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RURAL RESIDENCE AND FAMILY SIZE, RATHER THAN PARENTAL HEALTH LITERACY, ARE ASSOCIATED WITH PEDIATRIC BURN STATUS

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ABSTRACT

Background: Pediatric burn injuries are largely preventable and arise through a complex interaction of environmental, socioeconomic, and caregiver-related factors. Parental health literacy may theoretically influence injury prevention through risk recognition, supervision, and the ability to understand and apply health information; however, its independent relationship with pediatric burn status remains unclear. This study aimed to determine whether parental health literacy is independently associated with pediatric burn status after accounting for relevant sociodemographic and family-level characteristics.

Methods: This comparative cross-sectional study included parents of 57 children hospitalized with burn injuries and 86 parents of children without a history of burn injury. Parental health literacy was assessed using the validated Turkish version of the 16-item European Health Literacy Survey Questionnaire (HLS-EU-Q16), with scores transformed to a 0-50 index. Valid HLS-EU-Q16 scores were available for 116 participants (50 burn and 66 control). Sociodemographic and family characteristics were compared between groups. Multivariable binary logistic regression was performed with pediatric burn status as the dependent variable to evaluate the independent associations of health literacy, place of residence, number of siblings, maternal education, family income, and child age.

Results: Mean HLS-EU-Q16 index scores were similar in the burn and control groups (37.28 ± 7.04 vs 37.01 ± 6.51, respectively; p=0.832), and the distribution of health-literacy categories did not differ significantly between groups (p=0.587). In the multivariable model, parental health literacy was not independently associated with pediatric burn status (adjusted odds ratio [aOR] per 1-point increase, 1.01; 95% CI, 0.95-1.08; p=0.744). In contrast, rural/village residence was strongly associated with burn status (aOR, 13.81; 95% CI, 3.62-52.71; p<0.001). Each additional sibling was also associated with higher odds of belonging to the burn group (aOR, 1.47; 95% CI, 1.02-2.13; p=0.040). Maternal education, family income, and child age were not independently associated with burn status.

Conclusions: Pediatric burn status was independently associated with rural residence and larger family size, but not with parental health literacy. These findings suggest that the social and environmental context in which caregiving occurs may be more influential than parents' ability to access and understand general health information alone. Burn-prevention strategies should therefore extend beyond health-literacy education and particularly target rural households and families with greater caregiving demands.

Keywords: pediatric burns; health literacy; parents; rural residence; family size; injury prevention; HLS-EU-Q16

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INTRODUCTION

Burn injuries remain an important cause of preventable morbidity and mortality worldwide and disproportionately affect children and populations living in socioeconomically disadvantaged settings.[1,2] Young children are particularly vulnerable because of their developmental characteristics, limited ability to recognize hazards, high levels of exploratory behavior, and dependence on caregivers for environmental protection.[3,4] Although advances in acute burn management have improved survival, pediatric burns may still result in prolonged treatment, pain, functional impairment, psychological consequences, and substantial burdens for both children and their families.[5,6]

Most childhood burns occur in or around the home and are therefore closely linked to the physical and social environment in which children are cared for. Residence, housing characteristics, cooking and heating practices, socioeconomic conditions, and the degree of adult supervision may all influence exposure to burn hazards. Population-based data from Bangladesh showed that childhood burn incidence was more than four times higher among rural than urban children and that approximately 90% of childhood burns occurred at home.[7] A subsequent nested case-control study in rural Bangladesh identified household characteristics such as the absence of a separate kitchen and unsafe lighting practices as important determinants of childhood burns.[8] More recently, studies from socioeconomically disadvantaged populations have similarly suggested that family structure, parental employment, and the number of children in the household may contribute to pediatric burn occurrence.[9]

Caregiver-related factors constitute another potential layer of injury prevention. Larger families may create competing demands for parental attention and reduce the amount of supervision available to each child. In a Turkish study investigating mothers' health literacy and domestic childhood accidents, an increasing number of children requiring care was independently associated with a higher probability of home accidents.[10] These findings suggest that caregiving burden may be relevant to childhood injury independently of traditional socioeconomic indicators.

Parental health literacy (HL) may also affect injury prevention. Health literacy reflects the ability to access, understand, appraise, and apply health-related information.[11] Parents with limited HL may have difficulty interpreting safety recommendations, identifying hazards, understanding first-aid instructions, or navigating healthcare information. In a large pediatric primary-care cohort, low parental HL was associated with several injury-related behaviors, including lack of smoke detectors and poorer first-aid knowledge regarding burns.[12] However, associations between general parental HL and actual pediatric injury events are less consistent. Health literacy may be correlated with education, socioeconomic position, residence, and access to services, making it difficult to determine whether HL itself contributes independently to injury occurrence or instead acts as a marker of broader social disadvantage.

