Screening and Follow-Up Monitoring for Substance Use in Primary Care: An Exploration of Rural–Urban Variations

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BACKGROUND: Rates of substance use in rural areas are close to those of urban areas. While recent efforts have emphasized integrated care as a promising model for addressing workforce shortages in providing behavioral health services to those living in medically underserved regions, little is known on how substance use problems are addressed in rural primary care settings.

OBJECTIVE: To examine rural–urban variations in screening and monitoring primary care–based patients for substance use problems in a state-wide mental health integration program.

DESIGN: This was an observational study using patient registry.

SUBJECTS: The study included adult enrollees ($n=15,843$) with a mental disorder from 133 participating community health clinics.

MAIN OUTCOMES: We measured whether a standardized substance use instrument was used to screen patients at treatment entry and to monitor symptoms at follow-up visits.

KEY RESULTS: While on average 73.6 % of patients were screened for substance use, follow-up on substance use problems after initial screening was low (41.4 %); clinics in small/isolated rural settings appeared to be the lowest (13.6 %). Patients who were treated for a mental disorder or substance abuse in the past and who showed greater psychiatric complexities were more likely to receive a screening, whereas patients of small, isolated rural clinics and those traveling longer distances to the care facility were least likely to receive follow-up monitoring for their substance use problems.

CONCLUSIONS: Despite the prevalent substance misuse among patients with mental disorders, opportunities to screen this high-risk population for substance use and provide a timely follow-up for those identified as at risk remained overlooked in both rural and urban areas. Rural residents continue to bear a disproportionate burden of substance use problems, with rural–urban disparities found to be most salient in providing the continuum of services for patients with substance use problems in primary care.

KEY WORDS: substance screening and monitoring; rural–urban; primary health care.

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INTRODUCTION

Recent national statistics have shown that rates of substance use in rural areas are close to those in urban areas.¹ Of particular concern is the high rate of binge drinking and misuse of prescription drugs among young rural residents.^{2,3} Yet, availability of substance abuse treatment in rural areas is scarce, and almost half of treatment admissions are referred by the criminal justice system.⁴ Individuals with substance use disorders often suffer from multiple comorbid psychiatric conditions, physical illness and social problems; however, only a small proportion seek or receive adequate treatment.^{5–8} Failure to identify and provide timely monitoring and intervention to individuals at risk for substance use disorders results in missed opportunities for those who may benefit from treatment.

Rural residents experience greater disparities in access to health care than urban dwellers, in particular for preventive health services and specialty psychiatric treatment.^{9–12} Prior research on federally qualified health centers further showed that depression disease management yielded greater clinical benefits in urban than in rural patients.¹³ Overall, under-diagnosed and under-treated substance use and mental disorders remain salient among disadvantaged, underserved populations who are racial/ethnic minorities, low-income, lack health insurance, and/or reside in rural areas.^{14–16} Addressing these unmet-service needs, narrowing rural–urban health disparities, and improving coordination of care between different treatment sectors are pressing policy challenges. Integrating substance abuse and mental health services into primary care is a promising approach to address service needs that emphasizes problem identification, monitoring, brief interventions, and specialty referral when needed. The need for such integration can be witnessed through the growing demands for substance abuse and mental health services at safety-net community health clinics.^{17,18}

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While numerous studies have focused on access to mental health services in primary care, little information is available on how substance use problems are managed in rural community health clinics. Using data from a state-wide integrated care program, this study examines rural–urban variations in screening patients for substance use at treatment entry and monitoring substance use symptoms of those screened positive during the follow-up visits. We also explore whether patient demographics, clinical presentation, travel distance to community health clinics and provider’s experience are related to substance screening and symptom monitoring. Findings from this study may inform efforts to improve the quality of care for patients with substance use problems in primary care settings.

