

**Universal Newborn
Hearing Screening
and Early Intervention
Programme
(UNHSEIP)**

Monitoring Report

January – December 2014



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Contents

Contents	iii
List of Figures and Tables	iv
Executive Summary	1
Introduction	10
The Universal Newborn Hearing Screening and Early Intervention Programme ..	10
Programme Monitoring	10
Information Included in this Report	12
Data calculations.....	13
Data limitations	14
Monitoring Indicators	15
1.1. Newborn Hearing Screening Offers	15
1.2. Newborn Hearing Screening Consents and Declines	16
1.3. Newborn Hearing Screening Coverage	18
1.5. Referral Rate to Audiology	23
1.6. Hearing Surveillance Rate.....	25
1.8. Positive Predictive Value of the Screening Test	28
2.2. Audiology Assessment Completed	29
2.3. Audiology Assessment Not Attended.....	33
2.4. Hearing Loss Detected	35
Hearing screening indicators not yet monitored	38
Early Intervention Indicators	39
Appendix 1	40

List of Figures and Tables

Figures

Figure 1 Audiology assessment duration for babies referred from newborn hearing screening, all DHBs	33
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Tables

Table 1 Summary of newborn hearing screening participation indicators by DHB, 1 January to 31 December 2014	3
Table 2 Summary of newborn hearing screening coverage indicators by DHB, 1 January to 31 December 2014.....	4
Table 3 Summary of newborn hearing screening coverage indicators by ethnicity and deprivation quintile, 1 January to 31 December 2014	5
Table 4 Summary of newborn hearing screening outcome indicators by DHB, 1 January to 31 December 2014.....	6
Table 5 Summary of newborn hearing screening outcome indicators by ethnicity and deprivation quintile, 1 January to 31 December 2014	7
Table 6 Summary of newborn hearing screening audiology indicators by DHB, 1 January to 31 December 2014.....	8
Table 7 Summary of newborn hearing screening audiology indicators by ethnicity and deprivation, 1 January to 31 December 2014	9
Table 8 Offer of newborn hearing screening by DHB, 1 January to 31 December 2014.....	15
Table 9 Consents for newborn hearing screening by DHB, 1 January to 31 December 2014	16
Table 10 Newborn hearing screening declines by DHB, 1 January to 31 December 2014	17
Table 11 Newborn hearing screens completed by 1 month of age by DHB, 1 January to 31 December 2014.....	18
Table 12 Newborn hearing screens completed by 1 month of age by ethnicity, 1 January to 31 December 2014.....	19
Table 13 Newborn hearing screens completed by 1 month of age by deprivation, 1 January to 31 December 2014	19
Table 14 Total newborn hearing screens completed for the period by DHB, 1 January to 31 December 2014.....	20
Table 15 Total newborn hearing screens completed for the period by ethnicity, 1 January to 31 December 2014.....	21
Table 16 Total newborn hearing screens completed for the period by deprivation 1 January to 31 December 2014	21
Table 16 Newborn hearing screens completed as percentage of consents by DHB, 1 January to 31 December 2014	22
Table 17 Newborn hearing screens completed as percentage of consents by ethnicity, 1 January to 31 December 2014	23
Table 18 Newborn hearing screens completed as percentage of consents by deprivation, 1 January to 31 December 2014.....	23

Table 19 Referrals to audiology from newborn hearing screening by DHB, 1 January to 31 December 2014.....	24
Table 20 Referrals to audiology from newborn hearing screening by ethnicity, 1 January to 31 December 2014.....	24
Table 21 Referrals to audiology from newborn hearing screening by deprivation, 1 January to 31 December 2014	25
Table 22 Breakdown of referrals to audiology from newborn hearing screening by type (unilateral or bilateral), 1 January to 31 December 2014.....	25
Table 23 Referrals for targeted follow-up from newborn hearing screening by DHB, 1 January to 31 December 2014	26
Table 24 Referrals for targeted follow-up from newborn hearing screening by ethnicity, 1 January to 31 December 2014.....	27
Table 25 Referrals for targeted follow-up from newborn hearing screening by deprivation, 1 January to 31 December 2014.....	27
Table 26 Number and proportion of risk factors for babies referred for targeted follow-up from newborn hearing screening, 1 January to 31 December 2014	28
Table 27 Positive predictive value of newborn hearing screening by type of audiology referral, 1 January to 31 December 2014	29
Table 28 Audiology assessment completion for babies referred from newborn hearing screening by timeframe and DHB, 1 January to 31 December 2014.....	30
Table 29 Audiology assessment completion for babies referred from newborn hearing screening by timeframe and ethnicity, 1 January to 31 December 2014.....	30
Table 30 Audiology assessment completion for babies referred from newborn hearing screening by timeframe and deprivation, 1 January to 31 December 2014.....	31
Table 31 Proportion of babies with confirmed PCHL following newborn hearing screening who have a diagnosis by 3 months of age, 1 January to 31 December 2014	32
Table 32 Total audiology assessments not attended for babies referred from newborn hearing screening by DHB, 1 January to 31 December 2014	34
Table 33 Total audiology assessments not attended for babies referred from newborn hearing screening by ethnicity, 1 January to 31 December 2014	34
Table 34 Total audiology assessments not attended for babies referred from newborn hearing screening by deprivation, 1 January to 31 December 2014.....	35
Table 35 Proportion of babies screened that had permanent congenital hearing loss detected by DHB, 1 January to 31 December 2014.....	36
Table 36 Proportion of babies screened that had permanent congenital hearing loss detected by ethnicity, 1 January to 31 December 2014.....	36
Table 37 Proportion of babies screened that had permanent congenital hearing loss detected by deprivation, 1 January to 31 December 2014	37
Table 38 Proportion of babies screened that had permanent congenital hearing loss detected by type of hearing loss, 1 January to 31 December 2014	37
Table 39 Number of babies screened that had permanent congenital hearing loss detected by type of hearing loss and DHB, 1 January to 31 December 2014.....	40

Executive Summary

Universal newborn hearing screening is the standard of care internationally, and in New Zealand. The early detection of hearing loss, and the application of appropriate medical and educational interventions, has been demonstrated to significantly improve the baby's long-term language skills and cognitive ability.

In August 2010 the national implementation of the Universal Hearing Screening and Early Intervention Programme (UNHSEIP) was completed. All 20 District Health Boards (DHBs) offer screening to the families and whānau of newborn babies.

The core goals of the programme, which are based on international best practice, are described as '1-3-6' goals:

1= ≥95% babies to be screened by 1 month of age

3= ≥90% audiology assessments completed by 3 months of age

6= initiation of appropriate medical, audiological and early intervention education services by 6 months of age

This monitoring report covers the babies screened in the 12 month period from 1 January 2014 to 31 December 2014. Audiology data for these babies up to 11 February 2016, when final data was extracted, is captured in this report.

The *UNHSEIP monitoring framework 2009* was updated in 2015. Consistent with a maturing programme, the new framework shifts the focus of monitoring from the screening process to greater consideration of outcomes across the programme pathway and performance against international benchmarks. Some indicators in the revised framework are still under development, while others cannot be reported until additional data from the new newborn hearing information management system (NHIMS) and other sources is available.

It is important to note that the new framework was designed to reflect the updated aABR only screening protocol. However, the 2014 data in this report is from the previous AOAE/AABR screening regime. This means that some of the language and some indicators in this report are not yet reflective of the new framework.

Key Points from January 2014 to December 2014

- The total number of offers reported by DHBs for 2014 was 57,015 out of 59,097 live births (96.5%).
- 97.4% of parents/guardians that were offered screening consented, and 99.3% of those that consented completed screening.
- 85.5% of babies born completed screening by 1 month of age and a total of 93.3% completed screening for the period. Completion rates were higher for European and Asian babies than for Māori and Pacific babies, and for babies from areas of lower deprivation compared to high deprivation.

- The rate of referral to audiology for babies screened during the period was 2.2%. Northland and Hawke's Bay DHBs had the highest rates, and there were similar differences by ethnicity and deprivation as for completed screens.
- 4.6% of babies that passed screening were referred for targeted follow up due to the presence of a risk factor for development of hearing loss. Northland, Taranaki and Hawke's Bay DHBs had the highest targeted follow up rates, and rates by ethnicity varied from 7.1% for Māori to 2.3% for Asian babies.
- The most common risk factor identified for babies referred to for targeted follow up was family history (58.1% of babies referred, 2.6% of completed screens).
- The positive predictive value (PPV) of screening for 2014 was 13%.
- 812 (67.9%) out of 1,196 babies referred to audiology had assessments completed by the date of data extraction for this report. 58.0% of referrals had their assessments completed by 3 months of age. There were also 58 babies for whom the audiology outcome was DNA/lost contact/declined. Assessment completion rates were lower for Māori and Pacific babies, and for babies living in areas of greater deprivation.
- 91.4% of babies that had a confirmed diagnosis of permanent congenital hearing loss¹ (PCHL) received that diagnosis by 3 months of age.
- 79.4% of completed audiology assessments were started and completed on the same day. These babies equated to 53.9% of all referrals to audiology for the period.
- Nationally, 1.9 babies per 1,000 completed screens had PCHL diagnosed. The rate for Māori (2.5 per 1,000) was higher than for European babies (1.5 per 1,000).

¹ In this report permanent congenital hearing loss has been defined as a diagnosis that includes auditory neuropathy, sensorineural, conductive permanent, or mixed (combination of sensorineural and conductive) hearing loss.