This distinction may be especially important in pediatric burns, where environmental exposure and supervision patterns may exert a more immediate

effect than general health-information skills. Despite the potential relevance of HL, few studies have simultaneously evaluated parental HL, rural residence, and family structure in relation to pediatric burn status.

Therefore, the present study aimed to compare parental health literacy and sociodemographic characteristics between children with burn injuries and controls without a history of burn injury and, more importantly, to determine whether parental HL was independently associated with pediatric burn status after adjustment for relevant family and socioeconomic characteristics. We hypothesized that the apparent relationship between parental HL and burn status would be attenuated after accounting for contextual factors such as place of residence and family size.

METHODS

Study Design and Setting

This comparative cross-sectional study was conducted at a tertiary burn center between November 2020 and November 2022. Parents of children hospitalized with burn injuries were compared with parents of children attending a pediatric surgery outpatient clinic who had no history of burn injury.

Participants

The burn group consisted of parents of children younger than 18 years who were hospitalized with thermal burn injuries during the study period. Eligible participants were aged ≥18 years, were the parent or primary caregiver of the child, were able to communicate sufficiently to complete the questionnaire, and provided written informed consent. The control group consisted of parents of children attending the pediatric surgery outpatient clinic who had no previous history of burn injury. Participants were recruited using convenience sampling.

A total of 143 parent-child dyads were included, comprising 57 participants in the burn group and 86 participants in the control group.

Data Collection

Data were collected through face-to-face interviews. A structured sociodemographic questionnaire was used to obtain information on characteristics including child age, parental educational status, family income, number of siblings, and place of residence.

Place of residence was evaluated according to the family's usual living environment, with particular attention to rural/village residence because of its potential association with environmental burn exposures and access to preventive resources.

Assessment of Health Literacy

Parental health literacy was assessed using the Turkish version of the Health Literacy Scale-European Union-Q16 (HLS-EU-Q16). The Turkish validity and reliability study was performed by Emiral et al.[13] in 180 adults and demonstrated satisfactory psychometric properties.

The HLS-EU-Q16 contains 16 items evaluating perceived difficulty in accessing, understanding, appraising, and applying health information across healthcare, disease prevention, and health-promotion contexts. Responses are rated according to the perceived difficulty of each task.

For the present analysis, HLS-EU-Q16 scores were transformed to a standardized 0-50 health-literacy

index, with higher scores representing better health literacy. Participants were included in the health-literacy analysis when at least 14 of the 16 items had valid responses. Accordingly, valid HLS-EU-Q16 scores were available for 116 participants: 50 in the burn group and 66 in the control group.

Health-literacy levels were additionally examined according to the predefined categories derived from the standardized index.

STATISTICAL ANALYSIS

Continuous variables were summarized as mean ± standard deviation or median and interquartile range, as appropriate, and categorical variables as frequency and percentage.

Sociodemographic characteristics and HLS-EU-Q16 scores were compared between the burn and control groups using appropriate parametric or non-parametric tests for continuous variables and chi-square or Fisher's exact tests for categorical variables.

The primary multivariable analysis used binary logistic regression, with pediatric burn status (burn vs control) as the dependent variable. Variables considered clinically or epidemiologically relevant to pediatric injury were entered into the adjusted model. The final model included parental HLS-EU-Q16 index score, place of residence, number of siblings, maternal education, family income, and child age.

Adjusted odds ratios (aORs) with 95% confidence intervals (CIs) were calculated. Because HLS-EU-Q16 scoring required at least 14 valid responses, the regression model incorporating HL was performed among participants with valid HLS-EU-Q16 data. A two-sided p value <0.05 was considered statistically significant.

Ethical Considerations

Written informed consent was obtained from all participants. The study was conducted in accordance with the principles of the Declaration of Helsinki.

RESULTS

Participant Characteristics

A total of 143 participants were included in the study: 57 parents of children with burn injuries and 86 controls. Participant characteristics are summarized in Table 1.

The sociodemographic comparison indicated that the most prominent differences between the groups concerned family structure and place of residence. Children in the burn group came from families with a greater number of siblings and were substantially more likely to live in rural or village settings than children in the control group. In contrast, differences in parental educational characteristics were less pronounced.

