NATIONAL FOUNDATION FOR
Deaf & Hard of Hearing

National Foundation for Deaf & Hard of Hearing

Youth Hearing loss in New Zealand: a focus on secondary schools

February 2022

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Executive Summary

Hearing is the primary sense which enables communication and understanding. The human ear is able to detect vibrations and process these to perceive and decipher sound. Because of its importance, diagnosis and appropriate intervention in cases of hearing loss can improve wellbeing outcomes and enable a fuller life.

This report focuses on the 2021 screening and listening habits of a group of year-nine students from selected high schools across New Zealand conducted by the National Foundation for the Deaf and Hard of Hearing (the Foundation). This report also briefly discusses the economic and social costs associated with youth hearing loss.

Screening participants

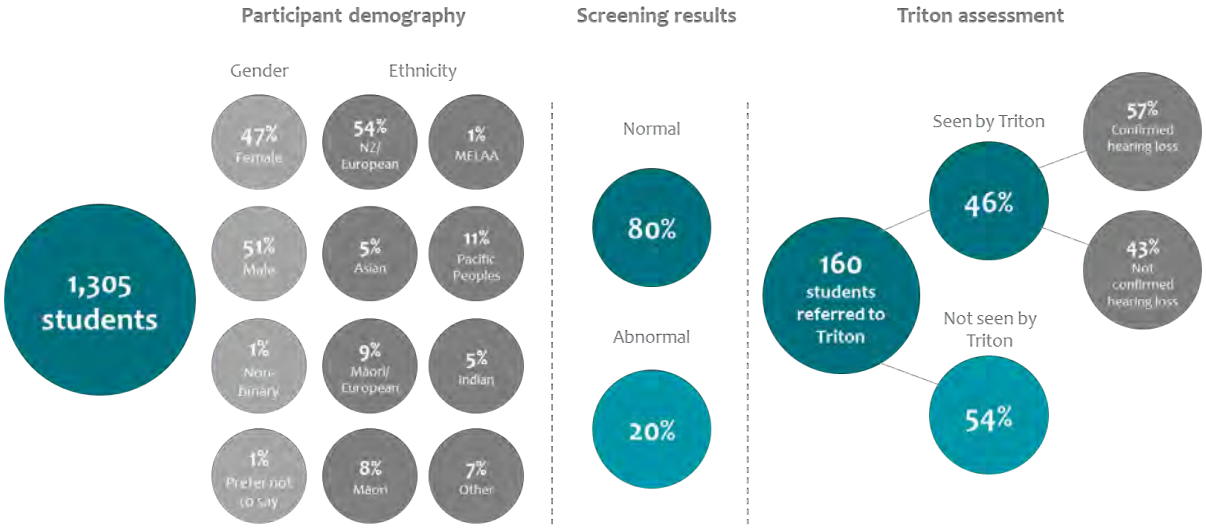
This report provides an outline of results from the Foundation's year-nine screening programme conducted during 2021. This builds on similar studies conducted by the Foundation, expanding to survey a larger student population. A total of 1,305 students across 15 schools were screened and surveyed.

Note all information used in this report was aggregated by mid-December 2021. Further information (e.g. from referrals) has been received by the Foundation since, but this is not included in this report.

Unlike previous years, all students tested in 2021 were tested at a broad frequency range of 500Hz – 8000Hz. Previous studies have used either a narrower range or a combination of narrow and wide range testing. This change to the broader frequency range was started in the 2020 study, and enables higher frequency abnormal results to be detected.

The other change in this 2021 study has been referral of some students to Triton for a more comprehensive hearing assessment.

Screening participant demography and screening results



Listening habits

Survey results were used to gauge student listening habits to allow identification of any potential relationships between listening habits and screening results. Although 38% of students listen to music with headphones or earbuds for less than 1 hour per day, 29% of students listen to music for more than 3 hours a day.

Based on an analysis of listening habits students were identified as either 'higher' or 'lower' risk, based on a combination of duration and volume. Using this method, 43% of students were identified as 'higher-risk'. Of the high-risk students 21% were identified as having abnormal hearing, compared to 19% of lower-risk students.

Tinnitus

Students were also asked questions regarding experiences with ringing in their ears, a symptom of tinnitus. Nearly a third of students (32%) reported having experienced ringing, which can be a pre-cursor to hearing loss. Listening habits appeared to have a relationship with ringing in the ears, with 36% of students identified as 'higher-risk' having experienced ringing compared to only 29% of those identified as 'lower-risk'.

Of those students who were identified as having abnormal hearing results, 37% also reported having experienced ringing in their ears. In comparison, of those students not identified as having abnormal hearing results, 30% also reported having experienced ringing in their ears. This indicates tinnitus can affect students who seemingly have normal hearing.

Triton Hearing results

As a new aspect of the 2021 study, students who returned abnormal results and were identified as failing the screening, or required further investigation, were referred to Triton Hearing for a complete hearing assessment. Where students were assessed by Triton, the results were reported back to the Foundation for the purposes of this study.

Of the population tested, 160 students (12%) were referred to Triton for further assessment. The rate of uptake was 46% (per information received as at mid-December), with 74 results being reported back to the Foundation. It is worth noting significant variations of uptake rates by schools based on factors such as access to a Triton clinic and time elapsed between referral and this report.

Out of the students assessed by Triton, 57% were confirmed as having hearing loss and 43% were not able to be confirmed.

Cost implications

The prevalence of youth with hearing loss in 2021 is estimated as **16,549**[1] people. Prevalence of hearing loss is higher in males than females in youth and across all age brackets. Higher rates of severe cases are more prevalent in males than females.

The total cost implications for youth with hearing loss are estimated as $18.7 million in 2021. The costs of youth hearing loss comprise health sector costs and other financial costs. This is an estimated per person cost of $1,130 for individual youth with hearing loss. **The annual estimated cost for youth hearing loss, per person, is $1,130 for 2021.**

Total costs of hearing loss for youth, 2021 ($ thousands)

Health expenditure sector	Total expenditure ($ 000s)	Per person ($)
Health system costs	$17,895	$1,081
Other financial costs	$814	$49
Total	**$18,709**	**$1,130**

Source: Deloitte calculation

[1] Per recent studies by Global Burden of Disease (GBD, 2021)

1. Introduction

In 2019, the National Foundation for the Deaf and Hard of Hearing (the "Foundation") carried out a pilot screening programme of 479 year-nine secondary pupils from schools and found that 34% of them had compromised hearing. In 2021 this programme has been expanded to 1,305 students from 15 schools throughout the country, assessing relationships between listening habits and hearing abnormalities in secondary school students.

The Foundation engaged Deloitte to analyse the 2021 screening results and update cost implications for youth based on the previous Deloitte Access Economics (2020) study. This report is a summary of the screening analysis and cost updates, and has been structured in the following chapters:

- **Chapter 1** introduces youth hearing loss, and provides local and global context
- **Chapter 2** provides a snapshot of youth hearing loss in New Zealand based on the data analysis
- **Chapter 3** presents our analysis of listening habits and exposure to recreational noise
- **Chapter 4** presents the updated cost implications of youth hearing loss for 2021
- **Chapter 5** concludes the report and summarises the next steps for ongoing study

The National Foundation for the Deaf and Hard of Hearing

The National Foundation for the Deaf and Hard of Hearing (NFDHH) is a national organisation dedicated to promoting the rights, interests and welfare of New Zealanders with hearing loss. Originally founded in 1978 under the Lions Club of New Zealand, the Foundation has since grown to become a consortium of ten consumer and hearing-health professional member organisations, including The Acoustical Society of NZ Inc, Deafness Research Foundation Inc, Hear for Families, Hearing Therapists Association of NZ, NZ Audiological Society Inc, NZ Federation for Deaf Children Inc, The NZ Society of Otolaryngology Head & Neck Surgery, Pindrop Foundation and the Southern Hearing Charitable Trust.

Hearing loss

Hearing is the ability to detect vibrations through the ear, and to perceive and understand sound. It is a primary sense, one which enables communication, together with vision and touch. A hearing loss essentially limits one's ability to communicate, and through this, limits a person's ability to interact with their community. There are several causes of hearing loss that may result in permanent or short-term loss, and commonly coexist with other conditions (Deloitte Access Economics, 2016).

There are a variety of thresholds and measures that are used to define whether a person has hearing loss. Tests for hearing impairments vary in frequency and testing conditions according to the age group tested. This informs the abnormality in hearing results and level of severity (mild, moderate, and severe).

