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## Emergency Department Use and Risk Factors among Deaf American Sign Language Users

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### Abstract

**Background**—Deaf American Sign Language (ASL) users comprise a linguistic minority population with poor health care access due to communication barriers and low health literacy. Potentially, these health care barriers could increase Emergency Department (ED) use.

**Objective**—To compare ED use between deaf and non-deaf patients.

**Method**—A retrospective cohort from medical records. The sample was derived from 400 randomly selected charts (200 deaf ASL users and 200 hearing English speakers) from an outpatient primary care health center with a high volume of deaf patients. Abstracted data included patient demographics, insurance, health behavior, and ED use in the past 36 months.

**Results**—Deaf patients were more likely to be never smokers and be insured through Medicaid. In an adjusted analysis, deaf individuals were significantly more likely to use the ED (odds ratio [OR], 1.97; 95% confidence interval [CI], 1.11–3.51) over the prior 36 months.

**Conclusion**—Deaf American Sign Language users appear to be at greater odds for elevated ED utilization when compared to the general hearing population. Efforts to further understand the drivers for increased ED utilization among deaf ASL users are much needed.

### Keywords

deaf; Emergency Department utilization; health access; LEP populations; disabilities

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## Introduction

Patterns of Emergency Department (ED) utilization provide a good opportunity to evaluate existing access to health care and potential barriers to routine care in the general population.<sup>1</sup> Higher rates of inappropriate ED utilization can lead to a variety of poorer health outcomes such as decreased preventive care services receipts, increased inpatient hospitalizations, lower satisfaction with health care, and higher health care costs.<sup>2,3</sup> National data show that one in five adult Americans (20.1%) utilized emergency room services in the last 12 months with this proportion varying on the basis of age, gender, race, educational achievement, income and status.<sup>4</sup> Another study estimated that 23% of Americans visited the ED at least once, with 92% of those going to the ED 3 or less times in the previous 12 months.<sup>5</sup>

Certain populations are at higher risk for increased ED utilization: female gender, elderly age, African-American race, poverty, low educational achievement, poorer health status, poor mental health, frequent use of outpatient services and those reported having no usual source of care.<sup>4,5</sup> Surprisingly, immigrant populations and linguistic minority groups appear to be at lower risk for ED use.<sup>6,7</sup>

Deaf American Sign Language (ASL) users represent a population group that is also considered to be a cultural and linguistic minority population<sup>8,9</sup> yet little is known about their use of ED care. ASL is commonly misunderstood to be a gestural language or a visual “English” language. ASL contains its own syntax and language structure, which is distinct from English and does not have a written form.<sup>8,9</sup> There is anecdotal evidence demonstrating higher than average ED use by deaf ASL users likely due to their existing language, communication, and cultural barriers in the health care setting. The lack of linguistic and cultural concordance among health care providers places the deaf population at high-risk for inappropriate health care use. Despite the vulnerability and the size of the population (estimated to be ~500,000 to 1 million),<sup>10,11</sup> health care utilization and patterns remain poorly understood in this group.

The primary objectives of this study were: 1) to evaluate whether deaf ASL users appear to be at higher odds for ED utilization compared to the general population and; 2) identify characteristics associated with ED utilization in the deaf population.

## Methods

The data source was medical records obtained from a large non-hospital affiliated primary care based outpatient health center in the Rochester, New York region. It was selected due to its diverse patient panel, including a large number of deaf ASL users, and records of language preferences by its patients. The health center was also selected due to its acceptance of both public- and private-based insurance. We used May 1, 2009–April 30, 2012 chart data from the designated health center’s electronic medical records to compare ED utilization among deaf and non-deaf patients. A report on the patient panel was generated listing patients by their known language preferences. Using this list of patients, we randomly selected 200 deaf ASL users and 200 hearing English speakers. These patients

were established health center patients representing the patient panels of multiple primary care providers (i.e. family medicine and internal medicine physicians). Both the University of Rochester Research Subjects Review Board and the health center where the data were collected approved the study protocol.

One of the authors trained a research assistant to abstract electronic medical record data from the targeted health center. A standardized chart abstraction tool was used. Independent chart abstraction review was done by the principal investigator on 10% of the charts for quality assurance. The percent agreement between raters for these variables was high, ranging from a low of 90% (smoking history) to a high of 100% for most variables (mean of 98.75%). This chart abstraction review was done throughout the data abstraction to provide regular feedback to the research assistant to further enhance the quality of the data abstracted.

