Supplement

Table S1. Number of audiograms (cumulative percent) by year and service branch. The Army and Marine Corp began population-level surveillance in 2006 and 2012, respectively. Air Force and Navy only enroll military personnel in the hearing conservation program who are deemed noise exposed (Nelson, 2017).

Year	Army Number Audiograms (Cumulative %)	Air Force Number Audiograms (Cumulative %)	Marine Corps Number Audiograms (Cumulative %)	Navy Number Audiograms (Cumulative %)
2001	0 *(0.0)*	0 *(0.0)*	2 *(0.5)*	0 *(0.0)*
2002	0 *(0.0)*	0 *(0.0)*	2 *(0.9)*	2 *(0.6)*
2003	4 *(0.2)*	2 *(1.2)*	6 *(2.3)*	8 *(3.2)*
2004	22 *(1.5)*	4 *(3.6)*	10 *(4.7)*	10 *(6.4)*
2005	38 *(3.8)*	4 *(6.0)*	2 *(5.1)*	2 *(7.0)*
2006	64 *(7.5)*	2 *(7.1)*	12 *(7.9)*	12 *(10.8)*
2007	106 *(13.7)*	8 *(11.9)*	24 *(13.5)*	12 *(14.7)*
2008	120 *(20.8)*	12 *(19.1)*	22 *(18.7)*	20 *(21.0)*
2009	192 *(32.0)*	18 *(29.8)*	32 *(26.1)*	16 *(26.1)*
2010	234 *(45.8)*	20 *(41.7)*	32 *(33.6)*	38 *(38.2)*
2011	242 *(60.0)*	26 *(57.1)*	50 *(45.2)*	48 *(53.5)*
2012	216 *(72.7)*	21 *(69.6)*	94 *(67.1)*	37 *(65.3)*
2013	192 *(83.9)*	16 *(79.2)*	65 *(82.3)*	36 *(76.8)*
2014	121 *(91.0)*	16 *(88.7)*	50 *(93.9)*	39 *(89.2)*
2015	105 *(97.2)*	13 *(96.4)*	19 *(98.4)*	20 *(95.6)*
2016	44 *(99.8)*	4 *(98.8)*	7 *(100.0)*	14 *(100)*
2017	4 *(100.0)*	2 *(100.0)*	0 *(100.0)*	0 *(100)*
Total	1704 -	168 -	429 -	314 -

Statistical Analysis Supplement

The unit of analysis is the audiogram. Let $\underline{y}_i$ denote the ith observed audiogram, i=1…2597, composed of pure tone thresholds elicited at 0.5, 1, 2, 3, 4, and 6 kHz in 490 Service Member ears. We assume a multivariate normal model for the audiograms $\underline{y}_i \sim N_6\left(\underline{\mu}_i, \Sigma\right)$, with $\underline{\mu}_i = \left\{\mu_i^{0.5}, \mu_i^1, \mu_i^2, \mu_i^3, \mu_i^4, \mu_i^6\right\}^T$. Σ is given a first-order autoregressive structure with heterogenous variances, denoted ARH(1), such that

$$\Sigma = \begin{pmatrix} \sigma_{0.5}^2 & \sigma_{0.5}\sigma_1\rho & \sigma_{0.5}\sigma_2\rho^2 & \sigma_{0.5}\sigma_3\rho^3 & \sigma_{0.5}\sigma_4\rho^4 & \sigma_{0.5}\sigma_6\rho^5 \\ \sigma_{0.5}\sigma_1\rho & \sigma_1^2 & \sigma_1\sigma_2\rho & \sigma_1\sigma_3\rho^2 & \sigma_1\sigma_4\rho^3 & \sigma_1\sigma_6\rho^4 \\ \sigma_{0.5}\sigma_2\rho^2 & \sigma_1\sigma_2\rho & \sigma_2^2 & \sigma_2\sigma_3\rho & \sigma_2\sigma_4\rho^2 & \sigma_2\sigma_6\rho^3 \\ \sigma_{0.5}\sigma_3\rho^3 & \sigma_1\sigma_3\rho^2 & \sigma_2\sigma_3\rho & \sigma_3^2 & \sigma_3\sigma_4\rho & \sigma_3\sigma_6\rho^2 \\ \sigma_{0.5}\sigma_4\rho^4 & \sigma_1\sigma_4\rho^3 & \sigma_2\sigma_4\rho^2 & \sigma_3\sigma_4\rho & \sigma_4^2 & \sigma_4\sigma_6\rho \\ \sigma_{0.5}\sigma_6\rho^5 & \sigma_1\sigma_6\rho^4 & \sigma_2\sigma_6\rho^3 & \sigma_3\sigma_6\rho^2 & \sigma_4\sigma_6\rho & \sigma_6^2 \end{pmatrix}.$$

