Using National Health Interview Survey Data to Demonstrate Disparities Experienced by Deaf People

Steven Barnett, M.D.

University of Rochester Department of Family Medicine • Rochester Prevention Research Center: National Center for Deaf Health Research

Purpose

To identify health disparities in two U.S. deaf populations: adults deaf since childhood and adults who became deaf later in life.

Synopsis

We used National Health Interview Survey (NHIS) data to demonstrate that health and health-care measures differ for deaf adults based on their age-at-onset of deafness. We identified disparities in health, healthcare use, health behaviors, and access to health research. We used these findings to secure further funding to help us understand and address these disparities, including support for the first CDC-funded prevention research center to partner with a disability community in health promotion and disease prevention research.

Background

Deaf people have limited access to health information, healthcare, and health research.

Prior health research about people with hearing loss often presented conflicting findings, possibly because health researchers typically considered all people with hearing loss as one group.

Other research that uses a single group of "people with hearing loss" often mixes together the full range of:

- severity (mild to deaf)
- age-at-onset (birth to presbycusis)
- language preference (signed or spoken)
- laterality (unilateral and bilateral involvement)

NHIS provided the best national data that would permit our analyses of subgroups of people with hearing loss.

The NHIS Hearing Supplement (administered in 1971, 1977, 1990, and 1991) includes data on severity, laterality, and age-at-onset of hearing loss.

The Gallaudet Hearing Scale (GHS) is a five-point scale to rate how well a person can usually hear and understand speech without the use of hearing aids, ranging from the "ability to hear and understand whispered speech" to the "inability to hear or understand any speech."

The Self-Rated Scale (SRS) is a four-point scale to rate hearing ability without the use of hearing aids, ranging from "good" to "deaf." The Hearing Supplement asks the SRS twice, once for each ear.

The NHIS Hearing Supplement asks three age-at-onset questions:

- age when hearing trouble began
- age when serious hearing trouble or deafness began
- age range category (for example, "before or after age 3")

Our research was possible because of the detail provided by the NHIS Hearing Supplement data, coupled with the ability to examine 2 consecutive years of NHIS data (1990 and 1991).

The NHIS Hearing Supplement did not ask directly about American Sign Language (ASL) use.

Adults who became deaf before they developed language (prelingually, age ≤3 years) are the group most likely to communicate with ASL.

Adults who became deaf later in life are likely to continue to communicate with the language they already know.

Theoretical Framework

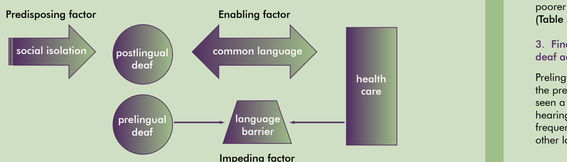
We theorized that age-at-onset of deafness differentially affects language barriers and social isolation, which, in turn, influence healthcare services use.

Social Isolation
People who are socially isolated are more likely to visit the healthcare system than those in the general population. We theorized that U.S. adults deafened later in life, who are more likely to communicate primarily in the spoken language they already know, would find their hearing loss socially isolating.

Language Barriers
We theorized that prelingually deafened adults would have less access to the healthcare system than those in the general population because of language barriers. Having a common language with healthcare practitioners is an enabling factor for healthcare services use.

We also theorized, by contrast, that prelingual deaf adults are more likely to communicate primarily in a sign language, socialize mostly with other deaf people, and not find their hearing loss socially isolating.

Figure 1. Behavioral model of healthcare services use



NHIS Research

Steven Barnett, M.D., and Peter Franks, M.D.

A. Methods

We examined NHIS data from 1990 and 1991, the most recent years to include the NHIS Hearing Supplement. We limited our analyses to adults who were "deaf," using criteria established in previous demographic analyses (Vital Health Statistics, Series 10, Numbers 101 [1975] and 188 [1994]). We classified individuals as deaf if they (1) indicated on the SRS that they at least "had a lot of trouble hearing" in both ears (a SRS score of 3 or greater in each ear) or (2) indicated on the SRS that, at best, they had "a little trouble hearing" in their better ear and indicated on the GHS that they could not hear and understand any speech (a SRS score of 2 or more in each ear and a GHS score of 5). The members of the resulting "deaf study population" have bilateral hearing loss that interferes with their ability to understand speech. We divided this deaf study population into two subpopulations based on whether the hearing loss was prelingual or postlingual. For this dichotomy, we used the responses of deaf adults to the NHIS question regarding the age range for onset of deafness (before or after their third birthday).

