



# Inconsistency in Universal Newborn Hearing Screening Programmes: a Systematic Review

Pierpaolo Mincarone

*National Research Council*

*Institute for Research on Population and Social Policies*

# Background

- HL, most frequent permanent congenital defect (Fujikawa et al. 2000) – conductive / sensorineural
- Risk factors for HL (most recent def.: JCIH, 2007)
- Prevalence of HL in newborns:
  - 2 - 5% - at  risk (Norton et al. 2000)
  - 0.1 - 0.3% (Mehl et al. 2002)
- Tests: TOAE / aABR
- No newborn screening 
  - diagnosis at  $\approx$ 14M (Erenberg et al. 1999)
  - impaired language and learning (Rach et al. 1988) & increased behaviour problems, decreased psychosocial well-being, and poor adaptive skills (Davis et al. 1999)

# Background

- US National Institutes for Health (NIH, 1993), American Academy of Pediatrics (AAP) (Erenberg et al. 1999), Joint Committee on Infant Hearing (JCIH, 1994) recommended **universal screening** and detection of newborns with hearing loss **≤3M**, and **intervention ≤6M**
- The AAP and JCIH recommendations (most recent: JCIH, 2007) □ **Universal Newborn Hearing Screening (UNHS)** programmes worldwide and include **indicators** and **benchmarks** for process quality assessment

# Aims

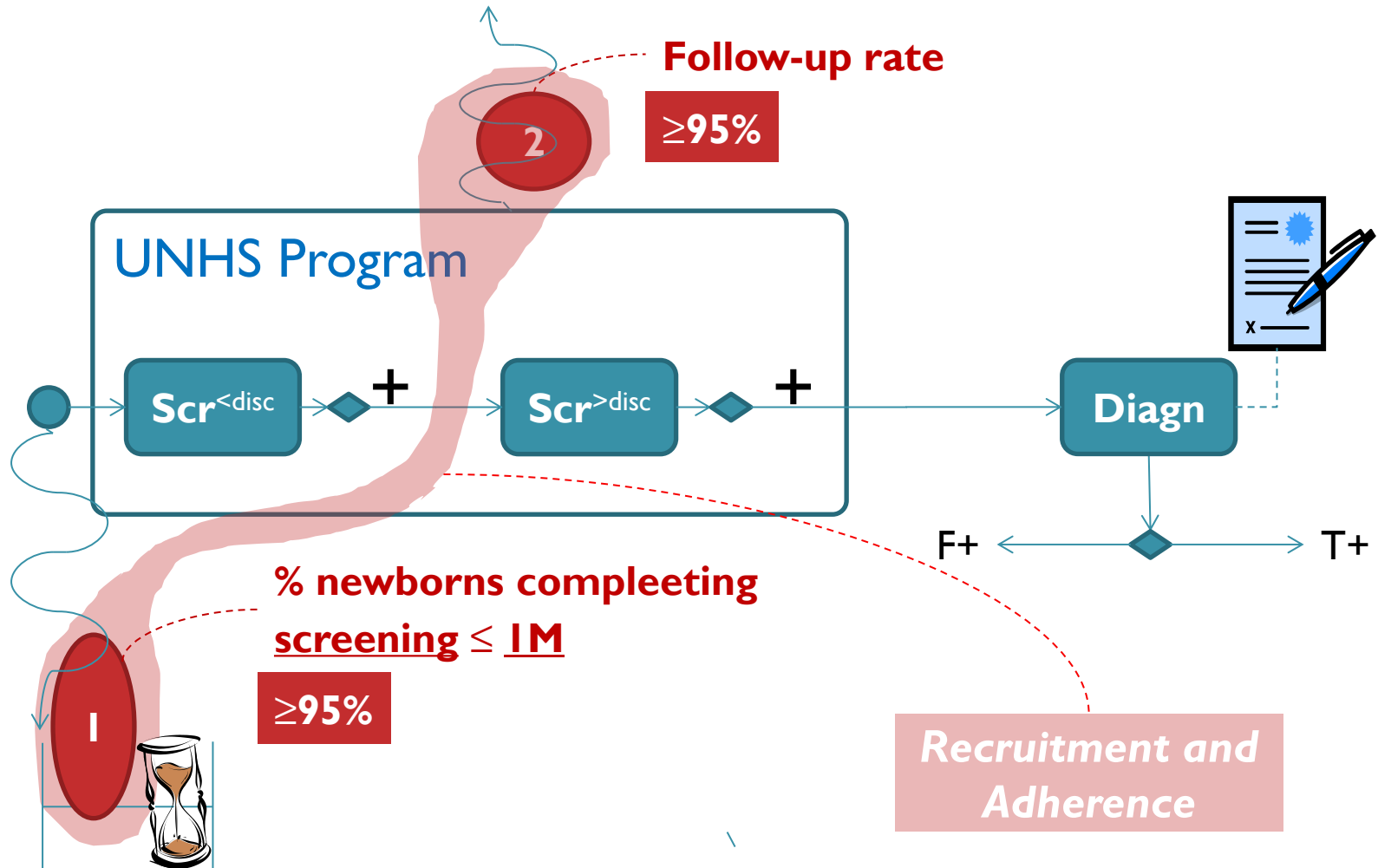
- **State of Art:** children with HL identified through UNHS 
  - obtained better language outcomes at school age than those not screened (Nelson et al. 2008)
  - had significantly earlier referral, diagnosis and treatment than those not screened (Wolff et al. 2010)
- **AIM:** to evaluate published UNHS programmes using the AAP and JCIH benchmarks