Hearing loss can be classified in the following ways (Lustig, 2019):

- Conductive hearing loss, in which lesions in the external auditory canal, tympanic membrane, or middle ear, prevent sound from being conducted to the inner ear
- Sensorineural hearing loss, in which hearing loss is caused by lesions of either the inner ear or the auditory nerve
- Mixed loss, which may be caused by severe head injury, chronic infection, genetic disorders, or when a transient conductive hearing loss occurs in conjunction with a sensorineural hearing loss

Causes of hearing loss

The causes of hearing loss can vary significantly, depending on the affected individual. Hearing loss can be congenital (present at birth) or acquired; progressive or sudden; and temporary or permanent.

Causes of hearing loss can include the following (World Health Organisation, 2020):

- Congenital causes (hereditary and non-hereditary genetic factors)
- Noise exposure / Noise-induced hearing loss (NIHL)
- Ageing
- Diseases and disorders
- Use of particular drugs
- Physical trauma
- Cerumen accumulation (build-up of earwax)

This report focuses on abnormal hearing screen results in secondary school students, and unsafe listening habits as a potential factor in causing future noise-induced hearing loss. Noise-induced hearing loss develops slowly and worsens with the length of exposure. According to the World Health Organisation, exposure to loud music seems to be the most frequent and potentially the most harmful environmental noise for youth (WHO, 2017). It is important to note that the effects of noise-induced hearing loss may be difficult to determine in young students who have only been listening to personal listening devices for a short period of time.

Youth hearing loss

In New Zealand, up to 170 babies are born each year with a significant hearing loss. Without screening, it is difficult to detect hearing loss in babies until speech and language development becomes delayed. Hearing loss and deafness can be identified in new-borns, with the Government funded initiative of Newborn Hearing Screening completed while babies are under one month of age (Ministry of Health, 2018).

Another Government funded initiative, the b4 School Check, assesses hearing loss for all four-year-olds as part of a comprehensive health check using audiometry screening. Screening is also available for new entrants and year one children who have not received the test or need a follow-up screening.

As children mature and develop listening habits, potential hearing loss can become harder to diagnose. Researchers have estimated that as many as 17% of youth (ages 12 to 19) have hearing tests which suggest noise-induced hearing loss (NIHL) in one or both ears (NIDCD, 2019).

According to the World Health Organisation (2020), 60% of childhood hearing loss is due to preventable causes. Identification of hearing loss and intervention is crucial to support a child's development and educational achievements. People with hearing loss benefit from early identification through the use of hearing aids, cochlear implants and other assistive devices; captioning and sign language; and other forms of educational and social support. This makes regular screening at wide frequency ranges (500HZ – 8000Hz) in youth especially important, allowing for early intervention.

Limitations and disclaimer

The data used to develop this report was aggregated as at mid-December 2021. Further information (e.g. from referrals) has been received by the Foundation since, but this is not included in this report. The analysis is based on the best available data set available in mid-December 2021.

The analysis contained in this report has been compiled by the Foundation with assistance from Deloitte, based on data provided by schools, and is made available to the public as general research. As general-purpose research, the Foundation and Deloitte disclaim reliance to any third party. The Foundation and Deloitte have relied on the accuracy of all data provided, and have not carried out any form of audit on the data. The Foundation and Deloitte disclaim any responsibility for updating this report based on further data and information received.

2. Screening participants

The Foundation began a screening programme in 2019 screening 479 students from three schools. Screening was expanded in 2020 to include 881 students from eight schools. This year the Foundation hoped to target 21 schools. However, but due to the COVID-19 pandemic, 1,305 students from 15 schools were screened.

Methodology

Students from selected schools were screened at the testing range of 500Hz-8,000Hz. The results from these tests were recorded and students hearing identified as either "normal" or "abnormal" based on the results. Students who were identified as failing the screening, or required further investigation, were referred to Triton Hearing for complete assessment. Note this did not include all students identified with abnormal results from screening. Where students completed a Triton assessment, the results were reported back to the Foundation. Screened students were also asked a variety of questions to gauge background and listening habits.

Schools

Select schools around New Zealand participated in this study, with representation of region, decile and single sex/co-educational schools. Of the planned 21 schools, 15 were able to participate in this study for 2021. Barriers for participation include covid-19 lockdown restrictions, largely focused in the Auckland and Waikato regions.

Table 1: Participants by school

School	Decile	Region	Students (#)
Aurora College	2	Southland	48
Avonside Girls High School	6	Canterbury	120
Darfield High School	9	Canterbury	55
Glenfield College*	6	Auckland	71
Greymouth High School	4	West Coast	67
Lynfield College*	6	Auckland	100
Manawatu College	2	Manawatu	32
Mangere College	1	Auckland	65
Manurewa High School	1	Auckland	141
Otumoetai College	7	Bay of Plenty	118
Queen Charlotte College*	6	Marlborough	42
Rotorua Lakes High School*	5	Bay of Plenty	53
Rutherford College*	5	Auckland	195
Taieri College	7	Otago	85
Wellington College*	10	Wellington	113
Total			**1,305**

* Indicates schools included in previous study

Student demography

Ethnicity and gender were recorded as students received their testing.

Ethnicity

Across the various schools we saw a range of ethnicities, summarised in the table below.

Table 2: Students by ethnicity

Ethnicity	Students (#)	Distribution
Asian	69	5%
Indian	63	5%
Māori (total)	216	17%
Māori	*101*	*8%*
Māori/ New Zealand-European	*115*	*9%*
MELAA (Middle Eastern, Latin-American and African)	9	1%
New Zealand/European	711	54%
Other	87	7%
Pacific Peoples	150	11%
Total	**1,305**	

The largest ethnic groups students self-identified with was New Zealand / European (54%), Māori or Māori / New Zealand-European (17%), and Pacific Peoples (11%). The smallest ethnic group within this study was MELAA (Middle Eastern, Latin-American and African) which made up 1% of students. Key statistics to note are a high proportion of Indian students at Lynfield College, Pacific Peoples students at Mangere College and Māori students at Aurora College and Queen Charlotte College.

Gender

Students reported their gender as part of this study, with options for male, female, non-binary or prefer not to say.

Table 3: Students by gender

Gender	Students (#)	Distribution
Male	660	51%
Female	616	47%
Non-binary	18	1%
Prefer not to say	11	1%
Total	**1,305**	

The largest reported gender groups were male (660) and female (616). Self-reporting also identified 18 non-binary participants, and 11 participants who would prefer not to say.

Hearing abnormality

Once students had completed the audiometry test, their results were classified as "normal", or "abnormal". These findings were made based on individual student audiograms. Potential mild hearing loss (classed as 25-30dB rather than the 30+dB used by b4 School Checks) were classed as abnormal in this study. Of the 1,305 students screened, 260 students (20%) were identified as having abnormal hearing.

School

Abnormal hearing results for participating schools ranged from 9%-28%. With Manurewa High School and Manawatu College indicating 28% of their respective students returning abnormal hearing results, and Wellington College close behind with 27% of participating students returning an abnormal hearing result.

Table 4: Hearing results by school

School	Decile	Students (#)	Normal	Abnormal	Abnormal proportion
Aurora College	2	48	37	11	23%
Avonside Girls High School*	6	120	109	11	9%
Darfield High School	9	55	50	5	9%
Glenfield College	6	71	55	16	23%
Greymouth High School	4	67	60	7	10%
Lynfield College	6	100	87	13	13%
Manawatu College	2	32	23	9	28%
Mangere College	1	65	49	16	25%
Manurewa High School	1	141	102	39	28%
Otumoetai College	7	118	104	14	12%
Queen Charlotte College	6	42	35	7	17%
Rotorua Lakes High School	5	53	41	12	23%
Rutherford College	5	195	147	48	25%
Taieri College	7	85	64	21	25%
Wellington College*	10	113	82	31	27%
Total		**1,305**	**1,045**	**260**	

***** Indicates single-sex school, Avonside Girls High School being girls-only and Wellington College being boys-only

There is no clear relationship between hearing outcomes and school deciles. As seen by the highest abnormal results of Manurewa High School and Manawatu College – decile 1 and 2 respectively – alongside Wellington College which is a decile 10 school.

The high abnormality results for Wellington College may be due to the all-male demographic of the school and participants, as males tend to have a higher proportion of abnormal results (refer table 6 below). The remaining schools and deciles do not indicate further relationships for abnormal results.

Ethnicity

Screening results presented variations between ethnic groups. With the highest rates of hearing outcome abnormalities within the ethnic group being Pacific Peoples (29%), followed by Other (26%) and Māori (24%).

