesized in our conceptual framework. The link between unmet need and user outcomes provides actionable evidence for policy makers to systematically assess and address individual users' specific need for HCBS. A crucial concern in the growth of HCBS is whether community-based supports result in improved outcomes for users over institutional care. Among individuals dually eligible for Medicaid and Medicare, both all-cause hospitalizations and potentially avoidable hospitalizations are more common among HCBS users than nursing home residents.[41] Results from our study suggest that addressing unmet needs among HCBS users could be one pathway for reducing avoidable hospitalizations and improving health and well-being, which could reduce overall health care costs for this population. This finding is particularly relevant for state and federal initiatives seeking to better integrate and coordinate LTSS and acute care for individuals receiving Medicaid LTSS. There has been significant growth in Managed Long-Term Services and Supports (MLTSS), which is the delivery of LTSS through capitated managed care organizations that are also typically responsible for acute care and other services such as behavioral health.[42-43] With meaningful stakeholder engagement, oversight, and quality metrics, these payment and delivery models could offer health plans better incentive to reduce unmet HCBS needs and potentially improve related health outcomes among their beneficiaries.[44]

This study has several limitations. The cross-sectional design limits our ability to make causal inferences about the relationship between unmet need and outcomes for HCBS users. For example, because the cross-sectional data does not ensure the temporal precedence of unmet need, there is possibility for reverse causality. Although the multivariate analysis controlled for certain respondent health and functional characteristics, it is possible that health and community living outcomes may contribute to a user's unmet need for HCBS. State-level administration of the NCI-AD survey presents another limitation for generalizability of the study findings. Participating states did not have identical sampling strategies and selected respondents from their own set of unique Medicaid HCBS programs, each with their own user eligibility requirements.[33] The study sample may not be representative of the Medicaid HCBS user population in each state or across states.

Because the data was aggregated across states (without the presence of a state identifier), the extent to which various state Medicaid program characteristics might differentially impact unmet need among HCBS users, user outcomes, or the relationship between the two is unknown. Prior research involving the Medicaid population has found wide variation between states in terms of program sufficiency and quality. Finally, because some survey items allowed for proxy responses, not all data collected by NCI-AD was user-reported. There may be cases where proxy responses do not accurately or fully capture user experiences.

Despite these limitations, the findings from this study emphasize the heightened risk of adverse health and community living outcomes related to unmet needs for HCBS among Medicaid beneficiaries. This study calls attention to the importance of user perspectives and community engagement as important measures for assessing the sufficiency, quality, and outcomes of HCBS programs. It also underscores the importance of person-centered approaches that incorporate the perspectives, needs, and desires of individuals receiving HCBS and the potential impact on health and community living outcomes. As states are working to shift LTSS programs away from institutional services and toward HCBS, additional efforts are needed to ensure that Medicaid HCBS programs are addressing the service needs of their beneficiaries. Programs should implement quality measures that track the extent to which recipients' needs are being met, in addition to whether the services they receive have been designed to further their individual life goals.

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Table 1. Sample Descriptives

		Total		Any Unmet Need		No Unmet Need	
		N	%	N	%	N	%
N		9,913	-	8,040	-	1,873	-
Gender (n=9,867)	Male	3,514	35.6	2,849	35.6	665	35.7
	Female	6,353	64.4	5,153	64.4	1,200	64.3
Age (n= 9,887)	18-54	2,207	22.3	1,818	22.7	389	20.8
	55-64	2,184	22.1	1,891	23.6	293	15.7
	65-74	2,231	22.6	1,851	23.1	380	20.3
	75-84	1,918	19.4	1,468	18.3	450	24.1
	85+	1,347	13.6	991	12.4	356	19.1
Race/ethnicity (n=9,913)							
	White, non-Hispanic	5,481	55.3	4,219	52.5	1,262	67.4
	Black, non-Hispanic	1,843	18.6	1,583	19.7	260	13.9
	Hispanic	1,411	14.2	1,256	15.6	155	8.3
	Other, non-Hispanic	623	6.3	514	6.4	109	5.8
	Unknown	555	5.6	468	5.8	87	4.6
Rural/Urban status (n=9,811)	Rural	545	5.6	412	5.2	133	7.2
	Urban	9,266	94.4	7,549	94.8	1,717	92.8
Needs help w. self-care (n=9,861)	None	1,954	19.8	1,477	18.5	477	25.5
	Some	4,301	43.6	3,583	44.8	718	38.4
	A lot	3,606	36.6	2,930	36.7	676	36.1
Needs help w. other daily activities (n=9,852)							
	None	488	5	365	4.6	123	6.6
	Some	5,811	59	4,819	60.4	992	53.1
	A lot	3,553	36.1	2,799	35.1	754	40.3
Health status (n=9,819)							
	Excellent/very good/good	4,376	44.6	3,201	40.2	1,175	63
	Fair	3,443	35.1	2,916	36.7	527	28.3
	Poor	2,000	20.4	1,837	23.1	163	8.7
Residence type (n=9,751)							
	Home/senior living	7,802	80	6,551	82.8	1,251	67.9
	Congregate setting	1,739	17.8	1,184	15	555	30.1
	Other	210	2.2	174	2.2	36	2
Living arrangement (n=9,073)	Lives alone	2,734	31.2	2,325	32.4	409	25.5
	Lives with others	6,039	68.8	4,845	67.6	1,194	74.5

