



Methodology Report 2023/24

New Zealand Health Survey

2024



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Introduction

The New Zealand Health Survey (NZHS) is an important data collection tool that is used to monitor population health and provide supporting evidence for health policy and strategy development. The Data, Analytics and Surveys group, within the Ministry of Health's Evidence, Research and Innovation directorate, is responsible for designing, analysing and reporting on the NZHS. The NZHS field activities are contracted out to a specialist survey provider, Ipsos Limited (formerly known as CBG Health Research Limited).

The NZHS collects information that cannot be obtained more effectively or efficiently through other means, such as by analyses of hospital administrative records, disease registries or epidemiological research. The NZHS is the best source of information at a population level for most of the topics it covers.

Before 2011, the Ministry conducted surveys about every four years (1992/93, 1996/97, 2002/03 and 2006/07). The wider survey programme included separate surveys on specific subjects (eg, nutrition; tobacco, alcohol and drug use; mental health; and oral health) at varying frequencies. In July 2011, all of these surveys were integrated into the single NZHS, which is now in continuous operation and reported on annually.

From 2013 onwards, a number of key outputs from the NZHS became Tier 1 statistics (a portfolio the government maintains of the most important official statistics, essential to understanding how well New Zealand is performing in different aspects of national concern). These are: smoking (current), past-year (alcohol) drinking, hazardous (alcohol) drinking, obesity, unmet need for a general practitioner (GP) due to cost, unfilled prescription due to cost, self-rated health, and mental health status (psychological distress).

This NZHS methodology report outlines the procedures and protocols followed to ensure that the NZHS produces the high-quality and robust data expected of official statistics (Stats NZ 2007). The information from the continuous NZHS specific to the 2023/24 year (data collected from July 2023 to July 2024) is included in the 'New Zealand Health Survey 2023/24' section of this report. The corresponding information for years 2011/12 to 2022/23 of the NZHS can be found in previous methodology reports.¹

Background

As a signatory to the *Protocols for Official Statistics* (Stats NZ 1998), the Ministry employs best-practice survey techniques to produce high-quality information from the NZHS. It uses standard frameworks and classifications, with validated questions where possible, so that NZHS data can be integrated with data from other sources.

¹ See the New Zealand Health Survey webpage on the Ministry of Health website at: health.govt.nz/statistics-research/surveys/new-zealand-health-survey

Goal

The goal for the NZHS was reviewed in 2019 as part of a project to ensure the survey remains fit for purpose for the future. The refreshed goal is to monitor and research the health and wellbeing of New Zealanders, including how people experience their own health and health services. The information covers population health, health risk and protective factors, as well as health service utilisation.

Objectives

To achieve this goal, four high-level objectives have been identified for the NZHS. These are to:

1. provide an evidence base to inform health system funding, policy, programmes and advocacy with a focus on long-term priorities
2. monitor and research population health status and the prevalence of key health behaviours and risk factors
3. monitor barriers to access and use of health care services
4. enable robust statistical analysis to be carried out and links to other data collections to be made, to address wider information needs.

Features of the survey

The NZHS has been carefully designed to minimise impact on survey respondents. Features for this purpose include:

- selecting only one eligible adult and one eligible child per dwelling
- using well-tested and proven questions
- using professional, trained interviewers to conduct the interviews
- making an appointment to conduct each interview at a time that suits the respondent and their family
- having the option of using a proxy respondent where would-be respondents living in private dwellings have severe ill health or cognitive disability
- having the option of computer-assisted video interviewing (CAVI) when it was not possible to do a computer-assisted personal interview (CAPI).

The New Zealand Health and Disability Multi-region Ethics Committee approved the 2023/24 NZHS (reference: MEC/10/10/103).

Survey content

The NZHS comprises core questions and measurements that are repeated every year, combined with a series of modules that usually change every 12 months.

For details on the rationale of topic inclusion, cognitive testing and the content of the questionnaires, see the *Content Guide 2023/24: New Zealand Health Survey* (Ministry of Health 2024b).

Core content

Most of the core content for both adults and children is drawn from the main topic areas included in the 2006/07 and 2011/12 NZHS. Topic areas include long-term conditions, health status and development, health behaviours and risk factors, health service utilisation and barriers to accessing health care, sociodemographic and health measurements. Table 1 summarises the topics included in the core content of the 2023/24 NZHS. See the *Content Guide 2023/24: New Zealand Health Survey* (Ministry of Health 2024b) for the module topics of each survey year between 2011/12 and 2023/24.

Table 1: New Zealand Health Survey 2023/24 core content

Domain	Topics
Children	
Long-term health conditions	Asthma, eczema, attention deficit hyperactivity disorder, autism spectrum disorder
Health status	Parent-rated health
Health behaviours and risk factors	Nutrition, physical activity, screen time, sleep, tooth brushing, child discipline
Health care services: utilisation and barriers	General practitioners (GPs), nurses, emergency departments (EDs), prescriptions, dental health care workers, getting help for mental health and substance use concerns
Household food security	Household food security
Sociodemographics	Child: gender, age, ethnicity, country of birth, health insurance, Household: housing, household income, household composition (age, gender and the relationship between all household members) Primary caregiver: education and employment status
Health measurements	Height, weight, waist circumference
Adults	
Long-term health conditions	Heart disease, stroke, high cholesterol, high blood pressure, diabetes, asthma, arthritis, chronic pain, hysterectomy
Health status	General health (physical and mental health), functional difficulties (disability status), psychological distress, life satisfaction, family wellbeing, loneliness

Domain	Topics
Health behaviours and risk factors	Tobacco smoking, vaping, alcohol use, drug use, nutrition, physical activity, sleep, tooth brushing
Health care services: utilisation and barriers	General practitioners, nurses, EDs, prescriptions, dental health care workers, getting help for mental health and substance use concerns
Sociodemographics	Adult: sex, gender, age, ethnicity, sexual orientation, languages spoken, country of birth, education, personal income and income sources, employment status, health insurance Household: housing, household income, household composition (age, gender and the relationship between all household members)
Health measurements	Height, weight, waist circumference, measured blood pressure

Notes: Health measurements (including measured blood pressure) were not collected in the 2021/22 NZHS due to COVID-19 restrictions. Blood pressure was not measured in the 2017/18 and 2022/23 surveys due to a lack of time. Body size measurements were reintroduced to the survey in 2022/23 and blood pressure measurements were reintroduced in 2023/24.

Survey population and sample design

This section describes the target population, the survey population and the sample design for the NZHS.

Target and survey population

The **target population** is the population the survey aims to represent. The **survey population** is the population that was covered in the survey.

Target population

The target population for the NZHS is the New Zealand 'usually resident' population of all ages, including those living in non-private accommodation.

The target population is approximately 4.3 million adults (aged 15 years and over) and 0.98 million children (aged from birth to 14 years), according to the Stats NZ estimated resident population as at September 2022 (Stats NZ 2024).

The target population for the current NZHS includes people living in some types of non-private accommodation, to improve coverage of older people. The 2006/07 NZHS and early surveys included only people living in private accommodation.

Survey population

Approximately 99% of the New Zealand 'usually resident' population of all ages is eligible to participate in the NZHS. For practical reasons, a small proportion of the target population is excluded from the survey population. People in this category include:

- those in most types of non-private dwellings (prisons, hospitals, hospices, dementia care units and hospital-level care in aged-care facilities)
- non-New Zealand diplomats, diplomatic staff and their dependants
- people who usually live in a household but are currently away and will not return within the next four weeks (except students based in hostels and boarding schools)
- people in households located on islands other than the North Island, South Island and Waiheke Island.

Included in the survey population are:

- usual residents who live in aged-care facilities (rest homes)

- students who live away for at least four weeks from their household in student accommodation (university hostels and boarding schools)
- usual residents who live in a household, but are away for less than four weeks
- children under shared care arrangements if they spend:
 - at least four days per week in the current household
 - equal time in the current household and somewhere else, and they are present in the household on the day of recruitment
- overseas visitors who intend to stay in New Zealand for more than 12 months.

Sample design

The sample design for the NZHS was developed by the National Institute for Applied Statistics Research Australia, University of Wollongong, Australia.

The sample design used in the current year is the same design used for the years 2015/16 to 2022/23, but it is slightly different from the design used for the years 2011/12 to 2014/15. The main changes made in 2015/16 were as follows:

- The first-stage selection units are now Stats NZ's household survey frame primary sampling units (PSUs) rather than the census meshblocks used in the first four years of continuous survey. PSUs are groupings of one or more meshblocks. There have also been some associated changes to the selection probabilities and the number of dwellings selected from each PSU.
- PSUs are now selected using the Stats NZ coordinated selection facility to manage overlap across many government surveys and to minimise the NZHS revisiting the same households.
- PSUs selected for the area component (defined below under 'Sample selection') of the sample are now surveyed in two different quarters of the same calendar year, but in different reporting years, such as 2022/23 and 2023/24. Different households are surveyed in these two different quarters.

For more detail on the current sample design, see *Sample Design from 2015/16: New Zealand Health Survey* (Ministry of Health 2016), and for detail on the sample design used prior to 2015/16, see Clark et al (2013) and *The New Zealand Health Survey: Sample design, years 1–3 (2011–2013)* (Ministry of Health 2011).

Sample selection

The NZHS has a multi-stage, stratified, probability-proportional-to-size (PPS) sampling design. The survey is designed to yield an annual sample size of approximately 14,000 adults and 5,000 children in a typical year (without disruption to data collection due to the COVID-19 pandemic).

A dual-frame approach has been used, whereby respondents are selected from an area-based sample and a list-based electoral roll sample. The aim of this approach is to increase the sample sizes for Māori, Pacific and Asian ethnic groups.

Area-based sample

Stats NZ's PSUs form the basis of the area-based sample. The area-based sample is targeted at the ethnic groups of interest by assigning higher probabilities of selection to areas (PSUs) in which these groups are more concentrated.

A three-stage selection process is used to achieve the area-based sample.

- First, a sample of PSUs is selected within each district health board (DHB) area. The PSUs are selected with PPS, where the size measure is based on the counts of occupied dwellings from the 2018 Census. This means that larger PSUs have a higher chance of being selected in the sample. The size measures are modified using a targeting factor to give higher probabilities of selection to PSUs where more Pacific or Asian people live, also based on the 2018 Census.
- Second, a list of households is compiled for each selected PSU. A systematic sample of approximately 21 households is selected from this list by choosing a random start point and selecting every k^{th} household. The skip k is calculated by the 2018 Census occupied-dwellings count divided by 21.
- Third, one adult (aged 15 years or over) and one child (aged from birth to 14 years, if any in the household) are selected at random from each selected household.

