

Evaluation of Targeted versus Universal Newborn Screening for Congenital Cytomegalovirus (cCMV)

Background

Congenital cytomegalovirus (cCMV) infection in infants is extremely common, impacting ~1 in 200 live births. Hearing loss resulting from cCMV infection is estimated to cause 15-25% of cases of sensorineural hearing loss in children. It is the only preventable risk factor for permanent hearing loss. Despite the high prevalence of cCMV infection, newborn screening for cCMV is not common. Two approaches for cCMV screening are: 1) targeted screening of infants who do not pass their newborn hearing screening (NBHS); and 2) universal screening of all infants at birth. The aim of this project is to evaluate the efficacy of a targeted versus universal cCMV screening protocol.

Methods

A review of literature was conducted along with a review of websites of state programs in the United States which implement cCMV screening. Articles were selected from credible search engines including Google Scholar, PubMed, American-Speech-Language-Hearing-Association journals, and Purdue Libraries. Key words used were: congenital cytomegalovirus (CMV) screening, permanent hearing loss, targeted screening, universal screening, early intervention

Review of Literature

Targeted cCMV Screening Approach

Main findings	References
A targeted cCMV screening program is feasible.	<ul style="list-style-type: none"> Beswick et al., 2019 Diener et al., 2017 Kadambari et al., 2015 Martin et al., 2021 Fowler et al., 2017
Targeted cCMV screening identifies cCMV-positive infants and is cost-effective.	<ul style="list-style-type: none"> Beswick et al., 2019 Kadambari et al., 2015
Targeted cCMV screenings can be performed non-invasively within the time frame to begin antiviral treatment if appropriate.	<ul style="list-style-type: none"> Diener et al., 2017 Kadambari et al., 2015 Kimberlin et al., 2003
Targeted screening misses cCMV-positive infants who are asymptomatic but develop later onset hearing loss. A universal screening approach is preferable.	<ul style="list-style-type: none"> Martin et al., 2021 Fowler et al., 2017 Lanzieri et al., 2017

Universal cCMV Screening Approach

Main findings	References
~85% of cCMV-positive infants are asymptomatic at birth and would be missed with targeted screening but identified with universal screening.	<ul style="list-style-type: none"> Boppana, Ross & Fowler, 2013 Fowler et al., 2017 Chen, Zhong & Gu, 2020 Goderis et al., 2016 Goderis et al., 2014 Vos et al., 2021
~33% of cCMV-positive children who are asymptomatic at birth develop progressive SNHL. They would be missed with targeted screening but identified with universal screening.	<ul style="list-style-type: none"> Goderis et al., 2014 Goderis et al., 2016 Lanzieri et al., 2017
Universal screening can be administered at the same time as NBHS. For cCMV-positive infants with SNHL at birth, the etiology of hearing loss could be identified.	<ul style="list-style-type: none"> Chen, Zhong & Gu, 2020 Martin et al., 2021 Fowler et al., 2017
~4-30% of cases of cCMV-related SNHL are progressive. Identifying all positive infants via universal screening would allow for close audiometric monitoring.	<ul style="list-style-type: none"> Berrettini, Ravecca, Sellari-Franceschini, Matteucci, Siciliano & Ursino, 1999 Martin et al., 2021

State Protocols

Aside from screening, some states have legislative mandates requiring education about cCMV to the public and/or healthcare professionals following these protocols:

- cCMV education plus cCMV screening
- Education about cCMV only
- Utah is the only state with targeted cCMV screening and mandated education accompanied by annual funding.

Results and Clinical Decision

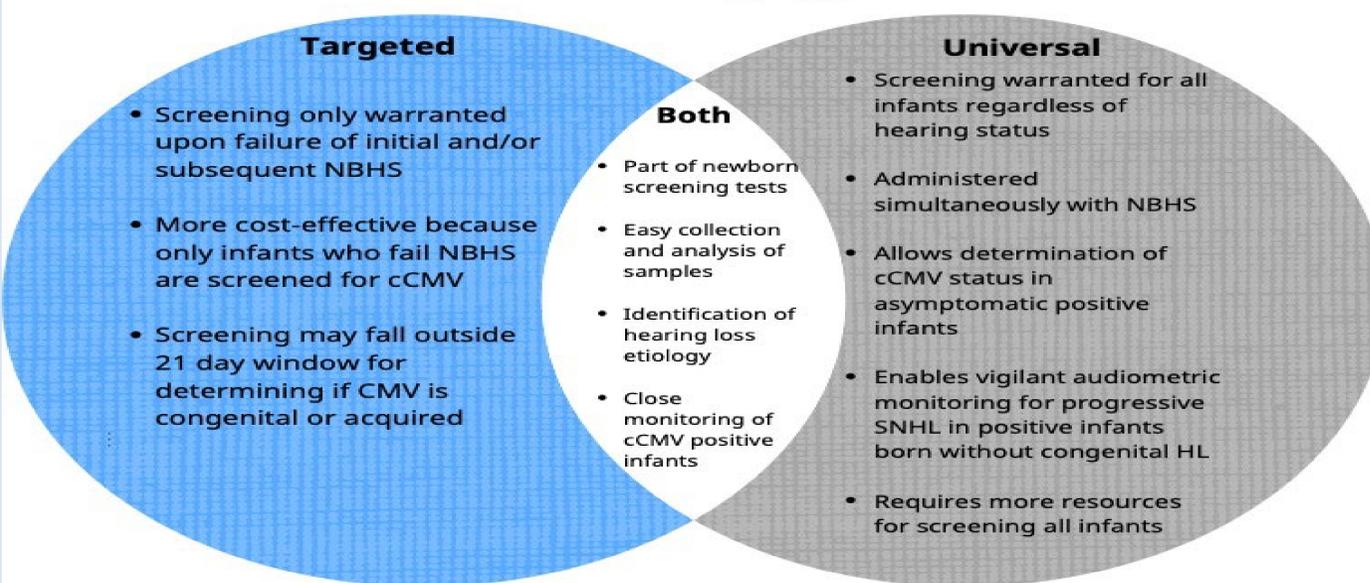
The literature review suggests that universal cCMV screening has greater overall efficacy than targeted screening.

- cCMV infections are asymptomatic in most cases, resulting in the exclusion of majority of cCMV-positive infants when using targeted screening.
- Late onset SNHL occurs in 1 out of 3 asymptomatic cCMV-positive infants, who would be missed if using targeted screening.
- Barriers for implementation of universal screening are state legislation and funding limitations.

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- References available on request.

Comparisons of Targeted vs. Universal cCMV Screening Approach



CCMV SCREENING IN THE UNITED STATES BY STATE

