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Oral Health Literacy and Outcomes in Rural Wisconsin Adults

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Abstract

Purpose: Low oral health literacy (OHL) is an emerging risk factor for several oral health outcomes, but there are very few studies of OHL overall and no studies of OHL in the rural United States. The purpose of this study was to examine the association between OHL and sociodemographic factors, as well as several oral health outcomes, in rural adults served by an integrated medical and dental care system in Wisconsin.

Methods: A cross-sectional survey was administered to a stratified random sample of patients from 2 rural communities. Survey data were linked to local electronic health records. Multivariable regression was used to identify sociodemographic determinants of low OHL, as well as associations between OHL and: oral hygiene, oral health quality of life, dentist visits, and emergency/urgent care visits for nontraumatic dental conditions.

Findings: Among the 164 respondents, OHL scores were generally high but were significantly lower among nonwhite participants ($P < .001$), as well as those without a college degree ($P < .001$) and those with an annual household income under $40,000 ($P = .029$). Lower OHL scores were significantly associated with lower quality of life scores ($P = .005$), fewer visits to the dentist ($P = .007$), and more emergency room visits for nontraumatic dental conditions ($P = .021$).

Conclusion: In rural Wisconsin, low OHL tracked closely with markers of socioeconomic status and appeared most influential in the context of appropriate dental care utilization. Future research should consider longitudinal explorations of how OHL influences preventive and emergency dental visits over time.

Key words adult health, health care utilization, health literacy, oral health, rural health.

Good oral health means being free of mouth pain, tooth decay, gum disease, and oropharyngeal cancer. This can be achieved by most, but despite general improvements in the oral health status of Americans,[1] not everyone has benefited equally. The highest rates of severe oral disease persist in poor, racial/ethnic minority, and unemployed populations.[2,3] This holds true in Wisconsin as well, where 40% of adults report having at least 1 permanent tooth removed due to decay or gum disease, and tooth removal rates are much higher among black, Hispanic, Native American, low income, and rural populations.[4]

Poor oral health is a function of numerous factors, most notably deficient oral self-care and limited access to (and utilization of) dental services secondary to socioeconomic, environmental, and interpersonal barriers.[5-7] More recently, low oral health literacy (OHL) has emerged as a possible underlying mechanism that explains why many groups have particularly poor oral health.[8,9] The Institute of Medicine defines health literacy as an individual's capacity to understand basic health information and services needed to make appropriate care decisions.[10] Extended to oral health, literacy is essentially the capacity to understand oral health information and use it to inform beneficial oral health prevention and treatment decisions.[8,9]

OHL is believed to largely reflect underlying personal and sociocultural values related to oral health education,

dental care, and related oral health outcomes.[8,10] Such values can vary considerably across regions and subpopulations, meaning knowledge of, as well as behaviors related to, oral health maintenance differ. For example, the Philippines has exceptionally high rates of dental caries in children[11] and tooth decay in adulthood.[12] And though no OHL data are available for this population, their generally poor oral health is believed to be at least partially related to limited knowledge of oral hygiene and minimal dental care over the lifespan.[13,14] The degree to which OHL differs between rural and urban populations is unknown, but given the lower rates of utilization of preventive oral health care services in the rural United States,[15] the burden of low OHL may also be greater. This would be consistent with general health literacy, which is lower in the rural United States and is likely driven by the higher proportion of older, less educated residents in rural regions.[16]

Low OHL is associated with lower levels of dental knowledge and dental information-seeking skills.[8,9] Some prior studies have also shown that low OHL in adults is associated with clinical facets of poor oral health, including fewer teeth and more bleeding sites,[17] as well as a lower frequency of tooth brushing.[18] Associations between OHL and dental care utilization are mixed, however, as 1 study found that low OHL was not associated with recent dental visits,[19] while another found patients with low OHL were more likely to miss their next scheduled dental appointment.[20] A meta-analysis found no significant association between OHL and oral health outcomes, including dental visit frequency.[21] A recent study on this topic (not included in the prior meta-analysis), however, found low OHL was associated with more self-reported visits to the emergency room for dental care.[22] These and other findings have intimated that OHL should be considered a distinct determinant of good oral health, but that greater research resources are needed to understand it.[9]

