Creating an input model outlining hearing loss etiologies and treatment modalities

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Introduction

A gap in literature exists on the epidemiological data surrounding probabilities of acquiring sensorineural or conductive hearing loss by various etiologies: infectious, environmental, congenital, toxicity, and trauma. Along with this, appropriate treatment modalities and their economic impact are further being investigated.

Objective

The aim of this study was to identify etiologies and prevalence of both conductive and sensorineural hearing loss, and determine appropriate treatment modalities, along with their economic burden, in order to construct a Markov microsimulation input model.

Methods and Materials

- A literature search was conducted to determine the varying rates of US hearing loss prevalence, stratified by etiology, age, and sex.
- Using these rates, a model was created based on various health states which depended on presence of hearing loss, type of hearing loss (sensorineural or conductive), and treatment modality (cochlear implant, hearing aid, or none).
- A high-quality estimate of overall hearing loss prevalence by age group was used.
- We removed the proportion of hearing loss estimated to be conductive (by age group) and separated M/F prevalence using age-specific risk ratios.
- Simulated patients experienced yearly probabilities of acquiring sensorineural hearing loss, worsening of SNHL severity, acquiring CHL, cure of CHL, and going on/off treatment.
- The model accumulated utility for time spent in each of these health states, along with patient direct (medical) and indirect (lost productivity) costs.
- Transition probabilities for going on or off treatment were based on the hearing loss cascade of care. Yearly transition probabilities were based on age-specific incidence of hearing loss and the hearing loss cascade of care.

Results

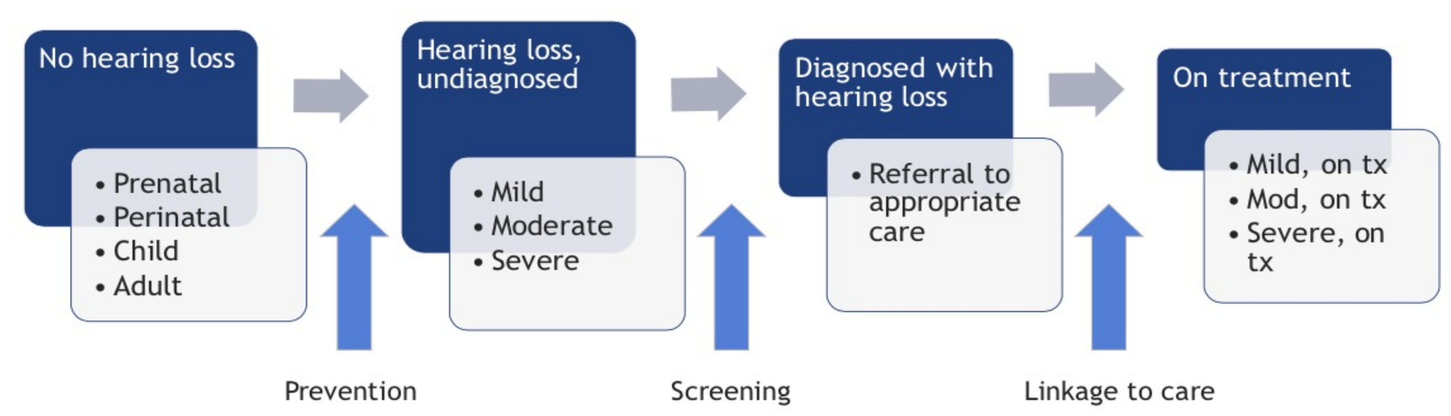

Figure 1. Hearing loss cascade of care..

	Proportion Conductive	Bilateral SNHL Prevalence	Bilateral CHL Prevalence
12-19 y	*0.1*	*0.16*	*0.02*
20-29 y	*0.07*	*0.39*	*0.03*
30-39 y	*0.05*	*2.51*	*0.13*
40-49 y	*0.03*	*6.33*	*0.20*
50-59 y	0.01	13.16	0.13
60-69 y	0.01	26.53	0.27
70-79 y	0.01	54.07	0.55
≥80 y	0.01	80.66	0.81

Table 1. Age-specific prevalence of bilateral sensorineural and conductive hearing loss.