Table 1 Summary of newborn hearing screening participation indicators by DHB, 1 January to 31 December 2014

DHB of first screen	Offers	Consents	Declines	Live births	1.1 Offers as % of births	1.2a Consents as % of offered ¹	1.2b Declines as % of offers
	<i>Number</i>				<i>Percentage</i>		
Northland	2,004	1,761	95	2,097	95.6	87.9	4.7
Waitemata	6,505	6,207	48	7,910	82.2	95.4	0.7
Auckland	8,098	8,037	67	6,370	127.1	99.2	0.8
Counties Manukau	6,572	6,299	33	8,279	79.4	95.8	0.5
Waikato	5,136	5,027	29	5,325	96.5	97.9	0.6
Lakes	1,448	1,377	13	1,393	103.9	95.1	0.9
Bay of Plenty	2,590	2,518	71	2,785	93.0	97.2	2.7
Tairāwhiti	704	691	4	722	97.5	98.2	0.6
Taranaki	1,472	1,497	9	1,529	96.3	101.7	0.6
Hawke's Bay	1,960	1,995	5	2,098	93.4	101.8	0.3
Whanganui	795	779	6	822	96.7	98.0	0.8
MidCentral	2,117	1,787	15	2,112	100.3	84.4	0.7
Hutt Valley	1,920	1,905	7	1,863	103.1	99.2	0.4
Capital and Coast	3,631	3,547	10	3,572	101.7	97.7	0.3
Wairarapa	494	476	1	443	111.5	96.4	0.2
Nelson Marlborough	1,287	1,433	18	1,438	89.5	111.3	1.4
West Coast	301	297	12	353	85.3	98.7	4.0
Canterbury	6,006	5,921	70	6,032	99.6	98.6	1.2
South Canterbury	655	640	5	658	99.5	97.7	0.8
Southern	3,320	3,314	20	3,296	100.7	99.8	0.6
Total	57,015	55,508	538	59,097	96.5	97.4	0.9

¹ The percentage consented and the percentage declined do not add to 100% (1.7% gap) due to offers and declines currently coming from a different data source than consents.

Table 2 Summary of newborn hearing screening coverage indicators by DHB, 1 January to 31 December 2014

DHB of birth	Screens completed by 1 month	Total screens completed	Consents	Live births	1.3a Complete by 1 month as % of births	1.3b Total complete as % of births	1.3c Complete as % of consented
	<i>Number</i>				<i>Percentage</i>		
Northland	1,076	1,720	1,756	2,097	51.3	82.0	97.9
Waitemata	6,227	7,177	7,240	7,910	78.7	90.7	99.1
Auckland	5,725	5,920	5,952	6,370	89.9	92.9	99.5
Counties Manukau	6,599	7,192	7,304	8,279	79.7	86.9	98.5
Waikato	4,785	5,046	5,065	5,325	89.9	94.8	99.6
Lakes	1,245	1,389	1,389	1,393	89.4	99.7	100.0
Bay of Plenty	2,231	2,486	2,514	2,785	80.1	89.3	98.9
Tairāwhiti	666	679	683	722	92.2	94.0	99.4
Taranaki	1,466	1,491	1,491	1,529	95.9	97.5	100.0
Hawke's Bay	1,786	1,963	1,979	2,098	85.1	93.6	99.2
Whanganui	697	722	725	822	84.8	87.8	99.6
MidCentral	1,079	1,817	1,838	2,112	51.1	86.0	98.9
Hutt Valley	1,848	1,856	1,859	1,863	99.2	99.6	99.8
Capital and Coast	3,553	3,645	3,650	3,572	99.5	102.0	99.9
Wairarapa	456	466	466	443	102.9	105.2	100.0
Nelson Marlborough	1,317	1,417	1,421	1,438	91.6	98.5	99.7
West Coast	266	292	295	353	75.4	82.7	99.0
Canterbury	5,700	5,918	5,925	6,032	94.5	98.1	99.9
South Canterbury	631	635	638	658	95.9	96.5	99.5
Southern	3,194	3,296	3,318	3,296	96.9	100.0	99.3
Total	50,547	55,127	55,508	59,097	85.5	93.3	99.3

Table 3 Summary of newborn hearing screening coverage indicators by ethnicity and deprivation quintile, 1 January to 31 December 2014

Ethnicity	Screens completed by 1 month	Total screens completed	Consents	Live births	1.3a Complete by 1 month as % of births	1.3b Total complete as % of births	1.3c Complete as % of consented
	<i>Number</i>				<i>Percentage</i>		
Māori	11,410	12,997	13,150	15,182	75.2	85.6	98.8
Pacific	4,989	5,599	5,672	6,209	80.4	90.2	98.7
Asian	8,508	8,973	9,007	9,413	90.4	95.3	99.6
European	24,428	26,239	26,351	27,030	90.4	97.1	99.6
Other	1,212	1,319	1,328	1,263	96.0	104.4	99.3
Total	50,547	55,127	55,508	59,097	85.5	93.3	99.3
NZ Dep 2013	<i>Number</i>				<i>Percentage</i>		
Quintile 1	8,023	8,439	8,473	8,512	94.3	99.1	99.6
Quintile 2	8,297	8,897	8,945	9,278	89.4	95.9	99.5
Quintile 3	9,756	10,581	10,629	10,593	92.1	99.9	99.5
Quintile 4	11,607	12,825	12,918	13,394	86.7	95.8	99.3
Quintile 5	12,782	14,296	14,453	17,320	73.8	82.5	98.9
Unknown	82	89	90	-	-	-	98.9
Total	50,547	55,127	55,508	59,097	85.5	93.3	99.3

Table 4 Summary of newborn hearing screening outcome indicators by DHB, 1 January to 31 December 2014

DHB of first screen	Total screens completed	Referred to audiology	Referred for targeted follow up	Screened and passed	1.5 Referred as % of screens	1.6a Targeted follow up as % of passed screens
		<i>Number</i>			<i>Percentage</i>	
Northland	1,727	92	125	1,630	5.3	7.7
Waitemata	6,156	115	235	6,036	1.9	3.9
Auckland	7,974	135	304	7,735	1.7	3.9
Counties Manukau	6,203	212	260	5,941	3.4	4.4
Waikato	5,010	96	211	4,913	1.9	4.3
Lakes	1,377	36	71	1,341	2.6	5.3
Bay of Plenty	2,489	54	90	2,435	2.2	3.7
Tairāwhiti	687	9	30	678	1.3	4.4
Taranaki	1,497	26	119	1,471	1.7	8.1
Hawke's Bay	1,979	86	198	1,888	4.3	10.5
Whanganui	776	14	48	762	1.8	6.3
Mid Central	1,766	38	90	1,727	2.2	5.2
Hutt Valley	1,902	50	73	1,852	2.6	3.9
Capital and Coast	3,543	59	193	3,484	1.7	5.5
Wairarapa	476	6	24	470	1.3	5.1
Nelson Marlborough	1,429	15	90	1,417	1.0	6.4
West Coast	294	1	15	293	0.3	5.1
Canterbury	5,915	68	184	5,847	1.1	3.1
South Canterbury	636	20	15	616	3.1	2.4
Southern	3,291	64	119	3,227	1.9	3.7
Total	55,127	1,196	2,494	53,763	2.2	4.6

Table 5 Summary of newborn hearing screening outcome indicators by ethnicity and deprivation quintile, 1 January to 31 December 2014

Ethnicity	Total screens completed	Total referred to audiology	Referred for targeted follow up	Screened and passed	1.5a	1.6a
					Audiology referrals as % of completed screens	Targeted follow up as % of passed screens
					<i>Number</i>	<i>Percentage</i>
Māori	12,997	389	890	12,573	3.0	7.1
Pacific	5,599	225	222	5,311	4.0	4.2
Asian	8,973	141	201	8,803	1.6	2.3
European	26,239	416	1,116	25,784	1.6	4.3
Other	1,319	25	65	1,292	1.9	5.0
Total	55,127	1,196	2,494	53,763	2.2	4.6

NZ Dep 2013 quintile	<i>Number</i>				<i>Percentage</i>	
Quintile 1	8,439	124	325	8,297	1.5	3.9
Quintile 2	8,897	142	371	8,742	1.6	4.2
Quintile 3	10,581	204	441	10,362	1.9	4.3
Quintile 4	12,825	276	594	12,526	2.2	4.7
Quintile 5	14,296	448	755	13,749	3.1	5.5
Unknown	89	2	8	87	2.2	9.2
Total	55,127	1,196	2,494	53,763	2.2	4.6

Table 6 Summary of newborn hearing screening audiology indicators by DHB, 1 January to 31 December 2014

DHB of first screen	Total screens completed	Total referred to audiology	Audiology completed by 3 months	Total audiology completed	PCHL diagnosed by 3 months	Total PCHL diagnosed	Audiology DNA/lost contact/declined	2.2a	2.2b	2.3	2.4
								Audiology assessment completion by 3 months	PCHL diagnosed by 3 months	Audiology DNA/lost contact/declined	Hearing loss detected
								<i>Percentage</i>		<i>Per 1,000</i>	
Northland	1,727	92	50	60	5	6	19	54.3	83.3	20.7	3.5
Waitemata	6,156	115	64	84	12	13	-	55.7	92.3	-	2.1
Auckland	7,974	135	105	109	15	15	1	77.8	100.0	0.7	1.9
Counties Manukau	6,203	212	74	111	3	5	-	34.9	60.0	-	0.8
Waikato	5,010	96	59	68	10	11	4	61.5	90.9	4.2	2.2
Lakes	1,377	36	16	16	3	3	6	44.4	100.0	16.7	2.2
Bay of Plenty	2,489	54	23	27	2	3	13	42.6	66.7	24.1	1.2
Tairāwhiti	687	9	5	6	1	1	-	55.6	100.0	-	1.5
Taranaki	1,497	26	16	18	3	3	2	61.5	100.0	7.7	2.0
Hawke's Bay	1,979	86	44	50	3	4	2	51.2	75.0	2.3	2.0
Whanganui	776	14	7	8	-	-	-	50.0	-	-	-
MidCentral	1,766	38	20	25	3	4	6	52.6	75.0	15.8	2.3
Hutt Valley	1,902	50	42	44	9	9	1	84.0	100.0	2.0	4.7
Capital and Coast	3,543	59	48	51	8	8	2	81.4	100.0	3.4	2.3
Wairarapa	476	6	5	5	-	-	-	83.3	-	-	-
Nelson Marlborough	1,429	15	11	11	1	1	-	73.3	100.0	-	0.7
West Coast	294	1	1	1	-	-	-	100.0	-	-	-
Canterbury	5,915	68	47	52	13	13	-	69.1	100.0	-	2.2
South Canterbury	636	20	14	15	-	-	2	70.0	-	10.0	-
Southern	3,291	64	43	51	5	6	-	67.2	83.3	-	1.8
Total	55,127	1,196	694	812	96	105	58	58.0	91.4	4.8	1.9