Despite the increased recognition of OHL's importance and the fact that low health literacy is considered a modifiable (or at least mitigatable) risk factor,[23,24] empirical research on OHL remains scant. Most prior studies have focused on OHL assessment, and those that have examined OHL as a distinct risk factor have been limited to select samples of patients who routinely receive dental care at a single center in a metropolitan area. There is no population-based surveillance of OHL, nor any known studies on this topic in rural areas of the United States, where education and dental insurance coverage tends to be lower.[25] The purpose of this study was to identify sociodemographic determinants of low OHL, as well as to examine the association between OHL and key oral health outcomes, in rural Wisconsin adults served by an integrated medical and dental care system.

Methods

Conceptual Model

Study methods were informed by an integrated conceptual model of health literacy advanced by Sorensen and colleagues,[26] which we transposed to the context of OHL. This conceptual model synthesizes the main health literacy dimensions developed in prior models (eg, access to, as well as understanding and application of, health information), including health literacy antecedents and consequences. Our first analysis focused on personal, proximal determinants of OHL, which include sociodemographic characteristics such as age, gender, and markers of socioeconomic status (in contrast to distal environmental determinants of health literacy outlined by Sorensen and colleagues, which include language, culture, or societal systems). Like the general concept of health literacy, low OHL is believed to limit participation in public and private dialogue about oral health and related knowledge. Such limitations negatively influence oral health behaviors and oral health care utilization decisions, which also reduce oral health quality of life. Thus our second analysis focused on the correlation between OHL and oral health outcomes, including oral self-care, quality of life, and aspects of oral health care utilization.

Design and Setting

A cross-sectional survey was administered, with linkage of participants' survey data and Marshfield Clinic Health System (MCHS) electronic medical/dental health records (EHR). The target population was working-age adult residents of the Marshfield Epidemiologic Study Area (MESA) in central Wisconsin. MESA Central is a regional population-based health research resource that tracks person-time from individuals who receive medical care from MCHS and reside in one of the ZIP codes that surround the MCHS primary service area in central Wisconsin.[27,28] This region is predominantly rural, covering several thousand square miles, and has about 80,000 total residents who receive over 90% of their inpatient and outpatient health care from MCHS facilities and/or providers.

Participants

Inclusion criteria were: (1) living in select MESA segments (described further in Sampling Frame section below), (2) age 18-64 years, (3) ≥1 encounter with an

MCHS medical or dental provider over the previous 3 years, and (4) conversational competence in English. Residents of medical, penal, or academic institutions were excluded. The upper age bound was used to focus on working-age adults, who are more likely to receive OHL interventions than those transitioning away from dental insurance and who may have very limited (mainly emergency) dental benefits in Medicare.[29] The encounter criterion was used to ensure that study-eligible individuals had some level of contact with MCHS in a reasonably close timeframe to their study enrollment date, and were thus more likely to have a current residential address and updated sociodemographic and clinical information in our EHR and administrative records. Study procedures were approved in advance by the MCHS Institutional Review Board and informed consent plus HIPAA authorization was obtained from all participants.

Sampling Frame

Because the MESA Central population predominantly includes residents of the city of Marshfield, the sampling frame included study-eligible individuals enumerated via a stratified random sampling approach to help ensure adequate representation of rural participants. Two sampling strata were selected and consisted of the ZIP codes with the highest and lowest Rural Urban Commuting Area (RUCA) scores[30] within the MESA Central region. The ZIP code with the lowest RUCA score has 4.0 points (ie, core micropolitan area around Marshfield—54,449), while the ZIP code with the highest RUCA score has 10.6 points (ie, most rural area around Colby—54,421). Given the exploratory nature of this study, a general sample size estimate was calculated[31] based on the mean difference in OHL score (as described below) between 2 compared exposure groups. Informed by OHL scores from previous observations,[18,32,33] a moderate Cohen's d effect size was expected of at least $d = 0.45$, which would roughly translate into a 1-point difference in OHL score between 2 compared groups (eg, male vs female). Under the assumptions of 80% power, an α level 0.05, and a 2-tailed *t*-test, the sample size estimate required at least 160 total participants.