We define $\underline{\mu}_i = \underline{X}_i \cdot \underline{\beta} + \underline{\delta}_{S[i]} + 1_6 \cdot \theta_{SE[i]}$, where 1_6 is a column vector of ones. The bracket notation identifies the index attached to the ith audiogram. For example, $S[i]$ identifies the Sth subject providing the ith audiogram. $\underline{X}_i$ corresponds to the fixed effects in the model (see Table X). β is the fixed effects parameter vector. We also assume a multivariate normal model for the subject-specific random effects $\underline{\delta}_S \sim N_6(0, \tau)$, with $\underline{\delta}_S = \{\delta^{0.5}, \delta^1, \delta^2, \delta^3, \delta^4, \delta^6\}_S$ and where τ is ARH(1). $\theta_{SE[i]}$ is a random subject-ear effect that is constant across frequencies for the Eth ear of the Sth subject.

Each ith audiogram provides 6x70 matrix ($\underline{X}_i$) of covariates, one row per frequency, described in Table X. Elements are constant down rows, within columns, unless the

column pertains to a stimulus frequency. For the ith audiogram, we define the 6x70 matrix $\underline{X}_i$ as:

Column	Description of Fixed Effect
1	1's for the intercept
2	Age
3	Service branch: 1 if Army, 0 otherwise
4	Service branch: 1 if Marine Corps, 0 otherwise
5	Service branch: 1 if Navy, 0 otherwise
6	Service branch: 1 if Air Force, 0 otherwise
7	Log_2 frequency
8	Log_2 frequency^2
9	2-way interaction: age x Log_2 frequency
10	2-way interaction: age x Log_2 frequency^2
11	Cumulative exposure to basic training
12	Cumulative exposure to an occupation with a low noise exposure rank
13	Cumulative exposure to an occupation with a moderate noise exposure rank
14	Cumulative exposure to an occupation with a high noise exposure rank
15	2-way interaction: cumulative exposure to basic training, Log_2 frequency
16	2-way interaction: cumulative exposure to basic training x Log_2 frequency^2
17	2-way interaction: cumulative exposure to basic training x Army
18	2-way interaction: cumulative exposure to basic training x Marine Corps
19	2-way interaction: cumulative exposure to basic training x Navy
20	2-way interaction: cumulative exposure to basic training x Air Force
21	3-way interaction: cumulative exposure to basic training x Army x Log_2 frequency
22	3-way interaction: cumulative exposure to basic training x Marine Corps x Log_2 frequency
23	3-way interaction: cumulative exposure to basic training x Navy x Log_2 frequency
24	3-way interaction: cumulative exposure to basic training x Air Force x Log_2 frequency
25	3-way interaction: cumulative exposure to basic training x Army x Log_2 frequency^2
26	3-way interaction: cumulative exposure to basic training x Marine Corps x Log_2 frequency^2
27	3-way interaction: cumulative exposure to basic training x Navy x Log_2 frequency^2
28	3-way interaction: cumulative exposure to basic training x Air Force x Log_2 frequency^2
29	2-way interaction: cumulative exposure to an occupation with a low noise exposure rank x Log_2 frequency
30	2-way interaction: cumulative exposure to an occupation with a low noise exposure rank x Log_2 frequency^2