Table 7 Summary of newborn hearing screening audiology indicators by ethnicity and deprivation, 1 January to 31 December 2014

Ethnicity	Total screens completed	Total referred to audiology	Audiology completed by 3 months	Total audiology completed	PCHL diagnosed by 3 months	Total PCHL diagnosed	Audiology DNA/lost contact/declined	2.2a Audiology assessment completion by 3 months	2.2b PCHL diagnosed by 3 months	2.3 Audiology DNA/lost contact/declined	2.4 Hearing loss detected
	<i>Number</i>							<i>Percentage</i>		<i>Per 1,000</i>	
Māori	12,997	389	182	218	-	33	38	46.8	-	9.8	2.5
Pacific	5,599	225	94	129	-	10	6	41.8	-	2.7	1.8
Asian	8,973	141	107	118	-	20	3	75.9	-	2.1	2.2
European	26,239	416	294	329	-	39	11	70.7	-	2.6	1.5
Other	1,319	25	17	18	-	3	-	68.0	-	-	2.3
Total	55,127	1,196	694	812	96	105	58	58.0	91.4	4.8	1.9

NZ Dep 2013	<i>Number</i>							<i>Percentage</i>		<i>Per 1,000</i>	
	Quintile 1	8,439	124	85	93	-	12	1	68.5	-	0.8
Quintile 2	8,897	142	104	119	-	21	2	73.2	-	1.4	2.4
Quintile 3	10,581	204	133	145	-	24	13	65.2	-	6.4	2.3
Quintile 4	12,825	276	166	195	-	24	17	60.1	-	6.2	1.9
Quintile 5	14,296	448	205	259	-	24	25	45.8	-	5.6	1.7
Unknown	89	2	1	1	-	-	-	50.0	-	-	-
Total	55,127	1,196	694	812	96	105	58	58.0	91.4	4.8	1.9

Introduction

The Universal Newborn Hearing Screening and Early Intervention Programme

The early detection of hearing loss, and the application of appropriate medical and educational interventions, has been demonstrated to significantly improve the baby's long-term language skills and cognitive ability.

New Zealand's Universal Newborn Hearing Screening and Early Intervention Programme (UNHSEIP) was implemented over a three year period from 2007 to 2010. The UNHSEIP is jointly overseen by two Government agencies, the Ministries of Health and Education. The Ministry of Health has responsibility for screening, audiological diagnosis of hearing loss and medical interventions, and the Ministry of Education has responsibility for early intervention services. District Health Boards (DHBs) are the main providers of newborn hearing screening, follow-up audiology services and medical interventions.

Newborn hearing screening must be offered to the family/whānau of all babies born in a DHB region, whether they are born in hospital or at home, within a framework of nationally consistent policies, standards and guidelines.

Programme Monitoring

The aim of the UNHSEIP is early identification of newborns with hearing loss, so that they can access timely and appropriate interventions, inequalities are reduced and the outcomes for these children, their families and whānau, communities and society are improved. The core goals of the UNHSEIP are described as "1-3-6" goals which are based on international benchmarks:

- ≥95% of babies to be screened by 1 month of age
- ≥90% of audiology assessments to be completed by 3 months of age
- Initiation of appropriate medical and audiological services, and early intervention education services, by 6 months of age.

Monitoring is a core aspect of quality improvement activities, which are concerned with maximising the likelihood that the day-to-day operations of the screening programme will deliver the expected outcomes. Routine monitoring based on newborn hearing screening and audiology data is reported to the Ministry by DHBs on a quarterly basis.

This report is the first to use the revised UNHSEIP Monitoring Framework. Reporting against the new framework is annual, rather than a 6 monthly as was done previously. It is important to note however, that the new framework was designed to reflect the updated aABR only screening protocol, and the 2014 data in this report is from the previous AOAE/AABR screening regime. This means that some of the language and some indicators in this report are not yet reflective of the new framework.

The data presented in this report covers the following indicators from the revised UNHSEIP Monitoring Framework:

- 1.1 Newborn hearing screening offered
- 1.2 Newborn hearing screening consents and declines
- 1.3 Newborn hearing screening coverage
 - (a) Completed by 1 month [*1 month goal*]
 - (b) Completed total
 - (c) Completed of those consented
- 1.5 Referral rate to audiology assessment
- 1.6 Hearing surveillance rate (referred to as targeted follow-up for this report)
 - (a) Referral for surveillance rate
 - (b) Distribution of risk factors
- 1.8 Positive predictive value of the screening test
- 2.2 Audiology assessment completion
 - (a) Audiology assessment completion rate [*3 month goal*]
 - (b) PCHL diagnosed by 3 months
- 2.3 Audiology not attended
- 2.4 Hearing loss detected

Other indicators from the framework, for which data is not currently available, are listed below:

- 1.4 Newborn hearing screening did not attend and lost contacts – The number of babies that do not complete screening due to not attending or the service losing contact as a proportion of all babies whose parents/guardians consented to screening.
- 1.7 Second screening rates – The number of babies referred from first to second automated auditory brainstem response (aABR) screening as a proportion of all babies that completed first aABR screens relates to the new protocol.
- 2.5 Outcome of hearing surveillance
 - (a) Hearing loss detected
 - (b) Referred for surveillance but not assessed
- 2.6 Cases not identified from screening
- 2.7 Age at first assistive hearing device [*6 month goal*]

In addition, indicator 2.1 (audiology assessment timeliness) will be reported by DHBs to the NSU as part of regular monitoring, and the Early Intervention education services indicators (3.1 to 3.4) will be reported separately by the Ministry of Education for 2014. Further details for indicators not covered by this report are given at the end of this report.

Information Included in this Report

The information included in this report relates to babies that commenced screening between 1 January 2014 and 31 December 2014.

Newborn hearing screening tests and audiology assessments

Newborn hearing screening and follow-up audiology information is captured by the Ministry of Health's National Screening Unit (NSU) in two ways. Some DHBs collect and record information on paper forms, which are regularly submitted to NSU and the data is entered into the NSU's national hearing database. An increasing number of DHBs submit their data electronically which is then uploaded into the national database. Data for babies who started screening during the reporting period was extracted on 16 September 2015. Final audiology data was extracted on 9 February 2016.

Additional information for monitoring was sourced from quarterly DHB contractual reporting. This information is used to monitor trends in the offer and decline of newborn hearing screening, as only information from babies with consent is recorded in the national database. In future this information will come from NHIMS.

Ethnicity

Ethnicity data in this report is grouped according to a prioritised system, which is commonly applied across the health sector. Prioritisation involves allocating each person to a single ethnic group, based on the ethnicities they have identified with, in the prioritised order of Māori, Pacific, Asian, Other and European. For example, if someone identifies as being New Zealand European and Māori, under the prioritised ethnic group method, they are classified as Māori for the purpose of the analysis.

Neighbourhood deprivation

Deprivation data was sourced from the NHI database. The New Zealand deprivation index (NZ Dep) is the average level of deprivation of people living in an area at a particular point in time, relative to the whole of New Zealand. Deprivation refers to areas (based on New Zealand Census mesh blocks) rather than individuals. All reporting by NZ Dep is based on the 2013 New Zealand deprivation index decile associated with the residential address held in the NHI database for each baby at the time of data extraction.

In the deprivation index system used by the health sector, areas classified as Decile 1 have the least deprivation and areas classified as Decile 10 have the most deprivation. This is opposite to some other systems of classification, such as that used by education, where level 10 is the least disadvantaged and level 1 the most disadvantaged.

This report presents results by 2013 NZ Dep quintiles. Each quintile groups two deciles together and contains about 20% of small areas in New Zealand. The two quintiles at opposite ends of the scale are quintile 1 (deciles 1 and 2), which represents children living in the least deprived 20% of small areas ('the least deprived areas'), and quintile 5 (deciles 9 and 10), which represents children living in the most deprived 20% of small areas ('the most deprived areas').

Births

The number of live births by DHB of residence was sourced from the National Maternity Collection, which combines information from live birth registrations from the Births, Deaths and Marriages (BDM) Register along with hospital discharge information and Lead Maternity Carer claims.

Data calculations

Reporting by DHB

Almost all indicators have been reported by the screening DHB as this DHB is responsible for ensuring screening is completed. The exceptions are indicators 1.1 and 1.3 (offer of screening and screening coverage) where the denominator is the number of births. As this data is only available by DHB of domicile at birth the numerator counts for these two indicators have also been calculated using DHB of birth. All remaining indicators (including audiology) are reported by the screening DHB location. For most babies (about 95%) this is the same as DHB of birth.

Previous monitoring reports reported audiology indicators by the DHB that delivered the audiology assessment. The screening and audiology DHBs are usually the same. Exceptions to this are Waitemata and West Coast DHBs whose audiology is provided by Auckland and Canterbury DHBs respectively.

Gestational age

Where gestational age was not recorded, a gestational age of 40 weeks was allocated (1% of records, n=569). This figure has dropped over time but has settled at around 1 percent. DHBs will continue to be encouraged to include the correct gestational age on data forms. For babies born at less than full term, age is corrected by the length of time pre-term for the purposes of calculating age at screen and age at audiology.

Data limitations

Accuracy of reporting

Where hand written screening forms are provided to the NSU, data is entered manually into the national database. Data is also imported into the database from DHBs electronically. The potential for errors in data entry is minimised by a two-step data checking process - one at data entry and the other during data processing. Each record must contain a value in eleven mandatory fields to be included in reporting. The NSU and screening providers have quality monitoring processes in place to maintain high data quality.

Audiology data

This report includes audiology information on 812 (67.9%) of the 1,196 babies that were referred for audiology assessment. A further 58 babies were identified as 'Did not attend' (DNA), declined or moved. The percentage of audiology referrals with completed assessment information recorded in the database is consistent with previous monitoring reports. Audiology assessment information had not been recorded in the national database for the remaining babies by the date of data extraction for this report.