Table 5: Hearing results by ethnicity

School	Students (#)	Normal	Abnormal	Abnormal proportion (by ethnicity)
Asian	69	61	8	12%
Indian	63	49	14	22%
Māori (total)	216	165	51	24%
Māori	*101*	*70*	*31*	*31%*
Māori/New Zealand European	*115*	*95*	*20*	*17%*
MELAA (Middle Eastern, Latin American and African)	9	8	1	11%
New Zealand/European	711	591	120	17%
Other	87	64	23	26%
Pacific Peoples	150	107	43	29%
Total	**1,305**	**1,045**	**260**	

Looking at the Māori ethnic groups separately – Māori and Māori/New Zealand European – we can see higher rates of abnormal hearing results for Māori (31%). We can see similar ethnic rates of abnormal hearing results between New Zealand/European (17%) and Māori/New Zealand European (17%).

Gender

The survey results also showed that males had a higher chance of being diagnosed with abnormal hearing than females. Of the students screened, 22% of males (148 students) had abnormal hearing compared to 17% of females (106 students).

Table 6: Hearing results by gender

Gender	Students (#)	Normal	Abnormal	Abnormal proportion (by gender)
Male	660	512	148	22%
Female	616	510	106	17%
Non-binary	18	14	4	22%
Prefer not to say	11	9	2	18%
Total	**1,305**	**1,045**	**260**	

These findings are consistent with the 2019 Deafness Notification Report which found males were more likely than females to be diagnosed with a hearing loss and notified to the Deafness Notification Database, and similar to patterns found in comparable overseas jurisdictions (Enable New Zealand, 2020).

Region

Schools were grouped into respective regions to assess potential relationships and influences of hearing outcomes.

Table 7: Hearing results by region

Region	Schools (#)	Students (#)	Abnormal (#)	Abnormal (%)
Auckland	5	572	123	23%
Bay of Plenty	2	171	26	15%
Canterbury	2	175	16	9%
Manawatu	1	32	9	28%
Marlborough	1	42	7	17%
Otago	1	85	21	25%
Southland	1	48	11	23%
Wellington	1	113	31	27%
West Coast	1	67	7	10%
Total		**1,305**	**260**	**20%**

The Auckland region had the most schools and largest group of student participants, which reflects the greatest number of abnormal results. The Bay of Plenty and Canterbury are the only other regions where more than one school participated. Across these regions, Manawatu and Wellington observed the highest abnormality rates (28% and 27%, respectively), with Canterbury and the West Coast observing the lowest (9% and 10% respectively).

Wellbeing

The Foundation asked students a series of questions relating to wellbeing implications. Students were asked the following questions:

- Do you ever have difficulty communicating due to your hearing? Please provide details.
- If answered YES to the above question, to what extent does your hearing impact performance at school?
- If answered YES to the previous question, to what extent does your hearing impact how you socialize with others?

A significant proportion of students indicated that their hearing has had an impact on their wellbeing. Of the 1,305 students questioned, 15% (194 students) had difficulty communicating due to their hearing, 13% (170 students) felt hearing impacted their performance at school and 13% (166 students) said it caused difficulty when socialising.

A proportionately high number of students who responded saying they had difficulties in one of the wellbeing areas were identified as having abnormal hearing. Of the 194 students who had difficulty communicating, 57 students (29%) had abnormal hearing. Furthermore, 32% of students who said communication difficulties impacted their performance and socialising had abnormal hearing.

The following statements are examples from students whose hearing has impacted their overall wellbeing:

3. Listening habits and hobbies

Listening habits

Listening to music through earphones is becoming more common due to the convenience of being able to listen to music anytime and anywhere. According to the World Health Organisation, 88% of teenagers and young adults are listening to music through earphones, and 1.1 billion young people worldwide could be at risk of hearing loss due to unsafe listening practices (WHO, 2017).

In the Survey, students were asked three questions related to their music listening habits:

- How often do you listen to music or content using headphones/earbuds each day?
- What type of headphones/earbuds do you use?
- What volume level do you normally listen to your music using headphones/earbuds?

How often do you listen to music or content using headphones/earbuds each day?
Students indicated the length of time they spent each day listening to music. Most students (38%) reported listening to music less than one hour per day, followed by 21% of students listening to music between 2-3 hours.

As the length of time increases, we see fewer participants report listening to music.

Table 8: Time spent listening to music

Time per day	Students (#)	Distribution
<1 hour	492	38%
2-3 hours	273	21%
3-4 hours	129	10%
4-5 hours	83	6%
5-6 hours	55	4%
6-7 hours	31	2%
7+ hours	94	7%
Other	148	11%
Total	**1,305**	**100%**

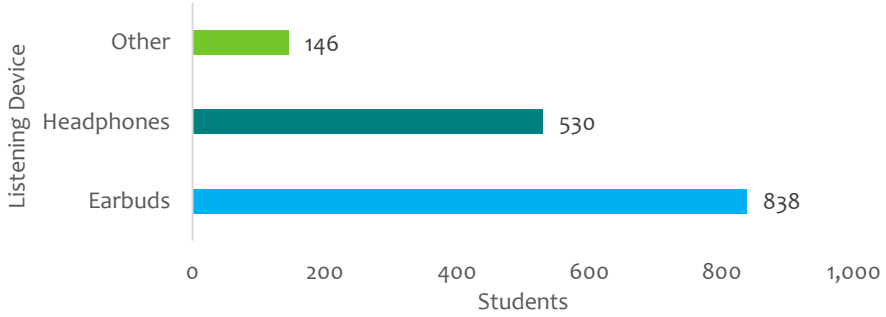
We note that a significant portion of students indicated "other" (11%) as time spent listening to music. This can be considered a self-reporting discrepancy as "<1 hour" and "7+ hours" cover each end of the spectrum.

What type of headphones/earbuds do you use?
The questionnaire provided to participants asked whether they used one of the three options:

- Earbuds (inserted into the ear)
- Over the ear headphones
- Other

Some participants indicated more than one listening device, and these responses are included in the chart below, which totals more than the 1,305 participants.

Figure 1: Type of listening device used



All participants provided information on the types of listening devices they used. The majority of these students (64%) listen to their music through earbuds. Reporting showed 16% of students used more than one type of listening device. Students which reported using other, may include participants who do not use listening devices.

What volume level do you normally listen to your music using headphones/earbuds?
Maximum volume in this context equates to 110 decibels on an iPhone (The Foundation, 2020). The World Health Organisation Global Standard for Sound Allowance indicates safe listening practices for children is below 75dB for no longer than 40 hours per week. As an example, a vacuum cleaner has a sound level of 75dB, and a motorcycle has a sound level of 95dB (WHO, 2015).

Table 10: Weekly permissible noise level exposure

Time per week	Sound level (L_{Aeq}), dB
1.5 min	107
6 min	101
12 min	98
48 min	92
1 hour 36 min	89
6 hours 24 min	83
12 hours 30 min	80
25 hours	77
40 hours	75

Source: World Health Organisation

Table 9: Listening volume and duration

Time per day	Low volume	Medium volume	Maximum volume	Total
<1 hour	8%	26%	4%	**38%**
2-3 hours	3%	15%	3%	**21%**
3-4 hours	1%	7%	1%	**10%**
4-5 hours	0%	4%	2%	**6%**
5-6 hours	0%	3%	1%	**4%**
6-7 hours	0%	2%	1%	**2%**
7+ hours	1%	4%	3%	**7%**
Other	3%	7%	1%	**11%**
Total	**16%**	**68%**	**16%**	**100%**

Higher risk students

Listening habits which do not fit WHO (2015) recommendations are considered unsafe hearing practices and are at risk of impacting hearing outcomes. Note that the Maximum volume on an iPhone is 110dB, which is outside of the WHO permissible noise level exposure range.

Screening data presented potential relationships between listening volume and abnormal hearing, with 28% of students who listen at maximum volume being identified with abnormal hearing. This compared to 18% for medium volume and 19% for low volume.

- The 28% of students who listen at maximum volume and were identified with abnormal hearing represented 57 students.

Based on the shaded area of the table above, 43% of students (555) indicated unsafe listening habits arising from a combination of listening to music for extended periods of time even at medium volumes and listening at maximum volume. The following figure shows the distribution of students in the two risk categories who were identified as having abnormal hearing:

Figure 2: Higher risk students with abnormal hearing

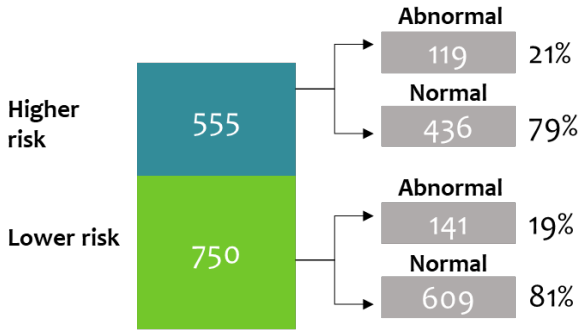
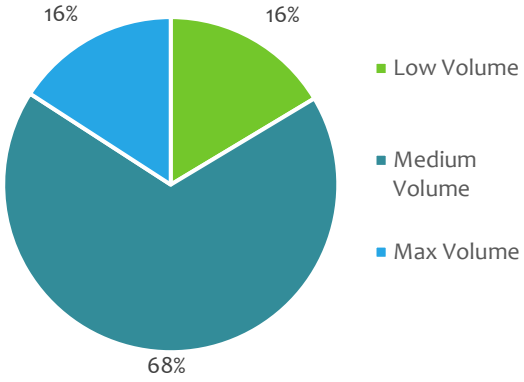


Chart 1: Listening volume for total participants



Of the 555 students identified as being at increased risk due to listening habits, a slightly higher rate of abnormal hearing rate of 21% was observed.