Age	M Prev	F Prev	RR
12-19 y	0.16	0.16	1
20-29 y	0.39	0.39	1
30-39 y	2.51	2.51	1
40-49 y	9.70	3.03	3.21
50-59 y	20.29	6.33	3.21
60-69 y	37.18	16.90	2.20
70-79 y	66.45	43.71	1.52
≥80 y	86.39	77.00	1.12

Table 2. Sensorineural hearing loss separated by M/F prevalence and age-specific risk ratios.

Discussion

Treatment for SNHL and CHL are similar, but the model must further consider some key differences: a potential cure for certain CHL cases, differential costs of CHL management (such as occasional surgery), and potentially different utility values (such as chronic OE). We will want to separate out age- and sex-specific incidences of SNHL and CHL. We will also want to model OM/OME as a separate yearly probability as there is high chance of resolution in the first year.

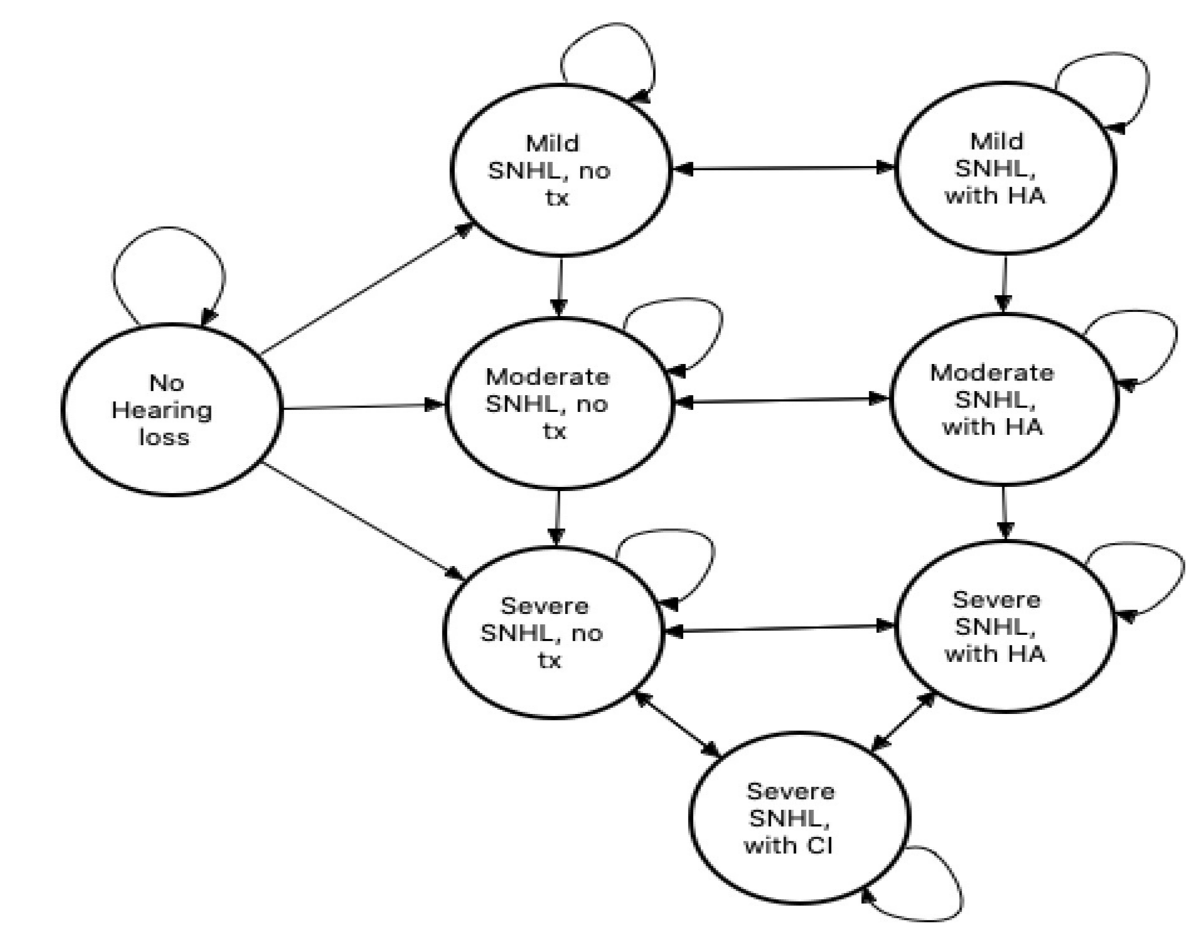

Figure 2. Visual model of hearing loss type and appropriate treatment modalities.

References

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