Unmet need for:	**N**	**%**
Help w. self-care/other daily activities (n=10,049)	2,124	21.1
Services meeting needs & goals (n=10,049)	3,016	30.0
Assistive technology (n=9,922)	5,389	54.3
Home modifications (n=9,876)	5,050	52.2
Transportation (n=10,064)	2,612	26.7

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Notes: Some individuals in the sample had missing data for the variables included in this table. Sample sizes among individuals without missing data for each variable are noted in parentheses.

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Table 2. Multivariate Logistic Regression Results: Health Outcomes

	Model A: ER visit	Model B: Hospital/rehab stay	Model C: Physical exam	Model D: Dental exam
Sample included:	7,850	7,834	7,724	7,712
	Odds ratio (95% confidence interval)			
Unmet Need for:				
Help w. self-care/other daily activities	1.31**(1.16 - 1.48)	1.12 (0.99 - 1.27)	0.95 (0.81 - 1.12)	1.16*(1.02 - 1.31)
Services meeting needs & goals	1.13*(1.01 - 1.26)	1.19**(1.06 - 1.33)	0.82**(0.71 - 0.95)	0.94 (0.84 - 1.05)
Assistive technology	1.60**(1.46 - 1.77)	1.54**(1.39 - 1.71)	0.74**(0.65 - 0.84)	0.85**(0.77 - 0.94)
Home modifications	1.30**(1.17 - 1.43)	1.16**(1.04 - 1.29)	0.89 (0.78 - 1.03)	0.83**(0.75 - 0.92)
Transportation	1.07 (0.96 - 1.20)	1.17**(1.05 - 1.32)	0.76**(0.66 - 0.88)	0.70**(0.63 - 0.78)
Female	1.22**(1.10 - 1.34)	1.07 (0.97 - 1.19)	1.16*(1.02 - 1.32)	1.08 (0.98 - 1.19)
Age (ref. 65-74)				
18-54	0.99 (0.86 - 1.14)	0.77**(0.67 - 0.90)	0.68**(0.57 - 0.83)	1.89**(1.64 - 2.18)
55-64	1.11 (0.97 - 1.27)	0.98 (0.85 - 1.13)	0.89 (0.73 - 1.07)	1.38**(1.21 - 1.59)
75-84	0.98 (0.84 - 1.13)	0.99 (0.85 - 1.15)	0.90 (0.73 - 1.10)	0.89 (0.77 - 1.04)
85+	0.86 (0.73 - 1.01)	0.78**(0.65 - 0.92)	0.99 (0.79 - 1.24)	0.80**(0.68 - 0.95)
Race/ethnicity (ref. White, non-Hispanic)				
Black, non-Hispanic	0.82**(0.72 - 0.93)	0.78**(0.68 - 0.89)	1.05 (0.88 - 1.25)	0.92 (0.81 - 1.05)
Hispanic or Latino	0.79**0.69 - 0.91)	0.71**(0.61 - 0.82)	0.89 (0.74 - 1.07)	1.15 (1.00 - 1.32)
Other, non-Hispanic	0.75**(0.61 - 0.92)	0.81*(0.65 - 1.00)	0.71**(0.55 - 0.91)	1.01 (0.82 - 1.23)
Unknown	1.20 (0.97 - 1.49)	0.95 (0.76 - 1.18)	1.14 (0.85 - 1.55)	1.07 (0.87 - 1.33)
Lives in urban area	1.28*(1.04 - 1.58)	1.10 (0.88 - 1.37)	1.35*(1.05 - 1.74)	1.19 (0.96 - 1.47)
Needs help w. self-care (ref. none)				
A lot	1.39**(1.18 - 1.63)	1.42**(1.20 - 1.69)	1.42**(1.15 - 1.74)	1.08 (0.92 - 1.27)
Some	1.28**(1.11 - 1.47)	1.24**(1.07 - 1.45)	1.20*(1.01 - 1.44)	1.19*(1.03 - 1.37)
Needs help w. other daily activities (ref. none)				
A lot	1.13 (0.87 - 1.46)	1.04 (0.79 - 1.38)	1.17 (0.85 - 1.61)	0.74*(0.57 - 0.96)
Some	0.97 (0.75 - 1.24)	0.97 (0.74 - 1.27)	1.13 (0.83 - 1.53)	0.81 (0.63 - 1.04)
Residence type (ref. home/senior living)				
Congregate setting	1.19*(1.04 - 1.36)	1.12 (0.97 - 1.29)	0.60**(0.50 - 0.72)	1.42**(1.23 - 1.63)
Other	0.80 (0.54 - 1.18)	0.95 (0.63 - 1.42)	0.54**(0.34 - 0.86)	0.89 (0.60 - 1.31)
Lives alone	1.16**(1.04 - 1.29)	1.04 (0.92 - 1.16)	0.85*(0.73 - 0.98)	1.07 (0.96 - 1.19)