Listening habits and screening results

The following tables show how levels of hearing abnormalities varied by student listening habits.

Table 11: Hearing results by listening volume

Listening volume	Students (#)	Normal (#)	Abnormal (#)	Abnormal (%)
Low volume	214	174	40	19%
Medium volume	884	721	163	18%
Max volume	207	150	57	28%
Total	**1,305**	**1,045**	**260**	

There was little difference between the screening results for students who listen at low and medium volumes, but we saw a potentially significant relationship between high volume and abnormal hearing with 28% of students who listen to music at maximum volume returning abnormal results.

Table 12: Tinnitus results by listening volume

Listening volume	Students (#)	Tinnitus? (#)	Tinnitus? (%)
Low volume	214	45	21%
Medium volume	884	291	33%
Max volume	207	78	38%
Total	**1,305**	**1,045**	

We also looked at the different proportions of students who reported ringing in the ears as an indicator of tinnitus. As the volume students listen at increases, so does the rate of ringing in the ears – increasing from 21% for low-volume listening to 38% for high-volume listening.

Table 13: Hearing results by listening duration

Listening duration	Students (#)	Normal (#)	Abnormal (#)	Abnormal (%)
<1 hour	492	402	90	18%
2-3 hours	273	211	62	23%
3-4 hours	129	101	28	22%
4-5 hours	83	65	18	22%
5-6 hours	55	49	6	11%
6-7 hours	31	23	8	26%
<7+ hours	94	75	19	20%
Other	148	119	29	20%
Total	**1,305**	**1,045**	**260**	

Unlike volume, clear relationships were not discernible from the survey data relating to listening duration.

Table 14: Hearing results by listening device used

Listening device	Students (#)	Normal	Abnormal	Abnormal proportion (by device)
Earbuds	838	692	147	18%
Headphones	530	413	117	22%
Other	146	113	33	23%
Total*	**1,514**	**1,218**	**297**	

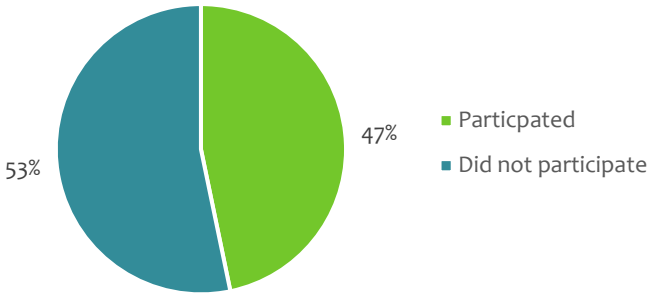
***** Note that students could select multiple options for listening device

Abnormal hearing rates differed by listening device, 18% of earbud users had abnormal hearing compared to 22% of headphone users and 23% of students who reported using a different listening device. This is suggestive of a relationship between headphones and other categories of listening devices and abnormal hearing results.

Hobbies

In the Survey, students were asked whether they were involved in any noisy activities or hobbies. Out of 1305 students, 47% (610 students) said they participated in one or more noisy activities or hobbies. It is worth noting that unlike the previous survey, students were unable to select multiple activities.

Chart 2: Participation in noisy activities



Students were then asked what types of noisy activities or hobbies they participated in. Responses ranged from mowing lawns, to motorsport events and attending concerts. The most commonly reported noisy activities and hobbies were lawn mowing, dance, band practice and noisy events. Gaming and playing music were the least reported activities of those included.

Chart 3: Noisy activities and hobbies – normal hearing

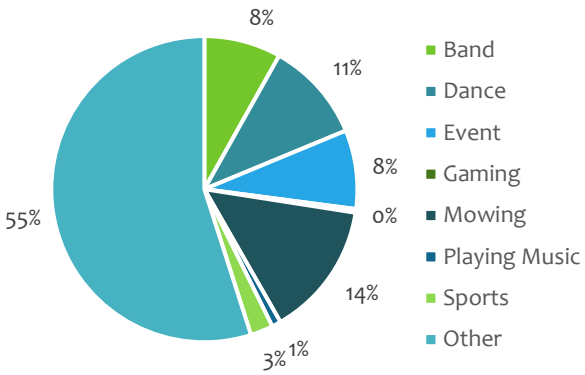
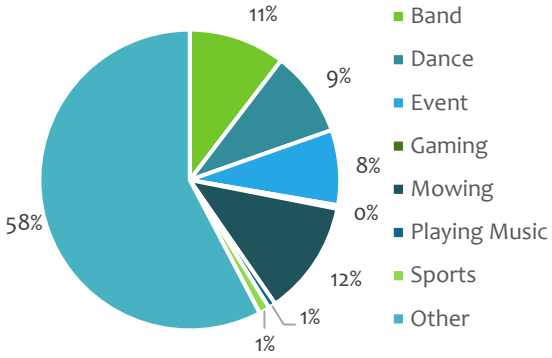


Chart 4: Noisy activities and hobbies – abnormal hearing



Mowing the lawns was the most frequently reported noisy activity, with dance practice a close second. However, these activities did not return the highest abnormality results. The highest rates were observed in band practice, gaming and events with loud music. Although gaming was disregarded due to only 5 students reporting it, one of whom had an abnormal result.

However, the rates of abnormality presented in most activities and hobbies didn't show large variations above the population rate of abnormal hearing.

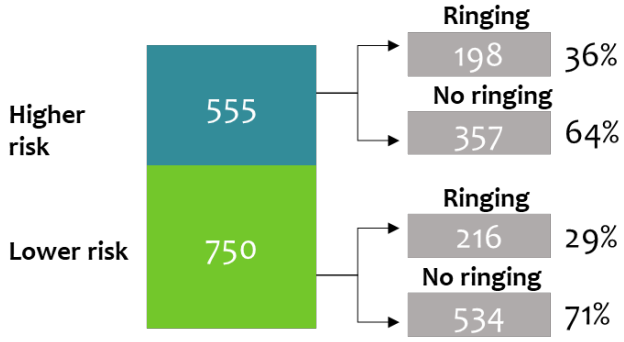
Tinnitus

Tinnitus is a perception of sound such as ringing, roaring or hissing which occurs in the absence of an external sound source (WHO, 2015). There have been many studies proving the correlation between tinnitus and hearing loss, with some saying tinnitus is an early warning symptom for noise-induced hearing loss (ACC, 2018). Tinnitus can be acute (temporary) or chronic (ongoing), but generally occurs for short periods of time immediately following exposure to loud sounds. Acute tinnitus has also been shown to occur in people who use personal listening devices regularly, although this is less prevalent (WHO, 2015).

Temporary tinnitus usually goes away within a few days, but chronic tinnitus can lead to a lack of sleep, anxiety, depression, and impaired concentration. Similar to hearing loss, this will impact on the quality of life of that individual (WHO, 2015).

A total of 414 students (32%) complained of experiencing ringing in the ear. There was a noticeable trend with students identified as 'higher risk' based on their listening habits, with 36% of these students having experienced ringing in their ears compared to 29% of those classed as 'lower risk'.

Figure 3: Higher risk students with ringing in the ears



Of the 414 students with ringing in the ears, 23% of students (96 students) were diagnosed with abnormal hearing, highlighting the fact that a high proportion of students with normal hearing nonetheless experience tinnitus symptoms.

