Addressing the Global Burden of Hearing Loss

Ethan D. Borre, Haley Cionfolo, Mohini Johri, Kamaria Kaalund, Elizabeth Kayzman, Megan Knauer, Brenna Morley, Minahil Shahid, Juliana Shank, Yajur Sriraman, Jacquelin Vicksman, Emily Xu, Danah Younis, Anna Zolotor, Osondu Ogbuoji, Gillian D. Sanders Schmidler

Duke University

Duke University · EHD Bass Connections Education & Human Development

Duke | Robert J. Margolis, MD Center for Health Policy

Decision Modeling Aims

Our model: Decision model of the Burden of Hearing loss Across the Lifespan (DeciBHAL)
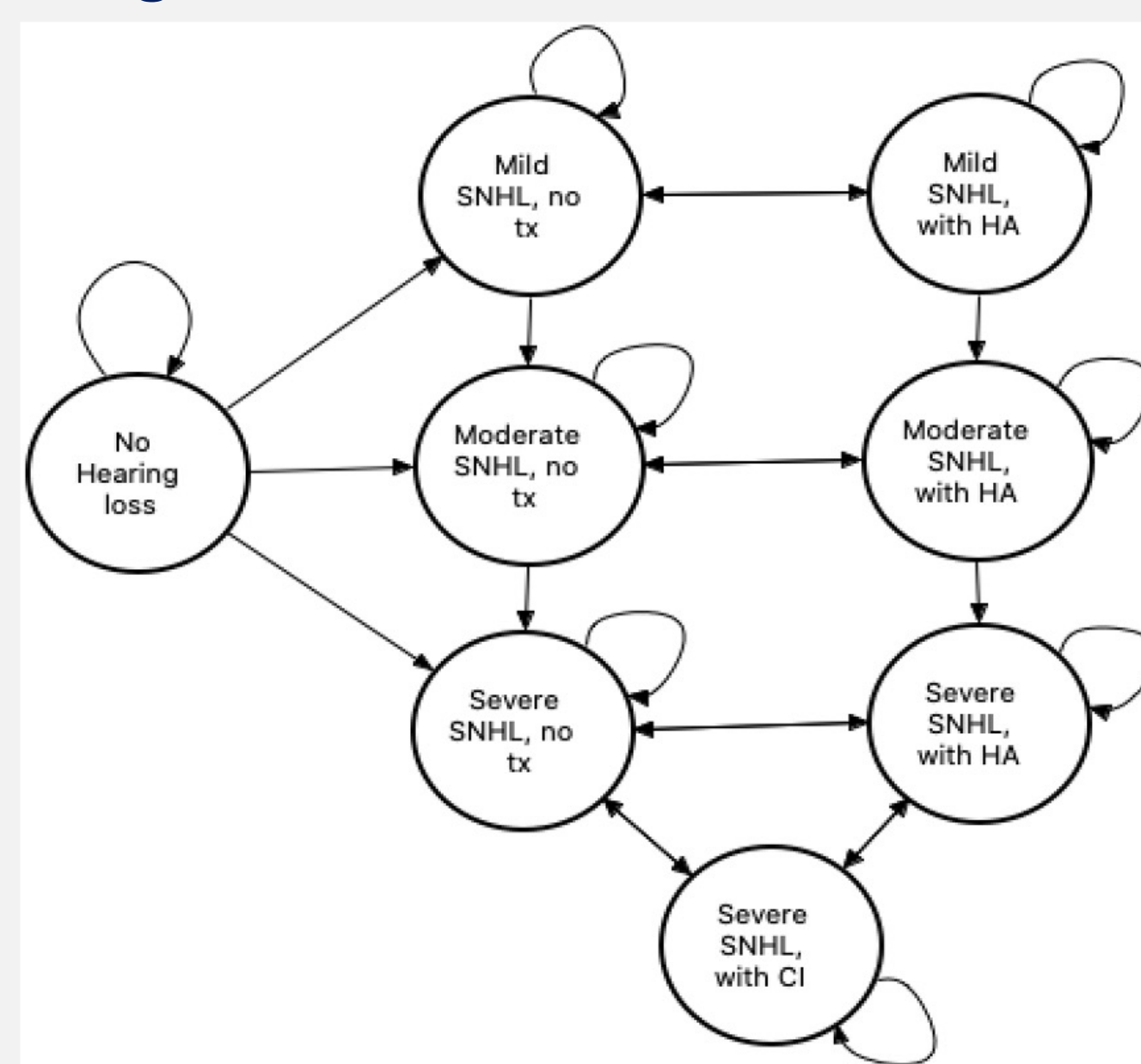
Objectives:
- Develop and parameterize versions of DeciBHAL for Chile, India, and Nigeria.
- Identify quantitative estimates of hearing health care scale-up strategies.