Numerator and denominator source differences

The data used for this report has come from different sources. Offers and declines data taken was from DHB contractual reporting and gives the count of offers and declines made during the 2014 year. Live births data relates to deliveries during the 2014 year. The screening and audiology data extracted from the national hearing database relates to babies that commenced screening during the 2014 year. There is a slight mismatch between these three cohorts. This mismatch leads to situations where a DHB may show as having offered screening to more than 100% of births, or as having more than 100% of births consenting to newborn hearing screening. The local over (and under) proportions should balance out at regional and national levels.

Monitoring Indicators

1.1. Newborn Hearing Screening Offers

Indicator 1.1	Target
The number of babies whose parents/guardians were offered screening as a proportion of live births.	100%

Using the numbers reported by DHBs for 2014, the national rate of screening offers was 96.5%. This is slightly higher than the rate reported for the July to December 2013 period (95.4%), but is below the target. As shown in table 8, rates by DHB ranged from 79.4% (Counties Manukau) to 127.1% (Auckland). Most DHBs had rates above 93%.

The number of babies offered screening within a reporting period can be greater than the number of live births attributed to the DHB for the same period, leading to the percentage offered being more than 100%. When the three Auckland region DHBs are combined the rate of offers to live births is 94%. The local over (and under) proportions should balance out at regional and national levels.

Table 8 Offer of newborn hearing screening by DHB, 1 January to 31 December 2014

DHB of birth	Offered Screening	Live births	Percentage offered
	N	N	%
Northland	2,004	2,097	95.6
Waitemata	6,505	7,910	82.2
Auckland	8,098	6,370	127.1
Counties Manukau	6,572	8,279	79.4
Waikato	5,136	5,325	96.5
Lakes	1,448	1,393	103.9
Bay of Plenty	2,590	2,785	93.0
Tairāwhiti	704	722	97.5
Taranaki	1,472	1,529	96.3
Hawke's Bay	1,960	2,098	93.4
Whanganui	795	822	96.7
MidCentral	2,117	2,112	100.3
Hutt Valley	1,920	1,863	103.1
Capital and Coast	3,631	3,572	101.7
Wairarapa	494	443	111.5
Nelson Marlborough	1,287	1,438	89.5
West Coast	301	353	85.3
Canterbury	6,006	6,032	99.6
South Canterbury	655	658	99.5
Southern	3,320	3,296	100.7
Total	57,015	59,097	96.5

1.2. Newborn Hearing Screening Consents and Declines

1.2 (a) Newborn hearing screening consents

Indicator 1.2a	Target
The number of babies whose parents/guardians consented to screening as a proportion of those offered.	No target set

Nearly all families that were offered screening accepted (97.4%). Offers data was sourced from DHB contractual reporting and gives the count of offers made during the 2014 year. Consents data was sourced from the national hearing database and relates to babies that commenced screening during the 2014 year. The slight mismatch between these cohorts has led to instances where a rate greater than 100% has been reported (see results for Taranaki, Hawke's Bay and Nelson Marlborough).

Table 9 Consents for newborn hearing screening by DHB, 1 January to 31 December 2014

DHB of screening	Consented	Offered Screening	Percentage consented
	N	N	%
Northland	1,761	2,004	87.9
Waitemata	6,207	6,505	95.4
Auckland	8,037	8,098	99.2
Counties Manukau	6,299	6,572	95.8
Waikato	5,027	5,136	97.9
Lakes	1,377	1,448	95.1
Bay of Plenty	2,518	2,590	97.2
Tairāwhiti	691	704	98.2
Taranaki	1,497	1,472	101.7
Hawke's Bay	1,995	1,960	101.8
Whanganui	779	795	98.0
MidCentral	1,787	2,117	84.4
Hutt Valley	1,905	1,920	99.2
Capital and Coast	3,547	3,631	97.7
Wairarapa	476	494	96.4
Nelson Marlborough	1,433	1,287	111.3
West Coast	297	301	98.7
Canterbury	5,921	6,006	98.6
South Canterbury	640	655	97.7
Southern	3,314	3,320	99.8
Total	55,508	57,015	97.4

1.2 (b) Newborn hearing screening declines

Indicator 1.2b	Target
The number of babies whose parents/guardians declined screening as a proportion of those offered.	No target set

For the 2014 period a small number of families that were offered screening declined (0.9%). The decline rates for most DHBs were between 0.2% and 1.4%. Exceptions to this were, Northland (4.7%), Bay of Plenty (2.7%), and West Coast (4.0%), see table 10. The percentage consented and the percentage declined do not add to 100% (1.7% gap) due to offers and declines currently coming from a different data source than consents.

Table 10 Newborn hearing screening declines by DHB, 1 January to 31 December 2014

DHB of screening	Declined	Offered Screening	Percentage declined
	N	N	%
Northland	95	2,004	4.7
Waitemata	48	6,505	0.7
Auckland	67	8,098	0.8
Counties Manukau	33	6,572	0.5
Waikato	29	5,136	0.6
Lakes	13	1,448	0.9
Bay of Plenty	71	2,590	2.7
Tairāwhiti	4	704	0.6
Taranaki	9	1,472	0.6
Hawke's Bay	5	1,960	0.3
Whanganui	6	795	0.8
MidCentral	15	2,117	0.7
Hutt Valley	7	1,920	0.4
Capital and Coast	10	3,631	0.3
Wairarapa	1	494	0.2
Nelson Marlborough	18	1,287	1.4
West Coast	12	301	4.0
Canterbury	70	6,006	1.2
South Canterbury	5	655	0.8
Southern	20	3,320	0.6
Total	538	57,015	0.9

1.3. Newborn Hearing Screening Coverage

Information on the number of screens completed was sourced from the national UNHSEIP database and information on live births was sourced from the National Maternity Collection. Both the numerator and the denominator have been calculated by DHB of birth to be more consistent. This is the first report to calculate coverage as a percentage of live births.

1.3 (a) Newborn hearing screening completed by 1 month of age

Indicator 1.3a	Target
The number of babies for whom screening is completed by 1 month of age as a proportion of live births.	≥95%

Nationally, 85.5% of babies completed screening by 1 month against the target of ≥95%. Six DHBs met the target (Taranaki, Hutt Valley, Capital and Coast, Wairarapa, South Canterbury and Southern) and Canterbury was slightly below (see table 11). Rates ranged from 51% (Northland and MidCentral) to 102.9% (Wairarapa). Values above 100% are the result of using different data sources for numbers screened and numbers of births.

Table 11 Newborn hearing screens completed by 1 month of age by DHB, 1 January to 31 December 2014

DHB of birth	Completed by 1 month of age ¹	Live births ²	Percentage complete 1 month
	N	N	%
Northland	1,076	2,097	51.3
Waitemata	6,227	7,910	78.7
Auckland	5,725	6,370	89.9
Counties Manukau	6,599	8,279	79.7
Waikato	4,785	5,325	89.9
Lakes	1,245	1,393	89.4
Bay of Plenty	2,231	2,785	80.1
Tairāwhiti	666	722	92.2
Taranaki	1,466	1,529	95.9
Hawke's Bay	1,786	2,098	85.1
Whanganui	697	822	84.8
MidCentral	1,079	2,112	51.1
Hutt Valley	1,848	1,863	99.2
Capital and Coast	3,553	3,572	99.5
Wairarapa	456	443	102.9
Nelson Marlborough	1,317	1,438	91.6
West Coast	266	353	75.4
Canterbury	5,700	6,032	94.5
South Canterbury	631	658	95.9
Southern	3,194	3,296	96.9
Total	50,547	59,097	85.5

¹ sourced from UNHSEIP national database

² sourced from National Maternity Collection

Completion of screening by 1 month of age varied by ethnicity (table 12). Rates for Māori (75.2%) and Pacific (80.4%) were lower than for Asian and European (both 90.4%).

Table 12 Newborn hearing screens completed by 1 month of age by ethnicity, 1 January to 31 December 2014

Ethnicity	Completed by 1 month of age ¹	Live births ²	Percentage complete 1 month
	N	N	%
Māori	11,410	15,182	75.2
Pacific	4,989	6,209	80.4
Asian	8,508	9,413	90.4
European	24,428	27,030	90.4
Other	1,212	1,263	96.0
Total	50,547	59,097	85.5

1 sourced from UNHSEIP national database
2 sourced from National Maternity Collection

Rates of completion by 1 month of age also varied by deprivation with the rate for the least deprived areas (quintile 1) being nearly 20 percentage points higher than the most deprived areas (quintile 5). The trend is not clear, however, as quintile 3 has the second highest rate of completion by 1 month (see table 13).

Table 13 Newborn hearing screens completed by 1 month of age by deprivation, 1 January to 31 December 2014

NZ Dep 2013	Completed by 1 month of age ¹	Live births ²	Percentage complete 1 month
	N	N	%
Quintile 1	8,023	8,512	94.3
Quintile 2	8,297	9,278	89.4
Quintile 3	9,756	10,593	92.1
Quintile 4	11,607	13,394	86.7
Quintile 5	12,782	17,320	73.8
Unknown	82	-	-
Total	50,547	59,097	85.5

1 sourced from UNHSEIP national database
2 sourced from National Maternity Collection

1.3 (b) Total newborn hearing screens completed

Indicator 1.3b	Target
The number of babies for whom screening is completed as a proportion of live births.	No target set

In total, 55,127 babies completed newborn hearing screening during the period, compared with 59,097 live births. While these figures come from different data sources, this indicates that approximately 93.3% of babies born in this period completed screening.

Total screening completion rates by DHB ranged from 82% (Northland) to 105% (Wairarapa). Twelve DHBs had rates around 94% or above (see table 14). Rates above 100% are due to the use of different data sources.