Chart 6: Noisy activities and hobbies – ringing in ear

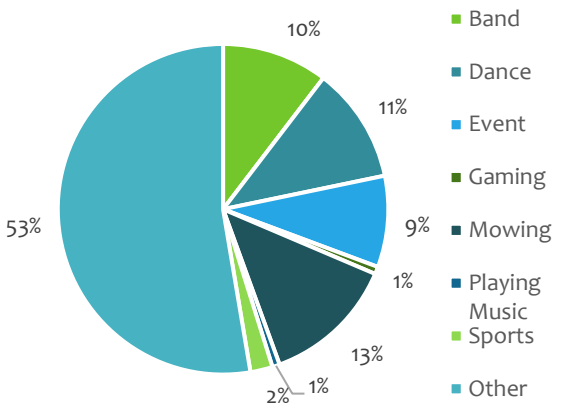
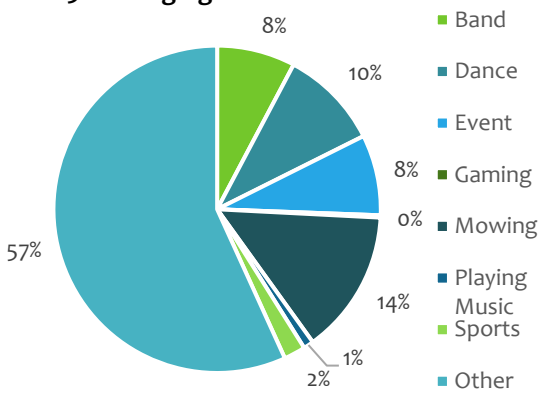


Chart 5: No ringing in ear



These charts suggest that activities such as band practice, dance and events with loud music may be correlated with experiencing ringing in the ears. This corresponds to relationship between these activities and abnormal hearing, where band practice and events with loud music were associated with higher levels of abnormal hearing. Similarly, despite being a common activity lawn mowing showed little correlation to tinnitus symptoms.

Triton Hearing Results

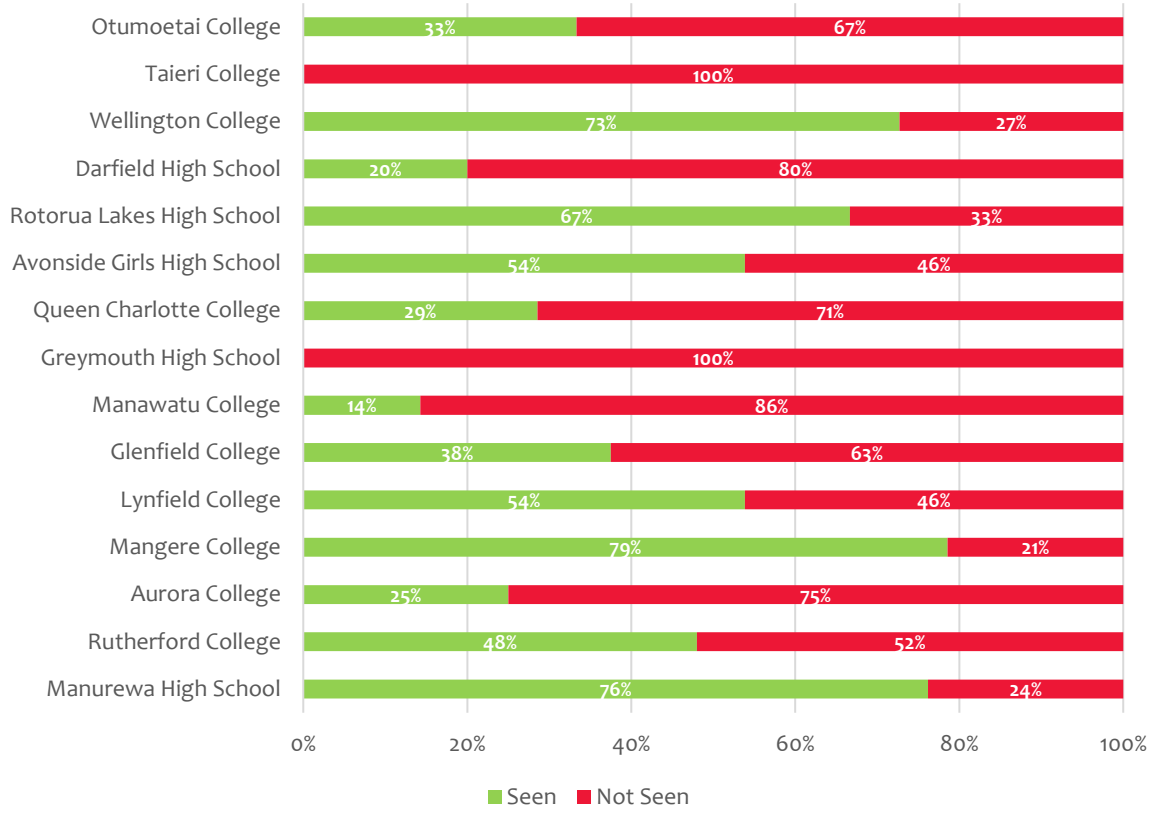
As part of the 2021 study, students whose hearing results raised concern were referred to Triton Hearing for a full hearing assessment. Note this did not include all students identified with abnormal hearing. The results of these Triton assessments were reported back to the Foundation and are included in this study.

Of the 1,305 students tested through the Foundation, 160 (12%) were referred to Triton for further testing. Only 46% (74) of the 160 students referred completed a hearing assessment with Triton for hearing loss as at the time data for this report was compiled. Of the 74 assessed, by Triton 42 were returned as confirmed hearing loss. Note a further 5 students were referred to Triton, but had been identified as suffering from hearing loss prior to the Triton assessment (i.e. total of 47 with hearing loss).

Uptake of assessments to date

Uptake of a complete assessment by Triton varied greatly by across schools. For Mangere College, this 79% of referred students completed the assessment, and results have been reported back. For other schools, this figure is substantially lower, e.g. Taieri College and Greymouth High School. This is not unexpected for Greymouth High School given the absence of any local Triton Hearing clinics – and referrals were sent to General Practitioners instead. Taieri College students were not screened until October 2021, so Triton Hearing results are expected at a later date. The next lowest assessment uptake to date was Manawatu College, with 14% of referred students seen by Triton Hearing. If we exclude Greymouth High School students, who lack access to a local Triton Hearing clinic, 57% of students referred before July 2021 were assessed by Triton Hearing.

Chart 7: Uptake of Triton Hearing assessment by school to date (per completed results received by mid-December 2021)

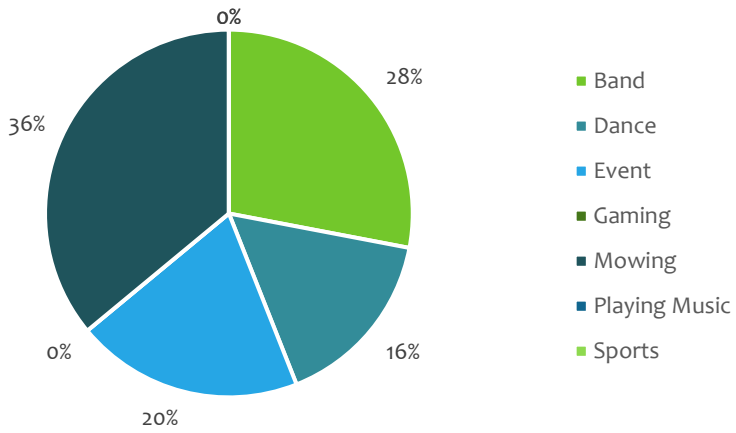


Of the students who were seen by Triton Hearing and were identified as having abnormal hearing by this study, 42 (57%) were confirmed by Triton as having hearing loss and 32 (43%) were not found to have hearing loss. Note a further 5 students were referred to Triton, but had been identified as suffering from hearing loss prior to the Triton assessment (i.e. total of 47 with hearing loss).

Hobbies and confirmed hearing loss

A comparison of the hobbies and activities partaken by students with confirmed hearing loss compared to those with normal or abnormal hearing shows a potential relationship with band practice and lawn mowing.

Chart 8: Noisy activities and hobbies – confirmed by Triton Hearing as hearing loss



4. Cost implications

During 2016, Deloitte Access Economics carried out a Cost of Illness study for the Foundation. This study estimated total economic costs attributable to the estimated New Zealand population with hearing loss overall. The following analysis updates the relevant costs from the 2016 report and applies these to the 2020 youth hearing loss cohort aged 10-19 years.

Methodological overview

We have used a prevalence approach to estimate the costs implications of youth hearing loss in New Zealand for the financial year 2021-2022. A prevalence approach measures the number of people with hearing loss at a given point in time, and estimates the costs incurred for a given year.

The broad types of cost associated with youth hearing loss included in this report are:

- **Direct costs -** financial costs to the New Zealand health system, which include the costs of hospital services (inpatient and outpatient services), out-of-hospital medical specialists (general practitioners, pathology and imaging, and other specialists), other professionals (audiologists and audiometrists), pharmaceuticals and over-the-counter medications, and cochlear implants.
- **Indirect costs -** financial costs of special aids and modifications, educational services, and interpreter and translation services.

When calculating costs for a total impacted population, additional costs are taken into consideration, such as productivity costs (reduced workforce participation, reduced productivity at work, and the value of informal care) and other costs (transfer costs, deadweight losses, and reduced economic efficiency). Due to the youth focus of this study, these costs are less applicable, because youth are typically less active in the workforce. Likewise, considerations of research costs are excluded from the analysis below, as these are generally minor and not generally attributable to specific age cohorts.