Data abstracted included: age, gender, insurance type, educational attainment, race, ethnicity, and smoking history and status. Each chart was reviewed for ED use during the assigned time period (2009–2012). We categorized any ED records documenting ED use in the previous 36 months as “Yes” or “No.” We also recorded the date and frequency of the ED visits to assess repeat ED utilization. The ED use was not restricted to any specific hospital. Any ED use regardless of location and type were included in the study. Because educational attainment was poorly documented in most clinical charts of the randomly selected participants (194 of 400 lacked educational attainment documentation), it was not used in the analysis. Race and ethnicity documentation was inconsistent but less so than educational attainment. Annual household income was not available; Medicaid was used as a surrogate measure for poverty. Medicare was not used in the model since it was strongly correlated with hearing loss (due to the association of hearing loss with aging and disability). Smoking history and status was inconsistently documented in many of the subjects’ chart. For example, the patient chart had a designated area to document patient’s smoking history but some providers occasionally documented the smoking use via free text in the patient’s note instead. This led to the lower percent agreement between reviewers within that variable.

### Statistical Analysis

Demographic characteristics relevant to ED use were compared between deaf and hearing persons using t-test or chi-square for continuous and categorical data, respectively. A univariate analysis was also conducted to identify associations with ED use among deaf patients. This was conducted to identify potential demographic factors that increase the odds of using the ED in the deaf sample. Finally, we assessed the association between the primary independent variable (i.e. deaf versus hearing) and ED use over the past 36 month study period using logistic regression that controlled for available demographics (sex, age, race/ethnicity, smoking status, and insurance type). Each of these demographic factors was incorporated into the model due to their relevance with ED use in the general population.<sup>4</sup> All statistical analyses were conducted using SAS version 9.3 (SAS Institute, Inc, Cary, NC).

## Results

Deaf patients were more likely to be never smokers and more often to have public insurance (Table 1). The only statistically significant demographic differences among deaf ED users versus deaf non-ED users were age and insurance type (Table 2). In an adjusted analysis, the odds of a deaf individual was 1.97 times as likely to have an ED visit over the past 36 months (odds ratio [OR], 1.97; 95% confidence interval [CI], 1.11–3.51; Table 3) compared to hearing peers.

Other predictors of ED use included being female (OR, 1.82; 95% CI, 1.05–3.15), black (OR, 3.20; 95% CI, 1.25–8.20), and Medicaid status (OR, 2.63; 95% CI, 1.34–5.19). Deaf ASL users were also more likely to experience repeat ED utilization during a 36 month period when compared to the hearing peers ( $p < 0.001$ ; Table 4).

## Discussion

We found that deaf ASL users had a 97% greater likelihood of using the ED over the past 36 months compared with their hearing peers. These effects persisted after controlling for age, sex, race, smoking history, and Medicaid status. Deaf ASL users also were more likely to be repeat users of ED during the 36 month time period. These findings are novel yet, consistent with previous reports that individuals with hearing loss are more likely to use the ED.<sup>12</sup>

Our study did not examine reasons why deaf ASL users went to the ED more often and we can only speculate. Deaf ASL users may be at increased risk for ED utilization due to a variety of factors: a) lower health literacy<sup>13</sup> and low general health knowledge<sup>14–17</sup> may result in a heightened perception for certain symptoms to be alarming and in need of urgent treatment; and b) patient-provider communication breakdowns that limit the deaf individual's ability to appropriately navigate the health care system effectively and to maximize one's health.<sup>18–21</sup> A qualitative review of the ED diagnoses listed showed 48.2% of deaf ED users (vs. 35.1% of hearing) had diagnoses consistent with low condition acuity (e.g. toe contusion, dermatitis, bug bites, and upper respiratory infection). Other possible factors for increased ED utilization among deaf may be cultural barriers between patients and providers and increased accessibility to ASL interpreters in the ED setting. Poorer health status of deaf individuals is a possible cause but one study showed that this is unlikely. There was no difference found with mortality between adults with prelingual deafness and non-deaf adults.<sup>22</sup>

Language and communication barriers contribute to health care marginalization for deaf ASL users.<sup>23</sup> Deaf ASL users may feel more confident in their ability to obtain sign language interpreters in the ED setting in contrast to other health care settings (e.g. urgent care). For example, multiple hospitals in the Rochester, New York region employed sign language interpreters on their hospital staff.