Aged-care facilities in the selected PSUs are included in the area-based sample by first dividing them into 'accommodation units', typically consisting of an individual or couple living together in the facility. Accommodation units are then treated as households in the sampling process, although, at most, five accommodation units are selected from a single facility.

Students living away from home in university hostels and boarding schools are eligible to be selected via their family's house if they still consider this to be their home. If selected, arrangements are made to survey them either when they are next at home or at their student accommodation.

Electoral roll sample

The electoral roll provides another sampling frame, used to increase the sample size of the Māori ethnic group. The electoral roll is used to select a sample of addresses where a person has self-identified as having Māori ancestry. A copy of the electoral roll is obtained quarterly for this purpose.

Stratified three-stage sampling is used to select the sample from the electoral roll.

- The first stage involves selecting a sample of PSUs within each stratum (DHB area), with probability proportional to the number of addresses on the electoral roll containing at least one person who has self-identified as having Māori ancestry. The sample of PSUs is selected so that it does not overlap with the sample of PSUs for the area-based sample.
- The second stage involves selecting a systematic sample of up to 14 addresses (from the list of households where any person has self-identified as having Māori ancestry) from each selected PSU, or all addresses if there are fewer than 14 addresses in a selected PSU.

- In the third stage, one adult (aged 15 years or over) and one child (aged from birth to 14 years, if there are any children in the household) are selected at random from each selected address.

The process of contacting households and selecting an adult and child is exactly the same for the electoral roll sample as for the area-based sample. The adult and child (if there are any children in the household) randomly selected into the sample can be Māori or non-Māori. This approach ensures that probabilities of selection can be correctly calculated for all respondents.

Data collection

Ipsos collects data for the NZHS. Approximately 71 professional interviewers worked on the 2023/24 survey.

The NZHS is a household survey with data usually collected face-to-face in the respondents' home, using a combination of interviews and objective measurements (for example, height and weight).

Interviews

Almost all (99%) of adult and child surveys for the 2023/24 NZHS were carried out face-to-face or using CAPI. For CAPI, the interviewer enters responses directly into a laptop, using the Askia survey platform. Data for some sensitive questions is collected via computer-assisted self-interviewing (CASI), whereby adult respondents enter their responses directly into a tablet computer.

Approximately 1% of the interviews for the 2023/24 NZHS were conducted via CAVI – see Computer-assisted video interviewing below.

'Showcards' with predetermined response options are used to help respondents where appropriate. Since 2017/18, electronic showcards on a tablet computer have been used help improve respondent engagement and the accuracy of their responses. The options displayed on the electronic showcards automatically change as the survey progresses.

Computer-assisted video interviewing

In response to COVID-19 restrictions in 2020, Ipsos developed a virtual interviewing system, which enables CAVI. The CAVI system provides a secure, private online 'room' where an interviewer and respondent can meet to complete the survey together, in a way that closely resembles an in-person interview. The system features an integrated video call component and a large survey window. The respondent can view the showcards on the screen and complete the CASI questions themselves. Video interviewing is offered to respondents who are apprehensive or reluctant to have an interviewer in their home; for example, because they are unwell.

Interviewer training

Interviewers participate in annual training for new module content and receive ongoing training and support during the year, in the form of individualised and group learning. In-field assessments are also conducted by field managers at regular intervals during the survey year. Interviewers are retrained annually and must pass a recertification assessment to ensure they maintain the required skill levels.

Objective measurements

Objective measurements are usually taken at the end of the interview component of the survey. All respondents aged two years and over are invited to have their height and weight measured, respondents aged five years and over are invited to have their waist circumference measured, and adults aged 15 years and over are invited to have their blood pressure measured. Respondents may decline to provide some or all measurements. Pregnant women are excluded from the measurement component of the survey.

Respondents are given a measurement card, detailing the readings taken on the day of the survey. The card also includes details about where to go for further information or advice.

Anthropometric measurements

Anthropometric measurements (height, weight and waist circumference) are part of the core NZHS. Height, weight and waist circumference measurements are taken at least twice for each respondent. If there is a variation of more than 1% between the first and second measurements, a third measurement is taken for accuracy. The final height, weight and waist measurements are calculated for each respondent by taking the mean of the two closest measurements.

Height

Laser height measurement was introduced with the 2012/13 NZHS. The laser design was trialled and refined before being introduced. It replaced the traditional stadiometers used in the 2011/12 NZHS and earlier nutrition surveys. The professional measuring device, a Precaster HANS CX100, consists of a laser meter mounted to a rigid headboard that the interviewer holds against a wall or a closed door. The headboard is lowered until it reaches the respondent's head, activating the laser to take a measurement to the nearest 0.1 centimetre. Respondents are asked to remove their shoes before their height is measured.

Weight

Weight is measured to the nearest 0.1 kilogram, using professional electronic weighing scales (Tanita HD-351), which can take a maximum of 200 kilograms. Respondents are asked to empty their pockets and remove their shoes and any bulky clothing before their weight is measured.

Waist circumference

Waist circumference is measured to the nearest 0.1 centimetre, using an anthropometric measuring tape (Lufkin® W606PM). Measurements are taken over one layer of clothing, at the midpoint between the lowest palpable rib and the top of the hip bone.

Blood pressure

Blood pressure measurement for adults was introduced into the NZHS in 2012/13. It has been included most years except the following:

- 2017/18 – to allow more time for the questionnaire portion of the survey
- 2021/22 – no measurements were taken due to COVID-19 restrictions
- 2022/23 – to allow more time for the questionnaire portion of the survey.

If the respondent consents, interviewers obtain a blood pressure measurement, using an OMRON HEM-907, a portable electronic sphygmomanometer with four cuff sizes. A fabric cuff is wrapped around the respondent's upper left arm, just above the elbow. Within the cuff is a plastic bladder connected by a tube to the main device. As the bladder inflates, the device detects the respondent's blood pressure. The device is programmed to take three readings, with a 1-minute pause between each.

The final systolic and diastolic measurements used for analysis are calculated for each respondent by taking the mean of the second and third measurements. The first reading is not used, to minimise the impact of any increase in blood pressure caused by taking measurements.

Equipment checks

Several techniques are used to ensure the quality of the objective measurement equipment. If interviewers report faulty equipment, replacements are supplied immediately. Ipsos managers carry out in-field checks of equipment a minimum of once a year. These checks include:

- a visual check of equipment for damage/cleanliness (to ensure, for example, that blood pressure cuffs are in good condition, blood pressure tubes and connectors are sound and weighing scales have all four feet)
- a check that the laser and blood pressure devices are still programmed with the correct settings.

At the time of the annual module change, the equipment is checked and recalibrated as follows.

- The electronic weighting scales and blood pressure monitors are recalibrated by a manufacturer-approved agent.
- The lasers are checked against a known fixed height to ensure they are measuring correctly and are still programmed to the correct settings.

Interviewers undergo retraining on the process for collecting measurements at the time of each annual module change. They must pass a certification assessment before being permitted to deliver the survey in the field. The assessment is administered by Ipsos managers and includes an assessment of the interviewer's ability to measure children.

Field work

Pilot study

Before the main data collection for the 2023/24 NZHS, a pilot study involving 112 respondents was carried out from 24 April to 7 May 2023. Respondents were recruited in accordance with the usual selection process, ie, respondents were randomly selected from within houses which had been randomly selected from within 11 PSUs. A total of 86 adult and 26 child interviews were completed in this pilot study. See the *Content Guide 2023/24: New Zealand Health Survey* (Ministry of Health 2024b) for more information about the purpose and results of the pilot study.

Enumeration

Ipsos pre-selects households from PSUs selected for the survey using the New Zealand Post address database, obtained quarterly. Each area PSU is re-enumerated by the interviewer when they first visit, to ensure accuracy of both new dwellings and those removed (since the previous census). New household details are entered into Ipsos sample management software while the interviewer is in the field, making those households eligible for random selection process within its PSU.

Invitation to participate

The NZHS is voluntary, relying on the goodwill of respondents, and interviewers obtain consent for participation without coercion or inducement. Ipsos posts each selected household an invitation letter from the Ministry, along with an information pamphlet. Interviewers take copies of the information pamphlet in 11 different languages when they subsequently visit households seeking people's agreement to participate in the survey.

Using Ipsos sample management software, one adult and one child (if any in the household) are randomly selected from each selected household to take part in the survey. Respondents are asked to sign an electronic consent form and are given a copy to keep. The consent form requires the respondent to confirm they have read and understood the information pamphlet, that they can ask questions at any time and that they can contact Ipsos or the Ministry for more information.

The consent form also informs respondents:

- of their right to request an interpreter if required
- that they can stop the interview at any time
- that they do not have to answer every question
- that their participation is confidential, and no identifiable information will be used in any reports
- that their answers are protected by the Privacy Act 2020.

Where a selected adult respondent is unable to provide consent themselves, a welfare guardian, or someone who holds enduring power of attorney for the respondent's personal care and welfare, is permitted to consent to and complete the survey on the respondent's behalf.

Child interviews are conducted with a guardian or primary caregiver of the child; that is, a person who has day-to-day responsibility for the care of the child.

All respondents for the NZHS are given a thank you card and a small token of appreciation, such as a pen or fridge magnet, at the conclusion of the interview. A list of health and community organisations is also included should respondents wish to discuss their participation, or if they need advice on a health issue.

Visit pattern

In attempting to make contact, interviewers visit each selected household, on different days and at different times of the day. Interviewers can visit as many times as they deem necessary; however, a household will only be recorded as a 'non-contact' once 8 unsuccessful visits have been made. Visits are recorded as separate events only if they are made at least two hours apart.