The cost approaches and figures are sourced from the Deloitte Access Economics (DAE) '*Social and economic costs of hearing loss in New Zealand*' report (2016). In order to update these costs for the scope of this study, we have taken the following approach:

- More recent information than previous prevalence estimates was available this year (refer below) and therefore previous prevalence estimates were updated for this, and applied to the population of New Zealand during 2021 (by gender and age cohorts 10-19).
- Unit costs identified in the DAE report (2020), have been inflated to 2021 values using the CPI and Health index.
- Per person costs for direct and indirect costs and attribution determined in the DAE (2016, 2020) analysis have been applied to the updated prevalence youth population.
- All costs have been rounded to $ thousands. Some totals and tables may not add exactly due to rounding.

Estimated prevalence

Note the prevalence estimates used here are not based on the findings from the Foundations screening programme described in the previous chapters, but rather on estimates in the literature.

This section estimates the prevalence considerations for youth hearing loss in New Zealand. There is limited data for hearing loss in New Zealand, however, recent studies by Global Burden of Disease (GBD, 2021) capture youth hearing loss prevalence for New Zealand during 2019. GBD considers a broad spectrum of condition severities, which in aggregate provide a higher rate of prevalence for New Zealand youth.

Table 15: Prevalence rates of youth hearing loss by age, gender and condition severity

Male youth	Mild	Moderate	Moderately severe	Severe	Profound	Complete hearing loss	Overall	Impacted population
10-14	1.65%	0.47%	0.17%	0.05%	0.10%	0.07%	2.51%	4,367
15-19	2.13%	0.49%	0.17%	0.04%	0.11%	0.08%	3.02%	4,873
Male youth total								**9,240**
Female youth								
10-14	1.46%	0.36%	0.09%	0.02%	0.09%	0.04%	2.06%	3,388
15-19	1.96%	0.36%	0.09%	0.01%	0.09%	0.05%	2.56%	3,921
Female youth total								**7,309**
Youth total	**11,711**	**2,752**	**856**	**200**	**637**	**393**		**16,549**

Source: Deloitte calculations based on GBD (2021)

Prevalence of hearing loss is higher in males across all youth age groups; however, this is particularly evident in the age cohort of 15-19. Mild and moderate prevalence rates are significantly higher (for both sexes) than other rates severity.

In comparison with the 2020 hearing loss estimates (Deloitte, 2020), total youth prevalence has increased from 15,271 youths to 16,549 youths in 2021. This 7.7% increase is largely a result of a change in the assumption source for prevalence.

Health system costs

Hospital services, GP, specialist and other health professional services and the costs of any pharmaceuticals associated with hearing loss fall under health system costs. Health system costs are updated from the DAE report (2016), which applies a combination of a bottom-up and a top-down approach

Hospital services

Hospital expenditure data in New Zealand includes general public and private hospital admissions, as well as outpatient services. Hospital admissions and outpatient services were calculated as $277,000 and $4,244,000 respectively. Total hospital expenditure for hearing loss was defined as the sum of both admitted and non-admitted patient expenditure. **The total hospital service costs for youth are estimated as $4,520,000 for 2021.**

There is limited data in New Zealand regarding service usage for out-of-hospital medical services, pharmaceuticals, research and other health system costs for people with hearing loss. As such, the estimates for these areas of the health system are based on the per person expenditure estimated in Deloitte Access Economics (2006, 2016).

Out-of-hospital medical specialists

These costs include specialists for hearing services. Out of hospital medical specialists include services provided by General Practitioners, pathology and imaging, and other specialists. **Total medical specialist costs are estimated as $991,000 for youth in 2021.**

Other professionals

Expenditure on hearing loss services associated with other health professionals includes hearing tests, fitting of hearing aids and other services provided by audiologists and audiometrists. This expenditure was calculated as the sum of hearing assessments and fitting costs conducted by audiologists and audiometrists. **Total costs for other professionals are estimated as $7,728,000 for youth in 2021.**

Pharmaceuticals

Non-prescription medication was the primary type of pharmaceuticals used for children identified in the Deloitte Access Economics report (2016). Medication could include antibiotics for middle ear infections, and steroids to reduce inflammation. The following pharmaceutical costs are based on an age breakdown reflective of the 10-19 age range. **Total pharmaceutical costs are estimated as $1,603,000 for youth in 2021.**

Cochlear implants

A cochlear implant is surgically fitted electronic device for individuals who have a severe hearing loss or deafness. This device assists an individual with a sense of sound or representation of sound in the environment (NIDCD, 2016). The cochlear implant is very different from a hearing aid. Hearing aids amplify sounds so they may be detected by damaged ears, however cochlear implants bypass damaged portions of the ear and directly stimulate the auditory nerve. The Deafness Notification Report (Enable New Zealand, 2017) reports 59 children and 59 ears receiving cochlear implants during 2017, this estimate and the cost per implant is the basis for 2021 costs. **The estimated cost for cochlear implants for youth is $3,053,000 in 2021.**

Summary of health system costs

Total health system costs associated with youth hearing loss in New Zealand are estimated as $17.9 million in 2021 (Table 15). The largest component was associated with other health professionals ($7.7 million), followed by outpatient services ($4.2 million). Cochlear implants represented around 17% of the total health system expenditure. It was not possible to allocate cochlear implants to the respective health sectors although this would be predominately shared by hospitals, other professionals and out-of-hospital-medical.

Table 16: Health system costs of hearing loss for youth, 2021 ($ thousands)

Health expenditure sector	Total expenditure	Expenditure distribution
Hospital admissions	$277	2%
Outpatient services	$4,244	24%
Out-of-hospital medical (e.g. imaging, pathology, specialists, GPs)	$991	6%
Other professionals (audiologists and audiometrists)	$7,728	43%
Pharmaceuticals	$1,603	9%
Cochlear implants	$3,053	17%
Total expenditure	**$17,895**	

Source: Deloitte calculations

Other financial costs

Youth with hearing loss can encounter additional financial costs, such as the costs of special aids and modifications, educational services, and interpreter and translation services.

Aids and modifications

Individuals with hearing loss can use aids and modifications for everyday communication – supporting people with hearing loss to remain independent and included in society. Aids and modifications such as hearing aids, hearing loops and FM (frequency modulation) or remote microphone systems allow people with hearing loss to hear in a wide variety of situations where they would otherwise not be able to. **The estimated cost for aids and modifications for youth is $666,000 in 2021.**

Education services

The Government provides direct funding to support New Zealand Sign Language in children. This includes sign language support for schools, such as sign language tutors. **The estimated cost for educations for youth is $114,000 in 2021.**

Interpreter and translator services

There is limited data to identify the use of interpreter or translator services in New Zealand. The breakdown of service use is identified in the Deloitte Access Economics (2016) report, including number of people using these services, the total time services were used by each person, and the cost of services. **The estimated cost for interpreter and translator services for youth is $34,000 in 2021.**

Table 17: Other financial costs of hearing loss for youth, 2021 ($ thousands)

Other financial costs	Total expenditure	Expenditure distribution
Aids, equipment and modifications	$666	82%
Education services	$114	14%
Interpreter and translator services	$34	4%
Total expenditure	**$814**	

Source: Deloitte calculation

Total cost of youth hearing loss

The prevalence of youth with hearing loss in 2021 is estimated as **16,549** people. A summary of associated costs is presented in Table 17, below.

Table 18: Total costs of hearing loss for youth, 2021 ($ thousands)

Health expenditure sector	Total expenditure	Per person ($)
Health system costs	$17,895	$1,081
Other financial costs	$814	$49
Total	**$18,709**	**$1,130**

Source: Deloitte calculation

The annual estimated cost for youth hearing loss, per person, is $1,130 for 2021.

5. Conclusions and next steps

This report provides a snapshot of results from the Foundation's 2021 year-nine screening programme, which follows a 2019 pilot and a similar screening programme in 2020. To date, only 26 of New Zealand's more than 350 secondary schools have been involved in the study.

This is the first year in which all students were screened using the 500 Hz – 8000 Hz frequency range, and this is also the first year in which selected students with abnormal hearing identified through the screening process were referred for a more comprehensive Triton hearing assessment.

The results so far support the need to continue with the screening programme – both to increase coverage and the opportunity for secondary students to be screened, and to continue to raise awareness about safe listening habits.

Over time, longitudinal information and larger sample size is likely to provide important information for policy and advocacy. In particular, we note the prevalence estimates used to calculate cost of illness (2% - 3%) is different from the observations through this screening programme – 20% of students showed abnormal screening results and 3.6% (47 out of 1,305) were identified as having some hearing loss (with more Triton results still to come). While the sample size for the screening programme is still relatively modest, and there may be some bias in the sample, it is possible that actual rates of hearing loss in New Zealand youth are substantially higher than previously estimated.