Notes: *p<0.05 **p<0.01

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Table 3. Multivariate Logistic Regression Results: Community Living Outcomes

	Model A: Active in community	Model B: Interact w. family/friends	Model C: Satisfied w. time spent	Model D: In control of life
Sample included:	6,702	6,450	6,746	6,681
	Odds ratio (95% confidence interval)			
Unmet Need for:				
Help w. self-care/other daily activities	0.56** (0.48 - 0.65)	0.64** (0.53 - 0.78)	0.57** (0.49 - 0.65)	0.68** (0.59 - 0.78)
Services meeting needs & goals	0.69** (0.61 - 0.79)	0.63** (0.53 - 0.75)	0.46** (0.41 - 0.52)	0.42** (0.37 - 0.48)
Assistive technology	0.75** (0.67 - 0.83)	0.90 (0.76 - 1.06)	0.82** (0.73 - 0.91)	0.85* (0.76 - 0.96)
Home modifications	0.71** (0.63 - 0.80)	0.88 (0.73 - 1.04)	0.85** (0.75 - 0.95)	0.90 (0.79 - 1.02)
Transportation	0.47** (0.41 - 0.53)	0.51** (0.43 - 0.60)	0.58** (0.51 - 0.65)	0.63** (0.55 - 0.71)
Female	0.81** (0.73 - 0.91)	1.06 (0.90 - 1.25)	0.92 (0.82 - 1.03)	0.91 (0.80 - 1.02)
Age (ref. 65-74)				
18-54	0.93 (0.79 - 1.10)	1.18 (0.94 - 1.48)	0.85 (0.73 - 1.00)	0.95 (0.81 - 1.13)
55-64	0.92 (0.79 - 1.08)	1.07 (0.86 - 1.33)	0.86* (0.73 - 1.00)	1.05 (0.89 - 1.23)
75-84	1.11 (0.94 - 1.32)	1.43** (1.10 - 1.84)	1.18 (0.99 - 1.41)	1.19 (0.99 - 1.43)
85+	1.04 (0.86 - 1.27)	1.61** (1.20 - 2.15)	1.24* (1.02 - 1.52)	1.20 (0.98 - 1.49)
Race/ethnicity (ref. White, non-Hispanic)				
Black, non-Hispanic	0.96 (0.83 - 1.11)	1.82** (1.45 - 2.28)	1.23** (1.07 - 1.42)	1.57** (1.34 - 1.83)
Hispanic or Latino	0.69** (0.58 - 0.82)	1.87** (1.43 - 2.45)	1.50** (1.27 - 1.77)	1.22* (1.03 - 1.44)
Other, non-Hispanic	1.20 (0.93 - 1.55)	1.27 (0.87 - 1.84)	1.37* (1.05 - 1.78)	1.14 (0.87 - 1.49)
Unknown	0.86 (0.67 - 1.10)	1.49* (1.02 - 2.18)	0.98 (0.77 - 1.25)	0.96 (0.75 - 1.24)
Lives in urban area	0.93 (0.73 - 1.17)	1.08 (0.78 - 1.50)	0.82 (0.64 - 1.04)	0.86 (0.67 - 1.11)
Needs help w. self-care (ref. none)				
A lot	0.71** (0.60 - 0.85)	1.33* (1.03 - 1.71)	1.03 (0.86 - 1.23)	0.94 (0.78 - 1.14)
Some	0.88 (0.76 - 1.03)	1.09 (0.88 - 1.36)	1.01 (0.87 - 1.18)	0.91 (0.77 - 1.08)
Needs help w. other daily activities (ref. none)				
A lot	1.12 (0.85 - 1.48)	0.80 (0.52 - 1.24)	1.04 (0.78 - 1.38)	0.94 (0.70 - 1.28)
Some	1.21 (0.93 - 1.57)	0.86 (0.57 - 1.31)	1.08 (0.82 - 1.41)	1.10 (0.82 - 1.48)
Health Status (ref. Excellent/very good/good)				
Fair	0.66** (0.59 - 0.74)	0.85 (0.71 - 1.03)	0.67** (0.59 - 0.76)	0.59** (0.52 - 0.67)
Poor	0.36** (0.31 - 0.43)	0.72** (0.58 - 0.89)	0.41** (0.36 - 0.48)	0.41** (0.35 - 0.48)
Residence type (ref. home/ senior living)				
Congregate setting	1.17* (1.00 - 1.37)	0.55** (0.44 - 0.69)	1.05 (0.89 - 1.24)	0.72** (0.61 - 0.85)
Other	1.10 (0.71 - 1.70)	0.45** (0.26 - 0.77)	0.97 (0.62 - 1.51)	0.63* (0.41 - 0.98)
Lives alone	1.00 (0.89 - 1.14)	0.97 (0.80 - 1.16)	0.97 (0.86 - 1.10)	1.69** (1.48 - 1.93)