Recruitment and Procedures

Recruitment was conducted in weekly waves between July 2017 and February 2018. In order to balance participant convenience, staff planning, and study costs, a given participant's study enrollment visit was coordinated with one of their upcoming medical or dental appointments at an MCHS center in either Marshfield or Colby. A weekly study eligibility file was generated and cross-referenced with confirmed upcoming scheduled appointments at the Marshfield medical or dental center, or at the Colby medical center. Each week, approximately 10 study-eligible individuals from each sampling strata (ie, Marshfield or Colby ZIP code) with a scheduled appointment at one of these MCHS centers (scheduled 1-4 weeks out) were randomly selected for invitation. Contact information for selected study-eligible individuals was extracted from MCHS administrative records. Potential participants were then contacted by telephone to receive a study description/invitation, screen for eligibility criteria, and set up an enrollment visit. Up to 4 telephone attempts were made to reach patients. For those interested in participating, a 30-minute study enrollment visit was scheduled with a trained research coordinator at an agreed upon time and location (usually just before or after their scheduled MCHS medical or dental appointment). At the enrollment visit, informed consent was obtained and the study survey was administered. Participants received a $20 gift card to a local retailer upon completion of their enrollment visit.

Oral Health Literacy

Literacy was assessed using the 17-item Oral Health Literacy in Adults Questionnaire (OHL-AQ). This instrument, which was originally developed in Iran[18,32] and recently validated in the United States,[34] includes self-reported and interviewer-administered sections covering functional aspects of OHL such as reading comprehension, numeracy, listening, and decision-making. Each correctly answered item on the OHL-AQ is awarded 1 point, and all points are then summed to create an index score ranging from 0 to 17 points (higher scores equal greater OHL). The OHL-AQ has shown good internal consistency and test-retest stability,[18,34,35] and it has been significantly correlated with tooth brushing frequency[18] and decayed, missing, and filled teeth.[35] It was selected for this study because it was previously validated (including a significant correlation with self-reported general oral health status) in a Midwestern sample[34] and it is the only known OHL assessment tool that includes functional aspects of literacy, such as listening and decision-making related to common directives received at a dental visit.

Other Measures

Several oral health outcomes and covariates were also extracted from the participant survey and stored medical/dental EHR data. The study survey ascertained education, household income, employment status, marital status, dental insurance coverage, and the number of dentist visits over the previous 5 years. Based on a prior

study[36] and recommendations from the American Dental Association,[37] oral hygiene habits were assessed and categorized as excellent/good or not excellent/good based on tooth brushing and flossing frequency. In addition, participants completed the 5-item Oral Health Impact Profile (OHIP-5).[38,39] A 0- to 20-point summary score was calculated from the OHIP-5 based on the reported frequency of common dental problems (eg, difficulty chewing, pain, unsightly appearance) experienced over the prior month, with higher scores indicating lower oral health quality of life.

The EHR data included measures routinely collected during previous encounters with medical and dental staff, including the most recently known values for age, gender, race/ethnicity, health insurance coverage, and smoking. The proportion of participants with at least one emergency room or urgent care visit for nontraumatic dental conditions (NTDC) was also assessed. Based on prior work by Serna and colleagues,[40] any visit to an MCHS emergency room or urgent care setting with an International Classification of Diseases code (Version 9 or 10) of 520-526.9, 528-528.9, 784.92, V52.3, V53.4, V58.5, V72.2, K00-K14.9, Z46.3, or Z46.4 was considered an emergency NTDC visit. Participants were categorized as having had 0 or ≥1 NTDC emergency/urgent care visits in the 20 years before their survey date. Any NTDC visit that occurred before the participant was age 18 was not considered in this categorization.