METHODS

Data Source

Data was drawn from the Washington State Mental Health Integration Program (MHIP),¹⁹ a state-wide integrated care program serving safety-net populations at community health clinics across Washington State. The program is based on a collaborative team approach that includes the patient’s primary care provider, an on-site care manager and a psychiatric consultant assigned to each clinic-based team. The current study includes adult patients who were recipients of state assistance due to unemployment and temporary disability, and who were determined by their primary care providers as needing treatment for a mental disorder. The majority of participants were enrolled for depression care. A total of 15,843 patients from 133 participating community health clinics enrolled in the program between 2008 and 2011 and completed an initial assessment.

Measures

Substance Screening and Monitoring. All patients enrolled in the program were tracked in MHIP’s web-based patient registry, which incorporated standardized instruments for clinical outcomes tracking. The Global Appraisal of Individual Needs-Short Screener (GAIN-SS)²⁰ was used for substance screening, monitoring, and as a measure of symptom severity change. The GAIN-SS is a five-item standardized screener assessing symptoms related to weekly alcohol and drug use, problems caused by use and use-induced withdrawal, with a scoring range from 0 to 5. A score of ≥ 2 demonstrates good sensitivity and specificity, and is highly indicative of a positive screen for substance use problems.^{20,21}

Rural Urban Classification. The degree of rurality of the clinic’s geographical location was classified into small/isolated rural, large rural, and urban using rural-urban commuting area codes (RUCA).^{22,23} The RUCA classification

allows characterization of rural urban areas regarding the city/town size and its functional relationships to the neighboring larger cities and towns.²³ Clinics’ zip codes were mapped onto the RUCA codes and then aggregated into three commonly used categories to approximate its location in relationship with urban areas (RUCA codes: 1.0, 1.1, 2.0, 2.1, 3.0, 4.1, 5.1, 7.1, 8.1, 10.1), large rural towns (RUCA codes: 4.0, 4.2, 5.0, 5.2, 6.0, 6.1) or small/isolated small rural towns (RUCA codes: 7.0, 7.2, 7.3, 7.4, 8.0, 8.2, 8.3, 8.4, 9.0, 9.1, 9.2, 10.0, 10.2, 10.3, 10.4, 10.5, 10.6). Of 133 participating clinics, 32 clinics are located in small rural, 16 in large rural and 91 in urban areas. Most rural clinics serve larger catchment areas but much smaller populations than urban clinics. In MHIP, the majority of the patients received care from clinics in urban areas ($n=14,344$), compared to large rural ($n=863$) and small rural areas ($n=636$).

Other Variables. The MHIP registry provided patient demographics and clinical data including age, gender, treatment history for mental and substance use problems, suicidal thoughts, Patient Health Questionnaire (PHQ-9) for depression symptom severity, Generalized Anxiety Disorder (GAD-7) for anxiety symptom severity, and psychiatric comorbid conditions of bipolar disorder, post-traumatic stress disorder, psychotic disorder, cognitive disorder and chronic pain. Geocoding was used to calculate travel distance between patient and clinic zip codes,²⁴ which was categorized into < 10 , 10–19, and 20+ miles. Patients residing within the clinic zip code were assigned a value of 0.5 mile for analytical purposes. Care managers’ experience with the MHIP was categorized as 2+ or < 2 years of experience.

Statistical Analysis

Frequency distributions of substance screening and follow-up monitoring were stratified by rural-urban areas. We used a multilevel Poisson model to assess substance screening and follow-up monitoring with an array of patient-level demographics, clinical presentations, travel distance to care, care manager’s experience and clinics’ rural urban classifications. As logistic models tend to overestimate risk association when prevalence of the outcome is high, the Poisson model was chosen.²⁵ Multilevel modeling accounts for the hierarchical clustering of patients within clinics, with the clinic treated as a random effect with its own intercept. Analysis started with an unconditional model (null model, Model 1) estimating the partition of variability between patient and clinic levels before accounting for any correlate effects; Model 2 added baseline patient-level demographics and clinical presentations; and Model 3 added travel distance, care manager’s experience and clinics’ rural urban classifications to Model 2 simultaneously. Since evaluation on follow-up monitoring applied to patients who received a substance screening, we conducted a propensity score analysis using a logit model to obtain a

predicted probability representing the likelihood of receiving a substance screening for each patient. Correlates with a significance level $p < 0.10$ were included for propensity score estimation. We repeated the same multilevel modeling with propensity score adjustments²⁶ to examine correlates associated with follow-up monitoring. Follow-up monitoring was examined among patients who received a screening and stayed in the program more than 3 months with at least one follow-up treatment contact with their care manager. Analyses were completed in Stata 13. The study was approved by the University of Washington Institutional Review Board.