Table 14 Total newborn hearing screens completed for the period by DHB, 1 January to 31 December 2014

DHB of birth	Completed total ¹	Live births ²	Percentage complete within period
	N	N	%
Northland	1,720	2,097	82.0
Waitemata	7,177	7,910	90.7
Auckland	5,920	6,370	92.9
Counties Manukau	7,192	8,279	86.9
Waikato	5,046	5,325	94.8
Lakes	1,389	1,393	99.7
Bay of Plenty	2,486	2,785	89.3
Tairāwhiti	679	722	94.0
Taranaki	1,491	1,529	97.5
Hawke's Bay	1,963	2,098	93.6
Whanganui	722	822	87.8
MidCentral	1,817	2,112	86.0
Hutt Valley	1,856	1,863	99.6
Capital and Coast	3,645	3,572	102.0
Wairarapa	466	443	105.2
Nelson Marlborough	1,417	1,438	98.5
West Coast	292	353	82.7
Canterbury	5,918	6,032	98.1
South Canterbury	635	658	96.5
Southern	3,296	3,296	100.0
Total	55,127	59,097	93.3

¹ sourced from UNHSEIP national database

² sourced from National Maternity Collection

Tables 15 and 16 show a breakdown of total screening completion rates by ethnicity and deprivation respectively. As for completion by 1 month, the rate of completed screens for Māori and Pacific babies was lower than for Asian and European, and the rate for the most deprived areas (quintile 5) was lower than the least deprived areas (quintile 1). Once again, rates by deprivation do not follow a clear trend. In this case the total completion rate was actually highest for quintile 3 (99.9%). Completion rates were greater than 95% for all quintiles other than quintile 5, which had a completion rate of 82.5%.

Table 15 Total newborn hearing screens completed for the period by ethnicity, 1 January to 31 December 2014

Ethnicity	Completed total ¹	Live births ²	Percentage complete within period
	N	N	%
Māori	12,997	15,182	85.6
Pacific	5,599	6,209	90.2
Asian	8,973	9,413	95.3
European	26,239	27,030	97.1
Other	1,319	1,263	104.4
Total	55,127	59,097	93.3

1 sourced from UNHSEIP national database
2 sourced from National Maternity Collection

Table 16 Total newborn hearing screens completed for the period by deprivation 1 January to 31 December 2014

NZ Dep 2013	Completed total ¹	Live births ²	Percentage complete within period
	N	N	%
Quintile 1	8,439	8,512	99.1
Quintile 2	8,897	9,278	95.9
Quintile 3	10,581	10,593	99.9
Quintile 4	12,825	13,394	95.8
Quintile 5	14,296	17,320	82.5
Unknown	89	-	-
Total	55,127	59,097	93.3

1 sourced from UNHSEIP national database
2 sourced from National Maternity Collection

1.3 (c) Newborn hearing screens completed as a percentage of consents

Indicator 1.3c	Target
The number of babies for whom screening is completed as a proportion of those who have been consented.	97%

Indicator 1.3(c) looks at the extent to which screening is completed for those parents/guardians who consented to have their baby's hearing screened. For the 2014 period the national rate was 99.3% and rates by DHB all exceeded the 97% target. Nearly all DHBs had rates of 99% or above.

Table 16 Newborn hearing screens completed as percentage of consents by DHB, 1 January to 31 December 2014

DHB of birth	Completed total	Consented	Complete as percentage of consented
	N	N	%
Northland	1,720	1,756	97.9
Waitemata	7,177	7,240	99.1
Auckland	5,920	5,952	99.5
Counties Manukau	7,192	7,304	98.5
Waikato	5,046	5,065	99.6
Lakes	1,389	1,389	100.0
Bay of Plenty	2,486	2,514	98.9
Tairāwhiti	679	683	99.4
Taranaki	1,491	1,491	100.0
Hawke's Bay	1,963	1,979	99.2
Whanganui	722	725	99.6
MidCentral	1,817	1,838	98.9
Hutt Valley	1,856	1,859	99.8
Capital and Coast	3,645	3,650	99.9
Wairarapa	466	466	100.0
Nelson Marlborough	1,417	1,421	99.7
West Coast	292	295	99.0
Canterbury	5,918	5,925	99.9
South Canterbury	635	638	99.5
Southern	3,296	3,318	99.3
Total	55,127	55,508	99.3

Tables 17 and 18 provide breakdowns by ethnicity and deprivation. The rates for Māori (98.8%) and Pacific (98.7%) are marginally lower than for Asian and European (both 99.6%). The difference in rates for babies from the least and most deprived areas was small (0.7 percentage points).

Table 17 Newborn hearing screens completed as percentage of consents by ethnicity, 1 January to 31 December 2014

Ethnicity	Completed total	Consented	Complete as percentage of consented
	N	N	%
Māori	12,997	13,150	98.8
Pacific	5,599	5,672	98.7
Asian	8,973	9,007	99.6
European	26,239	26,351	99.6
Other	1,319	1,328	99.3
Total	55,127	55,508	99.3

Table 18 Newborn hearing screens completed as percentage of consents by deprivation, 1 January to 31 December 2014

NZ Dep 2013	Completed total	Consented	Complete as percentage of consented
	N	N	%
Quintile 1	8,439	8,473	99.6
Quintile 2	8,897	8,945	99.5
Quintile 3	10,581	10,629	99.5
Quintile 4	12,825	12,918	99.3
Quintile 5	14,296	14,453	98.9
Unknown	89	90	98.9
Total	55,127	55,508	99.3

1.5. Referral Rate to Audiology

1.5 Referrals to audiology from screening test

Indicator 1.5	Target
The number of babies that are referred from screening to audiology as a proportion of all completed screens.	<2 %

The average rate of referral to audiology for the period was 2.2%. Northland DHB had the highest referral rate at 5.3%, followed by 4.3% at Hawke's Bay. All other DHBs had rates between 0% and 3.4% (see table 19). Rates for some DHBs are based on low numbers so care should be taken with interpretation.

Table 19 Referrals to audiology from newborn hearing screening by DHB, 1 January to 31 December 2014

DHB of screen	Referred to audiology	Completed screening	Percentage referred
	N	N	%
Northland	92	1,727	5.3
Waitemata	115	6,156	1.9
Auckland	135	7,974	1.7
Counties Manukau	212	6,203	3.4
Waikato	96	5,010	1.9
Lakes	36	1,377	2.6
Bay of Plenty	54	2,489	2.2
Tairāwhiti	9	687	1.3
Taranaki	26	1,497	1.7
Hawke's Bay	86	1,979	4.3
Whanganui	14	776	1.8
MidCentral	38	1,766	2.2
Hutt Valley	50	1,902	2.6
Capital and Coast	59	3,543	1.7
Wairarapa	6	476	1.3
Nelson Marlborough	15	1,429	1.0
West Coast	1	294	0.3
Canterbury	68	5,915	1.1
South Canterbury	20	636	3.1
Southern	64	3,291	1.9
Total	1,196	55,127	2.2

Referral rates by ethnicity are shown in table 20. Rates were highly variable, with much higher rates of 3.0% for Māori and 4.0% for Pacific compared to 1.6% for Asian and European.

Table 20 Referrals to audiology from newborn hearing screening by ethnicity, 1 January to 31 December 2014

Ethnicity	Referred to audiology	Completed screening	Percentage referred
	N	N	%
Māori	389	12,997	3.0
Pacific	225	5,599	4.0
Asian	141	8,973	1.6
European	416	26,239	1.6
Other	25	1,319	1.9
Total	1,196	55,127	2.2

The results for referral rate by deprivation suggest that there is a trend of increased rates of referral to audiology with increasing levels of deprivation (table 21). Babies resident in the most deprived areas had a referral rate that was twice that of babies in the least deprived areas.

Table 21 Referrals to audiology from newborn hearing screening by deprivation, 1 January to 31 December 2014

NZ Dep 2013	Referred to audiology	Completed screening	Percentage referred
	N	N	%
Quintile 1	124	8,439	1.5
Quintile 2	142	8,897	1.6
Quintile 3	204	10,581	1.9
Quintile 4	276	12,825	2.2
Quintile 5	448	14,296	3.1
Unknown	2	89	2.2
Total	1,196	55,127	2.2

Table 22 shows the split between audiology referrals that were unilateral (for one ear) and bilateral (for both ears). For the 2014 period the majority of the 1,196 babies that were referred to audiology were unilateral referrals (63.5%).

Table 22 Breakdown of referrals to audiology from newborn hearing screening by type (unilateral or bilateral), 1 January to 31 December 2014

Total referrals	Unilateral		Bilateral	
	N	%	N	%
1,196	760	63.5	436	36.5

1.6. Hearing Surveillance Rate

1.6 (a) Proportion of babies that pass screening but are referred for surveillance

Indicator 1.6a	Target
The number of babies who were referred to hearing surveillance as a proportion of all babies that completed screening with a pass result.	No target set

It is important to note that the new framework was designed to reflect the updated aABR only screening protocol, and the shift in policy and language to hearing surveillance rather than targeted follow-up. However the 2014 data in this report is

from the previous AOAE\AABR screening regime and targeted follow-up policy. For this report the term “targeted follow-up” will be used.

Nationally, 2,494 babies (4.6%) that passed screening were referred for targeted follow-up due to the presence of one or more risk factors for delayed onset/progressive hearing loss. This result is similar to previous reports. The targeted follow-up rate varied across DHBs from 10.5% at Hawke’s Bay to 2.4% at South Canterbury. Most DHBs had rates between 4 and 5% (see table 23).

Table 23 Referrals for targeted follow-up from newborn hearing screening by DHB, 1 January to 31 December 2014

DHB of screen	Referred for targeted follow-up	Screened and passed	Percentage referred for targeted follow-up
	N	N	%
Northland	125	1,630	7.7
Waitemata	235	6,036	3.9
Auckland	304	7,735	3.9
Counties Manukau	260	5,941	4.4
Waikato	211	4,913	4.3
Lakes	71	1,341	5.3
Bay of Plenty	90	2,435	3.7
Tairāwhiti	30	678	4.4
Taranaki	119	1,471	8.1
Hawke’s Bay	198	1,888	10.5
Whanganui	48	762	6.3
MidCentral	90	1,727	5.2
Hutt Valley	73	1,852	3.9
Capital and Coast	193	3,484	5.5
Wairarapa	24	470	5.1
Nelson Marlborough	90	1,417	6.4
West Coast	15	293	5.1
Canterbury	184	5,847	3.1
South Canterbury	15	616	2.4
Southern	119	3,227	3.7
Total	2,494	53,763	4.6

Targeted follow-up rates appear to vary by ethnicity (see table 24). The lowest rate of follow-up was 2.3% for Asian. Rates for Pacific (4.2%) and European (4.3) were close to the national rate, but the rate for Māori was higher (7.1%).