Univariate analyses: We used SUDAAN statistical software with a Taylor series approximation method to compute variances that allow adjustment for the multistage probability sampling strategy. The weights provided on the NHIS public use files were used to adjust for survey over-sampling and nonresponse to yield population estimates in the reported analyses. Chi-square tests and analysis of variance were used to examine the univariate relationships between each variable and hearing status (categorized as normal hearing, prelingual deafness, or postlingual deafness).

Variables: Sociodemographic variables included age, sex, race (dichotomized as Caucasian or not), place of residence (dichotomized as whether or not residence is in a metropolitan statistical area defined by the U.S. Office of Management and Budget), marital status (dichotomized as whether or not the individual is currently married but not separated), telephone status (dichotomized as having a telephone or not), education level (categorized as less than 12 years, high school graduate, or beyond high school), and family annual income (four categories: less than $10,000; $10,000–19,999; $20,000–$34,999; and $35,000 or more). Healthcare use variables included whether a doctor had been seen within the preceding 2 years; the number of doctor visits within the preceding year for those with at least one doctor visit (natural logarithm is used to normalize the distribution); and, for women 50 years of age and over, whether a mammogram had been performed within the preceding 2 years. Health behavior variables included whether the individual was a current smoker. Several analyses also adjusted for overall self-reported health status, using the Healthy People 2000 Years of Healthy Life (YHL) measure.

Health status: The YHL measure is constructed from questions on the annual NHIS and is used by the Public Health Service to track the health of the nation during the current decade. The measure assesses health on a continuum from 0.0 (death) to 1.0 (optimal health). The YHL measure is composed of two health domains (self-rated health and role limitations) and considers age and social role. The measure exhibits reasonable validity.

Multivariate analyses: In a series of regression analyses, we examined the impact of the age-at-onset of deafness on healthcare use, telephone ownership, and smoking, adjusting for sociodemographic factors and the health status variable. Prelingual and postlingual deafness were included in the regression analyses as two dummy variables, with the general population as the reference group.

The analyses adjusted for the health status variable and sociodemographic factors that were statistically significant or affected the parameter estimates for the effects of prelingual or postlingual deafness by 10% or more. Logistic regression analyses were used for dichotomous dependent variables, and ordinary linear regression was used for the continuously dependent variables.

Age effect: Because of the difference between the mean age in the postlingually deafened group and the hearing group, we conducted further analyses to examine the effect of age-interaction variables (age-squared and the interaction between age and other key variables). When the interaction between age and the deaf category was significant, we conducted additional analyses, stratified by age group (healthcare use and mortality).

Mortality: We determined mortality rates for the two deaf groups and the hearing group using methods described by the National Center for Health Statistics (NCHS). For those in the 1990 NHIS sample, we derived death rates for 1990 through 1995, and for those in the 1991 NHIS sample, we derived death rates for 1991 through 1995. We looked at the association between survival and deafness using a Cox proportional hazard survival analysis to adjust for potential confounding variables. We analyzed prelingual and postlingual onset-of-deafness separately, with the hearing group as the reference group. We adjusted the survival analyses for age, sex, race, marital status, and education level–the factors that showed a statistically significant effect on survival and affected the parameter estimates for the effects of prelingual or postlingual deafness by 10% or more. Because age and mortality have a non-linear relationship, we also adjusted for age-squared. We performed separate analyses that also adjusted for health status.

B. Findings

1. Findings: Deaf demographics

The age-at-onset of deafness for adults has a bimodal distribution, with peaks before age 1 and around age 60 **(Figure 2)**.

2. Findings: Sociodemographics and health status (univariate analyses)

Prelingual deaf adults are less likely to be married, have less education and lower family income, and report poorer health compared with hearing people **(Table 1)**.

Postlingual deaf adults are older, more likely to be men, Caucasian, not married, live outside a metropolitan statistical area (MSA), have less education and lower family income, and report poorer health compared with hearing people **(Table 1)**.

3. Findings: Healthcare use and prelingual deaf adults (multivariate analyses)

Prelingual deaf adults had fewer doctor visits in the preceding year and were less likely to have seen a doctor in the last 2 years compared with hearing people **(Table 2)**. Poorer health and less frequent physician visits is a pattern seen with other language minority groups in other research.

4. Findings: Healthcare use and postlingual deaf adults (multivariate analyses)

Postlingual deaf adults had more physician visits in the preceding year and were more likely to have seen a doctor in the preceding 2 years compared with hearing adults **(Table 3)**. Postlingual deaf women over age 50 were less likely to have had a mammogram in the preceding 2 years **(Table 3)**. Having poorer health and making more frequent physician visits—but using fewer preventive services—is a pattern observed in other research concerning those with some chronic health problems.

