Supplementary Material

How is enrolment with a general practice associated with subsequent use of the emergency department in Aotearoa New Zealand? A cohort study

Megan Pledger[A,*], *Maite Irurzun-Lopez*[A], *Nisa Mohan*[A] and *Jacqueline Cumming*[A]

[A]Te Hikuwai Rangahau Hauora - Health Services Research Centre, Te Wāhanga Tātai Hauora – Wellington Faculty of Health, Te Herenga Waka - Victoria University of Wellington, PO Box 600, Wellington 6140, New Zealand

*Correspondence to: Email: megan.pledger@vuw.ac.nz

Supplementary Material

Study Period and Follow-Up

The study period for the collection of ED events started for each respondent at the end date of the survey they were in and finished on 30 June 2020 which meant the study period was between 1 and 6 years.

The statistical modelling looked at the time until an ED presentation. Follow-up started at the same point as the study period and lasted until either the respondent had an ED presentation, the respondent died, or 30 June 2020; the last two events being censoring events.

Data for deaths were not available from January 2019 to June 2020. From the start of follow-up to December 2018, 220 respondents died without having an ED presentation. We estimate that there were 120 equivalent deaths (0.2% of respondents) in the unobserved period. These deaths were unknowingly treated as being censored at the end of the study period when they should have been censored at an earlier point by death, had the death been known, giving, on average, an extra 8.5 months of follow-up per missed death. See Figure S1 for a figurative description of the timeline.

Figure S1. Timeline of study data coverage from each dataset.
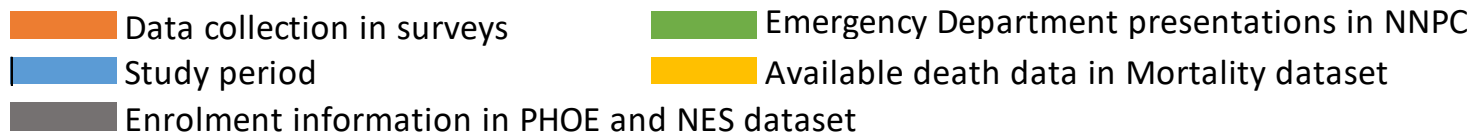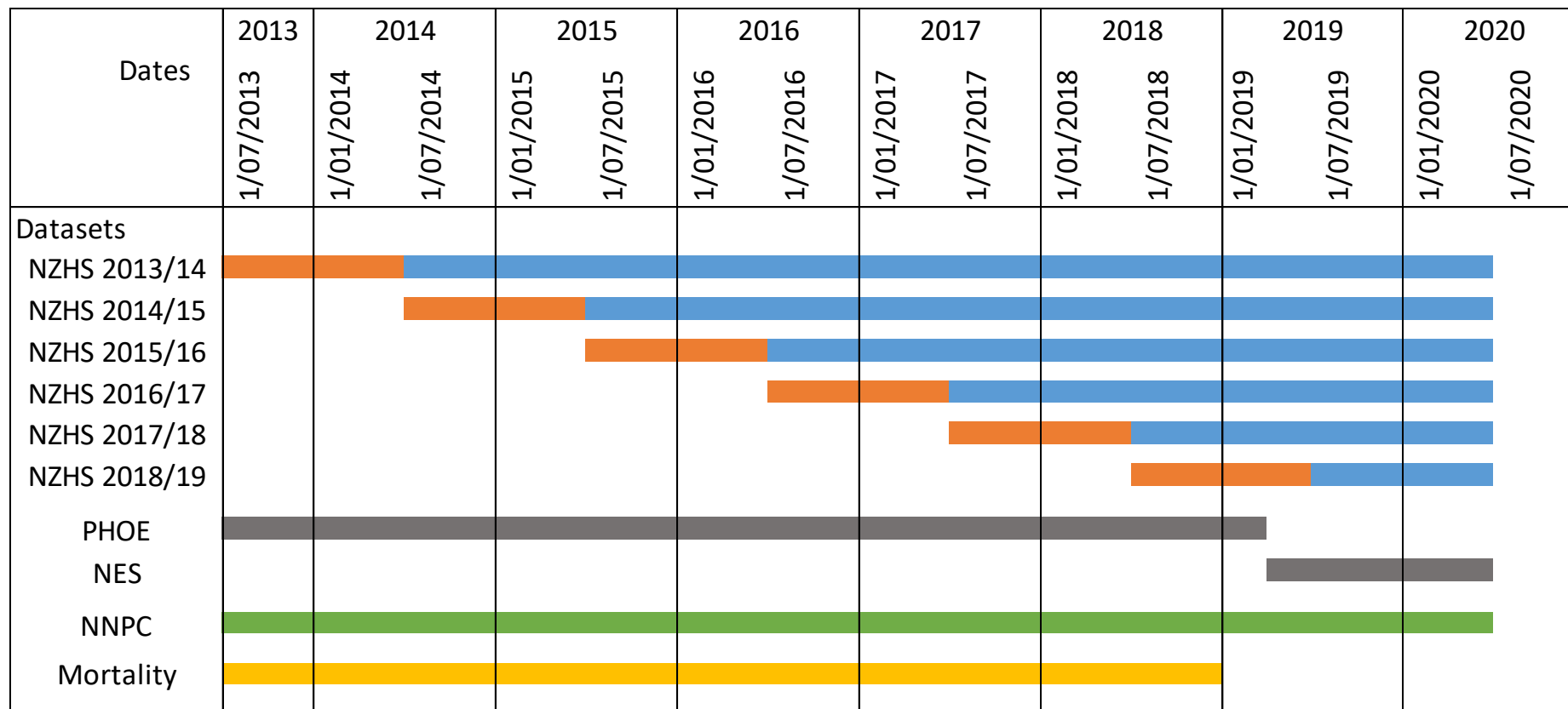
The supplementary material contains fuller information about the methods for the analysis presented in the article "How is enrolment with a General Practice associated with subsequent use of the Emergency Department in Aotearoa New Zealand? A cohort study."