Table 24 Referrals for targeted follow-up from newborn hearing screening by ethnicity, 1 January to 31 December 2014

Ethnicity	Referred for targeted follow-up	Screened and passed	Percentage referred for targeted follow-up
	N	N	%
Māori	890	12,573	7.1
Pacific	222	5,311	4.2
Asian	201	8,803	2.3
European	1,116	25,784	4.3
Other	65	1,292	5.0
Total	2,494	53,763	4.6

Differences by deprivation were smaller but targeted follow up rates were higher for babies in more deprived areas (see table 25).

Table 25 Referrals for targeted follow-up from newborn hearing screening by deprivation, 1 January to 31 December 2014

NZ Dep 2013	Referred for targeted follow-up	Screened and passed	Percentage referred for targeted follow-up
	N	N	%
Quintile 1	325	8,297	3.9
Quintile 2	371	8,742	4.2
Quintile 3	441	10,362	4.3
Quintile 4	594	12,526	4.7
Quintile 5	755	13,749	5.5
Unknown	8	87	9.2
Total	2,494	53,763	4.6

1.6 (b) Distribution of risk factors among babies referred for hearing surveillance

Indicator 1.6b	Target
The distribution of risk factors for babies referred to hearing surveillance.	No target set

The most frequently reported risk factor for babies referred for targeted follow-up in the 2014 period was family history (58.1%), followed by being in a neonatal intensive care unit (NICU) for longer than 5 days (21.6%). Of all completed screens these two risk factors were present for 2.6% and 1.0% of babies respectively. Table 26 shows the full count of babies for each risk factor. Where a baby had more than one risk factor reported they have been counted more than once.

Table 26 Number and proportion of risk factors for babies referred for targeted follow-up from newborn hearing screening, 1 January to 31 December 2014

Risk factor	Number with risk factor	Percentage referred with risk factor ²	Percentage of all screened with risk factor ²
	N	%	%
Family History	1,448	58.1	2.6
NICU more than 5 days	538	21.6	1.0
Jaundice Requiring Phototherapy	303	12.1	0.5
Ventilation	268	10.7	0.5
Head Trauma	151	6.1	0.3
Other	140	5.6	0.3
Bacterial/Viral Meningitis	109	4.4	0.2
Cranio-facial Anomalies	85	3.4	0.2
Jaundice Transfusion Level	68	2.7	0.1
Syndrome	50	2.0	0.1
TORCH/S ¹	37	1.5	0.1
Jaundice Any Level	21	0.8	0.0

1 TORCH/S refers to infection of a developing fetus by any of (T)oxoplasmosis, (O)ther Agents, (R)ubella (also known as German Measles), (C)ytomegalovirus, and (H)erpes Simplex
2 These percentage columns do not add to 100% because babies can have more than one risk factor. The total number of babies referred for targeted follow-up was 2,494, and the total number of babies that completed screening was 55,127

1.8 Positive Predictive Value of the Screening Test

Indicator 1.8	Target
The proportion of babies who are referred from screening and on audiology assessment are diagnosed with permanent congenital hearing loss.	No target set.

Positive predictive value (PPV) is a measure of the performance of the screening test. Results for this indicator give the probability that a baby referred from screening actually has permanent congenital hearing loss (PCHL). A high PPV means that there are few unnecessary referrals to audiology. If PPV is low, many children with no hearing loss will be referred for assessment, with associated costs and anxiety for families.

Of the 1,196 referrals to audiology from screening during 2014, completed audiology assessment data for 812 babies was available at the date of data extraction for this report. There were 105 true positives (refer result from screening followed by a diagnosis of PCHL at audiology) and 707 false positives (refer result from screening but no PCHL diagnosed at audiology) for these 812 babies. This equates to a PPV of 13% (see table 27). Because audiology assessment for the remaining babies referred to audiology is not included in this calculation, this result is only indicative and should not be considered the full programme PPV.

Table 27 Positive predictive value of newborn hearing screening by type of audiology referral, 1 January to 31 December 2014

Type of referral to audiology	True positives (TP) (Positive screen & PCHL on audiology)	False positives (FP) (Positive screen but no PCHL on audiology)	PPV TP/TP+FP
Bilateral	64	215	0.23
Unilateral	41	492	0.08
Total screening referrals	105	707	0.13

2.2 Audiology Assessment Completed

Data for this indicator relates to babies who were referred from screening to audiology (i.e. did not pass screening). Previous reports have calculated completed assessments as a proportion of babies that commenced audiology. The revised indicator presented in this report instead calculates completed assessments as a proportion of referrals, leading to quite different results compared to the indicator reported for previous periods.

2.2 (a) Proportion of babies referred from screening that complete audiology assessments

Indicator 2.2a	Target
The proportion of babies referred from screening who complete audiology assessment.	≥90% by 3 months of age

A total of 1,195 babies did not pass screening and were referred to audiology for the 2014 period. By the date of data extraction for this report 812 babies had completed audiology assessment (67.9%). This was made up of 694 (58.0%) babies that completed by the target time of 3 months of age, 98 (8.2%) that completed between 3 and 6 months of age, and 20 (1.7%) that were over 6 months of age when assessment was completed (see table 28). There were also an additional 58 babies for whom the audiology outcome was DNA, lost contact, or declined.

The target for this indicator is for at least 90% of assessments to be complete by the time babies reach 3 months of age. The national result (58.0%) was well below this target. Aside from West Coast and Wairarapa DHBs, which each had low numbers of referrals to audiology, Hutt Valley (88.0%) had the highest rate of assessment completion by 3 months. The next highest was 86.4% at Capital and Coast followed by 80.7% at Auckland. A further six DHBs had rates between 70% and 80% (Southern, Canterbury, South Canterbury, Nelson Marlborough, Waitemata, and Waikato).

Table 28 Audiology assessment completion for babies referred from newborn hearing screening by timeframe and DHB, 1 January to 31 December 2014

DHB of screen	Complete <3 months	Complete 3-6 months	Complete >6 months	Total referred to audiology	Complete < 3 months	Complete 3-6 months	Complete >6 months	Total complete
	N	N	N		N	%	%	
Northland	50	8	2	92	54.3	8.7	2.2	65.2
Waitemata	64	20	-	115	55.7	17.4	-	73.0
Auckland	105	4	-	135	77.8	3.0	-	80.7
Counties Manukau	74	34	3	212	34.9	16.0	1.4	52.4
Waikato	59	8	1	96	61.5	8.3	1.0	70.8
Lakes	16	-	-	36	44.4	-	-	44.4
Bay of Plenty	23	4	-	54	42.6	7.4	-	50.0
Tairāwhiti	5	1	-	9	55.6	11.1	-	66.7
Taranaki	16	2	-	26	61.5	7.7	-	69.2
Hawke's Bay	44	4	2	86	51.2	4.7	2.3	58.1
Whanganui	7	1	-	14	50.0	7.1	-	57.1
MidCentral	20	4	1	38	52.6	10.5	2.6	65.8
Hutt Valley	42	1	1	50	84.0	2.0	2.0	88.0
Capital and Coast	48	2	1	59	81.4	3.4	1.7	86.4
Wairarapa	5	-	-	6	83.3	-	-	83.3
Nelson Marlborough	11	-	-	15	73.3	-	-	73.3
West Coast	1	-	-	1	100.0	-	-	100.0
Canterbury	47	2	3	68	69.1	2.9	4.4	76.5
South Canterbury	14	1	-	20	70.0	5.0	-	75.0
Southern	43	2	6	64	67.2	3.1	9.4	79.7
Total	694	98	20	1,196	58.0	8.2	1.7	67.9

Audiology assessment completion by 3 months of age was below target for all ethnic groups (table 29). The highest rate was 75.9% for Asian, followed by 70.7% for European. Rates for Māori (46.8%) and Pacific (41.8%) were around half or less of the 90% target.

Table 29 Audiology assessment completion for babies referred from newborn hearing screening by timeframe and ethnicity, 1 January to 31 December 2014

Ethnicity	Complete < 3 months	Complete 3-6 months	Complete >6 months	Total referred to audiology	Percentage complete < 3 months	Percentage complete 3-6 months	Percentage complete >6 months	Total percentage complete
	N	N	N		N	%	%	
Māori	182	31	5	389	46.8	8.0	1.3	56.0
Pacific	94	32	3	225	41.8	14.2	1.3	57.3
Asian	107	7	4	141	75.9	5.0	2.8	83.7
European	294	27	8	416	70.7	6.5	1.9	79.1
Other	17	1	-	25	68.0	4.0	-	72.0
Total	694	98	20	1,196	58.0	8.2	1.7	67.9

Variation in three month completion rates by deprivation was also evident. Quintile 5, the most deprived, had a rate of 45.8% compared to rates of 68.5% for quintile 1 and 73.2% for quintile 2 (table 30).

Table 30 Audiology assessment completion for babies referred from newborn hearing screening by timeframe and deprivation, 1 January to 31 December 2014

NZ Dep 2013	Complete < 3 months	Complete 3-6 months	Complete >6 months	Total referred to audiology	Percentage complete < 3 months	Percentage complete 3-6 months	Percentage complete >6 months	Total percentage complete
	N	N	N	N	%	%	%	%
Quintile 1	85	5	3	124	68.5	4.0	2.4	75.0
Quintile 2	104	11	4	142	73.2	7.7	2.8	83.8
Quintile 3	133	8	4	204	65.2	3.9	2.0	71.1
Quintile 4	166	24	5	276	60.1	8.7	1.8	70.7
Quintile 5	205	50	4	448	45.8	11.2	0.9	57.8
Unknown	1	-	-	2	50.0	-	-	50
Total	694	98	20	1,196	58.0	8.2	1.7	67.9

2.2 (b) Proportion of babies with confirmed PCHL who have a diagnosis by 3 months of age

Indicator 2.2b	Target
The proportion of babies with confirmed permanent congenital hearing loss that have a diagnosis by 3 months of (corrected) age.	No target set

Assessment completion timeliness is particularly important for the group of babies that have a diagnosis of PCHL. Of the 1,196 babies referred to audiology during 2014, 105 had a confirmed diagnosis of PCHL. Of these 105 babies, 96 (91.4%) had hearing loss confirmed by the time they reached 3 months of age. The relatively low numbers involved limit meaningful comparison between DHB level rates but these have been included (see table 31).