Notes: *p<0.05 **p<0.01

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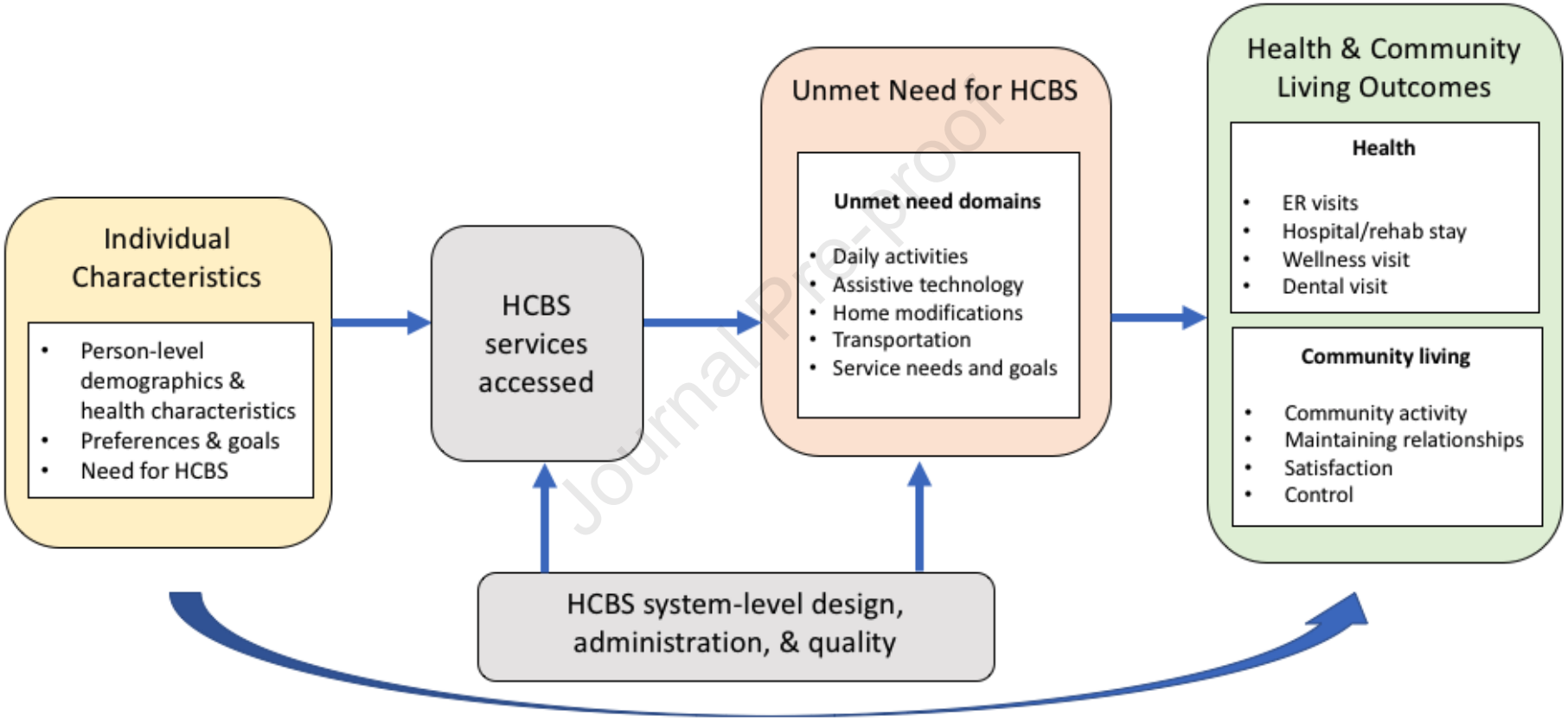
Color version