Methods

A range of governmental data sets are available at Statistics New Zealand through the Integrated Data Infrastructure (IDI).[1] Vetted individuals are allowed access to link, process and analyse selected data sets. All output must be reviewed by a staff member of Statistics New Zealand to ensure confidentiality.

Datasets
For the analysis, five datasets were accessed.

A subset of respondents from the **NZHS.** The NZHS is a national, cross-sectional survey that runs from 1st July in one year through to 31st June in the next year and interviews respondents in their homes. It asks respondents about their health risks, health conditions and the health services they have received. The sample frame is composed of NZ citizens, NZ residents and visitors who have stayed or intend to stay for a year or more (personal communication, MoH). However, people are excluded if they are receiving hospital level care, are in meshblocks with fewer than nine people or live on off-shore islands.[1]

The surveys this dataset covers are contiguous from 2011/12 to 2018/19; however, the surveys used in these analyses are from 2013/14 onwards, a cohort we have studied previously. Respondents were included in the IDI dataset if they agreed that their data could be used for further research and they could be matched to a National Health Index (NHI) based on their name, date of birth and address. On average, 400 respondents per survey requested that their responses not be linked and 1,105 respondents per survey could not be matched out of an average of 13,600 per survey (personal communication, Ministry of Health, MoH). See Supplementary Figure S2 for a visual description.

The surveys oversampled Māori, Pacific and Asian peoples and are weighted to provide a nationally representative sample, but in this analysis these respondents were treated as a cohort. Each survey had a response rate of between 79% and 80%.[1]