Methods:
- Literature search for estimates of model parameters in countries of interest and proxy countries.
- Literature search for data on efficacy of scale-up strategies, such as hearing screening across the lifespan.
- Input estimates into DeciBHAL to estimate impacts and identify optimal strategies.

Figure 1. DeciBHAL health state diagram

Model Validation Results:

	Table 1. Adult hearing aid use prevalence					
	Chile, % of persons with hearing loss		India, % of persons with hearing loss		Nigeria, % of persons with hearing loss	
Age	Model Outcome	Published Estimate	Model Outcome	Published Estimate	Model Outcome	Estimate
65	3.2	3.0 (1.3-4.8)	1.4	-	1.1	0.5-1.0
75	7.9	6.9 (4.4-9.5)	2.2	1.9	0.9	0.5-1.0
85	19.7	18.9 (13.9-24.0)	2.3	-	1.3	0.5-1.0

- We validated the simulation model to natural history and treatment data in Chile, India, and Nigeria.

Cascade Results:
- Literature search for Universal Newborn Hearing Screening (UNHS) programs in countries of interest or proxy countries
- Sample Cascade:

Initial screen coverage (99%) → Second screen (follow-up drops to ~66%) → Receiving diagnostic test after referral to specialist (follow-up drops to ~59%)

Source: (Ahmad 2011 in Malaysia)

Background

- *The Lancet* announced a commission in 2019 to identify ways to reduce the global burden of hearing loss.
- In 2015, 0.5 billion people had disabling hearing loss and 1.34 billion individuals had mild-to-complete loss in the better-hearing ear.
- The Lancet Commission and this Bass Connections team set out with the goal of finding innovative solutions to this global problem, splitting into a modeling team and a team to identify barrier and facilitators to hearing loss.
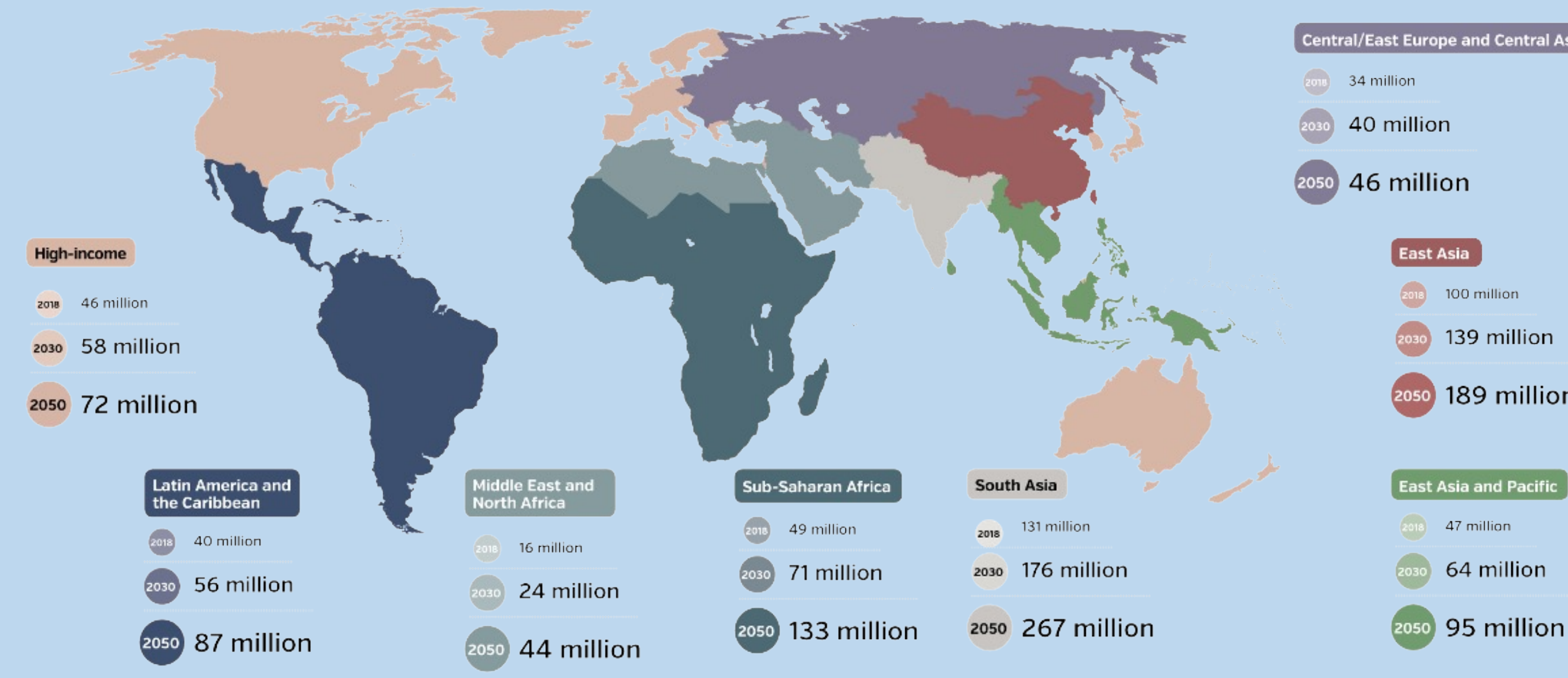
Key Findings