31	2-way interaction: cumulative exposure to an occupation with a low noise exposure rank x Army
32	2-way interaction: cumulative exposure to an occupation with a low noise exposure rank x Marine Corps
33	2-way interaction: cumulative exposure to an occupation with a low noise exposure rank x Navy
34	2-way interaction: cumulative exposure to an occupation with a low noise exposure rank x Air Force
35	3-way interaction: cumulative exposure to an occupation with a low noise exposure rank x Army x Log_2 frequency
36	3-way interaction: cumulative exposure to an occupation with a low noise exposure rank x Marine Corps x Log_2 frequency
37	3-way interaction: cumulative exposure to an occupation with a low noise exposure rank x Navy x Log_2 frequency
38	3-way interaction: cumulative exposure to an occupation with a low noise exposure rank x Air Force x Log_2 frequency
39	3-way interaction: cumulative exposure to an occupation with a low noise exposure rank x Army x Log_2 frequency^2
40	3-way interaction: cumulative exposure to an occupation with a low noise exposure rank x Marine Corps x Log_2 frequency^2
41	3-way interaction: cumulative exposure to an occupation with a low noise exposure rank x Navy x Log_2 frequency^2
42	3-way interaction: cumulative exposure to an occupation with a low noise exposure rank x Air Force x Log_2 frequency^2
43	2-way interaction: cumulative exposure to an occupation with a moderate noise exposure rank x Log_2 frequency
44	2-way interaction: cumulative exposure to an occupation with a moderate noise exposure rank x Log_2 frequency^2
45	2-way interaction: cumulative exposure to an occupation with a moderate noise exposure rank x Army
46	2-way interaction: cumulative exposure to an occupation with a moderate noise exposure rank x Marine Corps
47	2-way interaction: cumulative exposure to an occupation with a moderate noise exposure rank x Navy
48	2-way interaction: cumulative exposure to an occupation with a moderate noise exposure rank x Air Force
49	3-way interaction: cumulative exposure to an occupation with a moderate noise exposure rank x Army x Log_2 frequency
50	3-way interaction: cumulative exposure to an occupation with a moderate noise exposure rank x Marine Corps x Log_2 frequency
51	3-way interaction: cumulative exposure to an occupation with a moderate noise exposure rank x Navy x Log_2 frequency
52	3-way interaction: cumulative exposure to an occupation with a moderate noise exposure rank x Air Force x Log_2 frequency
53	3-way interaction: cumulative exposure to an occupation with a moderate noise exposure rank x Army x Log_2 frequency^2

54	3-way interaction: cumulative exposure to an occupation with a moderate noise exposure rank x Marine Corps x Log$_2$ frequency^2
55	3-way interaction: cumulative exposure to an occupation with a moderate noise exposure rank x Navy x Log$_2$ frequency^2
56	3-way interaction: cumulative exposure to an occupation with a moderate noise exposure rank x Air Force x Log$_2$ frequency^2
57	2-way interaction: cumulative exposure to an occupation with a high noise exposure rank x Log$_2$ frequency
58	2-way interaction: cumulative exposure to an occupation with a high noise exposure rank x Log$_2$ frequency^2
59	2-way interaction: cumulative exposure to an occupation with a high noise exposure rank x Army
60	2-way interaction: cumulative exposure to an occupation with a high noise exposure rank x Marine Corps
61	2-way interaction: cumulative exposure to an occupation with a high noise exposure rank x Navy
62	2-way interaction: cumulative exposure to an occupation with a high noise exposure rank x Air Force
63	3-way interaction: cumulative exposure to an occupation with a high noise exposure rank x Army x Log$_2$ frequency
64	3-way interaction: cumulative exposure to an occupation with a high noise exposure rank x Marine Corps x Log$_2$ frequency
65	3-way interaction: cumulative exposure to an occupation with a high noise exposure rank x Navy x Log$_2$ frequency
66	3-way interaction: cumulative exposure to an occupation with a high noise exposure rank x Air Force x Log$_2$ frequency
67	3-way interaction: cumulative exposure to an occupation with a high noise exposure rank x Army x Log$_2$ frequency^2
68	3-way interaction: cumulative exposure to an occupation with a high noise exposure rank x Marine Corps x Log$_2$ frequency^2
69	3-way interaction: cumulative exposure to an occupation with a high noise exposure rank x Navy x Log$_2$ frequency^2
70	3-way interaction: cumulative exposure to an occupation with a high noise exposure rank x Air Force x Log$_2$ frequency^2