RESULTS

The majority of participants were males (55.9 %), 30–49 years of age (53.2 %), reported thoughts of death and suicide (55.4 %) and endorsed considerable depression symptoms (83.6 % of PHQ-9 ≥ 10) and anxiety (78 % of GAD-7 ≥ 10). Participants in rural and urban clinics differed in demographic and clinical characteristics (Table 1). In particular, more rural residents reported prior treatment for mental and substance use disorders and exhibited greater psychiatric complexities than urban residents.

Patients of small/isolated rural clinics traveled as much as twice the distance of patients of urban clinics to receive care (20.2 vs. 9.7 miles, $p < 0.001$). Compared to care managers in large rural clinics, those care managers in small/isolated rural and urban clinics had a longer period of experience with integrated care.

Approximately three-quarters of participants (73.6 %) received a substance screening (Table 2). Clinics in large rural areas (87.8 %) screened more patients than clinics in small/isolated rural (79.4 %) and urban settings (72.5 %, $p < 0.001$). Screening scores were similar across rural and urban areas, although patients treated in urban clinics tended to report slightly higher numbers of substance use symptoms. Of those screened, 14.9 % scored 1 on the screener (13.9 % in small/isolated rural, 13.9 % in large rural and 15 % in urban), and 25.8 % scored 2 or higher (23.4 % in small/isolated rural, 20.6 % in large rural and 26.3 % in urban). Figure 1 shows the percentage of follow-up monitoring by initial screening scores and rural urban classifications. Of patients screened positive, 41.4 % received a follow-up monitoring. Overall, rural and urban clinics differed in monitoring patient's substance use symptoms (all rural clinics combined: 28.8 % vs. urban clinics: 42.6 %, $p = 0.001$). Specifically, 13.6 % from small/isolated rural areas received a follow-up monitoring compared

Table 1. Patient Demographic and Clinical Characteristics by Rural-Urban Classifications of Clinics

