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The Demographics of American Deafness from the National Health Interview Survey, 1997-2003*

Ross E. Mitchell

Gallaudet Research Institute

Gallaudet University

800 Florida Avenue, NE

Washington, DC 20002-3695

(Voice/TTY) 202-651-5576

e-mail: ross.mitchell@gallaudet.edu

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Abstract

The National Health Interview Survey (NHIS) is one of a few national surveys that regularly collects data identifying the American population of persons with hearing loss or deafness. As far as it relates to trouble hearing normal conversation, without a hearing aid, estimates from the NHIS (1997-2003) indicate that roughly than one in eight Americans (about 35,000,000) have at least a little trouble hearing. More than one third of all persons with any degree of hearing trouble or deafness are 65 or older and less than seven percent are under 18 years of age. However, fewer than one in forty Americans have a lot of trouble hearing or are deaf, more than half of whom are 65 or older and less than five percent of whom are under 18 years of age; nearly 6,000,000 report having a lot of trouble hearing, and close to 600,000 are deaf.

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In the United States, the longest running annual effort to collect nationally representative data on hearing loss and deafness has been sustained by the U.S. Public Health Service in the form of its National Health Interview Survey (hereafter, NHIS; Botman, Moore, Moriarty, & Parsons, 2000; National Center for Health Statistics, 1963; Schein & Delk, 1974). This article presents estimates of the number of persons reporting some degree of trouble hearing or deafness from an analysis of the most recent (1997-2003) NHIS public-use data files. Careful attention is given to the age distribution of the three levels of hearing trouble reported to the NHIS: a little trouble, a lot of trouble, or deaf. By taking advantage of recent NHIS design changes (Botman, Moore, Moriarty, & Parsons, 2000), fully and consistently implemented since the 1997 NHIS, population estimates are obtained with a level of statistical reliability not previously attainable. This improved reliability is noteworthy because other national surveys are unable to provide estimates of the number of deaf persons, by age group, particularly estimates of the number of deaf children in the United States (Mitchell, 2006).

Who Counts as Deaf?

As discussed by Mitchell (2006), surveys of the prevalence of deafness in the United States differ not only in their sampling methodology, but in their definition of deafness. In the case of the NHIS, adult respondents evaluate their own hearing in response to the following prompt:

> Which statement best describes your hearing without a hearing aid: good, a little trouble, a lot of trouble, or deaf? (National Center for Health Statistics, 2003a,

Question CAN.420; adults respond as proxies for children in the same household, see National Center for Health Statistics, 2003b, Question CHS.250)

This differs from the Survey of Income and Program Participation (SIPP), for example, because the SIPP requests judgments specifically about hearing normal conversation *even with a hearing aid* (see Mitchell, 2006). In other words, regardless of sample design differences, the demography of deafness in the United States based upon the NHIS does not provide the same profile as that obtained from the SIPP because deafness is not defined identically across both surveys.

The NHIS, with its roots in the U.S. Public Health Service, is more an audiological survey than, say, the SIPP, which traces its history to a colloboration between the Social Security Administration and the U.S. Census Bureau (see U.S. Bureau of the Census, 1986), because it does not limit the description of hearing trouble to how well a person can hear human speech or normal conversation (also see Schein, 1989). Nonetheless, the problem of self-identification with hearing trouble introduces a basic social-psychological-labeling element (Hale, 2001; also see Mitchell, 2006). As noted, respondents may select the label "deaf" to indicate their degree of hearing trouble. This alternative response exists not only as an extreme case of hearing trouble, but also because people who are born deaf or who experience hearing loss before acquiring spoken language often do not identify themselves as having any hearing trouble; they identify themselves as deaf. These respondents understand the referent to hearing trouble to mean that they had hearing which is now troublesome. But such a perspective does not apply to this small group of respondents because they could never hear. They are not troubled by their hearing; they are deaf.

It turns out that the NHIS does not routinely collect some data highly relevant to the experience of deafness. Namely, the timing of hearing loss, called the age at onset (see, e.g., Schein, 1989), is not recorded annually.

Conduct and Design of the NHIS

The NHIS employs a multi-stage, stratified, cluster sampling design (see Westat, 2001, for details). It is cross-sectional in time. Though the precise numbers varied from year to year from 1997 to 2003, especially a reduction in 2003 due to budget shortfall, annual samples included about 29,532 sample units (households) with a total of 69,413 persons (ages 0 to 89); however, on average, about 3.4% of the eligible persons were not interviewed each year. Again, all adults responded for themselves, but all data for children under age 18 were obtained through proxy interviews.