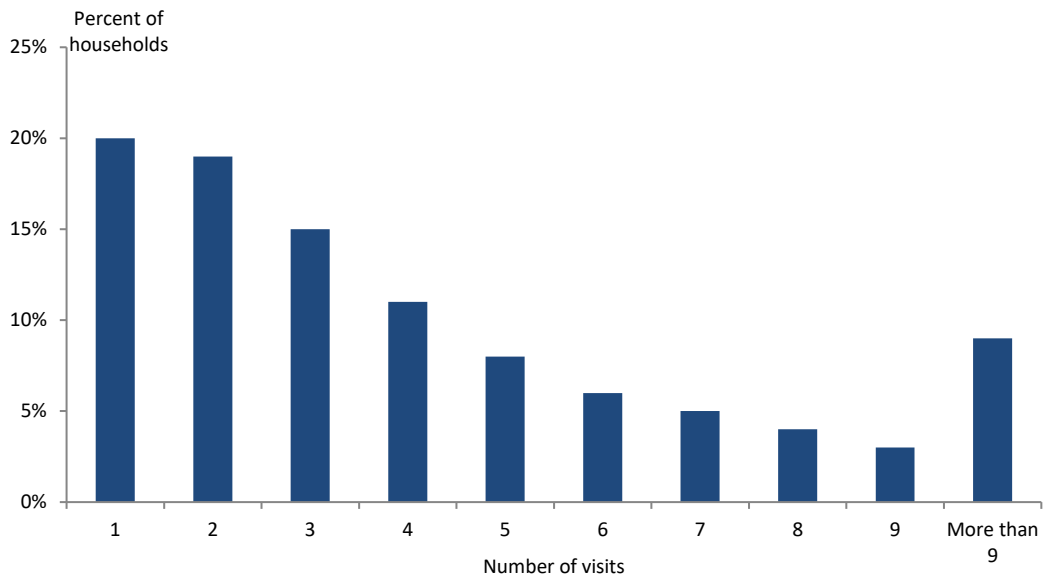
Interviewers space their PSU visits over a period of two to three months and are required to complete a call-back regime that meets the following minimum criteria.

- Contact attempted on at least three different days
- At least one attempt:
 - before noon
 - between noon and 6pm
 - after 6pm
 - on the weekend.

Interviewers will typically stagger their visits across the collection period, which helps with contacting people who might be away temporarily or who are otherwise engaged when their household is first approached.

The visit pattern used in the NZHS is an important part of achieving a high response rate. For 91% of households in the 2023/24 survey, the first (or only) interview took place within nine visits (Figure 1).

Figure 1: Proportion of households agreeing to first interview, by number of visits, 2023/24



Interview duration

The mean duration of the adult survey in 2023/24 was 40 minutes, comprising 35 minutes for the core questions and measurements and 5 minutes for the modules. The mean duration of the child survey in 2023/24 was 25 minutes, comprising 17 minutes for the core questions and measurements and 8 minutes for the modules. These durations do not include time taken for the interviewer to engage with the household to complete the consent process and pack away at the end of the survey (an average of 10 minutes).

Respondent feedback

To ensure survey protocols have been followed correctly and to ascertain respondents' satisfaction with the survey process, Ipsos conducts audit calls with at least 15% of all respondents and at least two households per PSU. Feedback is also encouraged via the survey helpline and email.

Audio recording

Audio recording of interviews was introduced in the 2017/18 NZHS as a part of quality control. Audio recording helps to ensure that interviews are conducted in a consistent and impartial manner. Upon respondent consent, random or pre-determined questions are recorded.

Response and coverage rates

The response rate is a measure of how many people who were selected to take part in the survey actually participated. The higher the response rate, the more representative the survey results are of the New Zealand population. Table 2 shows the response rate and sample size for adults and children from 2011/12 to the current survey year, 2023/24.

In the 2023/24 NZHS, the final weighted response rate was 73% for adults and 70% for children.

For more details on the response rates for 2023/24, see the 'New Zealand Health Survey 2023/24' section below.

Response rate is an important measure of the quality of a survey. Methods used to maximise response rates in the NZHS include:

- giving interviewers initial and ongoing training and development
- supporting and assessing interviewers in the field
- using well-designed call pattern processes, allowing for up to 8 calls to potential respondents at different times of the week and day
- revisiting 'closed' PSUs at the end of each quarter – non-contact households are revisited (up to 8 times overall) and attempts made to complete interviews with selected respondents who were unable to take part when they were originally selected.

Table 2: Sample size and response rates, 2011/12–2023/24

Year	Adult sample size	Child sample size	Adult response rate	Child response rate
2011/12	12,370	4,478	79%	85%
2012/13	13,009	4,485	80%	85%
2013/14	13,309	4,699	80%	85%
2014/15	13,497	4,754	79%	83%
2015/16	13,781	4,721	80%	80%
2016/17	13,598	4,668	80%	80%
2017/18	13,869	4,723	80%	79%
2018/19	13,572	4,503	80%	79%
2019/20	9,699	3,290	75%	74%
2020/21	9,709	2,954	77%	74%

Year	Adult sample size	Child sample size	Adult response rate	Child response rate
2021/22	4,434	1,323	56%	53%
2022/23	6,799	2,029	71%	67%
2023/24	9,719	3,062	73%	70%

Calculating the response rate

The NZHS calculates a weighted response rate. The weight of each household reflects the probability of the household being selected into the sample; the weighted response rate describes the survey's success in terms of achieving the cooperation of the population being measured.

For adults, the response rate calculation classifies all selected households into the four groups of:

1. ineligible (such as vacant sections, vacant dwellings and non-residential dwellings)
2. eligible responding (interview conducted; respondent confirmed to be eligible for the survey)
3. eligible non-responding (interview not conducted but enough information collected to indicate that the household did contain an eligible adult; almost all refusals were in this category)
4. unknown eligibility (such as non-contacts and refusals who provided insufficient information to determine eligibility).

The response rate is calculated as follows:

$$\text{Response rate} = \frac{\text{number of eligible responding}}{\left[\text{number of eligible responding} \right] + \left[\text{number of eligible non-responding} \right] + \left[\text{estimated number of eligibles from the unknowns} \right]} \times 100$$

The justification for using this calculation method is that a proportion of the unknowns is likely to have been eligible if contact could have been made. This proportion of the unknowns is therefore treated as eligible non-responding.

The estimated number of unknown eligibles is calculated as follows:

$$\left[\text{Estimated number of eligibles from the unknowns} \right] = \left[\text{number of unknowns} \right] \times \frac{\left[\text{number of eligible responding} \right] + \left[\text{number of eligible non-responding} \right]}{\left[\text{number of eligible responding} \right] + \left[\text{number of eligible non-responding} \right] + \left[\text{number of ineligible} \right]}$$

The response rate for children is calculated using the same approach as for adults, but 'eligible' means the household contained at least one child, and the definition of 'responding' is that a child interview was conducted.

Coverage rate

The coverage rate is an alternative measure related to survey response and shows the extent to which a population has been involved in a survey. It provides information on the discrepancy between the responding sample (weighted by selection weight) and the population. It encompasses the impact of non-response rates and also incorporates other factors, such as being excluded or missed from the sample frame. For example, dwellings that have just been built may not be included in the sample frame, in this way contributing to under-coverage.

The coverage rate is defined as the ratio of the sum of the selection weights for the survey respondents to the known external population size.

Unlike the response rate, the coverage rate can be calculated without making any assumption about how many households with unknown eligibility were in fact eligible. Moreover, the coverage rate can usually be broken down in more detail than the response rate, including by individual characteristics. However, definitional or operational differences between the survey scope and the external population size (such as differing definitions of usual residence) will affect the coverage rate. As a result, the response rate is generally used as the primary measure of the survey's quality. Some information on the coverage rate is included to provide more detail on response, particularly response by ethnicity and age group.

The coverage rate also represents the factor by which the calibrated weighting process adjusts selection weights to force agreement with calibration benchmarks (see the 'Weighting' section for more on calibration).

For details on the coverage rates in 2023/24, see the 'New Zealand Health Survey 2023/24' section below.

Data processing

Capturing and coding

Questionnaire responses are entered directly on interviewers' laptops using computer assisted software.

Most questions have single-response options or require discrete numerical responses, such as age at the time of a specific event or the number of visits to a specific medical professional. However, a number of questions allow for multiple responses. For these questions, all responses are retained, with each response shown as a separate variable on the data file.

A number of questions offer a category called 'other', where respondents can specify non-standard responses. Each 'other' category response is recorded (in free text).

Ethnicity is self-defined, and respondents can report their affiliation with more than one ethnic group, using the Stats NZ standard ethnicity question. Responses to the ethnicity question are coded to level 4 of the *Ethnicity New Zealand Standard Classification 2005* (Stats NZ 2005).

Securing information

Any information collected in the survey that could be used to identify individuals is treated as strictly confidential. Data is transferred daily from interviewers' laptops to Ipsos by a secure internet upload facility. The Ministry accesses the data through the Ipsos website using a secure username and password login.

The names and addresses of people and households that participate in the survey are not stored with response data. Unit record data are stored in a secure area and are only accessible on a restricted basis.

Checking and editing

The electronic questionnaire contains built-in edits, including 'hard' and 'soft' edits. Hard edits prevent impossible responses being entered, such as the year of arrival in New Zealand being earlier than the date of birth. These responses must be changed before the interviewer can proceed to the next question. Soft edits check for unlikely responses, such as inconsistency between responses or values that are unusually high or low. For example, if the response to A3.12a (hours of sleep per day) is less than 4 hours, the interviewer is prompted to verify the answer with respondent. Interviewers

may suppress these soft edits and proceed to the next question without changing the response.

Ipsos and the Ministry routinely check and edit the data throughout the field period of the NZHS. In addition, the final unit record data sets provided to the Ministry are edited for range and logic. Any inconsistencies found are remedied by returning to the interviewer and, if necessary, the respondent for clarification and correction.

In 2018/19, enhanced data cleaning was introduced by Ipsos. Previously, where a respondent decided to go back in the survey and change their response to an earlier question, any responses that were no longer on a valid logic path were retained in the data set. This resulted in extra cleaning being required at the analysis stage to manually remove these responses. To resolve this issue, Ipsos worked with the survey software provider to develop on-the-fly automatic cleaning of survey responses that were no longer on a valid logic route.

Missing data due to non-response

The term 'unit non-response' refers to the situation in which no response is obtained from the selected household or person; for example, if the household is unable to be contacted or declines to participate. 'Item non-response' refers to the situation in which a respondent does not provide an answer to some (but not all) questions in the questionnaire, usually because they do not know the answer or refuse to answer.

Unit non-response is adjusted for in the calculation of weights, as described in the 'Weighting' section. Weighting is also used to adjust for non-response to the measurement phase of the interview.

Table 3 shows questions where more than 3% of respondents either did not know the answer or refused to answer the question (called here 'item non-response'). In the 2023/24 NZHS, 11 adult questions had item non-response of 3% or more, and 7 child questions had item non-response of 3% or more.