Analyses

Analytical procedures were conducted using SAS Version 9.4 (SAS Institute Inc., Cary, NC). In the first analysis designed to identify OHL determinants, multivariable linear regression modeling for survey data was used, which accounted for the strata structure and applied a finite population correction. Sociodemographic factors considered were age, gender, race/ethnicity, education, household income, employment status, marital status, health insurance, and dental insurance. Univariate models were first created to examine the crude association between each sociodemographic exposure and OHL-AQ score. Then a multivariable model was fit by entering in all exposures simultaneously and, using backwards selection, excluding covariates until only significant ($P < .05$) predictors of OHL-AQ score remained in a final model. In the second analysis, separated modeling was conducted for each OHL-oral health outcome association (ie, oral hygiene, oral health quality of life, dentist visits, and emergency NTDC visits). Multivariable linear and logistic regression modeling for survey data were used. For each oral health outcome, a univariate model was first created to examine the crude association between OHL-AQ score and each measure. Then a quadratic interaction term for OHL-AQ score (OHL-AQ score squared) was entered in to test for a possible curvilinear association. Finally, a multivariable model was fit by entering each covariate (including all previously used sociodemographic covariates, plus current smoking) separately and, using forward selection, retaining any covariates that were significantly associated with the outcome or that changed the OHL-AQ score (or quadratic term) parameter estimate by more than 10% (ie, confounding). To correct for imbalances between the analytical sample of survey respondents and the broader study-eligible source population, statistical weights were applied to all analyses using propensity scores.

Results

Of the 620 patients randomly selected for study invitation, 164 (26%) enrolled. As outlined in Table 1, there were several differences between survey respondents and the study-eligible source population. Most notably, study participants were significantly older and more likely to be female and white. OHL-AQ scores ranged from 7 to 17 points, but they were generally high with a mean ±SE score of 14.9 ± 0.2 points.

In both univariate models and in the final multivariable model, race/ethnicity, education, and household income were significantly associated with OHL-AQ score (Table 2). Specifically, nonwhite or Hispanic participants had an OHL-AQ score that was 3.1 ± 0.7 points lower than white non-Hispanic participants ($P < .001$). Participants with a high school (or less) education or who lived in a household with less than $40,000 in annual income had OHL-AQ scores that were 1.9 ± 0.4 ($P < .001$) and 1.1 ± 0.4 points ($P < .001$) lower than those with a college degree or who lived in a household with $40,000-$80,000 in annual income, respectively.

In the second analysis, OHL-AQ score was not significantly associated with excellent/good oral hygiene (OR = 1.14, 95% CI: 0.86-1.50, $P = .358$). The magnitude of this association was in the expected direction in that those with lower OHL tended to have poorer oral hygiene, but no further multivariable modeling was conducted. OHL-AQ score (β±SE = −3.30 ± 1.14, $P = .005$) and its quadratic function (β±SE = 0.11 ±0.04, $P = .012$) were significantly associated with OHIP-5 (ie, oral health quality of life) score. Race/ethnicity was retained in the final model as an independent predictor of OHIP-5 score (Table 3). OHL-AQ scores were also significantly associated with both the number of dentist visits in the previous 5 years and the odds of at least 1 emergency NTDC visit. As outlined in Figure 1, each 2-point increase in OHL-AQ score was associated with approximately 1

Table 1 Descriptive Characteristics of Central Wisconsin Adults Who Did and Did Not Participate in an Oral Health Literacy Survey