The 1997-2003 NHIS public-use data files were downloaded from the NCHS web site and extracted into SPSS data files using the specifications (syntax files) provided. File-specific, person-level weights are assigned to each respondent. These weights are multipliers that increase or decrease the contribution of each individual's responses in proportion to their expected prevalence based on the sample design so that nationally representative estimates for the civilian non-institutionalized resident population can be obtained (i.e., does not include persons who are incarcerated, institutionalized, on military bases, or outside of the United States). Following the recommendations for analysis of NHIS public-use data files,[1] sample strata and primary sampling units, with replacement, were specified using the SPSS 13 Complex Samples module to calculate standard errors for the population estimates. These design-effect adjustments are necessary because the complex sample design employed by the NHIS increases the measurement

[1] Recommendations were provided to the author and all other attendees of the 2004 CDC/NCHS National Health Interview Survey Workshop, Hyattsville, Maryland.

error associated with each estimate when compared to the errors that would be calculated if respondents had been sampled randomly without regard to population clustering or assuring that persons from all significant social strata were included. For illustrative purposes, 95% confidence intervals are calculated (estimate ± 1.960×standard error) to highlight just how far away point estimates based upon the NHIS sample may be from the true numbers of persons in the population.

Findings from the NHIS

According to the estimates in Table 1, about 35,000,000 (35,168,095 ± 491,406) people have at least a little trouble hearing (12.8% of the population, or 128 per 1,000). However, if estimates are restricted to those who have a lot of trouble hearing or are deaf, then the number drops precipitously to less than 7,000,000 (6,611,821 ± 432,052, which is 2.4% of the population, or 24 per 1,000). About 600,000 (612,271 ± 43,403) are deaf (0.22% of the population, or about 2 per 1,000). Also shown are the estimated number of persons for whom no information about hearing trouble is known or available (i.e., refused, not ascertained, or don't know).

A bar graph displaying the percentages of persons by hearing trouble and age group, is shown in Figure 1 (percentage estimates are printed above each bar). Ninety-percent confidence-interval error bars are included in the figure. Except for the group of deaf young children (<6 years of age), where the size of the standard error is 48% of the estimate itself, the standard error of the estimate for each age group of deaf persons is no more than one-fourth of the value of the estimate itself. Though the magnitudes of the standard errors are large enough to leave room for uncertainty about the true population size, they remain small enough to have confidence that, with the exception of deaf young children, the point estimates are the right order of magnitude.

Table 1. Number of persons by level of hearing trouble and age group, annually weighted average, United States, 1997-2003.

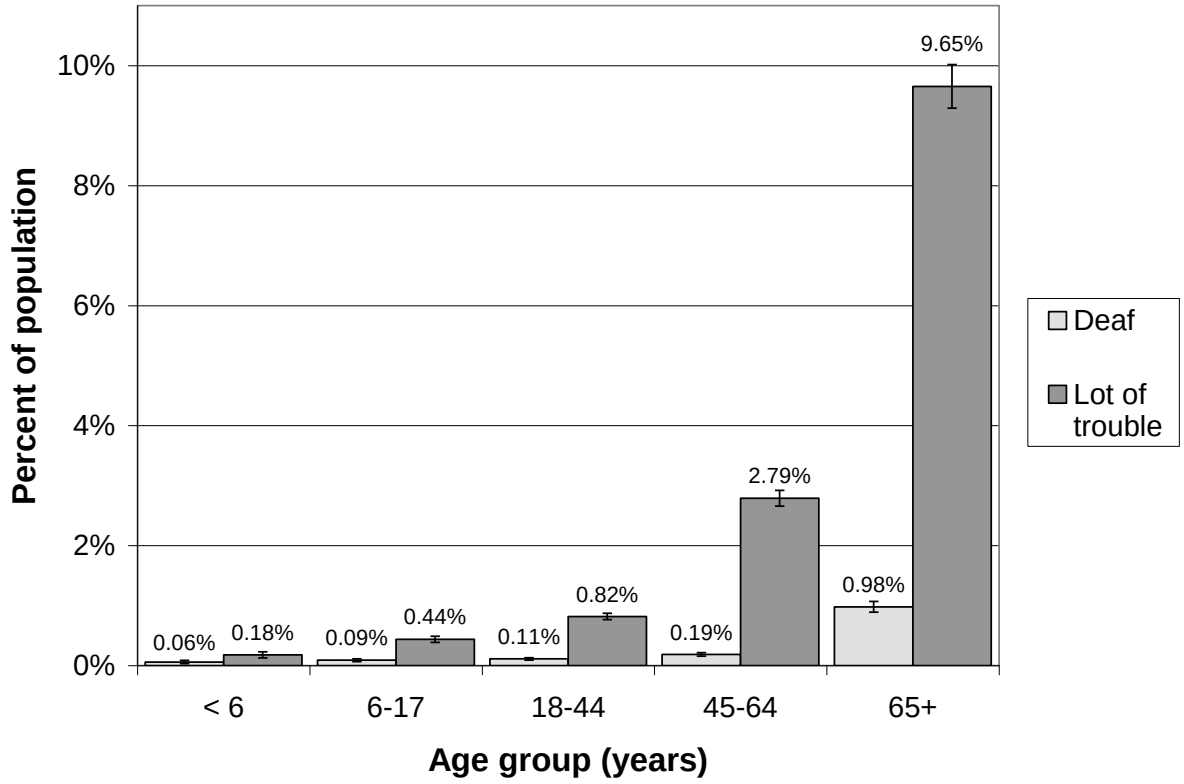
Description of Hearing without Hearing Aid	Age (years) Under 6	6 to 17	18 to 44	45 to 64	65 & older	Total
Good	23,255,927	46,688,653	100,053,654	49,245,492	19,993,338	239,237,063
	(244,104)	(433,717)	(839,245)	(440,766)	(260,062)	(1,716,737)
Little trouble	373,785	1,582,320	7,591,076	9,762,796	9,246,298	28,556,274
	(21,835)	(48,363)	(132,081)	(144,894)	(152,688)	(327,984)
Lot of trouble	42,611	212,344	889,269	1,696,446	3,158,880	5,999,550
	(7,370)	(15,432)	(35,305)	(49,068)	(72,233)	(107,505)
Deaf	14,169	43,490	121,370	112,624	320,618	612,271
	(4,140)	(6,690)	(13,068)	(10,605)	(17,904)	(26,315)
Refused	6,984	10,201	15,739	27,271	19,529	79,724
	(3,042)	(3,444)	(3,928)	(5,262)	(4,160)	(9,538)
Not ascertained	1,358	0	1,837	2,486	4,333	10,014
	(1,358)	(n/a)	(955)	(1,127)	(2,014)	(2,946)
Don't know	44,240	19,222	22,963	30,414	54,249	171,089
	(7,060)	(4,267)	(6,605)	(7,438)	(9,234)	(20,099)
Total	23,739,074	48,556,229	108,695,909	60,877,529	32,797,244	274,665,984
	(250,206)	(451,374)	(892,136)	(533,082)	(397,701)	(1,920,043)