Height measurements were obtained from 87% of eligible adult and 80% of eligible child respondents. Weight measurements were obtained from 87% of eligible adult and 80% of eligible child respondents. Waist measurements were obtained from 86% of eligible adult and 80% of eligible child respondents.

Table 3: Questions with item non-response for more than 3% of respondents, 2023/24

Question	% non-response
Adults	
Household income	25%
Self-reported weight	17%
Self-reported height	16%
Personal income	15%
Type of arthritis	14%
Type of arthritis affecting respondent the most	12%
Age when started smoking	8%
Age in years	7%
Amount charged for last GP visit	5%
Medical insurance type	5%
House ownership	4%
Children	
Household income	22%
Age when child stopped being breastfed	11%
Age when child given solids	10%
Age when child given drink/food other than breast milk	7%
House ownership	6%
Highest qualification of primary caregiver	4%
Household income meeting basic needs	4%

Where a respondent does not provide their date of birth or their age in years, age is imputed as the midpoint of the age group they have provided. No other imputation is used to deal with item non-responses.

Creating derived variables

A number of derived variables are created on the NZHS data set. Many of these, such as Alcohol Use Disorders Identification Test (AUDIT), and level of psychological distress (K10), are based on commonly used or standard definitions to enable comparison with other data sources and countries.

See the *Annual Data Explorer 2023/24* (Ministry of Health 2024a) for more detailed information on all of the indicators used in the NZHS.

Ethnicity

Ethnic group variables are derived using the concept of **total response ethnicity** (Stats NZ 2005). This means that respondents can appear in, and contribute to, the published statistics for more than one ethnic group.

NZHS reports generally provide statistics for the following four groups: Māori, Pacific peoples, Asian and European/Other. The group 'Other' (comprising mainly Middle-Eastern, Latin-American and African ethnicities) has been combined with European to avoid problems with small sample sizes.

Respondents who do not know or refuse to state their ethnicity are included as European/Other, as are those who identify themselves as 'New Zealander'.

The ethnicity data is collected using a standard Stats NZ ethnicity question that provides eight checkboxes for the most common ethnic groups in New Zealand, and up to three text responses for other ethnic group options. The ethnicity coding was improved in 2014/15. The Other ethnicity text response options have been coded to level 4 of the *Ethnicity New Zealand Standard Classification 2005* (Stats NZ 2005) since 2017/18. This is likely to have had a small effect on the time series; for example, increasing the size of the Asian ethnic group. It is unlikely to have affected responses relating to Māori ethnicity, because Māori is listed as an ethnicity in the eight checkboxes for the most common ethnic groups.

Neighbourhood deprivation

Neighbourhood deprivation refers to the New Zealand Index of Deprivation 2018 (NZDep2018), developed by researchers at the University of Otago (Atkinson et al 2019). NZDep2018 measures the level of socioeconomic deprivation for each neighbourhood (Statistical Area 1, SA1) according to a combination of the following 2018 Census variables: household income, benefit receipt, household crowding, home ownership, employment status, qualifications, single-parent families, living in a home with dampness/mould and access to the internet. An earlier version of NZDep (NZDep2013) was used between NZHS years 2014/15 and 2018/19, and NZDep2006 was used before NZHS 2014/15.

NZHS reports generally use NZDep2018 quintiles, where quintile 1 represents the 20% of small areas with the lowest levels of deprivation (the least deprived areas) and quintile 5 represents the 20% of small areas with the highest level of deprivation (the most deprived areas).

A small number of areas do not have a value for NZDep2018. If any of these areas are selected in the NZHS, the respondents are assigned to quintile 3 (the middle quintile) for weighting and analysis purposes.

Disability status

The 2023/24 NZHS results are presented by disability status for both adults and children. Different question sets are used for adults and children to identify disability

status. The question set used to identify adults with a disability in the NZHS Annual Data Explorer is known as the Washington Group Short Set (WG-SS). This question set has been included in the NZHS since 2018/19.

Using the WG-SS, disabled adults are those who have at least a lot of difficulty seeing or hearing (even with glasses or hearing aids), walking or climbing stairs, remembering or concentrating, self-care, or communicating. The six domains included in the WG-SS were chosen because they were found to be the ones that identified a majority of people at risk of being restricted in their independent participation in society.

The WG-SS should not be used to produce estimates of disability prevalence or to investigate levels of need for services or environmental change. To meet these and other data needs, a disability-specific survey, with a more extensive question set, would be required. The population identified as disabled using the WG-SS is considerably smaller than the population identified by disability-specific surveys. One of the limitations is that no WG-SS question fully captures mental health impairments.

The question set used to identify disabled children (aged 5–14 years) in the NZHS is known as the Washington Group / UNICEF Child Functioning Module (CFM). This question set was included in the NZHS for the first time in 2022/23.

Using the CFM, disabled children (aged 5 to 14 years) are those who have at least a lot of difficulty with seeing or hearing (even with glasses or hearing aids), walking, self-care, communicating, learning, remembering, concentrating, accepting change, controlling their own behaviour or making friends, or if they have anxiety, or depression.

For more information on the WG-SS, WG-SS Enhanced and CFM, please see the Washington Group on Disability Statistics website at: washingtongroup-disability.com

A small number of people have not been assigned a disability status due to responses of 'don't know' or 'refused' to the disability questions. As a result, the estimated number of disabled and non-disabled people shown in the Annual Data Explorer may not add to the total population count.

Health regions

The New Zealand health system underwent a major change in July 2022. One of those changes was the removal of the 20 district health boards that had operated throughout New Zealand. Under the new system, the country is split into four health regions:

- Northern – Northland, Waitematā, Auckland and Counties Manukau
- Te Manawa Taki – Waikato, Bay of Plenty, Lakes, Tairāwhiti and Taranaki
- Central – MidCentral, Whanganui, Capital & Coast/Hutt Valley, Hawkes Bay and Wairarapa
- Te Waipounamu – Canterbury, West Coast, Nelson Marlborough, Southern and South Canterbury.

The 2023/24 NZHS results are presented by these health regions.

Weighting

Weighting of survey data ensures the estimates calculated from this data are representative of the target population.

Most national surveys have complex sample designs whereby different groups have different chances of being selected in the survey. These complex designs are used for a variety of purposes; in particular, to:

- reduce interviewer travel costs by ensuring the sample is geographically clustered
- ensure all regions of interest, including small regions, have a sufficient sample size for adequate estimates to be made
- ensure important sub-populations – in particular, Māori, Pacific peoples and Asian ethnic groups – have a sufficient sample size for adequate estimates to be made.

To ensure no group is under- or over-represented in estimates from a survey, a method of calculating estimates that reflects the sample design must be used. Estimation weights are used to achieve this aim.

A weight is calculated for every respondent, and these weights are used in calculating estimates of population totals (counts), averages and proportions. Typically, members of groups that have a lower chance of selection are assigned a higher weight so that these groups are not under-represented in estimates. Conversely, groups with a higher chance of selection receive lower weights. Also, groups that have a lower response rate (such as young men) are usually assigned a higher weight so that these groups are correctly represented in all estimates from the survey.

The NZHS uses the calibrated weighting method to:

- reflect the probabilities of selecting each respondent
- make use of external population benchmarks (typically based on the population census) to correct any discrepancies between the sample and the population benchmarks; this improves the precision of estimates and reduces bias due to non-response.

NZHS weights are usually calculated for respondents in each survey quarter separately and are calibrated to population benchmarks for the corresponding calendar quarter. Data for the four quarters of the survey year is combined to produce annual survey statistics, and the weights are divided by four so that the combined annual sample represents the target population.

In 2023/24, data collection was attempted for the sample of households selected in the first three-quarters of the survey year and part of the sample of households selected in the fourth quarter. The proportion of the sample attempted in the fourth quarter varied by DHB, and this has been taken into account in the calculation of the selection weights. Data from the first two survey quarters were weighted separately to population benchmarks for that quarter. Due to smaller achieved sample sizes, data for

the last two quarters has been combined for weighting purposes and calibrated to the averages of the quarterly population benchmarks for those quarters.

Calculating selection weights

The first step in producing calibrated weights is to calculate a selection probability (and hence selection weight) for each respondent. It is crucial to calculate selection weights correctly to avoid bias in the final calibrated estimators.

Selection weights for the area-based sample and the electoral roll sample are calculated in different ways, as follows.

Area-based sample

- The probability of a PSU i being selected in the area-based sample (A) is written as π_{Ai} . The values of π_{Ai} are greater than 0 for all PSUs in the survey population.
- The probability of a dwelling being selected from a selected PSU i in the area sample is $1/k_{Ai}$, where k_{Ai} is a skip assigned to each PSU on the frame.
- The probability of any particular adult being selected from a selected dwelling j in a selected PSU i is then $1/N_{ij(\text{adult})}$, where $N_{ij(\text{adult})}$ is the number of adults in the dwelling. Similarly, the probability of any particular child (if any in the household) being selected is $1/N_{ij(\text{child})}$, where $N_{ij(\text{child})}$ is the number of children in the dwelling.

Electoral roll sample

- The probability of a PSU i being selected in the electoral roll sample (R) is written as π_{Ri} . The values of π_{Ri} are 0 for some PSUs (those with fewer than five households with residents who registered Māori descent on the electoral roll snapshot used in the sample design for that year).
- Dwellings are eligible for selection in the electoral roll sample if they have at least one adult registered as being of Māori descent in the electoral roll snapshot extracted for the enumeration quarter. ($E_{ij} = 1$ if PSU i has $\pi_{Ri} > 0$ and dwelling j in this PSU is eligible; $E_{ij} = 0$ otherwise.)
- A skip k_{Ri} is assigned to each PSU and applied to eligible dwellings. The probability of an eligible dwelling being selected from PSU i in the electoral roll sample is $1/k_{Ri}$, where k_{Ri} is a skip assigned to each PSU on the frame.
- The probability of any particular adult being selected in the electoral roll sample from a selected dwelling j in a selected PSU i is then $1/N_{ij(\text{adult})}$, and the probability of any particular child (if any in the household) being selected is $1/N_{ij(\text{child})}$.