	Total (n=15843)	Small/Isolated Rural (n=636)	Large Rural (n=863)	Urban (n=14344)
Age ^a				
18–29, n (%)	3340 (21.1)	146 (23.2)	209 (24.3)	2985 (20.8)*
30–49, n (%)	8405 (53.2)	323 (51.3)	456 (53.0)	7626 (53.3)
50+, n (%)	4059 (25.7)	161 (25.5)	195 (22.7)	3703 (25.9)
Gender ^a				
Male, n (%)	8759 (55.9)	345 (54.9)	424 (49.5)	7990 (56.4)*
Female, n (%)	6907 (44.1)	284 (45.1)	433 (50.5)	6190 (43.6)
Prior treatment for mental disorders, n (%)	5987 (37.8)	356 (56.0)	527 (61.1)	5104 (35.6)*
Prior treatment for substance abuse, n (%)	4025 (25.4)	178 (28.0)	304 (35.2)	3543 (24.7)*
Suicidal thoughts ^a , n (%)	8132 (55.4)	344 (55.8)	537 (63.6)	7251 (54.8)*
PHQ-9 ^a				
<10, n (%)	2364 (16.4)	111 (18.5)	113 (13.7)	2140 (16.5)*
10–19, n (%)	6580 (45.7)	286 (47.7)	356 (43.1)	5938 (45.8)
20–27, n (%)	5445 (37.9)	203 (33.8)	357 (43.2)	4885 (37.7)
Mean (SD)	16.5 (6.6)	15.8 (6.6)	17.3 (6.3)	16.5 (6.6)*
GAD-7 ^a				
<10, n (%)	2739 (22.0)	135 (23.1)	166 (20.7)	2438 (22.1)*
10–14, n (%)	2994 (24.1)	145 (24.9)	162 (20.2)	2687 (24.3)
15–21, n (%)	6700 (53.9)	303 (52.0)	474 (59.1)	5923 (53.6)
Mean (SD)	14.1 (5.6)	13.6 (5.7)	14.7 (5.4)	14.1 (5.6)*
No. of Comorbid conditions ^b				
0, n (%)	9238 (58.9)	351 (55.2)	323 (37.4)	8654 (60.3)*
1, n (%)	4645 (29.3)	235 (36.9)	378 (43.8)	4032 (28.1)
2+, n (%)	1870 (11.8)	50 (7.9)	162 (18.8)	1658 (11.6)
Travel distance ^a				
<10 miles, n (%)	10712 (68.9)	324 (52.3)	440 (51.7)	9948 (70.6)
10–19 miles, n (%)	2551 (16.4)	23 (3.7)	104 (12.2)	2424 (17.2)
20+ miles, n (%)	2293 (14.7)	273 (44.0)	307 (36.1)	1713 (12.2)*
Mean (SD)	10.4 (19.5)	20.2 (30.4)	14.9 (20.8)	9.7 (18.6)*
Care manager's experience ^c				
<24 months, n (%)	103 (43.1)	12 (40.0)	16 (64.0)	75 (40.8)
24 months+, n (%)	136 (56.9)	18 (60.0)	9 (36.0)	109 (59.2)*
Mean (SD)	25.6 (16.4)	22.9 (8.6)	19.0 (11.3)	27.0 (16.4)*

* $p < 0.05$ for comparisons across rural-urban areas

PHQ-9 Patient Health Questionnaire scale, GAD-7 Generalized Anxiety Disorder scale, S standard deviation

^aInformation was missing for age (n=39), gender (n=177), suicidal thoughts (n=1160), PHQ-9 (n=1454), GAD-7 (n=3410), travel distance (n=287)

^bComorbid conditions include bipolar disorder, post-traumatic stress disorder, psychotic disorder, cognitive disorder and chronic pains

^cBased on 239 care managers (30 in small/isolated rural; 25 in large rural, 184 in urban)

Table 2. Substance Screening Rate and Frequency Distribution of Screening Scores

	Total	Small/ Isolated Rural	Large Rural	Urban
Substance screening rate (%)	73.6	79.4	87.8	72.5*
Screening Score ^a (%)				
0	59.3	62.8	65.5	58.7*
1	14.9	13.9	13.9	15.0
2	6.1	6.9	4.9	6.2
3	4.1	3.5	2.6	4.3
4	5.0	4.0	3.6	5.1
5	10.6	8.9	9.5	10.7
Mean (SD)	1.1 (1.7)	1.0 (1.6)	0.9 (1.6)	1.1 (1.7)*

* $p < 0.05$ for comparisons across rural urban areas, SD standard deviation

^aScreening score of substance use screener GAIN-SS. Possible scores range from 0 to 5; a score of 2+ was screening positive

with 40.0 % from large rural and 42.6 % from urban clinics ($p < 0.001$). Among patients who scored zero on the initial screening, more patients in large rural (36.6 %) and urban (36 %) clinics received a reassessment than did those in small/isolated rural clinics (7.5 %, $p < 0.001$).

Differences across clinics are explained in part by patient, care manager and rural–urban classification variables (Table 3). There were significant variations between clinics in screening substance use [clinic-level variance=0.111, Standard error (SE)=0.019, Model 1] and monitoring substance use problems at follow-up visits [clinic-level variance: 1.130, SE=0.215, Model 1]. With regard to substance screening, individual-level variables remained significant after adding travel distance, care manager’s experience and rural-urban classifications to the model (Model 3). The results demonstrated that prior treatment for mental or substance use disorder, PHQ-9 score, comorbid conditions and care manager’s experience were significantly associated with an increased

likelihood of substance screening. Adding patient demographics and clinical presentations into the model reduced variance from 0.111 to 0.038, a 65.8 % reduction from the null model.