Source: 1997-2003 National Health Interview Survey public-use sample adult person and sample child person data files.

Note: Estimates are obtained by weighting each year's data equally, a one-seventh contribution to the total from each of the individual years 1997 through 2003, so that the total population of the United States, as defined, remains accurate (in this case, closest to the total non-institutionalized civilian population for 2000).
Standard errors are given in parentheses.

For over a century now, various U.S. census and survey efforts have identified substantial age variation in the population of persons with hearing loss or deafness (see, e.g., Best, 1943; Ries, 1994; Schein & Delk, 1974). The findings presented here, based on analysis of recent years' NHIS, confirm this pattern of age variation (see Figure 1). The absence of age at onset data, however, does not prevent making inferences about the time dependent nature of hearing

Figure 1. Percentage of persons with a lot of trouble hearing or deaf by age group, annually weighted average, United States, 1997-2003



Source: 1997-2003 National Health Interview Survey public-use sample adult person and sample child person data files.

loss or deafness. The dramatic growth in prevalence with increasing age, even with increasing life spans (see, e.g., Arias, 2002) and possible cohort effects (e.g., the maternal rubella "bulge" associated with the 1964-65, 1958-59, 1952-53, 1943-44, and 1935-36 birth cohorts; see, e.g., Brown, 1986; Preblud, Hinman, & Herrmann, 1980), could only occur if an increasing number of people are becoming hard of hearing or functionally deaf over their lifetimes. In other words, there is no way that these numbers would occur solely due to people being born into the

population with hearing loss. Further, despite relatively high rates of immigration into the United States since the 1960s (see, e.g., Graham, 2002), there is no evidence that geographical migration could possibly account for the *more than twenty-fold increase* in prevalence of hearing loss and deafness between childhood (ages 6-17) and late adulthood (ages 65 and older).

The NHIS Answer to "How Many Deaf?"

The NHIS provides fairly tight estimates for the number of deaf persons for most age groups, except young children (under age 6). Sampling rare populations is very difficult to do. Obtaining highly reliable estimates for the rarest of persons with deafness, namely children and those who identified as deaf, requires a different methodology than that employed by the NHIS, one that raises the probability of sampling the rare population (see, e.g., Kalton & Anderson, 1986; Schein & Delk, 1974). Nonetheless, the estimates obtained from the NHIS are reasonable given previous research (e.g., National Academy on an Aging Society, 1999; Niskar et al., 1998; Ries, 1994; Schein & Delk, 1974), so long as the exact nature of the questions asked is kept in mind.

In sum, as far as it relates to hearing trouble without a hearing aid, estimates from the NHIS indicate that about one in eight Americans has at least a little trouble hearing. In round numbers, there are nearly 35,000,000 persons with some degree of hearing trouble, but less than 7,000,000 with a lot of trouble or are deaf, and far fewer, close to 600,000, are deaf. More than one third of all persons with hearing loss or deafness are 65 or older and less than seven percent are under 18 years of age. But when it comes to those who are identified as deaf, more than half are 65 or older and the share being children (under age 18) increases to more than nine percent.

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