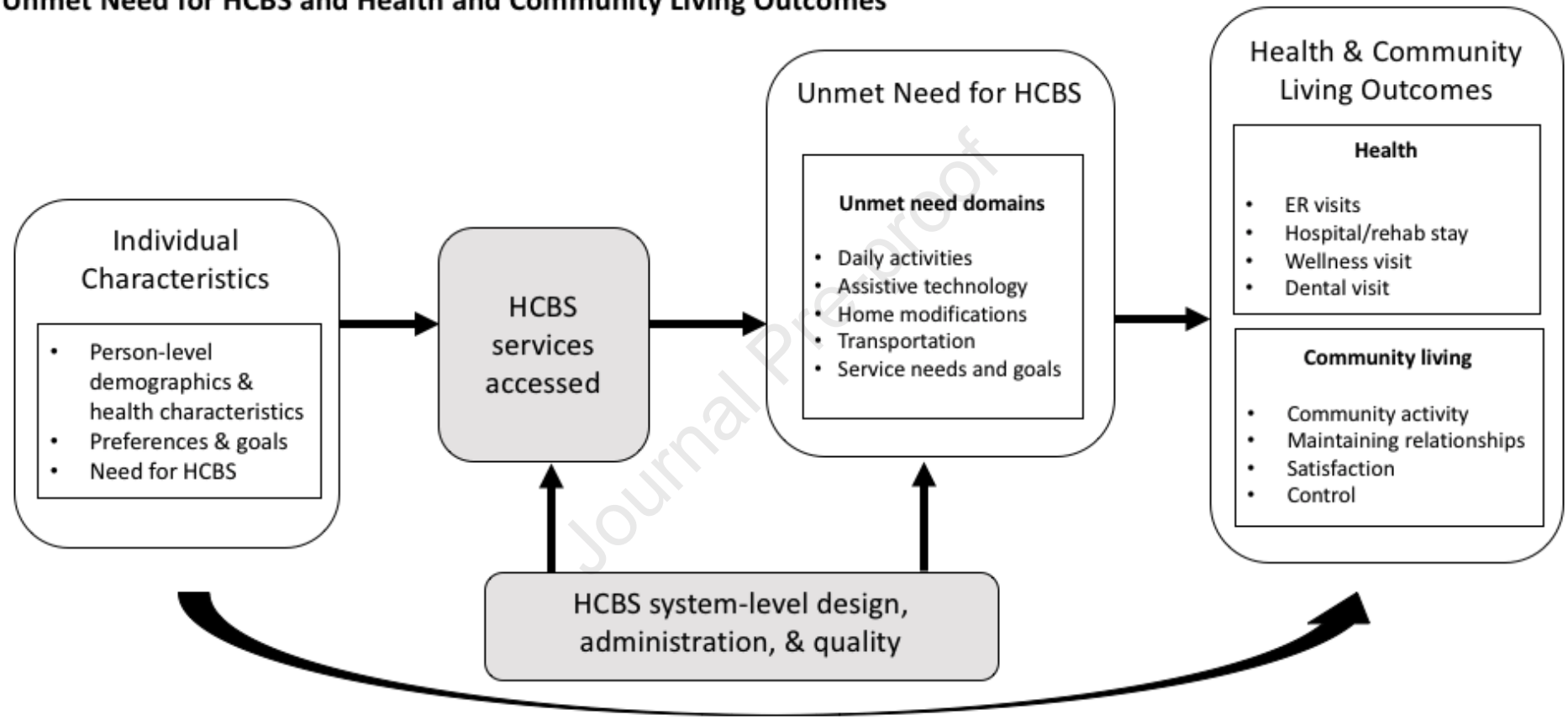
Figure 1. Conceptual Framework for the Relationship between Unmet Need for HCBS and Health and Community Living Outcomes