With regard to follow-up monitoring, patient demographics and clinical presentations explained little (0.9 %) of the clinic-level variance (Model 2). Controlling for patient-level variables, travel distance, care manager’s experience and rural urban classifications (Model 3) explained another 8.6 % of the variance. Model 3, where all variables were added simultaneously with propensity score adjustments, showed that initial screening score and care manager’s experience were positively associated with substance monitoring, but travel distance was negatively associated with substance monitoring. Notably, patients of urban clinics were 2.3 times more likely to receive follow-up monitoring for their substance use problem than patients of small/isolated rural clinics ($p = 0.02$). In a supplement analysis without propensity score adjustments, the association of rural urban areas remained strong and significant above and beyond all other variables (relative risk: 2.3, $p = 0.02$). Interactions of rural urban areas with each correlate were explored and no significant interaction was found. Across models, clinic-level variances were all significant, indicating strong clustering effects among patients of the same clinic.

DISCUSSION

Across both rural and urban settings, approximately three-quarters of primary care-based patients were screened for substance use while receiving care for their mental health problems. Although the majority of community health clinics complied with the state’s guideline in screening patients for

Figure 1. Percentage of follow-up monitoring by initial screening scores and rural-urban classifications.

Table 3. Correlates Associated with Substance Screening and Monitoring

	Substance screening						Substance monitoring ^b					
	Model 1		Model 2		Model 3		Model 1		Model 2		Model 3	
	RR	95 % CI	RR	95 % CI	RR	95 % CI	RR	95 % CI	RR	95 % CI	RR	95 % CI
Age												
18–29			1		1				1		1	
30–49			0.99	0.95, 1.04	0.99	0.95, 1.04			1.00	0.90, 1.11	1.00	0.90, 1.11
50+			0.97	0.92, 1.03	0.98	0.92, 1.03			1.04	0.93, 1.17	1.05	0.93, 1.18
Male			1.02	0.98, 1.06	1.02	0.98, 1.06			1.00	0.92, 1.08	0.99	0.92, 1.08
Prior treatment for mental disorder			1.06	1.02, 1.11*	1.07	1.02, 1.11*			0.98	0.89, 1.09	1.00	0.90, 1.11
Prior treatment for substance abuse			1.06	1.02, 1.10*	1.06	1.02, 1.11*			1.07	0.96, 1.19	1.09	0.97, 1.21
Suicidal thoughts			1.01	0.97, 1.05	1.01	0.97, 1.05			0.98	0.90, 1.07	0.98	0.90, 1.07
PHQ-9 score												
0–9			1		1				1		1	
10–19			1.07	1.00, 1.14*	1.07	1.00, 1.14*			0.97	0.86, 1.10	0.98	0.86, 1.11
20–27			1.09	1.02, 1.18*	1.09	1.02, 1.17*			1.00	0.86, 1.16	1.01	0.87, 1.18
GAD-7 score												
0–9			1		1				1		1	
10–14			0.96	0.90, 1.02	0.96	0.90, 1.02			1.02	0.90, 1.15	1.01	0.90, 1.14
15–21			0.94	0.89, 1.00*	0.94	0.89, 1.00			0.99	0.88, 1.11	0.99	0.87, 1.11
No. comorbid disorder ^a												
0			1		1				1		1	
1			1.07	1.03, 1.12*	1.08	1.03, 1.12*			1.04	0.94, 1.15	1.06	0.96, 1.18
2+			1.10	1.03, 1.16*	1.10	1.04, 1.17*			0.94	0.81, 1.10	0.98	0.84, 1.15
Substance screening score												
0									1		1	
1									1.14	1.02, 1.26*	1.13	1.02, 1.26*
2+									1.20	1.09, 1.32*	1.20	1.09, 1.32*
Travel distance (miles)												
<10					1						1	
10–19					1.01	0.96, 1.06					1.01	0.91, 1.12
20+					1.00	0.94, 1.06					0.88	0.77, 0.99*
CM's experience 24 months + (vs. less than 24 months)					1.09	1.02, 1.16*					1.22	1.03, 1.45*
Rural-urban classification					1						1	
Small/Isolated rural												
Large rural					1.09	0.89, 1.33					1.07	0.38, 3.01
Urban					1.07	0.92, 1.24					2.29	1.13, 4.63*
Random effects												
Variance (SE)	0.111 (0.019)		0.038 (0.008)		0.037 (0.008)		1.130 (0.215)		1.120 (0.214)		1.033 (0.199)	