Developed a framework to identify effectiveness of hearing loss interventions that improve detection and linkage to care.

UNHS screening cascade shows varying follow-up rates in different settings, depending on hospital or community clinic program.

Developed costing strategy to determine recurring and one-time costs for health states in the model.

Conducted international validation comparing model output to Global Burden of Disease data in countries of interest: India, Chile, and Nigeria.

Patient financial constraints and lack of physician knowledge, training in cochlear implant surgery are the most frequently reported barriers in cochlear implant access and use.

Barriers and Scale-up Strategies

Objective: Determine the barriers and facilitators of scaling-up hearing healthcare interventions.

**Methods**: Systematic review
Screening and data extraction: DistillerSR
Interventions: Cochlear Implants, Hearing Aids, Neonatal screening, Child screening, Adult screening

Analysis Framework: Access to health care framework (Levesque et al. 2013)

Results: **Cochlear Implant (CI) Analysis** reveals 3 key dimensions of demand side and supply side barriers/facilitators.
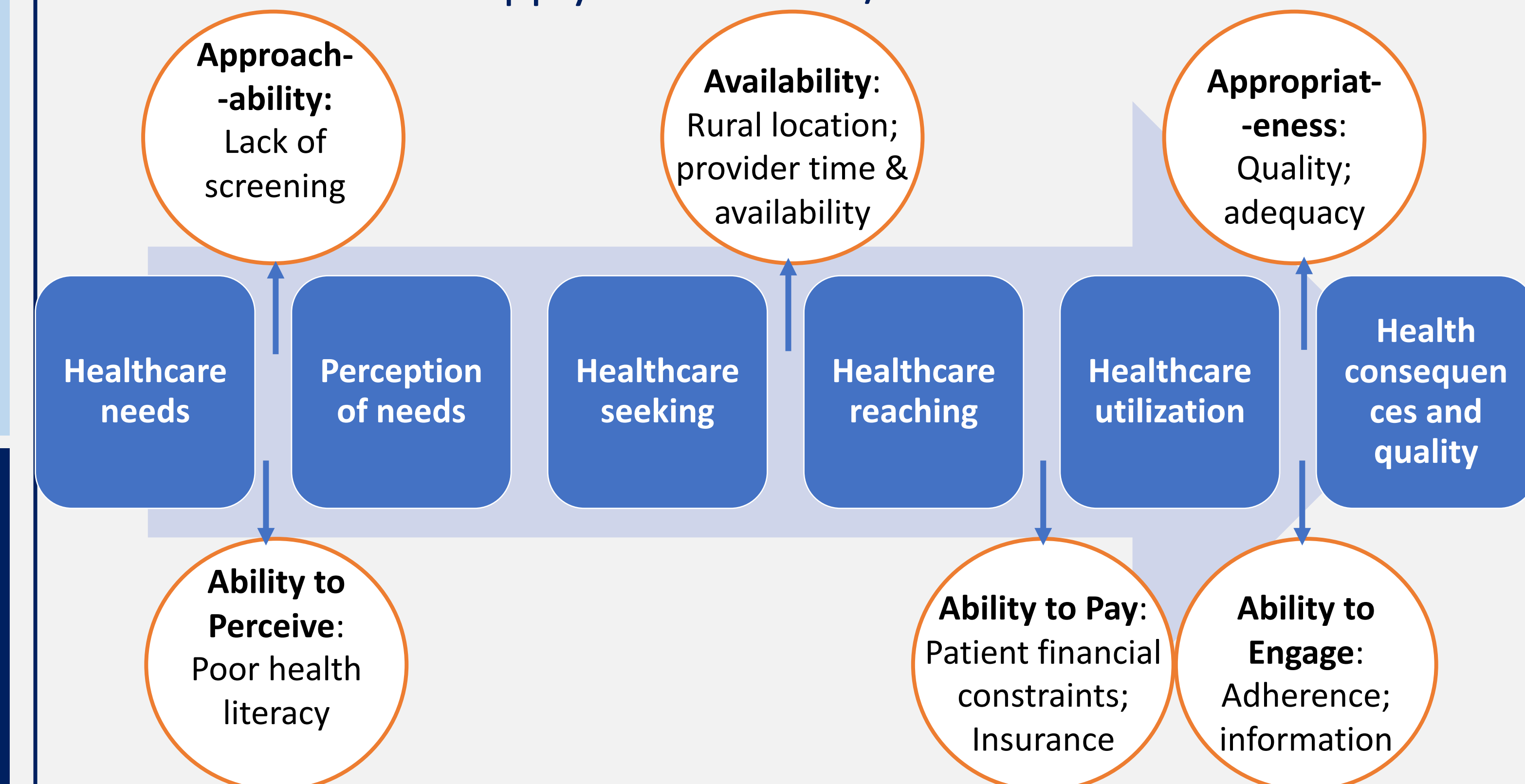