Programme for 2022

The Foundation plans to continue its research with a 2022 Hearing Screening & Make Listening Safe Programme.

Currently, the foundation plans to include more than 40 schools across New Zealand in 2022, which could provide for more than 5,000 students being screened.

Further research in this area will support the importance of hearing loss screening of adolescents and help to educate New Zealanders about the importance of preventing hearing loss.

Appendix A: Methodology

Screening and survey approach

The Foundation visited 15 schools in 2021 and screened year-nine students for hearing loss. The aim of the screening was to determine if students had any hearing issues at that time and to gather information on the demographics and listening habits/hobbies of the students to determine any correlation between the two. The screening process was a combination of medical testing and a questionnaire.

In the 2021 study all students were administered a screening range of 500Hz – 8,000Hz. This differs from the 2020 study, where a mixture of wide and narrow frequency testing was used. Otoscopy was performed to examine the ear canal for any obstruction (e.g. wax) and the condition of the eardrum, which can indicate inflammation, scarring or middle ear infections. Referrals to the student's GP were made as necessary. If the student could not be tested due to obstructed ear canals, they were removed from the survey results. This resulted in 19 students being removed from the results.

Pure audiometry uses an audiometer to play a series of tones through headphones in each ear, separately. The tones vary in pitch (measured along a frequency spectrum) and loudness (measured in decibels, from -10 to 110). For most pupils, testing began at 500Hz, because this frequency is easily heard by most and has the greatest test-retest reliability. The frequency sequence used for pure-tone threshold search testing was at 250, 500, 1,000, 2,000, 4,000, 8,000 and 1,000 (repeat), 500 Hz.

Students whose initial screening raised concerns of abnormal results were then referred to Triton Hearing for a complete assessment. In the case students undertook a complete assessment at a Triton Hearing clinic, the results of this were reported back to the Foundation for analysis. Due to the time delay between referral, assessment by Triton and reporting back of the results to the Foundation, it is possible a number of referred students are still intending to have an assessment done or have completed an assessment, but the results were not available as at the writing of this report.

The pre-screening questionnaire recorded demographic data including age, gender, ethnicity and family history of hearing impairment, medical history of Ear/Nose/Throat infections and lifestyle factors (such as listening to music on high volume for extended periods and participating in noisy hobbies and activities). The questionnaire was administered in a quiet room by the screening technician at the screening venue within school premises (as designated by the school administration). The data was compiled on Excel spreadsheets and forwarded to the Foundation research office for analysis at regular intervals.

Notes about survey results

Music as a listening hobby

In this year's report 1% of students indicated listening to music as a hobby. This is despite 51% of students confirming they listen for over 1 hour a day in the question about listening duration. We have opted to include listening to music as a self-reported hobby/activity, but it is worth noting the previous report excluded it.

Listening device used

Students were asked what listening device they use and presented with the option to pick multiple out of earbuds, headphones or other. Students were unable to indicate that they do not use any listening devices, so any students falling into this category would have likely selected "Other".

Listening duration

Students were asked how many hours a day they roughly spend listening to music, presented with hour ranges from "<1 hour" to ">7+ hours". They were also presented with the option to select "Other" for this question despite the numerical ranges covering the spectrum of possible answers. Just over 11% of students (148 students) included in the survey selected "Other" for listening duration.

Appendix B: References

Accident Compensation Corporation. (2018). *Assessment of occupational noise-induced hearing loss for ACC: A practical guide for otolaryngologists*; 91.

Deloitte Access Economics. (2006). *The economic impact and cost of hearing loss in Australia*.

Deloitte Access Economics. (2016). *Social and economic costs of hearing loss in New Zealand*.

Deloitte. (2020). *Youth hearing loss in New Zealand: a focus on secondary schools*.

Enable New Zealand. (2017). *Deafness Notification Report 2017: Notified cases of hearing loss (not remediable by grommets) among New Zealanders under the age of 19.* https://www.audiology.org.nz/assets/Uploads/DND/Deafness-Notification-Database-2017-Report-19-November-2018.pdf, accessed 27 December 2022.

Enable New Zealand (2020). *Deafness notification database*; 8.

Global Burden of Disease. (2021). *GBD Compare*. https://vizhub.healthdata.org/gbd-compare/, accessed 27 January 2022.

Lustig, L.R. (2019). *Hearing Loss*. https://www.merckmanuals.com/professional/ear,-nose,-and-throat-disorders/hearing-loss/hearing-loss, accessed 10 November 2020.

Ministry of Health. *Newborn hearing screening*. https://www.health.govt.nz/your-health/pregnancy-and-kids/first-year/first-6-weeks/health-checks-first-6-weeks/newborn-screening-tests/newborn-hearing-screening, accessed November 20, 2020.

National Institute on Deafness and Other Communication Disorders. (2019). *Noise-Induced Hearing Loss*. https://www.nidcd.nih.gov/health/noise-induced-hearing-loss, accessed 20 November 2020.

The National Foundation for Deaf and Hard of Hearing. (2020). *Safe Listening Weekly Allowances*, https://645bf685-ed44-4c0e-8b53-eb1336ee190d.filesusr.com/ugd/39736a_b19c5a8e55cb489d81225c1433e11e6d.pdf, accessed 7 December 2020.

World Health Organisation. (2015). *Hearing loss due to recreation exposure to loud sounds: A review*; 4- 8.

World Health Organisation. (2017). *WHO Environmental noise guidelines for the European region: A systematic review on environmental noise and permanent hearing loss and tinnitus*, International Journal of Environmental Research and Public Health, 14, 1139; 15.

World Health Organisation. (2020). *Deafness and hearing loss*, https://www.who.int/en/news-room/fact-sheets/detail/deafness-and-hearing-loss, accessed 11 November 2020.

Appendix C: Data by school

Demographics

School and location decile

School	Region	Decile	Students
Manurewa High School	Auckland	1	141
Rutherford College	Auckland	5	195
Aurora College	Southland	2	48
Mangere College	Auckland	1	65
Lynfield College	Auckland	6	100
Glenfield College	Auckland	6	71
Manawatu College	Manawatu	2	32
Greymouth High School	West Coast	4	67
Queen Charlotte College	Marlborough	6	42
Avonside Girls High School	Canterbury	6	120
Rotorua Lakes High School	Bay of Plenty	5	53
Darfield High School	Canterbury	9	55
Wellington College	Wellington	10	113
Taieri College	Otago	7	85
Otumoetai College	Bay of Plenty	7	118
			1,305

Gender

School	Female	Female Proportion	Male	Male Proportion	Non-binary	Non-binary Proportion	Prefer not to say	Prefer not to say proportion
Manurewa High School	67	48%	72	51%	1	1%	1	1%
Rutherford College	96	49%	93	48%	4	2%	2	1%
Aurora College	17	35%	31	65%	0	0%	0	0%
Mangere College	28	43%	35	54%	2	3%	0	0%
Lynfield College	41	41%	59	59%	0	0%	0	0%
Glenfield College	34	48%	36	51%	0	0%	1	1%
Manawatu College	20	63%	12	38%	0	0%	0	0%
Greymouth High School	28	42%	38	57%	1	1%	0	0%
Queen Charlotte College	17	40%	23	55%	1	2%	1	2%
Avonside Girls High School	112	93%	0	0%	6	5%	2	2%
Rotorua Lakes High School	24	45%	28	53%	1	2%	0	0%

Darfield High School	27	49%	27	49%	0	0%	1	2%
Wellington College	0	0%	111	98%	0	0%	2	2%
Taieri College	38	45%	47	55%	0	0%	0	0%
Otumoetai College	67	57%	48	41%	2	2%	1	1%
	616		**660**		**18**		**11**	

Ethnicity

School	Asia	Indian	*Māori*	*Māori/ NZ European*	Māori Total	Middle Eastern/ Latin American/ African (MELAA)	NZ/ European	Other	Pacific Peoples
Manurewa High School	6%	10%	22%	6%	28%	0%	8%	9%	40%
Rutherford College	9%	8%	10%	8%	18%	2%	49%	6%	8%
Aurora College	0%	0%	13%	19%	31%	0%	58%	4%	6%
Mangere College	3%	0%	9%	0%	9%	2%	5%	5%	77%
Lynfield College	14%	25%	1%	3%	4%	1%	42%	8%	6%
Glenfield College	14%	4%	10%	8%	18%	3%	39%	17%	4%
Manawatu College	6%	0%	9%	19%	28%	0%	66%	0%	0%
Greymouth High School	0%	0%	4%	16%	21%	0%	73%	4%	1%
Queen Charlotte College	0%	2%	17%	17%	33%	0%	62%	2%	0%
Avonside Girls High School	1%	0%	4%	11%	15%	0%	79%	2%	3%
Rotorua Lakes High School	2%	4%	4%	11%	15%	0%	58%	17%	4%
Darfield High School	0%	0%	0%	13%	13%	0%	78%	9%	0%
Wellington College	8%	1%	0%	3%	3%	1%	81%	4%	3%
Taieri College	1%	0%	5%	7%	12%	0%	74%	11%	2%
Otumoetai College	3%	1%	5%	11%	16%	1%	71%	5%	3%