# Methods

- Systematic search □ UNHS programmes.
- Exclusion Criteria:
  - non-English, no protocol description, equivocal assignment of results to the protocols, no false positive
- Data Extracted:
  - study design, duration, starting year
  - participants (#neonates, #screened, #at higher risk, risk assess.)
  - protocol (tests, audible threshold, uni- vs. bi-lateral HL, timing, environmental test conditions, personnel)
  - quality indicators

# Methods

## Quality indicators and benchmarks (1/2)



# Methods

## Quality indicators and benchmarks (2/2)

% Ref. at discharge

5-20% (OAE)

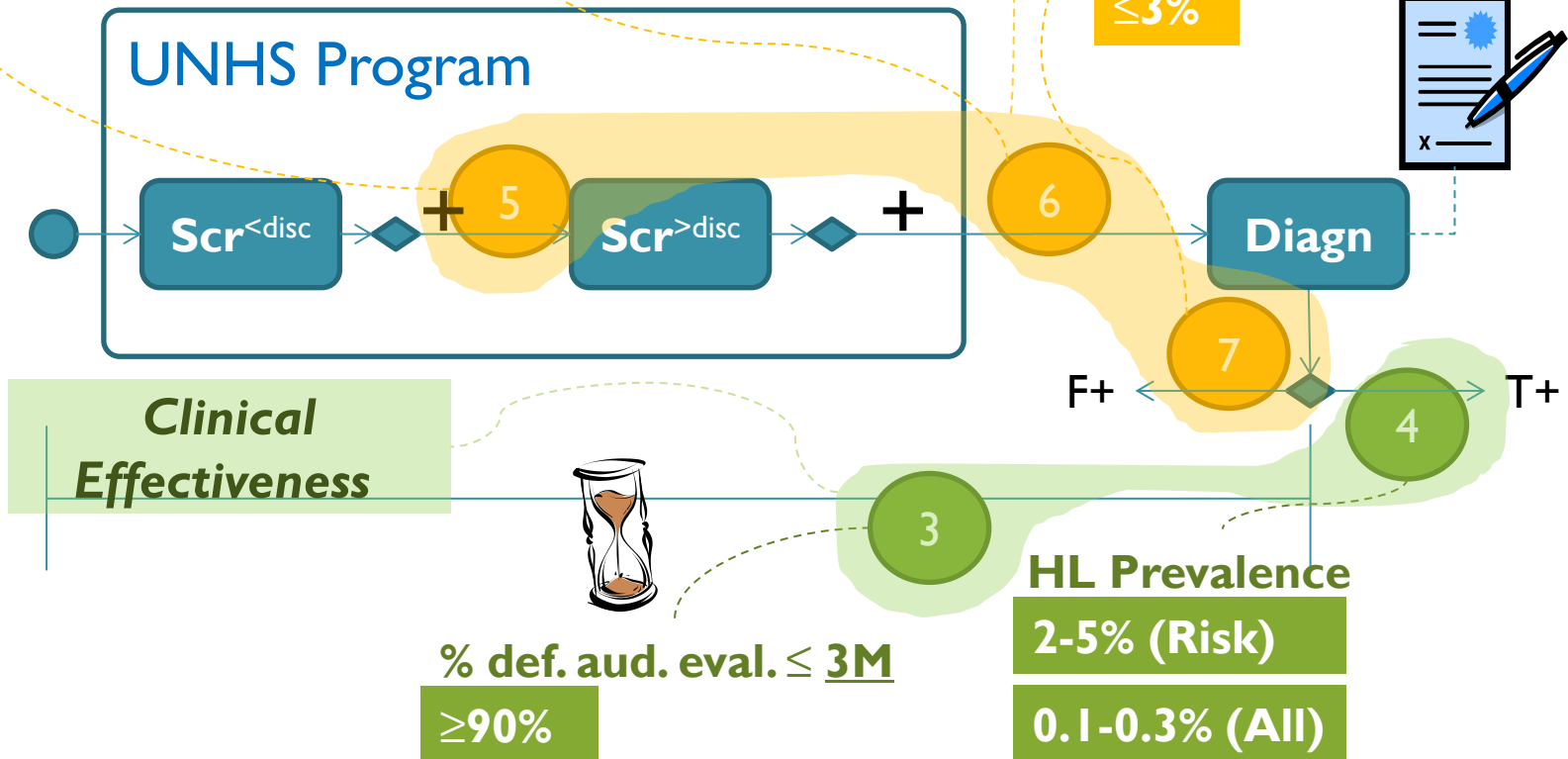
4% (ABR)