These findings suggested that the two groups differed more clearly in their household and residential contexts than in conventional educational indicators.

Table 1. Sociodemographic and family characteristics of the burn and control groups

Characteristic	Burn group (n=57)	Control group (n=86)	p value
Child age, years, median (IQR)	4.0 (1.0-12.0)	4.0 (2.0-7.0)	0.481

Characteristic	Burn group (n=57)	Control group (n=86)	p value
Maternal age, years, median (IQR)	34.0 (29.0-42.0)	33.0 (29.0-37.8)	0.518
Paternal age, years, median (IQR)	36.0 (32.0-45.0)	37.0 (32.0-42.0)	0.995
Number of siblings, median (IQR)	2.0 (1.0-3.0)	1.0 (1.0-2.0)	0.037
Maternal education, n (%)			0.918
Primary school or less	19 (33.3%)	26 (30.2%)	
Middle school	11 (19.3%)	17 (19.8%)	
High school	17 (29.8%)	24 (27.9%)	
Postsecondary	10 (17.5%)	19 (22.1%)	
Paternal education, n (%)			0.967
Primary school or less	15 (26.3%)	25 (29.1%)	
Middle school	13 (22.8%)	17 (19.8%)	
High school	16 (28.1%)	25 (29.1%)	
Postsecondary	13 (22.8%)	19 (22.1%)	
Family income, n (%)			0.570
Good	14 (24.6%)	15 (17.4%)	
Moderate	37 (64.9%)	60 (69.8%)	
Poor	6 (10.5%)	11 (12.8%)	
Place of residence, n (%)			<0.001
Urban/district center	36 (63.2%)	81 (94.2%)	
Rural/village	21 (36.8%)	5 (5.8%)	

Data are presented as median (IQR) or n (%). Continuous variables were compared using the Mann-Whitney U test; categorical variables were compared using the chi-square test. IQR, interquartile range.

Parental Health Literacy

Valid HLS-EU-Q16 data were available for 116 participants, including 50 parents in the burn group and 66 controls. Health literacy results are presented in Table 2.

The mean HLS-EU-Q16 index score was 37.28 ± 7.04 among parents of children with burns and 37.01 ± 6.51 among controls. There was no statistically significant difference between the groups (p=0.832).

Similarly, the distribution of participants across health-literacy categories did not differ significantly between the burn and control groups (p=0.587).

Thus, neither the continuous health-literacy score nor the categorical classification provided evidence of poorer general health literacy among parents of children with burn injuries.

Table 2. Comparison of parental HLS-EU-Q16 scores and health literacy categories

Health literacy measure	Burn group (n=50)	Control group (n=66)	p value
HLS-EU-Q16 index, mean ± SD	37.28 ± 7.04	37.01 ± 6.51	0.832
Health literacy category, n (%)			0.587
Inadequate	3 (6.0%)	1 (1.5%)	
Problematic/limited	10 (20.0%)	13 (19.7%)	
Sufficient	24 (48.0%)	36 (54.5%)	
Excellent	13 (26.0%)	16 (24.2%)	

HLS-EU-Q16 scores were calculated when at least 14 of 16 items had valid responses; response option 5 was treated as missing for index calculation. The 0-50 index was calculated as (mean item score - 1) × 50/3. Categories: inadequate, 0-25; problematic/limited, >25-33; sufficient, >33-42; excellent, >42-50. SD, standard deviation.

Multivariable Analysis of Factors Associated With Pediatric Burn Status

In multivariable binary logistic regression analysis, parental health literacy was not independently associated with pediatric burn status. Each 1-point increase in the HLS-EU-Q16 index was associated with an aOR of 1.01 (95% CI, 0.95-1.08; p=0.744). Key adjusted estimates are summarized in Table 3.

In contrast, place of residence showed the strongest independent association. Participants living in rural/village settings had substantially higher odds of belonging to the pediatric burn group than those living in the reference residential category (aOR, 13.81; 95% CI, 3.62-52.71; p<0.001).

Family size also remained independently associated with burn status. Each additional sibling was associated with a 47% increase in the odds of belonging to the burn group (aOR, 1.47; 95% CI, 1.02-2.13; p=0.040).

Maternal education, family income, and child age were not independently associated with burn status in the adjusted model.

Taken together, these findings indicate that residential and family-context factors, rather than parental general health literacy, accounted for the principal independent associations with pediatric burn status.