Findings

Abnormal/normal hearing

School	Abnormal	Abnormal (%)	Normal	Normal (%)
Manurewa High School	39	28%	102	72%
Rutherford College	48	25%	147	75%
Aurora College	11	23%	37	77%
Mangere College	16	25%	49	75%
Lynfield College	13	13%	87	87%
Glenfield College	16	23%	55	77%
Manawatu College	9	28%	23	72%
Greymouth High School	7	10%	60	90%
Queen Charlotte College	7	17%	35	83%

Avonside Girls High School	11	9%	109	91%
Rotorua Lakes High School	12	23%	41	77%
Darfield High School	5	9%	50	91%
Wellington College	31	27%	82	73%
Taieri College	21	25%	64	75%
Otumoetai College	14	12%	104	88%
	260		**1045**	

Ringing in the ears

School	Ringing	Ringing (%)	No ringing	No ringing (%)
Manurewa High School	20	14%	121	86%
Rutherford College	55	28%	140	72%
Aurora College	24	50%	24	50%
Mangere College	8	12%	57	88%
Lynfield College	29	29%	71	71%
Glenfield College	21	30%	50	70%
Manawatu College	11	34%	21	66%
Greymouth High School	23	34%	44	66%
Queen Charlotte College	19	45%	23	55%
Avonside Girls High School	49	41%	71	59%
Rotorua Lakes High School	20	38%	33	62%
Darfield High School	19	35%	36	65%
Wellington College	44	39%	69	61%
Taieri College	34	40%	51	60%
Otumoetai College	38	32%	80	68%
	414		**891**	

Correlation between volume and time spent listening to music (by school)

Manurewa High School

Time per day	Low volume	Medium volume	Max volume
<1 hour	5	37	14
2-3 hours	5	7	8
3-4 hours	2	9	5
4-5 hours	0	4	4
5-6 hours	0	3	0
6-7 hours	0	4	1

>7+ hours	0	5	7
Other	1	15	5
	13	**84**	**44**

Rutherford College

Time per day	Low volume	Medium volume	Max volume
<1 hour	16	39	5
2-3 hours	11	34	4
3-4 hours	5	12	0
4-5 hours	2	13	4
5-6 hours	0	6	2
6-7 hours	0	1	1
>7+ hours	1	9	5
Other	6	15	4
	41	**129**	**25**

Aurora College

Time per day	Low volume	Medium volume	Max volume
<1 hour	2	10	1
2-3 hours	3	6	1
3-4 hours	1	4	1
4-5 hours	0	2	3
5-6 hours	0	3	0
6-7 hours	0	0	0
>7+ hours	0	4	4
Other	1	2	0
	7	**31**	**10**

Mangere College

Time per day	Low volume	Medium volume	Max volume
<1 hour	4	15	6
2-3 hours	0	7	5
3-4 hours	0	2	4
4-5 hours	0	0	1

5-6 hours	0	0	3
6-7 hours	0	1	1
>7+ hours	0	3	4
Other	1	5	3
	5	**33**	**27**

Lynfield College

Time per day	Low volume	Medium volume	Max volume
<1 hour	15	29	0
2-3 hours	3	17	2
3-4 hours	1	6	0
4-5 hours	0	6	2
5-6 hours	1	4	0
6-7 hours	0	0	0
>7+ hours	1	3	1
Other	4	5	0
	25	**70**	**5**

Glenfield College

Time per day	Low volume	Medium volume	Max volume
<1 hour	3	22	1
2-3 hours	2	14	1
3-4 hours	0	3	2
4-5 hours	0	3	1
5-6 hours	0	3	2
6-7 hours	1	2	1
>7+ hours	0	4	0
Other	2	2	2
	8	**53**	**10**

Manawatu College

Time per day	Low volume	Medium volume	Max volume
<1 hour	5	8	1
2-3 hours	0	4	0
3-4 hours	0	1	0
4-5 hours	0	1	1

5-6 hours	1	2	1
6-7 hours	0	0	0
>7+ hours	0	3	0
Other	1	3	0
	7	**22**	**3**

Greymouth High School

Time per day	Low volume	Medium volume	Max volume
<1 hour	6	17	2
2-3 hours	1	7	0
3-4 hours	0	13	2
4-5 hours	0	2	0
5-6 hours	0	0	0
6-7 hours	0	2	0
>7+ hours	0	2	2
Other	2	8	1
	9	**51**	**7**

Queen Charlotte College

Time per day	Low volume	Medium volume	Max volume
<1 hour	4	9	2
2-3 hours	2	4	0
3-4 hours	2	4	0
4-5 hours	0	2	1
5-6 hours	0	0	0
6-7 hours	0	0	0
>7+ hours	0	1	3
Other	2	5	1
	10	**25**	**7**

Avonside Girls High School

Time per day	Low volume	Medium volume	Max volume
<1 hour	7	33	3
2-3 hours	2	15	4
3-4 hours	0	5	1
4-5 hours	1	5	4
5-6 hours	0	8	3

6-7 hours	0	3	2
>7+ hours	0	3	4
Other	2	14	1
	12	**86**	**22**

Rotorua Lakes High School

Time per day	Low volume	Medium volume	Max volume
<1 hour	4	18	2
2-3 hours	2	9	0
3-4 hours	2	4	0
4-5 hours	0	3	0
5-6 hours	0	0	0
6-7 hours	0	0	0
>7+ hours	0	0	0
Other	4	5	0
	12	**39**	**2**

Darfield High School

Time per day	Low volume	Medium volume	Max volume
<1 hour	5	18	1
2-3 hours	0	13	1
3-4 hours	0	5	0
4-5 hours	0	0	0
5-6 hours	0	2	0
6-7 hours	0	1	1
>7+ hours	0	0	1
Other	4	3	0
	9	**42**	**4**

Wellington College

Time per day	Low volume	Medium volume	Max volume
<1 hour	7	40	4
2-3 hours	4	25	4
3-4 hours	0	5	1
4-5 hours	0	5	2
5-6 hours	0	5	0

6-7 hours	2	1	0
>7+ hours	0	1	0
Other	2	5	0
	15	**87**	**11**

Taieri College

Time per day	Low volume	Medium volume	Max volume
<1 hour	9	12	4
2-3 hours	4	10	4
3-4 hours	0	14	3
4-5 hours	0	2	1
5-6 hours	0	2	1
6-7 hours	0	3	0
>7+ hours	5	6	4
Other	1	0	0
	19	**49**	**17**

Otumoetai College

Time per day	Low volume	Medium volume	Max volume
<1 hour	10	34	3
2-3 hours	5	23	0
3-4 hours	1	9	0
4-5 hours	1	4	3
5-6 hours	1	2	0
6-7 hours	1	2	0
>7+ hours	0	3	5
Other	3	6	2
	22	**83**	**13**

Triton Hearing Results

Uptake by school

School	Students referred	Students Seen	Seen (%)
Manurewa High School	21	16	76%
Rutherford College	25	12	48%
Aurora College	8	2	25%
Mangere College	14	11	79%
Lynfield College	13	7	54%
Glenfield College	8	3	38%
Manawatu College	7	1	14%
Greymouth High School	7	0	0%
Queen Charlotte College	7	2	29%
Avonside Girls High School	13	7	54%
Rotorua Lakes High School	3	2	67%
Darfield High School	5	1	20%
Wellington College	11	8	73%
Taieri College	12	0	0%
Otumoetai College	6	2	33%
	160	**74**	**46%**

Results by school

School	Confirmed HL	No HL
Manurewa High School	13	3
Rutherford College	3	9
Aurora College	2	0
Mangere College	9	2
Lynfield College	3	4
Glenfield College	1	2
Manawatu College	0	1
Greymouth High School	0	0
Queen Charlotte College	1	1
Avonside Girls High School	6	1
Rotorua Lakes High School	2	0
Darfield High School	0	1
Wellington College	1	7
Taieri College	0	0
Otumoetai College	1	1
	42	**32**

Note a further 5 students were referred to Triton, but had been identified as suffering from hearing loss prior to the Triton assessment (i.e. total of 47 with hearing loss).

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