Combined sample

The electoral roll sample and the area-based sample are selected according to the probabilities calculated using the above methods. The two samples of PSUs do not overlap. The complete NZHS sample is defined as the union of the two samples. The probability of selecting any adult in dwelling j in PSU i in the combined sample is therefore:

$$(1) \quad \pi_{ij(\text{adult})} = E_{ij}\pi_{Ri}k_{Ri}^{-1}N_{ij(\text{adult})}^{-1} + \pi_{Ai}k_{Ai}^{-1}N_{ij(\text{adult})}^{-1} = (E_{ij}\pi_{Ri}k_{Ri}^{-1} + \pi_{Ai}k_{Ai}^{-1})N_{ij(\text{adult})}^{-1}$$

Similarly, the probability of selecting any child in dwelling j in PSU i in the combined sample is:

$$(2) \quad \pi_{ij(\text{child})} = E_{ij}\pi_{Ri}k_{Ri}^{-1}N_{ij(\text{child})}^{-1} + \pi_{Ai}k_{Ai}^{-1}N_{ij(\text{child})}^{-1} = (E_{ij}\pi_{Ri}k_{Ri}^{-1} + \pi_{Ai}k_{Ai}^{-1})N_{ij(\text{child})}^{-1}$$

The selection weights for adults and children are given by the reciprocal (inverse) of the above:

$$(3) \quad d_{ij(\text{adult})} = \pi_{ij(\text{adult})}^{-1} = (E_{ij}\pi_{Ri}k_{Ri}^{-1} + \pi_{Ai}k_{Ai}^{-1})^{-1}N_{ij(\text{adult})}$$

$$(4) \quad d_{ij(\text{child})} = \pi_{ij(\text{child})}^{-1} = (E_{ij}\pi_{Ri}k_{Ri}^{-1} + \pi_{Ai}k_{Ai}^{-1})^{-1}N_{ij(\text{child})}$$

For the purposes of calculating weights, values of $N_{ij(\text{adult})}$ or $N_{ij(\text{child})}$ greater than five are truncated to five. This affects only a small proportion of households (approximately 1%) and is designed to reduce the variability of weights to avoid instability in weighted statistics.

Calibration of selection weights

Calibrated weights are calculated by combining the selection weights and population benchmark information obtained externally from the survey. The NZHS uses counts from Stats NZ's estimated resident population for each calendar quarter, broken down by age, sex, ethnicity and socioeconomic position, as its benchmark population.

Calibrated weights are calculated to achieve two specific requirements.

- A. The weights should be close to the inverse of the probability of selecting each respondent.
- B. The weights are calibrated to the known population counts for a range of sub-populations (such as age-by-sex-by-ethnicity categories). This means that the sum of the weights for respondents in the sub-population must equal exactly the known benchmark for the sub-population size.

Requirement A ensures that estimates have low bias; requirement B improves the precision of estimates and achieves consistency between the survey estimates and external benchmark information. The calibrated weights are calculated in such a way as to minimise a measure of the distance between the calibrated weights and the inverse selection probabilities, provided that requirement B above is satisfied.

A number of distance measures are in common use. A chi-square distance function (case 1 in Deville and Särndal 1992) is used for calibrating the NZHS weights, which corresponds to generalised regression estimation (also known as GREG). This distance function is slightly modified to force weights to lie within certain bounds, with the aim of avoiding extreme weights. For details on the weights for 2023/24, see the 'New Zealand Health Survey 2023/24' section below.

The inverse selection probability is sometimes called the initial weight. The final, calibrated weights are sometimes expressed as: final weight = initial weight * g-weight. The 'g-weight' indicates the factor by which calibration has changed the initial weight.

Population benchmarks

The following population benchmarks are used in the NZHS weighting.

- Age group (0–4, 5–9, 10–14, 15–19, 20–24, 25–29, 30–34, 35–39, 40–44, 45–49, 50–54, 55–59, 60–64, 65–74, 75+ years) by sex (male, female) for all people in the target population
- Age group (0–4, 5–9, 10–14, 15–29, 30–34, 35–39, 40–44, 45–49, 50–54, 55–64, 65+ years) by sex (male, female) for all Māori
- Adult population by Pacific peoples and non-Pacific peoples
- Adult population by Asian and non-Asian
- Total population by NZDep2018 quintile.

Age, sex, ethnicity (Māori, Pacific peoples, Asian, using self-identified total ethnicity) and socioeconomic position (NZDep2018) are included because these variables are related to many health conditions and to non-response, and they are a key output classification for the survey.

Benchmarks for the total population

Quarterly benchmarks for the total population are Stats NZ's population estimates as at the end of each calendar quarter.

Benchmarks for the Māori population

Quarterly benchmarks for the Māori population are constructed for the NZHS by projecting forward the annual (mid-year) population estimates for Māori released by Stats NZ.

Using the Māori population estimates and total population estimates as at 30 June, the proportion of the total population who are Māori is calculated for each five-year age-by-sex group. Then these proportions are applied to quarterly total population estimates, by age and sex, for the subsequent four quarters. For example, the proportion of each age-by-sex group who are Māori as at 30 June 2023 is used to construct estimates of the Māori population by age and sex in each of the quarters ending 30 September 2023, 31 December 2023 and 31 March 2024.

Benchmarks for the Pacific and Asian populations

Annual population estimates are not available for the Pacific and Asian populations in New Zealand, and so quarterly benchmarks for the adult Pacific and Asian populations are derived from Stats NZ's Household Labour Force Survey. This large national survey of around 15,000 households per quarter achieves a high response rate, with a target of 90%.

The Household Labour Force Survey publishes quarterly estimates of the working-age (aged 15 years and over) Pacific and Asian populations. From these estimates, the proportions of the adult population who are Pacific peoples and Asian are obtained for each quarter. Some of the quarter-to-quarter variation in these proportions is smoothed out by applying a moving average over the quarterly figures. The final smoothed proportions are applied to the total adult benchmark for the corresponding quarter to give quarterly benchmarks for Pacific and Asian adults.

Benchmarks for the NZDep2018 quintiles

Benchmarks for the quintiles of NZDep2018 are derived by dividing the latest total population figures (of all age groups) into five groups of equal size.

The calibration for the 2011/12 and 2012/13 surveys used benchmarks from the New Zealand Index of Deprivation 2006 (NZDep2006) based on 2006 Census data. The surveys conducted between 2013/14 and 2018/19 used NZDep2013 based on 2013 Census data, while NZDep2018 was used for surveys from 2019/20 to 2023/24.

Calibration by sex

From 2022/23, the NZHS included three response options for sex and gender. The adult questionnaire asked about the respondent's sex at birth ('male', 'female', 'another term') and gender ('male', 'female', 'another gender'). The child questionnaire asked about the child's gender ('male', 'female', 'another gender').

However, the Stats NZ population statistics used in calibration are only available for the binary sex categories 'male' and 'female'.

Following advice from Stats NZ, calibration of the NZHS weights has been carried out using respondent data on sex at birth for adults and gender for children, where non-binary responses have been replaced with imputed binary values of 'male' or 'female'. This imputation was only done for the purposes of calibrating the survey weights. All outputs in the Annual Data Explorer are presented by gender as specified by the respondent or their parent/caregiver.

From 2023/24, nearest-neighbour donor imputation has been used to assign children with another gender, and adults with sex at birth specified as 'another term', to male or female, for weighting purposes only.

For each adult respondent with sex at birth specified as 'another term', a donor is randomly selected out of the set of respondents with sex at birth 'male' or 'female' who are closest to the respondent in terms of age group and gender. The sex at birth of the

donor replaces the sex at birth of the non-binary respondent, for weighting purposes only.

Similarly, for each child respondent with another gender, a donor is randomly selected out of the set of respondents with gender 'male' or 'female' who are in the same age group as the respondent. The gender of the donor replaces the gender of the non-binary respondent, for weighting purposes only.

Calibrating software and bounding of weights

Calibrated weights were calculated in R using the 'survey' package developed by Thomas Lumley.² The input weights are the selection weights, first rescaled to sum to the overall population benchmark. Final weights are constrained to be less than or equal to 2.5 times the input weight.

Jackknife replicate weights

The NZHS uses the delete-a-group jackknife method (Kott 2001) to calculate standard errors for survey estimates.

One hundred jackknife replicate weights are produced for every respondent in the survey, in addition to the final calibrated weight. Each replicate weight corresponds to removing a group of PSUs from the sample and reweighting the remaining sample. This is achieved using exactly the same approach that was used to construct the weights for the full sample, including calibration to the same population benchmarks.

For any weighted estimate calculated from the survey, 100 jackknife replicate estimates can also be calculated using the 100 jackknife weights. The standard error of the full sample estimate is based on the variation in the replicate estimates.

Prior to 2015/16, the assignment of meshblocks to jackknife replicate groups was done independently in separate survey years. With the introduction of PSUs in the 2015/16 sample design, PSUs in the area sample of one survey year are usually reused in the following survey year as well (see also 'Sample design' in the 'Survey population and sample design' section). Therefore, a given PSU is assigned to the same jackknife replicate group in each of the two consecutive years that it is used in. This ensures that the resulting jackknife weights appropriately take into account the clustering of the sample when calculating jackknife variances for:

- differences of estimates between consecutive years (with repeat PSUs)
- estimates from pooled data across years.

A number of statistical analysis packages, including SAS, Stata and R, can calculate standard errors using jackknife weights.

² Available from the webpage Survey: Analysis of Complex Survey Samples on The Comprehensive R Archive Network website at URL: <https://cran.r-project.org/web/packages/survey/index.html> (accessed 9 November 2023).

Weights for objective measurements

An additional set of estimation weights (and corresponding jackknife replicate weights) has been created specifically for analysing the measurements collected from respondents as part of the core NZHS interview. Height and weight measurements are obtained from around 87% of eligible adult and 80% of eligible child respondents. Because variables derived from height and weight are key outputs from the survey, it is useful to have this additional set of estimation weights to compensate for the non-response to these items.

The extra set of weights is calculated for the subset of respondents who have their height and weight measured. Creating these estimation weights follows the same process as for the full sample. This consistent approach ensures that any bias due to lower participation in the measurement phase of the survey for particular demographic subgroups (such as age groups or ethnic groups) is accounted for in the final estimates for the survey.

These measurement weights are also used for analysis of waist measurements and blood pressure. Waist measurements are obtained from nearly all respondents who have had their height and weight measured.

Analysis methods

Estimating proportions, totals and means

Most statistics published in NZHS reports are proportions, totals or means; that is, survey estimates of:

- the proportion (or percentage) of people with a particular characteristic, such as a specific health condition, behaviour or outcome
- the total number of people with a particular characteristic
- the mean per person of some numeric quantity.

A description of the calculation method for each of these types of statistics follows. References to weights mean the final calibrated weights discussed in the 'Weighting' section.