The **Primary Health Organisation Enrolment** (PHOE) dataset is an administrative data set that recorded enrolment information for people in NZ accessing general practice in each quarter. Data stopped being recorded in this dataset after the first quarter of 2019.
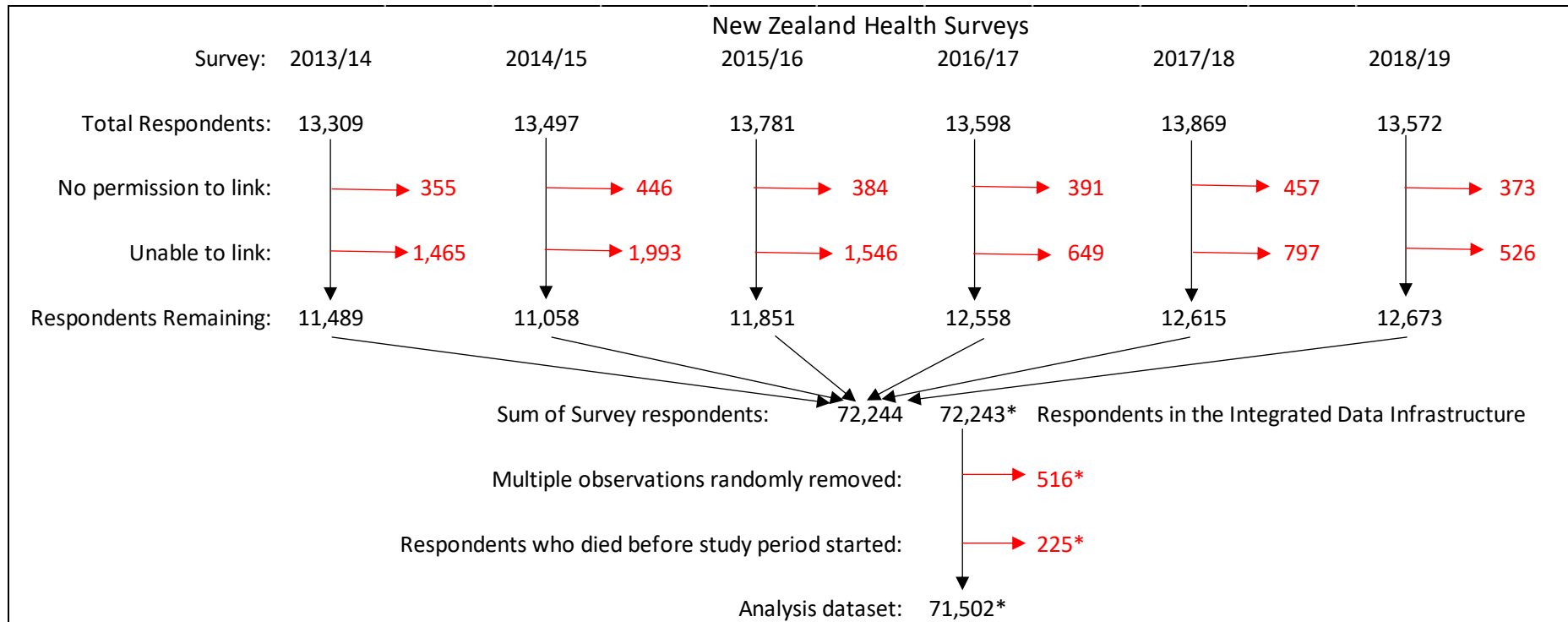
The **National Enrolment Service** (NES) dataset is an administrative data set that records enrolment information for people in NZ accessing primary health care every month. This dataset supersedes the PHOE data set and first appears in the IDI from April 2019**.**

The **National Non-Admitted Patient Collection** (NNPC) is an administrative dataset that records outpatient appointments (non-admitted medical and surgical events), community referred diagnostic appointments, and ED presentations. The dataset at the time of analysis contained events up until 30 June 2020.

The **Mortality Dataset** is an administrative dataset that records all deaths and the reasons for death. The dataset at the time of analysis contained mortality events up till the end of December 2018.

Statistics New Zealand sourced all datasets from the MoH and each contain an identifier that allows linkage between MoH datasets.

Figure S2. Flow diagram of the numbers of respondents from the NZHS 20213/14-2018/19 used in the analysis dataset.