RR relative risk, 95 % CI 95 % confidence interval, SE standard error, PHQ-9 Patient Health Questionnaire scale, GAD-7 Generalized Anxiety Disorder scale, CM care manager

^aNumber of comorbid conditions includes bipolar disorder, post stress traumatic stress disorder, psychotic disorder, cognitive disorder and chronic pains

^bMixed effects models for substance monitoring were adjusted for propensity scores. Propensity score of substance screening receipt was calculated using a logit model with correlates of treatment history of mental health, treatment history of substance abuse, PHQ-9 score, comorbid conditions and care manager's experience. Missing values were included as separate categories

* $p < 0.05$

substance use, few clinics provided timely symptom follow-ups for those screening positive. Patients in small/isolated rural clinics were least likely to be monitored for substance use during follow-up care. These findings underscore that while many rural communities lack access to specialty care, rural-urban differences tend to be exacerbated in small, remote rural areas that are likely affected most by the shortages of behavioral health professionals and facilities.

Despite guidelines from the US Preventive Services Task Force recommending alcohol screening to identify patients who may benefit from brief intervention²⁷ and the passage of reimbursement for screening and brief intervention by Medicare, most health care organizations have not implemented alcohol or drug use screening in routine care.²⁸ In this program, state guidelines suggest routine screening of all

new patients in the program, and screening rates are close to those reported from Veterans Administration primary care settings²⁹. More than a quarter of patients, however, were not screened. Additionally, one quarter of the patients scored ≥ 2 on the screener and 10 % of the patients endorsed all five substance use symptoms, indicating the rates of substance use problems in this population are substantial. The proportion of positive screenings appears to be uniform across rural and urban areas, suggesting that regardless of geographical location, comorbid mental and substance abuse conditions are common in this safety-net population seeking care from community health clinics. In order to provide timely intervention before substance use problems become debilitating, it is suggested that substance screening and monitoring be integrated as part of routine primary care.

Our analyses show that patients who had prior treatment for mental or substance use disorder and who exhibited greater psychopathology were more likely to receive a screening. These findings are in line with the notion that targeted efforts should be aimed at high-risk populations to improve the overall effectiveness of screening and case finding. While screening is the first step in identifying at-risk individuals, the effectiveness of screening is valuable only when ongoing symptom monitoring and intervention are available for those identified as at risk. This study thus further examined whether community health clinics provided follow-up monitoring for patients who screened positive for a substance use problem. We found that only two-fifths were actually followed up while receiving treatment for their mental disorder. The biggest disparities were found in patients of small, isolated rural clinics and those who traveled longer distances to receive care. Earlier research has highlighted that lack of recognizing substance use as a problem in small rural towns explains much of the low rate of treatment utilization in rural areas.³⁰ For patients treated for mental disorders, inadequate follow-up monitoring for co-occurring substance use problems likely results in missed opportunities to intervene and impact the effectiveness of mental and other health care provided.