Table 3. Key results of the multivariable logistic regression analysis for pediatric burn status

Variable	Adjusted OR	95% CI	p value
HLS-EU-Q16 index (per 1-point increase)	1.01	0.95-1.08	0.744
Rural/village residence	13.81	3.62-52.71	<0.001
Number of siblings (per additional sibling)	1.47	1.02-2.13	0.040

The model was additionally adjusted for maternal education, family income, and child age; these covariates were not statistically significant. OR, odds ratio; CI, confidence interval; HLS-EU-Q16, 16-item European Health Literacy Survey Questionnaire.

DISCUSSION

The main finding of this study was that rural residence and larger family size, rather than parental health literacy, were independently associated with pediatric burn status. Although parental HL was initially considered a plausible contributor to childhood burn vulnerability, parents in the burn and control groups had almost identical HLS-EU-Q16 scores, and HL remained unrelated to burn status after adjustment for sociodemographic factors. In contrast, rural/village residence showed a particularly strong association, while each additional sibling was associated with higher odds of belonging to the burn group.

Rural Residence: The Dominant Contextual Association

The strong association between rural residence and pediatric burn status is consistent with evidence indicating that burn injuries are not distributed randomly across populations but are closely linked to the environments in which children live. Mashreky et al.[7] reported a more than fourfold higher incidence of childhood burns among rural than urban children in a large population-based study in Bangladesh. Importantly, most burns occurred at home, with kitchens representing a major site of injury.

A subsequent nested case-control study from the same setting showed that specific characteristics of rural households—including the absence of a separate kitchen, lack of barriers restricting children's access to cooking areas, and use of traditional kerosene lamps—substantially increased childhood burn risk.[8] These observations illustrate why geographical residence may function as more than a simple demographic variable: it can represent a cluster of environmental exposures involving cooking methods, heating systems, housing design, household crowding, supervision patterns, and access to preventive resources.

Our adjusted estimate for rural/village residence was large, although the wide confidence interval reflects the limited sample size and requires cautious interpretation. Nevertheless, the persistence of the association after adjustment for health literacy, maternal education, income, family size, and child age supports the possibility that the residential environment captures determinants of pediatric burn exposure that are not adequately represented by conventional socioeconomic measures.

The findings therefore argue against interpreting pediatric burns solely as a consequence of inadequate parental knowledge. Even well-informed caregivers may be unable to fully compensate for hazardous housing conditions, unsafe heating or cooking arrangements, or physical environments in which children are repeatedly exposed to burn hazards.

Family Size and Caregiving Burden

The second important finding was the independent association between the number of siblings and pediatric burn status. Each additional sibling was associated with approximately 47% higher odds of belonging to the burn group.

This finding has a particularly relevant parallel in the Turkish literature. Karayurek and Ozaydin[10] examined maternal health literacy and domestic accidents and reported that an increasing number of children requiring care was independently associated with domestic childhood accidents. Their analysis suggested an approximately 1.58-fold increase in

accident probability with an increase in the number of children requiring care.

The similarity is important because it supports a mechanism related to caregiving burden rather than merely household size. As the number of children increases, parental attention must be distributed among more individuals. Periods of inadequate direct supervision may become more frequent, particularly during cooking, heating, feeding, household work, or care of another child. Such effects may be amplified in homes where environmental hazards are readily accessible.

Recent pediatric burn research has also identified the number of children in a household as a variable associated with burn occurrence.[9] Although the direction and magnitude of associations vary across social settings and family structures, collectively these studies indicate that household composition should be considered alongside more traditional socioeconomic indicators when developing burn-prevention strategies.

Importantly, the number of siblings should not be viewed as inherently hazardous. Rather, it may act as a proxy for the intensity and complexity of caregiving demands. The association observed in our study is therefore better interpreted in terms of supervision capacity, competing household responsibilities, and exposure opportunities than as a direct biological or deterministic effect of family size.

Why Was Health Literacy Not Associated With Burn Status?

Perhaps the most notable result was the absence of an association between parental HL and pediatric burn status. Mean HLS-EU-Q16 scores were virtually identical between groups, and the adjusted odds ratio for the HL index was close to unity.

This finding initially appears to contrast with studies linking low parental health literacy to pediatric injury-related behaviors. Cheng et al.[12], in a cohort of more than 17,000 parents, found that low parental HL was associated with several potentially unsafe behaviors and knowledge deficits, including absence of a working smoke detector and inadequate first-aid knowledge regarding burns. Similarly, studies of health-information seeking suggest that HL can influence how parents obtain and use injury-prevention information.[14]

However, several factors may explain why this relationship did not translate into an association with actual burn status in our study.