Adjusting for item non-response

Before calculating proportions, totals or means for a particular variable, an adjustment is made to the final weights to account for respondents who answered with 'don't know' or 'refused' to the relevant question or questions.

The adjustment increases the final weights of the respondents who answered the question, to represent the final weights of the respondents who answered 'don't know' or 'refused'. This is carried out within cells defined by gender and age group (10-year age groups for adults and five-year age groups for children), therefore making use of some information on what type of respondents are more likely to be item non-respondents to the variable. Then the item non-respondents can be safely left out of the calculation of proportions, totals or means for the variable.

The adjustment is most important for totals to ensure that item non-response does not lead to underestimating the number of people who have a particular condition or behaviour. The effect will usually be very small for proportions and means; that is, proportions and means using the adjusted weights will be very similar to those using the final calibrated weights.

The adjustment is done 'on the fly' in the sense that the item-specific weights are created and used for estimating but are not kept on the survey data set.

Calculating proportions

The proportion of the population who belong to a particular group (such as the proportion of the population who have diabetes) is estimated by calculating the sum of the weights of the respondents in the group divided by the sum of the weights of all respondents.

The proportion of people in a population group who belong to a subgroup (such as the proportion of Māori who have diabetes) is estimated by calculating the sum of the weights of the respondents in the subgroup (Māori who have diabetes) divided by the sum of the weights of the respondents in the population group (Māori).

Calculating totals

Estimates of totals are given by calculating the sum, over all the respondents, of the weight multiplied by the variable of interest. For example, the estimate of the total number of people with diabetes in the whole population would be given by the sum, over all respondents, of the weight multiplied by a binary variable indicating which respondents have diabetes. This is equivalent to the sum of the weights of the respondents who have diabetes in the population.

Calculating means

Estimates of population averages are determined by calculating the sum, over all respondents, of the weight multiplied by the variable of interest divided by the sum of the weights. For example, the average number of males visiting a GP. The estimate is given by calculating the sum, over respondents in the group, of the weight multiplied by the variable of interest, divided by the sum of the weights of the respondents in the group.

Suppression of small sample sizes

Small samples can affect both the reliability and the confidentiality of results. Problems with reliability arise when the sample becomes too small to adequately represent the population from which it has been drawn. Problems with confidentiality can arise when it becomes possible to identify an individual; usually someone in a subgroup of the population within a small geographical area.

To ensure the survey data presented is reliable and the respondents' confidentiality is protected, proportions have only been estimated when there are at least 30 people in the denominator (the population group being analysed).

The relative standard error (the standard error expressed as a proportion of the estimate, or RSE) is another indicator of data quality. Data was suppressed when the RSE was over 100%, which indicates very poor-quality data. Estimates with an RSE of over 30% are moderate quality and have been flagged to indicate that they should be interpreted with caution.

Comparing population groups

Age standardisation

NZHS reports mainly focus on presenting crude (unadjusted) estimates of the proportion or mean in the total population by age group (age-specific rates or means). However, age is an important determinant of health, so population groups with different age structures (such as men and women, whose age structures differ due to women's longer life expectancy) may have different rates or means due to these age differences. This means that comparisons of crude rates or means over time and between groups may be misleading if the age structure differs between the groups being compared.

One approach to making more meaningful comparisons between groups is to compare age-specific rates or means. Alternatively, it can be useful to summarise a set of age-specific rates or means for a group into a single age-independent measure. This is achieved by a process called **age standardisation**.

Age standardisation in NZHS reports is performed by **direct standardisation** using the World Health Organization (WHO) world population age distribution:

Age-standardization of Rates: A new WHO standard (Ahmad et al 2000). The direct method calculates an age-standardised rate (ASR), which is a weighted average of the age-specific rates, for each of the population groups to be compared. The weights applied represent the relative age distribution of the WHO population. This provides a single summary rate for each of the population groups being compared that reflects the rate that would have been expected if the group had had an age distribution identical to the WHO population.

The ASR is given by:

$$ASR = \sum r_i (n_i / \sum n_i),$$

where n_i is the population in the i^{th} age group of the standard population and r_i is the rate in the i^{th} age group from the survey.

Age-standardised rates are provided in some tables to help make comparisons by gender, ethnic group and neighbourhood deprivation and between survey years.

Results for children are age-standardised to the population younger than 15 years, and results for adults are age-standardised to the population aged 15 years and over.

The same approach is used to age-standardised estimates of means.

Adjusted rate ratios

NZHS reports also present comparisons between population groups as **rate ratios**; that is, as the ratio of the estimated proportions having the characteristic of interest in the two groups.

Rate ratios are used for comparing:

- men and women
- Māori and non-Māori (for the total population, men and women)
- Pacific peoples and non-Pacific peoples (for the total population, men and women)
- Asian and non-Asian (for the total population, men and women)
- people living in the most and least socioeconomically deprived areas
- disabled and non-disabled (for the total population).

In keeping with the use of total response ethnicity to present statistics by ethnic group, ethnic comparisons are presented such that Māori are compared with non-Māori, Pacific peoples with non-Pacific peoples and Asian with non-Asian. For this purpose, all respondents who identified as Māori are included in the Māori group; all other respondents are included in the non-Māori group. Similar groups are formed for Pacific peoples and Asian ethnic groups.

Rate ratios can be interpreted in the following ways.

- A value of 1 shows that there is no difference between the group of interest (for example, women) and the reference group (for example, men).
- A value higher than 1 shows that the proportion is higher for the group of interest than for the reference group.
- A value lower than 1 shows that the proportion is lower for the group of interest than for the reference group.

The rate ratios presented in NZHS reports are adjusted for differences in demographic factors between the groups being compared that may be influencing (confounding) the comparison. The adjustments are as follows.

- The gender comparison is adjusted for age.
- The ethnic comparisons are adjusted for age and gender.
- The deprivation comparison is adjusted for age, gender and ethnic group.

Adjusting for potential confounding factors makes comparisons more accurate and meaningful because the adjustment removes the effect of these confounding factors.

In the above comparisons, the comparison across neighbourhood deprivation is adjusted for ethnicity as well as age and gender. However, ethnicity comparisons are adjusted for age and gender but not for neighbourhood deprivation. This approach is used because ethnicity confounds the association between deprivation and health outcomes. By contrast, deprivation is only a mediator, not a confounder, of the association between ethnicity and health outcomes; that is, deprivation is on the path that links ethnicity to health outcomes. So, if ethnic comparisons were adjusted for deprivation, the analyses would not reflect the full independent effect of ethnicity but only that portion of the ethnicity effect that is not mediated by the socioeconomic position of deprivation.

Adjusted rate ratios are calculated using the **predictive margins** approach of Korn and Graubard (1999), which Bieler et al (2010) call **model-adjusted risk ratios**. In this method:

- a logistic regression model is fitted to the data. The variable defining the groups to be compared, and the adjustment variables, are explanatory variables in the model
- the parameters of the fitted model are used to estimate the proportion with the characteristic of interest as if all the respondents belong to the group of interest (such as all male), but otherwise each respondent keeps their own values for the adjustment variables in the model (such as age). That is, the proportion being estimated is for a hypothetical population of men who have the same age distribution as the full sample
- in the same way, the parameters of the fitted model are used to estimate the proportion with the characteristic of interest as if all the respondents belong to the comparison group of interest (such as total females), but otherwise each respondent keeps their own values for the adjustment variables in the model (such as age). That is, the proportion being estimated is for a hypothetical population of women who have the same age distribution as the full sample
- once the model-adjusted proportions for the group of interest (men) and the comparison group (women) have been estimated in this way, their ratio can be calculated.

In the neighbourhood deprivation comparisons, the rate ratio refers to the **relative index of inequality** (Hayes and Barry 2002). This measure is used instead of simply comparing the most deprived quintile with the least deprived quintile. It is calculated by first using data from all quintiles to calculate a line of best fit (linear regression line), adjusted for age group, gender and ethnic group. The points on the regression line corresponding to the most and least deprived areas are used to calculate the rate ratio that is presented in the reports. This method has the advantage of using data from all the NZDep2018 quintiles to give an overall test for trend (gradient) by neighbourhood deprivation rather than only using the data from quintiles 1 and 5.

While total response ethnicity is used to report ethnic group statistics in the NZHS reports, a prioritised ethnicity variable is used when adjusting for ethnicity in the regression model underlying the relative index of inequality. Using prioritised ethnicity in the model simplifies the modelling process and gives results similar to including total response ethnicity variables in the model. The priority ordering of ethnic groups used is as follows: Māori, Pacific peoples, Asian, European/Other.

Confidence intervals and statistical tests

Ninety-five percent confidence intervals are used in NZHS reports to represent the sampling error associated with the statistics; that is, the uncertainty due to selecting a sample to estimate values for the entire population. A 95% confidence interval for a statistic is constructed in such a way that, under a hypothetical scenario where selecting the sample could be repeated many times, 95% of the confidence intervals constructed in this way would contain the true population value.

Calculating confidence intervals

NZHS statistics that are estimates of means or totals (population counts) are calculated using the usual normal approximation. The upper and lower limits of the 95% confidence interval are found by:

$$\text{estimate} \pm 1.96 \times \text{standard error of the estimate}$$

However, most NZHS statistics are estimates of proportions. Confidence intervals based on the normal approximation sometimes do not work well for these statistics. For example, when estimating very small (close to 0%) or very large (close to 100%) proportions, the symmetric behaviour of normal confidence intervals can be unrealistic and can even lead to confidence intervals containing negative values or values greater than 100%.

Instead, the Korn and Graubard (1998) method is used to calculate better confidence intervals for proportions. For very small or very large proportions, this method produces asymmetric confidence intervals which still have appropriate statistical properties but stay within the limits of 0% and 100%. For proportions further away from 0% or 100%, the method will produce confidence intervals almost identical to the normal approximation method.

Confidence intervals for percentiles such as medians are calculated using the Woodruff (1952) method.

Tests for statistically significant differences

Some analysts assess whether two estimates differ significantly by seeing whether their confidence intervals overlap or not. This procedure is known to be overly conservative, resulting in a substantial degrading of statistical power, with some significant differences incorrectly assessed as insignificant.

When confidence intervals do not overlap, it can be concluded that the estimates differ significantly. However, when they do overlap, it is still possible that there is a significant difference. In this case, a *t*-test is used to correctly test the statistical significance of differences between NZHS estimates.

Time trends

Where possible, the results of indicators presented in the Annual Data Explorer are compared with the corresponding results from the previous years of the continuous NZHS (from 2011/12 onwards). This is referred to as 'time trends'.