Characteristics	Enrolled n = 164	Invited, did not enroll n = 456	Eligible, not invited n = 16,781	P
Age (y)	48.2 ± 12.6	44.6 ± 13.8	41.0 ± 14.0	< .001
Gender				
Female	112 (68%)	264 (58%)	8,706 (52%)	< .001
Male	52 (32%)	192 (42%)	8,075 (48%)	
Race/Ethnicity				
White, non-Hispanic	159 (97%)	419 (92%)	15,182 (90%)	.012
Nonwhite or Hispanic	5 (3%)	37 (8%)	1,599 (10%)	
Smoking				
Current	30 (18%)	68 (15%)	3,241 (19%)	.006
Former	28 (17%)	87 (19%)	2,717 (16%)	
Never	106 (65%)	297 (65%)	10,364 (62%)	
Unknown	0 (0%)	4 (1%)	459 (3%)	
Health insurance				
Private	107 (65%)	253 (55%)	9,837 (59%)	.001
Public-assisted	51 (31%)	198 (43%)	6,249 (37%)	
None	6 (4%)	5 (1%)	695 (4%)	
Dental insurance				
Covered	133 (81%)	—	—	—
Not covered	25 (15%)			
Unknown	6 (4%)			
Education				
College degree	54 (33%)	—	—	—
Some college or associate degree	65 (40%)			
High school or less	45 (27%)			
Annual household income				
≥ $80,000	46 (28%)	—	—	—
$40,000-$79,999	55 (34%)			
< $40,000	48 (35%)			
Unknown	5 (3%)			
Employment				
Currently employed	129 (79%)	—	—	—
Not currently employed	35 (29%)			
Marital status				
Married or living with partner	102 (62%)	—	—	—
Not married or living with partner	62 (38%)			

additional dentist visit over the previous 5 years ($\beta \pm SE = 0.50 \pm 0.18$, $P = .007$). Also, each 1-point increase in OHL-AQ score was associated with approximately 38% lower odds of having at least 1 prior emergency NTDC visit (OR = 0.62, 95% CI: 0.41-0.93, $P = .021$). Household income was retained in the final model as a modest confounder of the association between OHL-AQ score and dentist visits, while dental insurance was retained in the final model as an independent predictor of emergency NTDC visits (Table 3).

Discussion

This is the first known OHL study conducted in a sample of rural US adults from a medical-dental integrated health care system. Our findings indicate that OHL was generally high in this sample, with OHL-AQ scores averaging about 40% higher than previous observations of urban adults in Iran[18,32] and 10% higher than school teachers in India.[35] As previously shown,[18,35,41] and consistent with the Sorensen and colleagues conceptual model of health literacy,[26] OHL levels tracked closely with markers of socioeconomic status, being significantly lower in racial/ethnic minorities and participants with lower education and income. Having current dental insurance was not correlated with OHL.

Unlike several prior studies, OHL was not significantly associated with oral hygiene.[18,33,35] Reasons for this are unclear since the OHL-AQ tool was used in each of these prior studies, and our sample was very similar to one of

Table 2 Univariate and Multivariable Association Between Sociodemographic Characteristics and Oral Health Literacy Score Among Rural Wisconsin Adults (n = 164)

	Oral Health Literacy in Adults Questionnaire (Points)	
Exposures	Univariate unadjusted models	Multivariate adjusted model
Age (y)	0.01 ± 0.01 *P* = .655	—
Gender		
Female vs male	0.46 ± 0.34 *P* = .177	—
Race/ethnicity		
Nonwhite or Hispanic vs white, non-Hispanic	–2.47 ± 0.96 *P* = .011	–3.06 ± 0.71 *P* < .001
Health insurance		
Public-assisted vs private	–0.75 ± 0.46 *P* = .103	—
None vs private	–1.03 ± 0.98 *P* = .296	—
Dental insurance		
Not covered vs covered	–0.18 ± 0.38 *P* = .640	—
Unknown vs covered	–0.55 ± 0.58 *P* = .338	—
Education		
College degree vs high school or less	1.87 ± 0.43 *P* < .001	1.86 ± 0.43 *P* < .001
Some college/associate's vs high school or less	1.55 ± 0.41 *P* < .001	1.72 ± 0.46 *P* < .001
Annual household income		
≥$80,000 vs <$40,000	0.90 ± 0.48 *P* = .065	0.31 ± 0.39 *P* = .425
$40,000-$79,999 vs < $40,000	1.14 ± 0.51 *P* = .028	1.09 ± 0.42 *P* = .010
Unknown vs <$40,000	–0.35 ± 0.57 *P* = .538	–0.55 ± 0.58 *P* = .341
Employment		
Not currently employed vs currently employed	–1.19 ± 0.62 *P* = .058	—
Marital status		
Married/partnered vs not married/partnered	0.72 ± 0.41 *P* = .081	—