Table 31 Proportion of babies with confirmed PCHL following newborn hearing screening who have a diagnosis by 3 months of age, 1 January to 31 December 2014

DHB of screen	Confirmed PCHL by 3 months	Total babies with confirmed PCHL	% PCHL confirmed by 3 months
	N	N	%
Northland	5	6	83.3
Waitemata	12	13	92.3
Auckland	15	15	100.0
Counties Manukau	3	5	60.0
Waikato	10	11	90.9
Lakes	3	3	100.0
Bay of Plenty	2	3	66.7
Tairāwhiti	1	1	100.0
Taranaki	3	3	100.0
Hawke's Bay	3	4	75.0
Whanganui	-	-	-
MidCentral	3	4	75.0
Hutt Valley	9	9	100.0
Capital and Coast	8	8	100.0
Wairarapa	-	-	-
Nelson Marlborough	1	1	100.0
West Coast	-	-	-
Canterbury	13	13	100.0
South Canterbury	-	-	-
Southern	5	6	83.3
Total	96	105	91.4

2.2 (c) Duration of audiology assessment

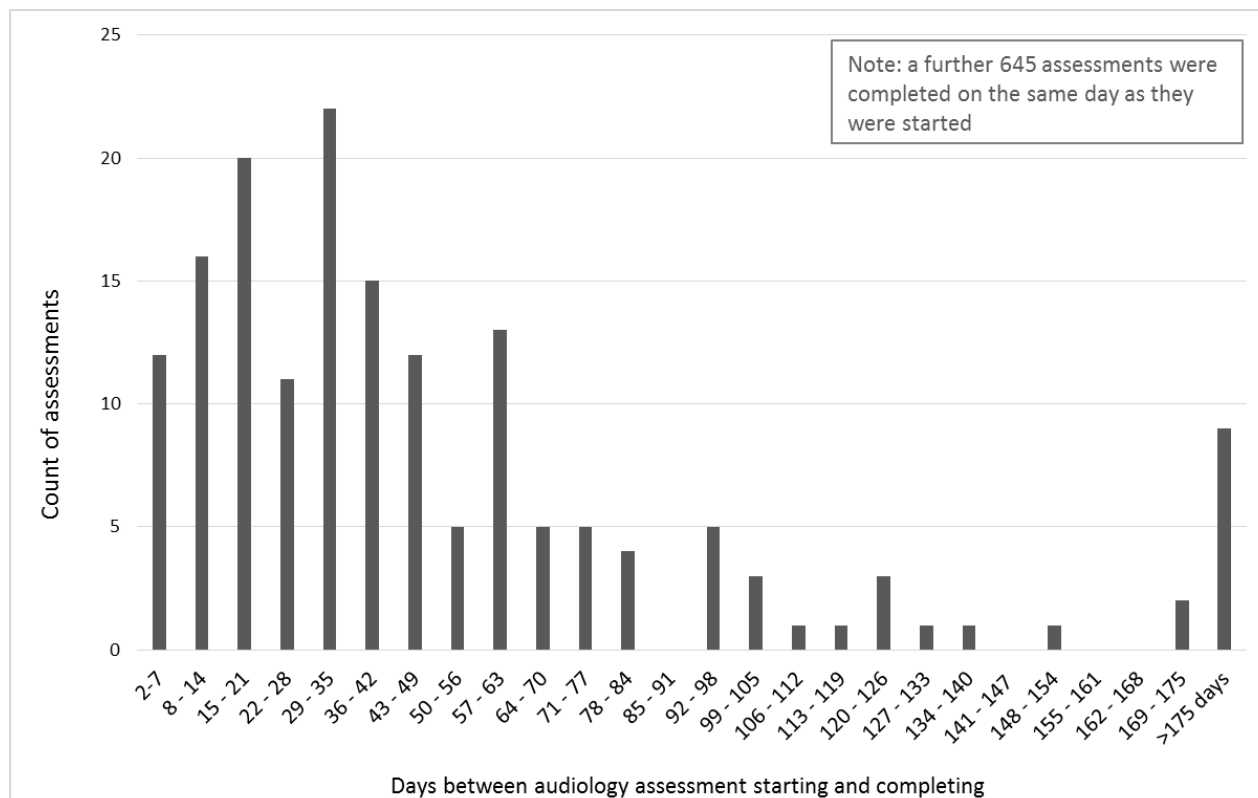
Indicator 2.2c	Target
The duration of audiology diagnosis from assessment to completion.	No target set

This indicator looks at the duration of audiology assessment from the date assessment starts to date of completion. The national median assessment duration was one day, meaning that for most babies assessment was completed on the same day it started (645 out of 812 completed assessments, or 79.4%). All DHBs had a median assessment duration of 1 day.

Figure 1 shows the frequency distribution of completed assessments by duration of assessment. The duration range covered by the graph excludes those completed on the same day they were started (i.e. duration of one day) because the size of this group would mean that the other bars would not be visible on the graph. Each bar

represents one week, with the exception of the '> 175 days' category at far right. The labels used for each bar show the number of days.

Figure 1 Audiology assessment duration for babies referred from newborn hearing screening, all DHBs



2.3 Audiology Assessment Not Attended

Indicator 2.3	Target
The proportion of babies referred from screening who did not complete audiology assessments due to DNA, lost contact, declined or deceased.	No target set

Attendance at audiology assessments is a key factor in the success of the programme. Indicator 2.3 analyses the reasons recorded for audiology assessments that were not attended. It should be noted that DHB policies vary regarding the number of attempts that should be made to contact parents before the appointment is classified as 'did not attend' (DNA). As audiology data completeness increases it is expected that the reasons for non-attendance will be available for more assessments, and hence the counts reported will increase.

According to the data available from the national database at the time of reporting, 58 out of 1,196 audiology referrals were classified as either DNA, lost contact or declined for the 2014 period (4.8%). Included within the 58 were 13 assessments that

were declined by the baby's parents/guardians (1.1% of all referrals). The low numbers involved limit meaningful comparison across DHBs (see table 32).

Table 32 Total audiology assessments not attended for babies referred from newborn hearing screening by DHB, 1 January to 31 December 2014

DHB of screen	Total DNA, lost contact, declined	Total referred to audiology	Percentage not attended
	N	N	%
Northland	19	92	20.7
Waitemata	-	115	-
Auckland	1	135	0.7
Counties Manukau	-	212	-
Waikato	4	96	4.2
Lakes	6	36	16.7
Bay of Plenty	13	54	24.1
Tairāwhiti	-	9	-
Taranaki	2	26	7.7
Hawke's Bay	2	86	2.3
Whanganui	-	14	-
MidCentral	6	38	15.8
Hutt Valley	1	50	2.0
Capital and Coast	2	59	3.4
Wairarapa	-	6	-
Nelson Marlborough	-	15	-
West Coast	-	1	-
Canterbury	-	68	-
South Canterbury	2	20	10.0
Southern	-	64	-
Total	58	1,196	4.8

Tables 33 and 34 provide breakdowns by ethnicity and deprivation. The numbers involved are low but the rate for Māori appears higher than other ethnicities, as does the rate for babies from areas of higher deprivation.

Table 33 Total audiology assessments not attended for babies referred from newborn hearing screening by ethnicity, 1 January to 31 December 2014

Ethnicity	Total DNA, lost contact, declined	Total referred to audiology	% not attended
	N	N	N
Māori	38	389	9.8
Pacific	6	225	2.7
Asian	3	141	2.1
European	11	416	2.6
Other	-	25	-
Total	58	1,196	4.8

Table 34 Total audiology assessments not attended for babies referred from newborn hearing screening by deprivation, 1 January to 31 December 2014

NZ Dep 2013	Total DNA, lost contact, declined	Total referred to audiology	% not attended
	N	N	N
Quintile 1	1	124	0.8
Quintile 2	2	142	1.4
Quintile 3	13	204	6.4
Quintile 4	17	276	6.2
Quintile 5	25	448	5.6
Unknown	-	2	-
Total	58	1,196	4.8

2.4 Hearing Loss Detected

Indicator 2.4	Target
The number of babies that have hearing loss detected as a proportion of all babies screened.	No target set

The detection of PCHL via newborn hearing screening is a key indicator of programme performance, and should be in line with international evidence on PCHL prevalence in comparable programmes. It is anticipated between 1 and 2 babies per 1,000 screened will have moderate or more severe permanent congenital hearing loss identified.

The national rate of PCHL for the 2014 period was within the expected range with 1.9 babies per 1,000 screens receiving a confirmed diagnosis of PCHL. A breakdown by DHBs has been provided but numbers are too low to make comparisons (table 35).

Table 35 Proportion of babies screened that had permanent congenital hearing loss detected by DHB, 1 January to 31 December 2014

DHB of screen	Number of babies with confirmed PCHL			Total babies screened	Babies with confirmed PCHL per 1,000 screened		
	Unilateral	Bilateral	Total		Unilateral	Bilateral	Total
Northland	2	4	6	1,727	1.2	2.3	3.5
Waitemata	8	5	13	6,156	1.3	0.8	2.1
Auckland	10	5	15	7,974	1.3	0.6	1.9
Counties Manukau	2	3	5	6,203	0.3	0.5	0.8
Waikato	2	9	11	5,010	0.4	1.8	2.2
Lakes	-	3	3	1,377	-	2.2	2.2
Bay of Plenty	2	1	3	2,489	0.8	0.4	1.2
Tairāwhiti	-	1	1	687	-	1.5	1.5
Taranaki	-	3	3	1,497	-	2.0	2.0
Hawke's Bay	1	3	4	1,979	0.5	1.5	2.0
Whanganui	-	-	-	776	-	-	-
MidCentral	2	2	4	1,766	1.1	1.1	2.3
Hutt Valley	3	6	9	1,902	1.6	3.2	4.7
Capital and Coast	2	6	8	3,543	0.6	1.7	2.3
Wairarapa	-	-	-	476	-	-	-
Nelson Marlborough	-	1	1	1,429	-	0.7	0.7
West Coast	-	-	-	294	-	-	-
Canterbury	4	9	13	5,915	0.7	1.5	2.2
South Canterbury	-	-	-	636	-	-	-
Southern	2	4	6	3,291	0.6	1.2	1.8
Total	40	65	105	55,127	0.7	1.2	1.9

Rates of PCHL diagnosis by ethnicity ranged from 1.5 per 1,000 for European to 2.5 per 1,000 babies screened for Māori (table 36). While numbers are low, the data suggests a higher rate of PCHL diagnoses for Māori. There was no consistent trend in rates of PCHL diagnoses by deprivation (see table 37).