First, general health literacy and burn-specific hazard recognition are not equivalent constructs. The HLS-EU-Q16 measures perceived ability to access, understand, evaluate, and use general health information. A parent may perform well on these domains while living in a household where exposure to open heating sources, hot liquids, unsafe kitchen configurations, or other hazards remains difficult to eliminate.

Second, HL may influence knowledge and preventive behavior but may lie further upstream from the actual injury event. A burn occurs through a combination of hazard availability, child behavior, timing, supervision, and chance. When environmental exposure is strong, the incremental contribution of general HL may be comparatively small.

Third, health literacy is socially patterned. Education, socioeconomic resources, residence, and healthcare access may all overlap with HL. Once these contextual

factors are considered simultaneously, an apparent crude association between HL and injury may weaken or disappear.

The EHLJ study of domestic accidents provides an instructive example.[10] Although low HL was associated with simple home accidents, the multivariable findings also emphasized maternal age and the number of children being cared for. This supports the broader interpretation that HL is only one component of a multidimensional injury-prevention environment.

Therefore, the absence of a significant HL effect in the present study should not be interpreted as evidence that health literacy is unimportant. Clear communication, understandable safety education, and appropriate first-aid information remain essential. Rather, our findings suggest that health-literacy interventions alone are unlikely to address the full burden of pediatric burns when structural and caregiving-related hazards remain present.

Implications for Prevention

The results have practical implications for pediatric burn prevention. Educational strategies aimed at parents are useful, but interventions should be risk-stratified and context-sensitive.

Families living in rural areas may benefit from home-safety assessments that focus specifically on cooking areas, heating equipment, hot-water access, electrical hazards, and children's physical access to dangerous household zones. Prevention programs should also recognize that families caring for several children may face limitations in continuous supervision even when their knowledge of injury prevention is adequate.

Primary care physicians, family physicians, pediatricians, community nurses, and other healthcare professionals may be particularly well positioned to identify these higher-risk households. Instead of relying only on generic safety education, prevention strategies could integrate family size, residential context, supervision demands, and household hazards into anticipatory guidance.

Such an approach shifts the prevention framework from asking only “Does the parent understand the risk?” toward the more practical question of “Does the family have an environment in which that risk can realistically be controlled?”

Strengths and Limitations

A major strength of this study is the simultaneous evaluation of parental health literacy and family- and environment-related variables. The multivariable approach allowed us to distinguish the independent contribution of HL from contextual factors such as residence and family size. In addition, the use of a validated Turkish version of the HLS-EU-Q16 provided a standardized assessment of parental general health literacy.

Several limitations should nevertheless be acknowledged. First, this was a single-center study with a relatively modest sample size. The particularly wide confidence interval surrounding the rural-residence estimate indicates limited precision and the magnitude of this association should therefore be interpreted cautiously.

Second, the cross-sectional design prevents causal inference. The results identify factors associated with burn-group membership rather than prospective determinants of future burn injury.

Third, valid HLS-EU-Q16 scores were available for 116 of the 143 participants. Although the requirement for at least 14 valid responses improves the reliability of score calculation, the resulting missing HL data may have introduced selection bias.

Fourth, the HLS-EU-Q16 assesses general health literacy rather than burn-specific safety knowledge, hazard perception, or first-aid competence. A burn-specific literacy or safety instrument might identify associations that a general HL measure cannot detect.

Fifth, detailed characteristics of the home environment—including kitchen configuration, heating methods, physical barriers, household crowding, and the intensity or timing of direct child supervision—were not comprehensively quantified. These factors may partly explain the strong association observed with rural residence and should be incorporated into future research.

Finally, controls were recruited from a pediatric surgical outpatient population rather than from a population-based community sample, which may limit generalizability.

CONCLUSIONS

In this comparative study, parental health literacy was not independently associated with pediatric burn status, whereas rural residence and a greater number of siblings remained significant independent factors.

These findings suggest that the occurrence of pediatric burns may be shaped more strongly by the physical and social context of caregiving than by general parental health literacy alone. Rural environments may involve greater exposure to household burn hazards, while larger families may place additional demands on caregiver supervision.

Burn prevention should therefore move beyond information provision alone. Strategies combining understandable health communication with targeted environmental modification, household-safety interventions, and additional attention to families with high caregiving demands may provide a more effective framework for preventing childhood burns.

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