Most preventive and disease management services are provided in primary care, and primary care providers rely on routine screening and monitoring to identify problems, promote wellness and initiate treatment. Due to the shortage of specialists, rural residents are more likely than their urban counterparts to rely on primary care providers for mental health and substance abuse services.^{16,31,32} This is particularly true for low-income, uninsured rural residents. Research has shown that limited resources, competing demands, and lack of time and training may impede primary care clinics and providers in managing patients with substance use problems.^{33–36} These barriers could be more prominent in community health clinics. The limited study data prohibited further examinations of these barriers; however, our finding of a positive association between care manager's experience and providing substance screening and monitoring highlights the importance of training and experience of health care providers in managing patients with substance use disorders.

The observed low rate of follow-up for substance use in both rural and urban clinics may reflect the limited capacity of the current integrated mental health program in managing patients with co-occurring mental and substance use disorders. Emerging evidence has suggested that brief interventions, especially repeated brief interventions, are effective in reducing patients' hazardous drinking^{37–43}, enhancing problematic drug use reduction⁴⁴ and increasing treatment entry and attendance.⁴⁵ Brief intervention, on the other hand, has also shown secondary benefits in improving patients' mental health functioning.⁴⁶ A recent study further demonstrated that alcohol care management could be effectively delivered in primary care settings, leading to better treatment access and health improvement.⁴⁷ To implement such changes in primary care,

process improvement models such as Network for the Improvement of Addiction Treatment⁴⁸ may help accommodate unique resources and needs in these rural settings. Training on brief intervention skills and focusing clinic process improvements on co-occurring disorders are thus important next steps.

Additional strategies, such as telehealth or adding an addiction consulting specialist to the integrated care team, may be useful in bridging treatment access barriers and facilitating the integration of substance abuse treatment into primary care practices. Incorporating substance abuse diagnosis and treatment into medical training and increasing online and telehealth based educational resources will help prepare physicians with needed knowledge and skills to care for patients with substance use disorders.^{49,50} Adoption of information and communication technologies^{51–53} such as technology-assisted interventions and mobile devices may further enhance the continuum of care and facilitate access to consultation from addiction specialists who are often not available in rural settings.

Using data from a state-wide integrated care program allows us to systematically evaluate substance screening and monitoring patterns, especially in largely understudied rural, geographic areas. The screening rate is slightly higher than in a previous report⁵⁴ where substance screening was evaluated using earlier cohorts of intake assessment data from MHIP. In this study, we reviewed intake and follow-up data to identify whether a patient was ever screened for substance use and whether follow-up monitoring was made for those identified as at-risk at the initial screening. While our analysis revealed discernible differences in patient, care manager and rural urban characteristics with regard to substance screening and monitoring, our variance component analysis from multilevel modeling suggests there may be other important contextual factors to consider for future research (e.g., previously mentioned primary care system and provider barriers). Additionally, lack of transportation, service costs, and perceived stigma associated with substance abuse treatments may prevent rural residents from seeking and participating in treatment, which may result in refusal to complete screening and follow-up assessments.^{55,56}

Notwithstanding, our findings show that substance use problems are prevalent among primary care patients enrolled in this mental health integration program. While initial substance screening was associated with patient's treatment history and severity of psychopathology, follow-up monitoring was appreciably associated with clinics' rural-urban geographical locations. Timely follow-up on patient's substance use remained overlooked in both rural and urban areas, with the biggest disparities found to be in small, remote rural areas. Clinics in large rural towns tend to provide timely follow-up more often than clinics in small/isolated rural towns. One of the explanations could be that clinics in large rural towns have better access to adjacent metropolitan areas for substance treatment services, while clinics in small/isolated rural towns largely suffer from lack of access and resources. The low rate of symptom monitoring is a key challenge in reducing health

disparities between rural and urban areas in caring for patients with substance use problems. Study findings further demonstrate that using a more refined geographic typology may be needed in distinguishing residents of the most remote/isolated areas from residents of other rural areas with regard to access to care. Our findings reinforce prior research that health care disparities correspond to the degree of rurality, with residents in more remote areas facing the greatest challenges in access to care as compared to rural areas that are closer to urban centers. Future research could focus on developing collaborative care models that incorporate brief interventions, telehealth and mobile health technologies to improve engagement and service delivery for patients with substance use disorders in remote rural settings.

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