Testing the statistical significance of changes over time is based on age-standardised statistics to adjust for changes in the age structure of the population over time.

New Zealand Health Survey 2023/24

This section provides some field-related information specific to the data collection and analysis of the 2023/24 NZHS.

2023/24 module topics

Table 4 outlines the NZHS 2023/24 module topics.

Table 4: New Zealand Health Survey 2023/24 module topics

Child module topics	Adult module topics
Exposure to second-hand smoke	Self-perceived height and weight
Child development	Migraine
Functional difficulties (CFM) ³	Tobacco, vaping and exposure to second-hand smoke
	Extra questions on functional difficulties (WG-SS Enhanced)
	Racial discrimination

For details about the questionnaires used in the 2023/24 NZHS, see *Content Guide 2023/24: New Zealand Health Survey* (Ministry of Health 2024b).

Data collection

A NZHS 'survey year' usually refers to the sample drawn from July to June, in four calendar quarters (that is, July to September, October to December, January to March and April to June). Data collection for each quarter usually occurs during the calendar quarter, with some 'mop-up' at the end of the quarter. However, this approach has been disrupted since the first COVID-19 lockdown in March 2020.

Data for the 2023/24 NZHS was collected over 12 months from 13 July 2023 to 24 July 2024. Data collection was slower than it was in pre-COVID years, due to ongoing operational challenges and weather events. As a result, quarter 4 was only partially opened, and the sample size for 2023/24 is smaller than surveys before COVID-19.

³ The functional difficulties module questions used for children in the 2018/19, 2019/20 and 2020/21 surveys (WG-SS) did not work well to identify disabled children. In 2022/23 and 2023/24, a different set of module questions (CFM) was used. This set of questions is better at identifying disabled children, and these questions are likely to become core questions.

Table 5 shows the number of respondents in each survey quarter, as well as the data collection dates.

Table 5: Number of survey respondents by quarter, 2023/24

	Adults		Children	
	Number	Percentage of total respondents	Number	Percentage of total respondents
Quarter 1 (13 July 2023–23 July 2024)	2,983	31	943	31
Quarter 2 (2 October 2023–13 July 2024)	3,088	32	985	32
Quarter 3 (28 February 2024–24 July 2024)	2,993	31	923	30
Quarter 4 (1 May 2024–21 July 2024)	655	7	211	7
Total (July 2023–July 2024)	9,719	100	3,062	100

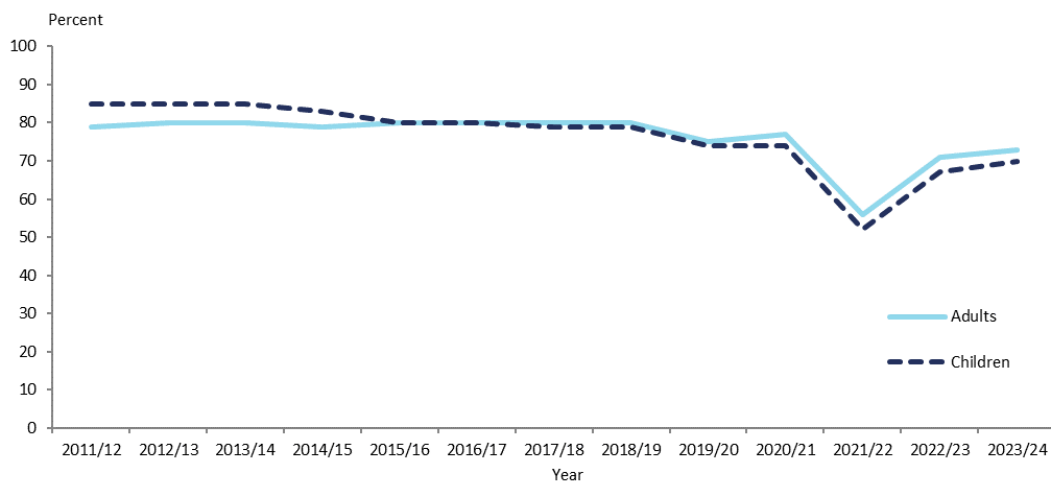
The final achieved sample size for the 2023/24 NZHS was 9,719 adults and 3,062 children. These sample sizes are higher than they were in the previous 2 years, but lower than surveys pre-COVID-19.

Response rates

The 2023/24 weighted response rate was 73% for adults and 70% for children.

Figure 2 shows the time trend of response rates for adults and children from 2011/12 to the current survey year, 2023/24.

Figure 2: Response rates for adults and children, 2011/12–2023/24



Coverage rates

A coverage rate records the extent to which a population has been involved in a survey. It provides information on the discrepancy between the responding sample (weighted by selection weight) and the population. The coverage rate is defined as the ratio of the sum of the selection weights for the survey respondents to the known external population size.

In 2023/24, the coverage rates were 54% for adults and 61% for children. Figure 3 shows the time trend of coverage rates for adults and children from 2011/12 to the current survey year, 2023/24.

Figure 3: Coverage rates for adults and children, 2011/12–2023/24

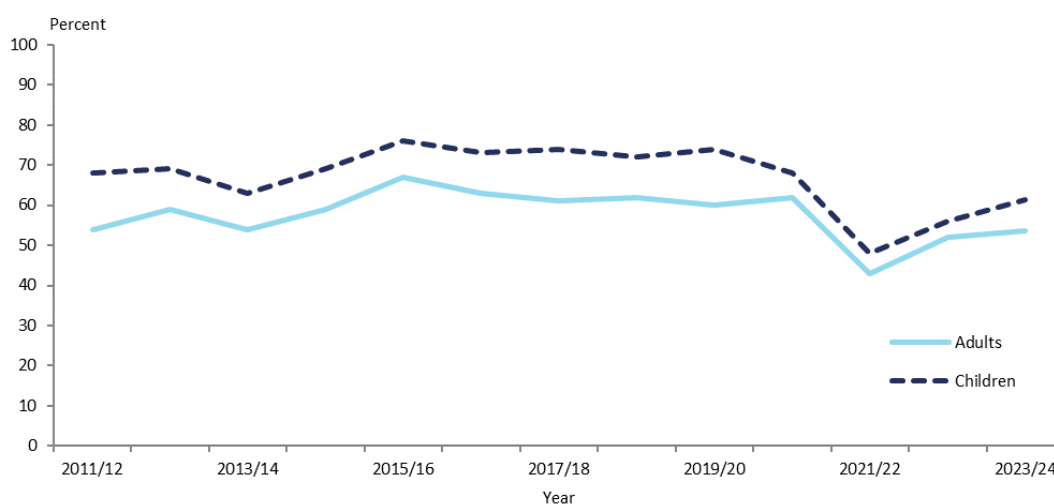
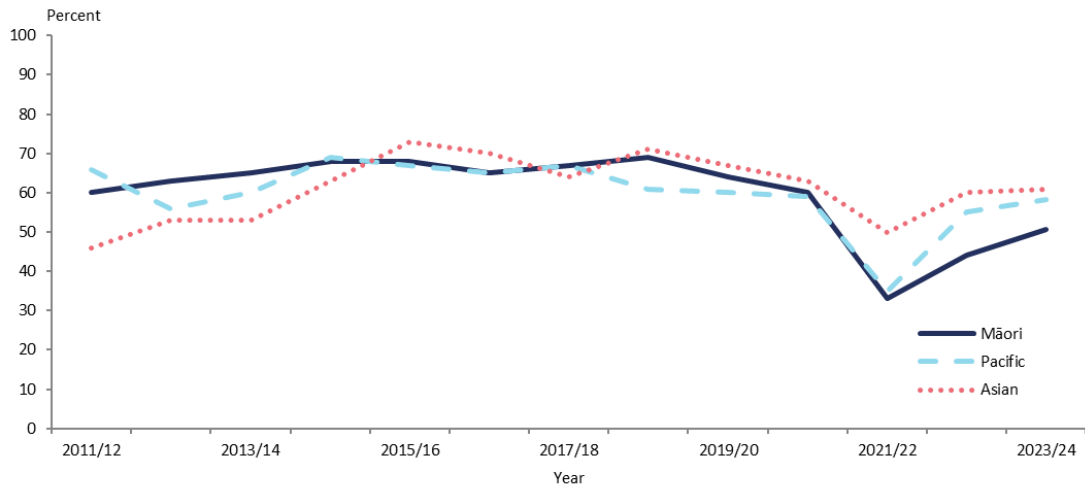


Figure 3 shows that coverage rates for children have been higher compared to adults across all years since 2011/12.

In 2023/24, the coverage rates were 51% for Māori, 58% for Pacific peoples and 61% for Asian people.

Figure 4 shows the time trend of coverage rates for the Māori, Pacific peoples and Asian ethnic groups from 2011/12 to the current survey year, 2023/24.

Figure 4: Coverage rates for Māori, Pacific peoples and Asian ethnic groups, 2011/12–2023/24



In 2023/24, the coverage rates for quintiles of neighbourhood deprivation were: 49% (NZDep quintile 1), 54% (NZDep quintile 2), 58% (NZDep quintile 3), 57% (NZDep quintile 4) and 56% (NZDep quintile 5). Figure 5 shows the time trend figures for NZDep quintile 1 to NZDep quintile 5 from 2011/12 to the current survey year, 2023/24.

Figure 5: Coverage rates by New Zealand Index of Deprivation quintiles, 2011/12–2023/24

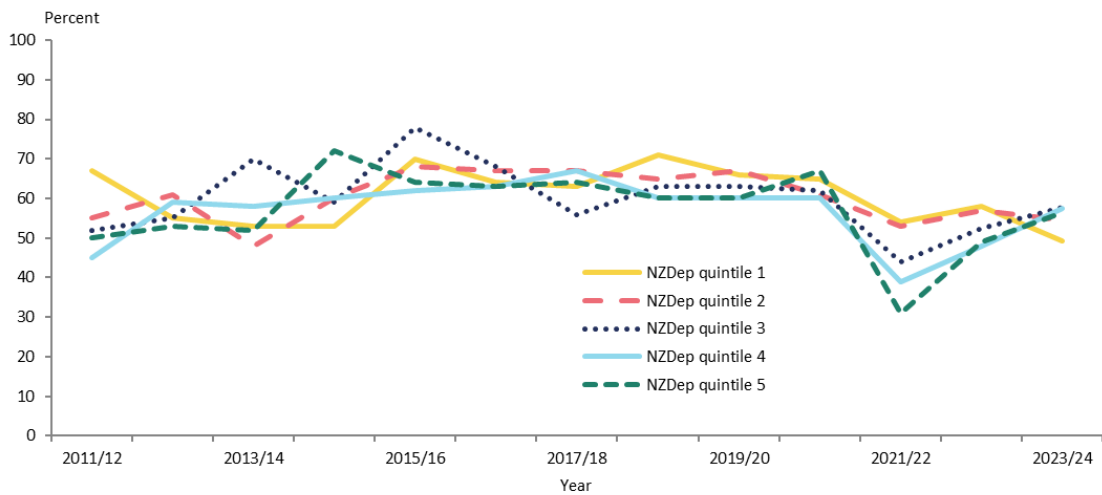


Figure 6 and Figure 7 show the coverage rates by age group and gender for 2023/24 for the total population and Māori respectively.