Journal Pre-proof

Black and white version

Figure 1. Conceptual Framework for the Relationship between Unmet Need for HCBS and Health and Community Living Outcomes



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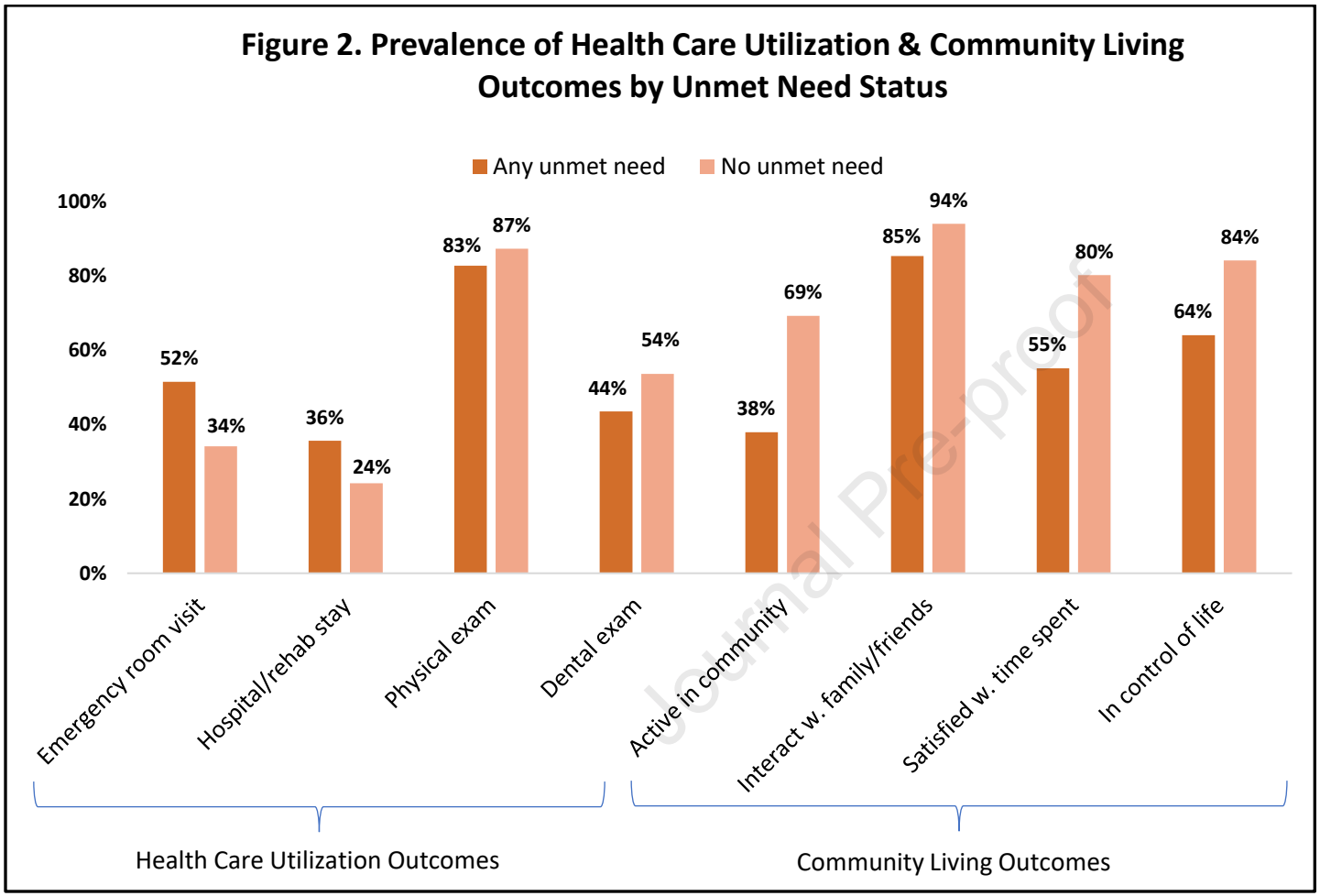