Values are reported as point estimate ±SE. Negative values indicate that, relative to the reference category, the estimated Oral Health Literacy in Adults Questionnaire score decreases.

— Indicates that variable was not included in the final multivariable model.

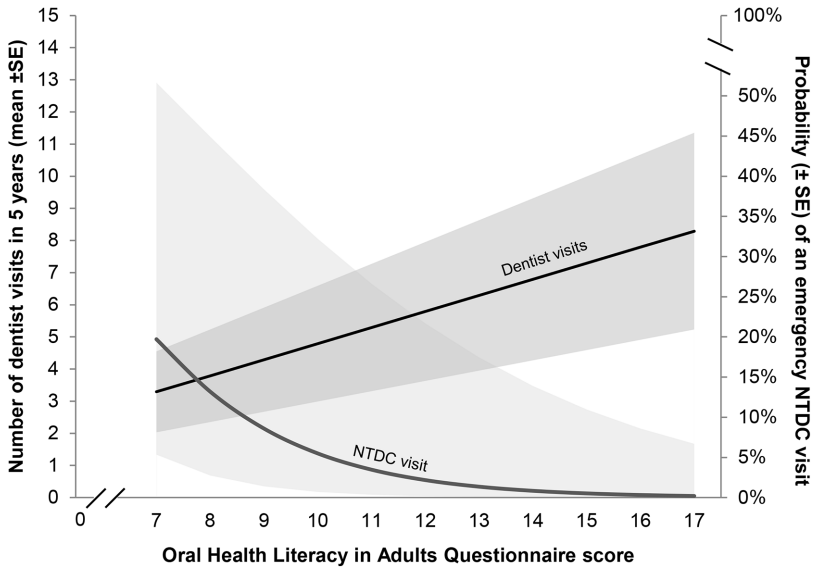
these prior studies as well.[33] In rural Wisconsin adults, low OHL was associated with lower oral health quality of life, as observed in an other study,[34] and seemed to be particularly influential in the context of appropriate dental care utilization in that lower OHL was significantly associated with both fewer visits to the dentist and more emergency/urgent care visits for NTDC. These findings were again consistent with the Sorensen and colleagues conceptual model of health literacy,[26] but they are in contrast to the recent meta-analysis that concluded no association between low OHL and visits to the dentist.[21] This may be because participants in our study reported on the total number of dentist visits over the previous 5 years, which may have been a more sensitive outcome as compared to the more typical dental utilization metric of having seen a dentist or not in the last year. Only 1 other study has examined the association between OHL and emergency NTDC visits (conducted in a sample of Brazilian adults),[22] and our findings are similar to theirs, which relied on self-reported dental emergency visits. Emergency visits for NTDCs are a considerable burden on health care costs in many areas of the United States.[42]

Table 3 Multivariable Association Between Oral Health Literacy in Adults Questionnaire (OHL-AQ) Score, Oral Health Impact Profile (OHIP-5) Score, Number of Dentist Visits in the Previous 5 Years, and Emergency/Urgent Care Visit for Nontraumatic Dental Conditions (NTDC) Among Rural Wisconsin Adults (n = 164)