Figure 6: Coverage rates for total population, by age group and gender, 2023/24

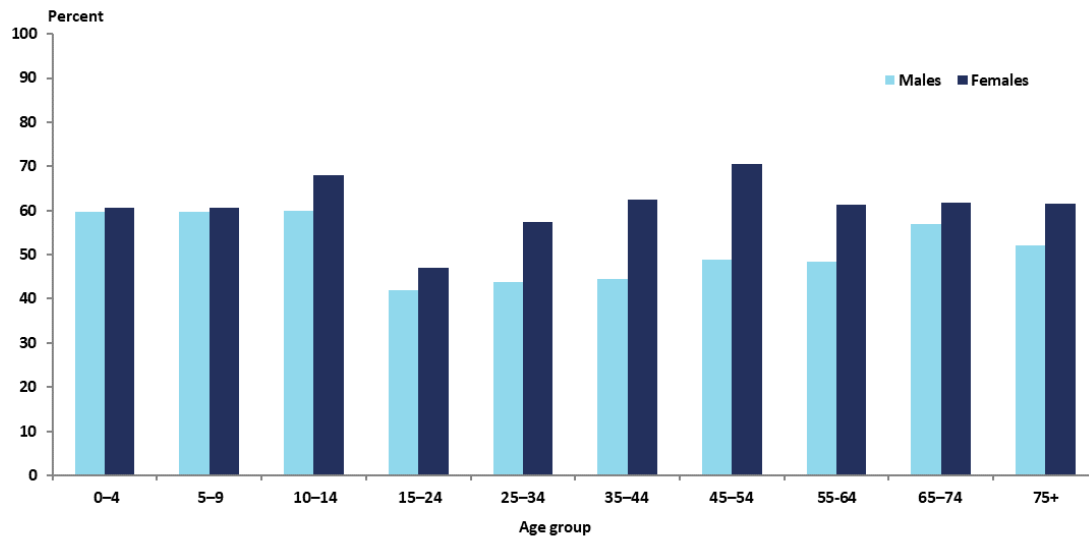
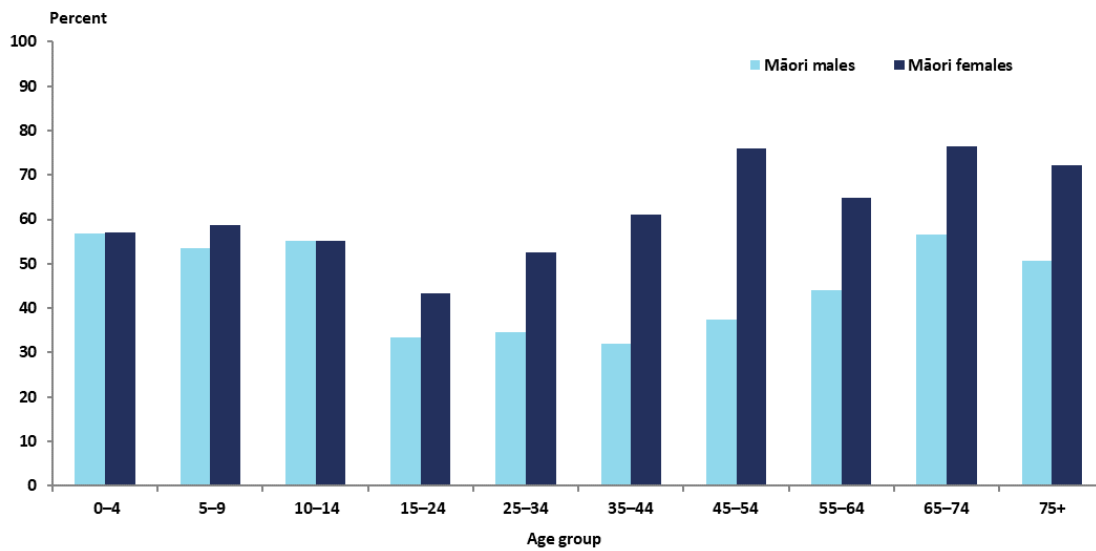


Figure 7: Coverage rates for Māori, by age group and gender, 2023/24



Final weights

The section on weighting has explained how the calibrated weights were calculated.

Table 6 gives basic descriptive information on the final weights calculated for the 2023/24 survey.

The g-weights are the ratios of the final weights to the initial selection weights. The mean g-weight is 1.9, which we consider reasonable. This means the calibrated weights, which we calculated using population benchmark information, have changed the initial selection weight by an average factor of 1.9.

Table 6: Final weights, 2023/24

	Final weight
Minimum	28
Median	308
90th percentile	843
95th percentile	1116
99th percentile	1798
Maximum	4941
Coefficient of variation (CV%)	86
Approximate design effect due to weighting (1 + CV ²)	1.7

Sample sizes

Table 7–12 show the 2023/24 NZHS sample sizes and the total ‘usually resident’ population counts, by gender, ethnicity, age, NZDep2018 quintile, disability status and health region.

Table 7: Sample sizes and population counts for children and adults, by gender, 2023/24

Population group	Gender	Interviews	Population count
Children (0–14 years)	Boys	1,558	500,925
	Girls	1,502	475,704
	Another gender	2	216
	Total	3,062	976,845
Adults (15 years and over)	Men	3,996	2,135,645
	Women	5,694	2,177,144
	Another gender	29	19,580
	Total	9,719	4,332,368

Table 8: Sample sizes and population counts for children and adults, by total response ethnicity, 2023/24

Ethnic group	Population group	Interviews	Population count
European/Other	Children	1,925	653,498
	Adults	6,999	3,157,112
Māori	Children	1,015	268,995
	Adults	1,978	645,203
Pacific	Children	457	129,911
	Adults	713	290,333
Asian	Children	608	190,472
	Adults	1,300	702,667

Table 9: Sample sizes and population counts, by age, 2023/24

Age group (years)	Interviews	Population count
0–4	1,024	302,583
5–9	899	327,090
10–14	1,139	347,172
15–24	868	666,860
25–34	1,595	774,438
35–44	1,634	728,768
45–54	1,507	652,048
55–64	1,516	630,777
65–74	1,412	491,835
75 and over	1,187	387,642

Table 10: Sample sizes and population counts, by NZDep2018 quintile, 2023/24

NZDep2018 quintile	Population group	Interviews	Population count
Quintile 1 (least deprived neighbourhoods)	Children	369	200,494
	Adults	1,231	861,349
Quintile 2	Children	473	183,115
	Adults	1,638	878,728
Quintile 3	Children	559	167,972
	Adults	1,997	893,871
Quintile 4	Children	709	182,335
	Adults	2,324	879,508
Quintile 5 (most deprived neighbourhoods)	Children	952	242,930
	Adults	2,529	818,913

Table 11: Sample sizes and population counts, by disability status, 2023/24

Disability status	Population group	Interviews	Population count
Disabled	Children	283	90,372
	Adults	1,039	368,796
Non-disabled	Children	1,713	571,779
	Adults	8,656	3,950,865

Table 12: Sample sizes and population counts, by health region, 2023/24

Health region	Population group	Interviews	Population count
Northern	Children	1,037	364,903
	Adults	2,838	1,534,569
Te Manawa Taki	Children	751	214,268
	Adults	2,297	903,601
Central	Children	717	197,851
	Adults	2,377	851,612
Te Waipounamu	Children	557	199,823
	Adults	2,207	1,042,586

Changes in previously published statistics

This section notifies NZHS users about changes or corrections to statistics published in previous annual reports or *Annual Data Explorers*. The focus of this section is on changes or errors that could alter the meaning of previously published statistics. The revised data for previous years is available in the current Annual Data Explorer.

Child nutrition indicators

An error was found in the derivation of the child indicator 'Meets vegetable intake recommendation', which consequently affected the indicator 'Meets both vegetable and fruit intake recommendation'. The error was due to a misapplication of age and gender recommendations for some groups. As a result, the percentage of children who met the vegetable intake recommendation was slightly underestimated in 2021/22 and 2022/23, especially for those aged 2–4 years.

Raised blood pressure indicator

An error was found in the application of estimation weights for the adult indicator 'Raised blood pressure (measured)'. This indicator had previously been calculated using the estimation weights for the entire population, rather than the estimation weights calculated for respondents who had their measurements taken (see the section 'Weighting' above for more details on the different estimation weights used). In 2023/24, the measurement estimation weights have been correctly applied to all years of data for the raised blood pressure indicator, resulting in small revisions for all years. In a small number of cases, the change had a larger impact, but the revised statistics were within the 95% confidence interval of the previously published statistics.

Child disability

A change was made to the treatment of partial non-response to the CFM. In 2022/23, if a child had a response of 'don't know' or 'refused' to any CFM questions, this was categorised as a residual response to the child disability indicator (see the section 'Disability status' above for more information). From 2023/24, children are classified as disabled if they meet the criteria, even if some of their responses are residual. This change has been made to improve the consistency of the child and adult disability indicators.

Treatment of residual values

We have improved the consistency of the way we derive indicators where some of the input questions have residual values (eg, 'don't know', 'refused' or no response). For most indicators, respondents are classified as having a residual response to an

indicator if they have a residual response to any of the input questions. We make adjustments to the outputs to account for these residual values.

Changes to the treatment of residual values had little to no impact on the NZHS results; most revised statistics were within 0.1–0.2 percentage points of the previously published statistics. In a small number of cases, the change had a larger impact, but the revised statistics were within the 95% confidence interval of the previously published statistics.

Adjustment for non-response

We previously adjusted item non-response by sex and age-group. We now adjust it by gender and age-group. This change had a very small impact on data for 2022/23 only.

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