Access to care for the deaf population may also be perceived differently from the general population. For example, simply having a primary care provider to address urgent needs may not suffice for this population. When these individuals request an urgent appointment with their primary care provider, there is a need to also coordinate additional steps with

interpreter agencies to ensure the presence of an interpreter. In many cases, urgent interpreter requests were not always met. This was also a problem even for the health center involved in the study, especially during times when the ASL fluent provider or part time interpreter was not present. The Joint Commission encourages health care sectors, managed care, and federal agencies to prioritize accessible health communication through the use of interpreters and ASL language-concordant providers (when available) and easy to understand health educational materials for deaf ASL users,<sup>24</sup> yet this is frequently problematic due to high costs, interpreter shortages, and lack of awareness with legal obligations to ensure accessible communication by many providers and staff. Many providers inaccurately assume that deaf ASL users are generally proficient in both lip-reading and/or reading English potentially resulting in poor provider-patient communication, trust, and relationship and reduced outpatient visits.<sup>20</sup>

Deaf ASL users' lack of accessible health communication and reduced opportunities for incidental learning opportunities may negatively affect their health knowledge and ability to adequately navigate and interact with the health care system appropriately.<sup>25</sup> Many deaf ASL users (reported to be as high as 90–95%) are born to hearing non-ASL fluent parents which may limit a potentially rich source of health education.<sup>25</sup> Many of these parents fail to learn or become fluent in ASL, thereby limiting the ability to share relevant health information (e.g. family history) to their deaf children.<sup>25</sup> Deaf ASL users comprise a linguistic minority group in America that historically has been excluded from health educational outreaches and is understudied by health researchers.<sup>26</sup> This population also has been considered to be the non-English speaking minority groups at greatest risk for miscommunication with their health providers.<sup>23</sup> Inappropriate use of ED services among deaf individuals may be a contributor to health disparities seen in this population. Further research is needed to study the factors that lead to increased ED utilization among deaf individuals and how these factors can be addressed effectively.

### Strengths and Limitations

The availability of a health center with a diverse panel provided a unique opportunity to evaluate the ED use of deaf ASL users when compared to the general hearing population. The use of the medical records can minimize self-report data limitations.

This study has some limitations. The randomly sample selection was based on language preferences and not matched on demographics or comorbidities. We did not collect morbidity data. Our data do not indicate specifically why deaf individuals are more likely than hearing to use the ED. The data were based on patients from a single non-hospital affiliated health center in Rochester, New York, limiting the generalizability of the study. It also relies on data in the health center's medical records, which may or may not have all ED records from hospitals outside the Rochester region, but this potential limitation is unlikely to differ between the two groups (deaf vs. hearing). Certain variables such as educational attainment were also poorly documented in the majority of patients' records. The same also occurred to a lesser degree with race/ethnicity. The use of a 36-month period, rather than simply a 12-month period, to evaluate ED use was utilized to avoid the limitations of a

smaller sample size. Post hoc analysis demonstrated that a sample size of 720 would be needed to analyze a 12-month period, which was not feasible for our study.

Rochester differs from a number of other deaf communities across America in regards to its higher rate of accessible programs and interpreters. It is reported that Rochester has one of the highest per capita of deaf individuals in America.<sup>27</sup> The designated health center used in this study was unique in the sense that they cared for a larger deaf patient panel than most health centers ever see. The dataset used was obtained from this health center, with its increased familiarity and commitment to achieve language concordance with their deaf ASL using patients. This was provided through the use of a part time sign language interpreter and a part time ASL fluent provider during the time period (2009–2012). This potentially mitigated some of the differences in ED usage rates between deaf and hearing individuals, and the actual disparity may be even greater than what we found, especially if compared to other health centers with less language concordance or cultural awareness. The literature reports that ED use is lower when language concordance is ensured to limited-English proficiency populations.<sup>28</sup> Furthermore, the health center also provided after-hour urgent care appointments, which may not be available at other health centers and may provide another disincentive for ED visits. Despite these limitations, this dataset provides the first ever opportunity to explore some of the key features of deaf individuals in regards to their ED use.

## Conclusion

Deaf American Sign Language users appear to be at greater odds for elevated ED utilization when compared to the general hearing population. Efforts to further understand the drivers for increased ED utilization among deaf ASL users are much needed.