Exposures	OHIP-5	Dentist Visits in the Previous 5 Years	Emergency/Urgent Care Visit for NTDC
OHL-AQ	−3.3 ± 1.1 *P* = .005	0.5 ± 0.2 *P* = .007	0.62 (0.41-0.93) *P* = .021
OHL-AQ × OHL-AQ	0.1 ± 0.0 P = .012	—	—
Race/ethnicity			
Nonwhite or Hispanic vs white, non-Hispanic	2.4 ±0.9 P = .012	—	—
Dental insurance			
Not covered vs covered	—	—	7.16 (1.21-42.23) *P* = .030
Unknown vs covered	—	—	*not estimable*
Annual household income			
≥ $80,000 vs < $40,000	—	1.6 ± 0.9 P = .102	—
$40,000-$79,999 vs < $40,000	—	1.1 ± 1.0 P = .267	—
Unknown vs <$40,000	—	0.4 ± 2.1 *P* = .834	—

For OHIP-5 score and dentist visits, values are reported as point estimate ±SE. For emergency/urgent NTDC visits, values are reported as odds ratio (95% confidence interval).
— Indicates that variable was not included in the final multivariable model.

Figure 1 Model-Estimated Dental Care Utilization Outcomes by Oral Health Literacy Level in Rural Wisconsin Adults.



In concert with underutilized primary/preventive dental care, the degree to which OHL may causally influence inappropriate acute dental care decisions over time should be further explored.

Though it was not a topic in our observational study, the optimal method of intervening to address low OHL is an open research question. In their Health Literacy Universal Precautions Toolkit, the Agency for Healthcare Research and Quality emphasizes accommodations (eg, clear communication techniques, simplified written materials, self-support tools) in the clinical environment so that health care providers are better equipped to

interact with all patients, including those with low health literacy.[43] Such clinical adaptations are not likely routine in the dental care environment[44,45] and may require better coordinated, systems-level efforts from both dental and medical providers. The degree to which OHL can be more directly improved via clinical education (or could complement modifications to the clinical environment) is unknown, but medical literacy levels increased by 15% in a trial of adults with low health literacy and depression who participated in regular clinic-based depression education classes.[24]

Strengths of this study included the use of a previously validated OHL assessment tool and the linkage of OHL-AQ scores to EHR-based measures, most notably the complete capture of emergency NTDC visits. Also, statistical weighting was used to balance the known biases of the respondent sample relative to the broader source population. The cross-sectional design precluded cause-and-effect conclusions though, and most oral health outcome measures were self-reported and thus subject to recall or self-presentation biases. The sample size estimate was based on the exploratory analyses of sociodemographic predictors of OHL-AQ score, and it was likely underpowered to detect some associations with oral health outcomes that were clearer in prior studies, such as oral hygiene. The source population, though rather typical of rural central Wisconsin, was obviously homogenous and not representative of other parts of the United States. Additional research is needed on this topic with larger and more diverse samples to better determine associations across racial/ethnic and other groups, and to clarify some inconsistent OHL associations. Also, our study did not include an urban comparison group, thus some features of OHL that may be unique to rural settings require further investigation. Like general health literacy,[16] the burden of low OHL may be greater in the rural United States since education[46] and dental care utilization[15] are higher in urban areas. Assuming OHL is found to be lower in rural areas, there may be regional nuances in terms of population-level impact. In the Midwest for example, household incomes are actually higher and less disparate in rural areas,[47] which could obscure some associations between OHL and oral health outcomes relative to other rural regions.

In the context of oral health, improved dental care systems that reduce situational demand and better accommodate low literacy levels could help patients in rural areas get primary/preventive dental care more regularly and avoid going to the emergency room for NTDC. Through dental clinics embedded within MCHS and its associated Federally Qualified Health Centers, participants in our study area have access to low-cost primary dental care. Yet, some patients do not take full advantage of this access[48] and that could be at least partially driven by low OHL. OHL is an emerging research area, and critical information is still needed on its epidemiology and burden in other parts of the United States, particularly in impoverished and deprived areas where education and literacy needs are likely to be high and access to dental care more limited.

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