Table 36 Proportion of babies screened that had permanent congenital hearing loss detected by ethnicity, 1 January to 31 December 2014

Ethnicity	Number of babies with confirmed PCHL			Total babies screened	Babies with confirmed PCHL per 1,000 screened		
	Unilateral	Bilateral	Total		Unilateral	Bilateral	Total
Māori	7	26	33	12,997	0.5	2.0	2.5
Pacific	6	4	10	5,599	1.1	0.7	1.8
Asian	10	10	20	8,973	1.1	1.1	2.2
European	17	22	39	26,239	0.6	0.8	1.5
Other	-	3	3	1,319	-	2.3	2.3
Total	40	65	105	55,127	0.7	1.2	1.9

Table 37 Proportion of babies screened that had permanent congenital hearing loss detected by deprivation, 1 January to 31 December 2014

NZ Dep 2013	Number of babies with confirmed PCHL			Total babies screened	Babies with confirmed PCHL per 1,000 screened		
	Unilateral	Bilateral	Total		Unilateral	Bilateral	Total
Quintile 1	4	8	12	8,439	0.5	0.9	1.4
Quintile 2	8	13	21	8,897	0.9	1.5	2.4
Quintile 3	14	10	24	10,581	1.3	0.9	2.3
Quintile 4	9	15	24	12,825	0.7	1.2	1.9
Quintile 5	5	19	24	14,296	0.3	1.3	1.7
Unknown	-	-	-	89	-	-	-
Total	40	65	105	55,127	0.7	1.2	1.9

Table 38 provides a count of PCHL diagnoses according to right and left ear results. Bilateral sensorineural hearing loss was the most common type of hearing loss identified with 8.7 babies diagnosed per 10,000 completed screens. This equated to 45.7% of PCHL diagnoses for the 2014 period.

Table 38 Proportion of babies screened that had permanent congenital hearing loss detected by type of hearing loss, 1 January to 31 December 2014

Right ear result	Left ear result	Number of babies	Number per 10,000 screens	% of babies with PCHL
Auditory Neuropathy	Auditory Neuropathy	4	0.7	3.8
Auditory Neuropathy	Normal	1	0.2	1.0
Conductive Permanent	Conductive Permanent	1	0.2	1.0
Conductive Permanent	Normal	5	0.9	4.8
Conductive Temporary	Mixed	1	0.2	1.0
Mixed	Mixed	10	1.8	9.5
Mixed	Normal	1	0.2	1.0
Normal	Auditory Neuropathy	3	0.5	2.9
Normal	Conductive Permanent	4	0.7	3.8
Normal	Mixed	2	0.4	1.9
Normal	Sensorineural	10	1.8	9.5
Sensorineural	Mixed	2	0.4	1.9
Sensorineural	Normal	13	2.4	12.4
Sensorineural	Sensorineural	48	8.7	45.7
Total		105	19.0	100.0

A further breakdown of PCHL diagnoses by DHB and type of hearing loss is included as appendix 1.

Hearing screening indicators not yet monitored

The indicators below are either under development or data is not currently available. Indicator 2.1 will be monitored by DHBs using data contained in NHIMS rather than in the annual national monitoring report.

Indicator	Target
<p>1.4 Newborn hearing DNAs and lost contact</p> <p>The number of babies that do not complete screening due to not attending or the service losing contact as a proportion of all babies whose parents/guardians consented to screening.</p>	No target set
<p>1.7 First refer rates</p> <p>The number of babies referred from first to second aABR screening as a proportion of all babies that completed first aABR screens.</p>	No target set.
<p>2.1 Audiology assessment commencement</p> <p>2.1a The proportion of babies referred from screening who are offered audiology appointments dated within 4 weeks of referral.</p> <p>2.1b The proportion of babies referred from screening who start audiology assessment within 4 weeks of referral, and in total for the reporting period.</p>	100%
<p>2.5 Outcome of hearing surveillance</p> <p>2.5a The proportion of babies with identified risk factor(s) that have permanent congenital hearing loss (PCHL) identified.</p> <p>2.5b The proportion of babies who are referred for hearing surveillance that do not have an audiology assessment.</p>	No target set No target set
<p>2.6 Cases not identified by screening</p> <p>The number of cases of moderate or more severe hearing permanent hearing loss identified during the reporting period in children less than 6 years of age that were not referred from screening to audiology.</p>	No target set
<p>2.7 Age at first assistive device</p> <p>The number of babies referred from screening diagnosed with PCHL who have an assistive hearing device fitted by 6 months of age as a proportion of all babies referred from screening diagnosed with PCHL.</p>	No target set

Early Intervention Indicators

Indicators 3.1 to 3.4 will be reported separately by the Ministry of Education for the 2014 period.

Indicator	Target
<p>3.1 Making initial contact with families</p> <p>The number of working days taken for Early Intervention education services to make contact with the family/whānau.</p>	<p>≥95% contacted within 10 working days</p>
<p>3.2 Commencement of Early Intervention education services</p> <p>3.2a Proportion of children eligible for and referred to Early Intervention education services who began receiving a service within one month following receipt of referral. Number of months following receipt of referral that other families/whānau and children began receiving a service.</p> <p>3.2b Proportion of children up to six months of age eligible for and referred to Early Intervention education services who began receiving a service by six months of age.</p> <p>3.2c Proportion of children eligible for and referred to Early Intervention education services after six months of age.</p>	<p>≥90%</p> <p>≥90%</p> <p>No target set.</p>
<p>3.3 Continuation of Early Intervention services</p> <p>3.3a The proportion of children referred as a result of newborn hearing screening and eligible for the Early intervention education service who exited services prior to three years of age.</p> <p>3.3b The proportion of children referred as a result of newborn hearing screening and eligible for the Early Intervention education service who exited services prior to five years of age.</p>	<p>No target set</p> <p>No target set</p>
<p>3.4 Outcome of Early Intervention</p> <p>3.4a Proportion of children referred as a result of newborn hearing screening and eligible for the Early intervention education service who received a language assessment between four years six months and five years of age.</p> <p>3.4b Proportion of children referred as a result of newborn hearing screening and eligible for the Early intervention education service whose language level was within six months of their chronological age at four years six months to five years of age.</p> <p>3.4c Proportion of children referred as a result of newborn hearing screening and eligible for the Early intervention service whose language level was delayed six months or more for their chronological age at four years six months to five years of age.</p>	<p>No target set</p>

Appendix 1

Table 39 Number of babies screened that had permanent congenital hearing loss detected by type of hearing loss and DHB, 1 January to 31 December 2014

DHB of Screening	Right ear result	Left ear result	Number of babies
Northland	Normal	Sensorineural	1
Northland	Sensorineural	Normal	1
Northland	Sensorineural	Sensorineural	4
Waitemata	Conductive Permanent	Conductive Permanent	1
Waitemata	Conductive Permanent	Normal	1
Waitemata	Mixed	Mixed	1
Waitemata	Normal	Conductive Permanent	2
Waitemata	Normal	Sensorineural	1
Waitemata	Sensorineural	Normal	4
Waitemata	Sensorineural	Sensorineural	3
Auckland	Auditory Neuropathy	Auditory Neuropathy	1
Auckland	Conductive Permanent	Normal	4
Auckland	Mixed	Mixed	2
Auckland	Normal	Mixed	2
Auckland	Normal	Sensorineural	1
Auckland	Sensorineural	Normal	3
Auckland	Sensorineural	Sensorineural	2
Counties Manukau	Mixed	Mixed	1
Counties Manukau	Normal	Auditory Neuropathy	1
Counties Manukau	Normal	Sensorineural	1
Counties Manukau	Sensorineural	Sensorineural	2
Waikato	Auditory Neuropathy	Auditory Neuropathy	1
Waikato	Mixed	Mixed	1
Waikato	Normal	Conductive Permanent	1
Waikato	Sensorineural	Normal	1
Waikato	Sensorineural	Sensorineural	7
Lakes	Sensorineural	Sensorineural	3
Bay of Plenty	Normal	Sensorineural	2
Bay of Plenty	Sensorineural	Sensorineural	1
Tairāwhiti	Sensorineural	Sensorineural	1
Taranaki	Auditory Neuropathy	Auditory Neuropathy	1
Taranaki	Sensorineural	Sensorineural	2
Hawke's Bay	Mixed	Mixed	1
Hawke's Bay	Normal	Auditory Neuropathy	1
Hawke's Bay	Sensorineural	Sensorineural	2
Mid Central	Mixed	Normal	1
Mid Central	Sensorineural	Normal	1
Mid Central	Sensorineural	Sensorineural	2

DHB of Screening	Right ear result	Left ear result	Number of babies
Hutt Valley	Auditory Neuropathy	Normal	1
Hutt Valley	Normal	Auditory Neuropathy	1
Hutt Valley	Sensorineural	Normal	1
Hutt Valley	Sensorineural	Sensorineural	6
Capital & Coast	Auditory Neuropathy	Auditory Neuropathy	1
Capital & Coast	Normal	Sensorineural	1
Capital & Coast	Sensorineural	Normal	1
Capital & Coast	Sensorineural	Sensorineural	5
Nelson Marlborough	Sensorineural	Sensorineural	1
Canterbury	Mixed	Mixed	3
Canterbury	Normal	Sensorineural	3
Canterbury	Sensorineural	Normal	1
Canterbury	Sensorineural	Sensorineural	6
Southern	Conductive Temporary	Mixed	1
Southern	Mixed	Mixed	1
Southern	Normal	Conductive Permanent	1
Southern	Sensorineural	Mixed	2
Southern	Sensorineural	Sensorineural	1
Total			105