5. Findings: Mortality

We used NHIS data (1990–1991) linked with the National Death Index (1990–1995) in the NHIS Multiple Cause of Death Public Use Data File. Postlingual deafness was associated with higher mortality than the general hearing population in analyses that adjusted for sociodemographics **(Table 4)**. The relationship between postlingual deafness and mortality attenuated and was no longer statistically significant when analyses also adjusted for health status (YHL). Higher mortality for postlingual deaf adults may be related to other chronic health conditions. However, the YHL measure includes items, such as restriction of activities of daily living, which might be affected by deafness. The adjustment for health status with YHL may mask the effect of postlingual deafness on mortality.

6. Findings: Telephone ownership

Prelingual deaf adults were less likely than hearing adults to own a telephone. Postlingual deaf adults were as likely to own a telephone as hearing adults **(Table 5)**. This is consistent with a sociocultural model, where prelingual deaf adults are likely to partner and socialize with other prelingual deaf adults, whereas postlingual deaf adults partner and socialize with the hearing people they knew prior to becoming deaf. Low rates of telephone ownership have implications for public health surveys.

7. Findings: Smoking

Prelingual deaf adults were less likely to smoke, whereas postlingual deaf adults were as likely to smoke as adults in the general U.S. hearing population **(Table 6)**. This finding fits our theoretical framework that late-deafened adults are socioculturally tied to the majority culture, whereas prelingual deaf adults likely comprise a language and sociocultural minority group.

Figure 2. Percent distribution of age-at-onset of deafness for deaf adults

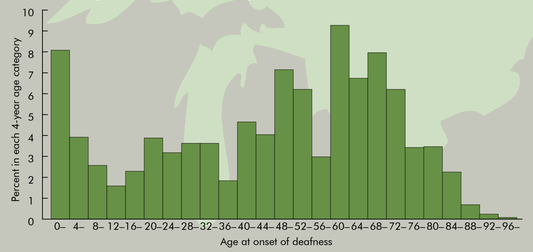


Table 1: Sociodemographic characteristics and health status of the deaf and hearing samples

	Hearing	Prelingual deaf	Postlingual deaf
N (unweighted)	49,546	183	2,545
Age in years	44.0 ± 0.2	44.5 ± 1.5	70.0 ± 0.4
Male	46.9 ± 0.3	48.1 ± 3.6	59.1 ± 1.0
Caucasian	85.1 ± 0.6	91.0 ± 2.4	93.2 ± 0.7
Reside outside MSA	21.5 ± 0.7	23.9 ± 3.3	33.5 ± 1.7
Married (not separated)	66.1 ± 0.4	49.8 ± 4.3	61.3 ± 1.1
Education less than 12 years	20.7 ± 0.4	34.5 ± 4.1	45.5 ± 1.3
Education beyond high school	41.4 ± 0.5	25.3 ± 4.0	24.1 ± 1.1
Family income less than $10,000	27.6 ± 0.6	30.6 ± 3.7	39.6 ± 1.3
Family income greater than $35,000	35.2 ± 0.5	23.8 ± 3.6	19.1 ± 1.1
Health Status Index (YHL)	0.85 ± 0.00	0.68 ± 0.02	0.62 ± 0.01

NOTES: Except for age and Health Status Index, results are percent ± standard error. Age is presented as mean ± standard error. MSA is Metropolitan Statistical Area. YHL is Healthy People 2000 Years of Healthy Life measure (scale 0–1, where 1 is healthy). YHL results are mean ± standard error.

Table 2. Adjusted relationships between healthcare use and prelingual deafness

	Models not adjusted for health status[1]	Models adjusted for health status[1]
Doctor visits—none in the preceding 2 years[2]	1.16 (0.70, 1.92)	2.02 (1.25, 3.25)
Log doctor visits in the preceding year[3]	0.18 (-0.06, 0.42)	-0.22 (-0.36, 0.00)

[1] Health Status Index, Healthy People 2000 Years of Healthy Life (YHL) measure.
[2]Logistic regression analyses, with adjusted odds ratio (95 percent confidence interval).
[3] Linear regression, with estimated coefficients (95 percent confidence interval).
NOTE: Analyses compare prelingual deaf adults with hearing adults, adjusted for age, sex, race, marital status, education level, and income (with and without adjustment for health status).

Table 3. Adjusted relationships between healthcare use and postlingual deafness

	Models not adjusted for health status[1]	Models adjusted for health status[1]
Doctor visits—none in the preceding 2 years[2]	0.60 (0.50, 0.73)	0.81 (0.66, 0.98)
Log doctor visits in the preceding year[3]		
Age 19–44 years	0.48 (0.26, 0.70)	0.17 (-0.03, 0.37)
Age 45–64	0.24 (0.12, 0.36)	0.01 (-0.09, 0.11)
Age > 64	0.22 (0.14, 0.30)	0.05 (-0.01, 0.11)
Mammogram—none in the preceding 2 years[2,4]	1.40 (1.05, 1.86)	1.43 (1.07, 1.92)

[1] Health Status Index, Healthy People 2000 Years of Healthy Life (YHL) measure.
[2] Logistic regression analyses, with adjusted odds ratio (95 percent confidence interval).
[3] Linear regression, with estimated coefficients (95 percent confidence interval).
[4] Women aged 50 and over.
NOTE: Analyses compare postlingual deaf adults with hearing adults, adjusted for age, sex, race, marital status, education level, and income (with and without adjustment for health status).