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Table 1

## Sample Demographics.

	Total (n = 400)	Deaf (n = 200)	Hearing (n = 200)	Chi-square p-value
Age (mean and range in years)		45.25 (18–84)	44.9 (18–92)	0.182
18 – 39 years	38.75% (155)	37.50% (75)	40.00% (80)	
40 – 59 years	44.50% (178)	48.50% (97)	40.50% (81)	
60 + years	16.75% (67)	14.00% (28)	19.50% (39)	
Gender				0.961
Female	51.50% (206)	51.50% (103)	51.50% (103)	
Male	48.50% (194)	48.50% (97)	48.50% (97)	
Race				0.195
White	82.86% (290)	86.86% (152)	78.86% (138)	
Black	9.43% (33)	8.00% (14)	10.86% (19)	
Asian	4.57% (16)	3.43% (6)	5.71% (10)	
Other/Mixed	3.14% (11)	1.71% (3)	4.57% (8)	
Ethnicity				0.134
Non-Hispanic	95.42% (333)	97.11% (168)	93.75% (165)	
Hispanic	4.58% (16)	2.89% (5)	6.25% (11)	
Race/Ethnicity				0.070
Non-Hispanic White	81.09% (283)	85.55% (148)	76.70% (135)	
Non-Hispanic Black	9.17% (32)	8.09% (14)	10.23% (18)	
Hispanic/Other/Mixed	9.74% (34)	6.36% (11)	13.07% (23)	
Smoking Status				<b>0.001</b>
Current	16.61% (48)	9.63% (13)	22.73% (35)	
Prior	24.22% (70)	20.00% (57)	27.92% (43)	
Never	59.17% (171)	70.37% (95)	49.35% (76)	
Education				0.155
College degree or above	14.08% (29)	11.11% (10)	16.38% (19)	
Some college	54.85% (113)	51.11% (46)	57.76% (67)	
High school or less	31.07% (64)	37.78% (34)	25.86% (30)	
Insurance				<b>&lt; 0.001*</b>
None	1.50% (6)	1.00% (2)	2.00% (4)	
Medicare	7.25% (29)	12.00% (24)	3.00% (6)	
Medicaid	16.25% (65)	26.00% (52)	6.00% (12)	
Private	75.00% (300)	61.00% (122)	89.00% (178)	
Emergency Department Use In Past 36 Months				<b>&lt;0.001</b>
None	67.50% (270)	59.00% (118)	76.00% (152)	
Once or more	32.50% (130)	41.00% (82)	24.00% (48)	

\* Fisher's exact test. Column percentages reported for deaf and hearing.



**Table 2**

Demographics of Deaf by Emergency Department use (number of times) in the past 36 months.

	Emergency Department Use		Chi-square <i>p</i> -value
	None ( <i>n</i> = 118)	Once or more ( <i>n</i> = 82)	
Age			<b>0.036</b>
18 – 39 years	40.68% (48)	32.93% (27)	
40 – 59 years	41.53% (49)	58.54% (48)	
60 + years	17.8% (21)	8.54% (7)	
Gender			0.426
Female	49.15% (58)	54.88% (45)	
Male	50.85% (60)	45.12% (37)	
Race			0.152
White	90.29% (93)	81.94% (59)	
Black	6.80% (7)	9.72% (7)	
Asian	0.97% (1)	6.94% (5)	
Other/Mixed	1.94% (2)	1.39% (1)	
Ethnicity			1.00*
Non-Hispanic	97.06% (99)	97.18% (69)	
Hispanic	2.94% (3)	2.82% (2)	
Race/Ethnicity			0.204
Non-Hispanic White	89.22% (91)	80.28% (57)	
Non-Hispanic Black	6.86% (7)	9.86% (7)	
Hispanic/Other/Mixed	3.92% (4)	9.86% (7)	
Smoking Status			0.151
Current	5.41% (4)	14.75% (9)	
Prior	18.92% (14)	21.31% (13)	
Never	75.68% (56)	63.93% (39)	
Education			0.5
College degree or above	11.54% (6)	10.53% (4)	
Some college	55.77% (29)	44.74% (17)	
High school or less	32.69% (17)	44.74% (17)	
Insurance			<b>0.017*</b>
None	0.85% (1)	1.22% (1)	
Medicare	10.17% (12)	14.63% (12)	
Medicaid	19.49% (23)	35.37% (29)	
Private	69.49% (82)	48.78% (40)	

\* Fisher's exact test. Column percentages reported for deaf and hearing.

**Table 3**

Adjusted ORs of 1 or more ED visits over 36 months

<b>1 ED Visit Model n=342 Adjusted OR (95% CI)</b>	
<b>Characteristics</b>	
ED Use in the past 36 months	
Hearing	referrent
Deaf	1.97 (1.11–3.51)
Demographics	
Age	0.993 (0.98–1.01)
Gender	
Male	referrent
Female	1.82 (1.05–3.15)
Race	
White	referrent
Black	3.20 (1.25–8.20)
Other	1.14 (0.47–2.76)
Medicaid	2.63 (1.34–5.19)
Not Medicaid	referrent
Current smokers vs. nonsmokers	1.98 (0.93–4.20)
Prior smokers vs. nonsmokers	1.16 (0.59–2.29)

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**Table 4**

## Repeat ED Use in Last 36 Months

	<b>Total</b>	<b>Deaf</b>	<b>Hearing</b>	<b>Chi-square <i>p</i>-value</b>
Repeat ED Use in Last 36 Months				<b>&lt;0.001</b>
None	101 (77.7%)	58 (70.7%)	43 (89.6%)	
1 or more	29 (22.3%)	24 (29.3%)	5 (10.4%)	

\* Fisher's exact test. Column percentages reported for deaf and hearing.

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