Supply-side: *health system, provider, organization's perspective*
Approachability: Lack of newborn, adult hearing screening & cognitive testing for CI candidates inhibits early receipt of CI; universal newborn hearing screening is a facilitator.
Availability: Living in rural and minority communities is associated with delays in CI; lack of audiologists, audiology clinics and provider time for hearing evaluation noted as barriers to CI uptake.
Appropriateness: Physician uncertainty and lack of knowledge regarding CI surgery, candidacy, and outcomes create gaps in quality of care.

Demand-side: *population, community, HH, patient's perspective*
Ability to Perceive: Lack of patient awareness about availability, eligibility & impact/effectiveness of CI are barriers to receiving appropriate care.
Ability to Pay: High device and rehabilitation costs act as deterrents to CI uptake; insurance coverage of CI significantly influences patient decisions.
Ability to Engage: Patient disengagement and non-compliance are barriers to evaluation & management of CI; access to information packets/resourc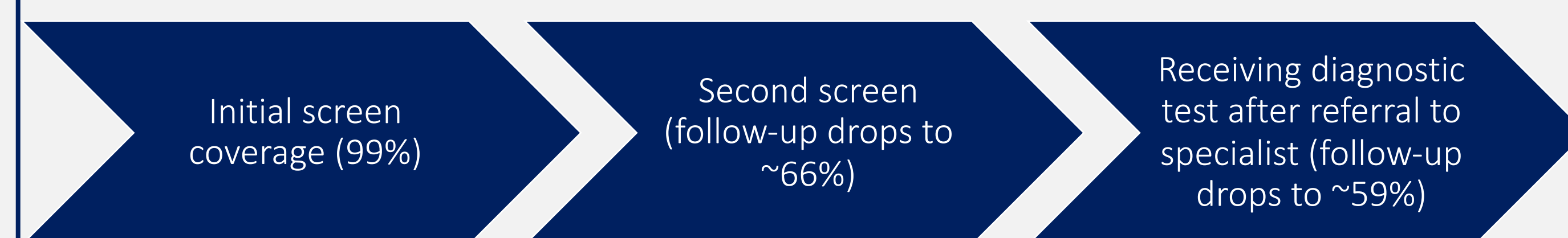es on CI and CI support services act as facilitators.