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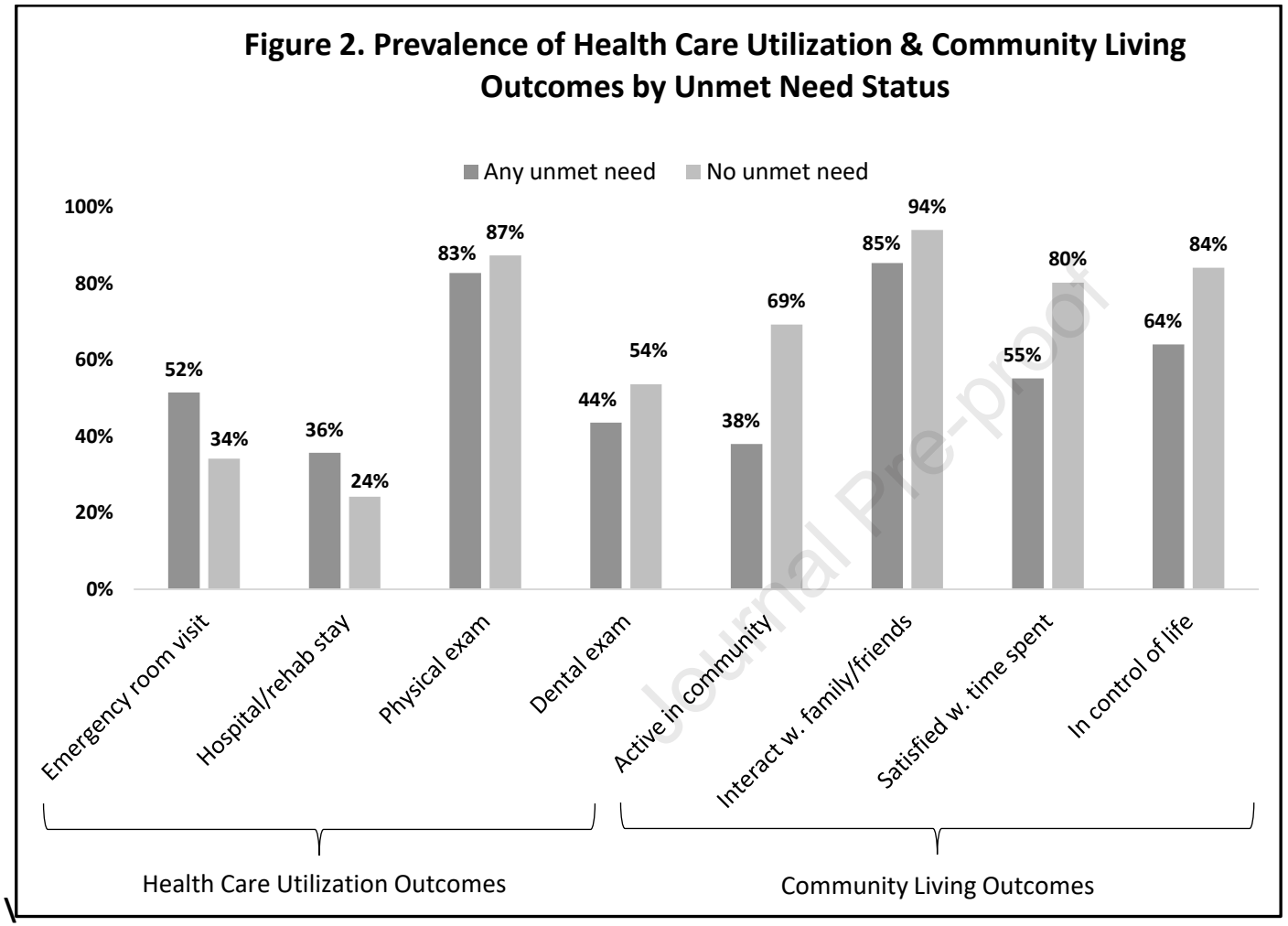

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