% Ref. def. aud. eval.





<4%
































































False-positive rate

≤3%







# Results



























































-  Benchmark not achieved;
-  Benchmark achieved
-  Measured prevalence above literature data
-  Measured prevalence under literature data

Source	Test [Type; N.]	Audiol. Risk Assess.	HL Extent	Performance Indicators		
				Recruit. and Adherence	Clinical Effectiv.	Resource Cons.
Bevilacqua M, 2010	OAE 2	JCIH 2007	40dB HL unilateral	 	 	  
Watkin P, 1996	OAE 2	-	40dB HL bilateral	 	 	  
Aidan D, 1999	OAE 2	JCIH 1990	40dB HL unilateral	 	 	  
Habib H, 2005	OAE 2	JCIH 1994	26dB HL unilateral	 	  (NICU)	  
Lin H, 2007	OAE 2-3	-	- unilateral	 	 	  
Korres S, 2008	OAE 3-4	-	40dB HL unilateral	 	 	  
Tatli MM, 2007	OAE 2	Specifically reported	- unilateral	 	 	  
Kennedy C, 2005 - Wessex, 1998	Both 2	NIH, 1994	40dB HL bilateral	 	 	  
Lin H, 2007	Both 2	-	- unilateral	 	 	  



# Results

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Source	Test [Type; N.]	Audiol. Risk Assess.	HL Extent	Performance Indicators		
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Calevo M, 2007	Both 4	JCIH 1994	40db HL unilateral	 	 	  
De Capua, 2007	Both 3	JCIH, 2000	30dB nHL unilateral	 	 	  
Barsky-Firkser L, 1997	ABR 1	JCIH 1994	WBB: 35dB HL NICU: 40dB HL bilateral	 	  (NICU)	  
Mason JA, 1998	ABR 1	ASHA 1988; ASHA 1989	35dB nHL bilateral	 	  (NICU)  (all)	  
Mason JA, 1998	ABR 2	ASHA 1988; ASHA 1989	35dB nHL bilateral	 	  (NICU)  (all)	  
Lin H, 2007	ABR 2	-	- unilateral	 	 	  
Tsuchiya H, 2006	ABR 2	-	35dB HL unilateral	 	 	  
Clemens CJ, 2000	ABR 2-3	Admission to NICU	35dB nHL unilateral	 	 	  

# Limits

- Quality indicators and benchmarks established and updated by the AAP and JCIH since February 1999 while most of the studies initiated or concluded recruitment prior to that date □ *we tested feasibility of performing standardised evaluations of UNHS programmes*
- Articles only in English □ *9 / 14 studies in our review from non-English-speaking countries*

# Bottom line

- Our systematic review □ substantial **variability**, **incomplete reporting** and **performance gaps**, in the scientific literature published to date
- Need to **optimise reporting** of
  - screening protocols and
  - process performance
- Future research:
  - assessment of long-term outcomes of neonates with negative screening tests (**false negative**)
  - causes for and interventions to reduce **lost to follow-up**
  - **standardisation** of recommended quality indicators

# Bottom Line

This research was possible also thanks to

- Carlo Giacomo LEO
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Pierpaolo Mincarone

[pierpaolo.mincarone@irpps.cnr.it](mailto:pierpaolo.mincarone@irpps.cnr.it)