International Journal of Pediatric Otorhinolaryngology (2006) **70**, 807—815

International Journal of
Pediatric
Otorhinolaryngology

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Universal newborn hearing screening follow-up in two Georgia populations: Newborn, mother and system correlates[☆]

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Received 23 June 2005; received in revised form 12 September 2005; accepted 13 September 2005

KEYWORDS
Newborn hearing screening;
Follow-up;
Hearing loss

Summary

Background: Nearly half of babies who "fail" their newborn hearing screening do not receive appropriate follow-up. Various explanations have been suggested.
Objective: To investigate, in two contrasting populations of newborns in Georgia, contemporaneous medical, socio-demographic and screening correlates of follow-up after newborn hearing screening. Three hypotheses were addressed: (1) follow-up correlated with particular medical, social and demographic features; (2) screening performance indicators correlated with follow-up; and (3) screening policies and procedures correlated with follow-up.
Methods: The studied babies, born July 2001 through June 2003 at Atlanta's Piedmont Hospital and Waycross Health District, had failed screening in both ears. Each site had about 4000 births per year, and a plan for outpatient follow-up of in-patient "fail" babies.
Results: At Piedmont, where Medicaid funded less than 7% of the births, 57% (130/230) had known follow-up to outpatient screening. In contrast, at Waycross, where Medicaid funded 89.6% of the births, 100% (38/38) had follow-up. The first study hypothesis was only partially supported by the data—from Piedmont, but not Waycross. White race and maternal age 30 years or older correlated with following-up: odds ratios 2.07 (95% CI 1.17, 3.68) and 1.83 (1.05, 3.17), respectively. Private health insurance and marriage trended with following-up. Follow-up rates did not correlate with the rates of screening refusal, missed screening and "fail" rates. Follow-up was unrelated to mothers witnessing the screening, receiving in-person explanations and having appointments arranged for them.

The Piedmont and Waycross programs were quite different. Piedmont's began in 2001, mothers typically learned about screening when it was done and "fail" babies

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[☆] Presented at the CDC Early Hearing Detection and Intervention Journal Club, December 1, 2004; and also, at the meeting of the Society for Ear, Nose and Throat Advances in Children, Toronto, December 2—5, 2004.

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doi:10.1016/j.ijporl.2005.09.019

were reported to many public health entities. In contrast, the Waycross program was more than 20 years old, prenatal care included teaching about screening and reporting was to one public health entity.

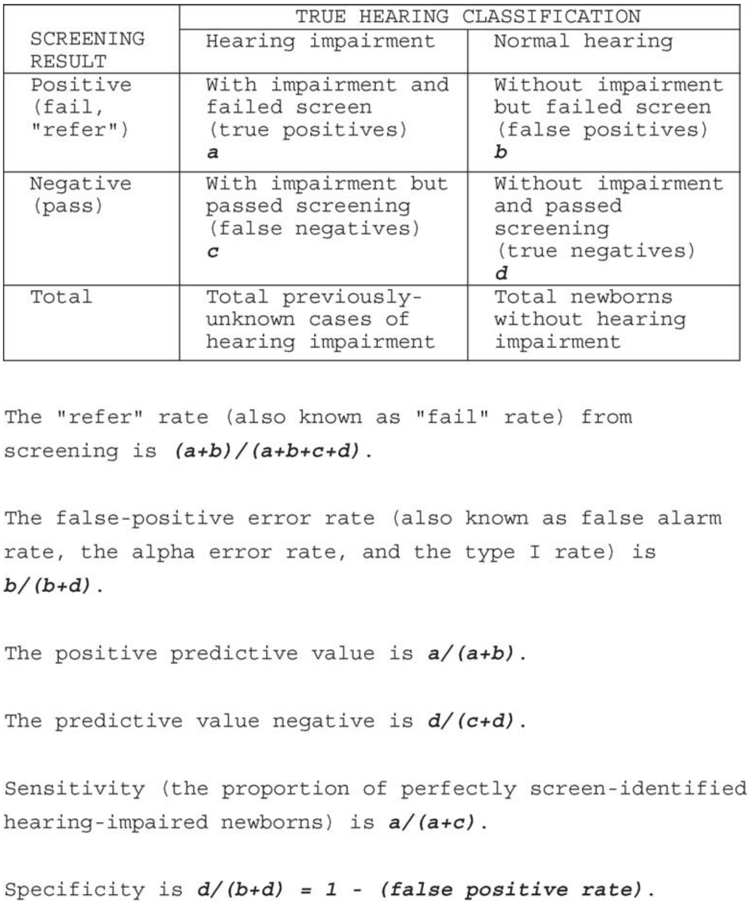
Conclusions: Though maternal socio-demographic features (poor, non-white, young) and access problems have been considered factors for non-follow-up, this study found two program characteristics most important: the lack of prenatal education about newborn hearing screening, and the lack of functionally integrated hospital hearing information with Public Health.

1. Introduction

A baby who fails newborn hearing screening needs follow-up to determine if the result was a false alarm (i.e., false-positive), or if in fact hearing loss truly exists (Fig. 1). By age 3 months, audiologic evaluation should occur. By age 6 months, intervention services should occur [1]. Hearing impaired babies who begin intervention (e.g., hearing aids, sign language) after age 6 months have language delays, developmental skill delays, behavior problems and lifelong delays in literacy and academic performance [2]. Without universal newborn hearing screening and timely diagnosis and intervention, about 3 babies per 1000 face a lifetime of poor communication.

Present evidence, however, is that nearly half of babies who "refer" (i.e., fail) at screening do not receive timely follow-up [3] (glossary is Table 1).

Incongruous explanations and resolutions for the follow-up problem are offered. Some of the incongruity may be attributable to the distinction between demonstration projects and "real world" reports. In general, follow-up rates from demonstration projects are rosier than are follow-up rates from real world reports.



SCREENING RESULT	TRUE HEARING CLASSIFICATION	
	Hearing impairment	Normal hearing
Positive (fail, "refer")	With impairment and failed screen (true positives) ***a***	Without impairment but failed screen (false positives) ***b***
Negative (pass)	With impairment but passed screening (false negatives) ***c***	Without impairment and passed screening (true negatives) ***d***
Total	Total previously-unknown cases of hearing impairment	Total newborns without hearing impairment

The "refer" rate (also known as "fail" rate) from screening is $(a+b)/(a+b+c+d)$.

The false-positive error rate (also known as false alarm rate, the alpha error rate, and the type I rate) is $b/(b+d)$.

The positive predictive value is $a/(a+b)$.

The predictive value negative is $d/(c+d)$.

Sensitivity (the proportion of perfectly screen-identified hearing-impaired newborns) is $a/(a+c)$.

Specificity is $d/(b+d) = 1 - (\text{false positive rate})$.

Fig. 1 Standard 2 × 2 table depicting screening test result and the true hearing classification of newborns screened for hearing impairment.