Table 4. Adjusted relationship between mortality and age-at-onset of deafness for adults

	Models not adjusted for health status[1]	Models adjusted for health status[1]
Prelingual deaf adults	0.97 (0.58, 1.64)	0.82 (0.48, 1.41)
Postlingual deaf adults		
Age 19–64 years	1.32 (1.05, 1.64)	1.05 (0.84, 1.32)
Age > 64	1.15 (1.03, 1.27)	0.99 (0.88, 1.10)

[1] Health Status Index, Healthy People 2000 Years of Healthy Life (YHL) measure.
NOTE: Cox proportional hazard survival analyses compare deaf and hearing adults, adjusted for age, age-squared, sex, race, marital status, and education level (with and without adjustment for health status). We show hazard ratio with 95% confidence interval.

Table 5: Adjusted relationship between telephone ownership and age-at-onset of deafness

Prelingual deaf adults	0.35 (0.15, 0.82)
Postlingual deaf adults	1.00 (0.78, 1.28)

NOTE: Logistic regression analyses compare each deaf adult group to hearing adults, adjusted for age, sex, race, marital status, education level, and health status (Health Status Index, Healthy People 2000 Years of Healthy Life [YHL] measure). We show adjusted odds ratio with 95% confidence interval.

Table 6. Adult smoking and age-at-onset of deafness

	Hearing	Prelingual deaf	Postlingual deaf
Smokers, current, percent ± standard error	26.3 ± 0.4	17.0 ± 5.4	19.3 ± 1.4
Adjusted odds ratio with 95% confidence interval[1]	----	0.48 (0.23,0.99)	1.07 (0.86, 1.33)

[1]Logistic regression analyses, adjusted for age, sex, race, marital status, education level, income, and health status (Health Status Index, Healthy People 2000 Years of Healthy Life [YHL] measure).

Dissemination

Publications

Barnett S, Franks P. Health care utilization and adults who are deaf: Relationship with age at onset of deafness. Health Serv Res 37:105–20. 2002.

Barnett S, Franks P. Smoking and deaf adults: Associations with age at onset of deafness. Am Ann Deaf 144(1):44–50. 1999.

Barnett S, Franks P. Telephone ownership and deaf people: Implications for telephone surveys. Am J Public Health 89:1754–6. 1999.

Barnett S, Franks P. Deafness and mortality: Analyses of linked data from the National Health Interview Survey and National Death Index. Public Health Rep 114:330–6. 1999.

Presentations

Barnett S, Franks P. Healthcare utilization by prelingually and postlingually deafened adults: A new look at the 1990–1991 National Health Interview Survey. Poster presented at: The Public Health Conference on Records and Statistics and Data Users Conference, Washington, D.C., July 30, 1997.

Barnett S, Franks P. Healthcare utilization by prelingually and postlingually deafened adults: A new look at the 1990–1991 National Health Interview Survey. Poster presented at: The American Public Health Association Annual Meeting; Indianapolis, IN., November 12, 1997.

Barnett S. Hearing loss and conflicting health services research findings: Who are we studying? Presented at: The American Public Health Association Annual Meeting; Washington, D.C., November 17, 1998.

Barnett S, Franks P. Deaf people and smoking: Association with age at onset of deafness. Poster presented at: The American Public Health Association Annual Meeting; Washington, D.C., November 18, 1998.

Barnett S. Healthcare experiences of adults deaf since childhood: A review of the research. Presented at: CDC Early Hearing Detection and Intervention Conference; Atlanta, GA., March 3, 2005.

Conclusions

Our analyses of NHIS data identified new avenues for research that led to resources for researcher-community collaborations that will continue to be instrumental in identifying and addressing health and healthcare disparities experienced by deaf people and their families.

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Contact Information

Steven Barnett, M.D.

University of Rochester Department of Family Medicine
Family Medicine Research Programs

1381 South Ave, Rochester NY 14620

Voice: (585) 506-9484 ext 110
TTY: (585) 461-4902
Fax: (585) 473-2245

Steven_Barnett@URMC.Rochester.edu

Winner: Poster contest commemorating the National Health Interview Survey's 50th anniversary.