New Zealand Health Surveys

Survey:	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
Total Respondents:	13,309	13,497	13,781	13,598	13,869	13,572
No permission to link:	355	446	384	391	457	373
Unable to link:	1,465	1,993	1,546	649	797	526
Respondents Remaining:	11,489	11,058	11,851	12,558	12,615	12,673

Sum of Survey respondents: 72,244   72,243*   Respondents in the Integrated Data Infrastructure

Multiple observations randomly removed: → 516*

Respondents who died before study period started: → 225*

Analysis dataset: 71,502*

Note: * randomly rounded base 3 counts

Variables

Enrolment Variable

The primary variable of interest is whether a respondent was enrolled in a general practice. If a respondent was in a NZHS between 2013/14 and 2017/18 and had a record in the PHOE database for the quarter corresponding to the last day of the survey period for the survey they were in, then they were placed in the enrolled group. Similarly, if a respondent in the NZHS 2018/19 was recorded in the NES dataset as being enrolled in June 2019, then they were placed in the enrolled group. Otherwise, they were placed in the not-enrolled group.

New Zealand Health Survey Variables

The variables chosen from the NZHS were about general practice health services, chronic conditions, self-rated health, and socio-demographic variables. Two extra variables were chosen that can be considered substitutes for health care in general practice: care at an after-hours medical centre or at an ED at a Public Hospital. Amongst the socio-economic variables, prioritised ethnicity, and the New Zealand Deprivation Index (NZDep) were used. Prioritised ethnicity is a unique ethnicity assigned to a respondent based on their reported ethnicities in the priority order Māori, Pacific people, Asian and European New Zealander/Other. NZDep is an area-based measure of deprivation based on answers people give to census questions and is assigned to each respondent according to their address.[2] For the NZHS 2013/14 and 2014/15, NZDep was based on data from the 2006 census. For the remaining surveys, NZDep was based on data from the 2013 census. It was analysed here in quintiles. Most of the values in the NZHS survey were self-reported by the respondent.

Hospitalisation Variables

Variables created from the NNPC were about the characteristics of ED presentations that were attended during the study period i.e. the likelihood of a presentation, the number of presentations in the study period and time until first presentation in the study period.

Statistical Analysis

Statistics New Zealand require that the data output is confidentialised. For the statistics presented here this means that: 1) Values are suppressed for counts if the underlying count is <6. Values are suppressed for means and standard deviations if the underlying count is <20; 2). Counts are rounded to the nearest multiple of 3 with probability 2/3 or the second

closest multiple of 3 with probability 1/3. Counts are checked so the rounding is consistent across outputs; 3) Percentages, means, standard deviations and t-tests are produced using the randomly rounded base 3 counts. These methods were used to produce statistics on the demographic and health profile of the respondents, their general practice utilisation and the characteristics of their ED presentations and hypotheses tests on differences between enrolment groups.

The length of time to the first ED presentation was modelled using survival analysis, specifically proportional hazards regression with enrolment status being the primary variable of interest (Model 1). The coefficients of this model are given in terms of hazard ratios which are a comparison of hazard rates between two groups. The higher the hazard rate for a group, the sooner a random respondent from that group will have an ED presentation.

The model was expanded twice: Model 2) with demographic variables – sex, age group, prioritised ethnicity and NZDep and Model 3) a health variable – self-reported health.

The size of the dataset means that comparisons may be statistically significant when they are not practically significant. For example, the percentage of people going to a general practice in the last year for the two groups may be 76% and 78% which may be statistically significant at the 5% level; however, a difference between the two groups of 2% is not practically significant. When comparing two figures we will comment when the difference is considered practically significant and statistically significant at the 5% level; otherwise, we will refer to the figures as being similar. For percentages, this will be an absolute difference of 5%. For the differences in the average 1) number of visits or stays: 0.5 consults/visits, 2) consultation cost: $5 and 3) difference in time to first presentation: 30 days.

No ethics approval was sought for this project as this was secondary analysis of administrative and survey data. Ethics approval had been sought previously by the MoH from the New Zealand Health and Disability Multi-Region Ethics Committee for each survey.[1]

In the writing of this article, ChatGPT was occasionally used to suggest different ways to express ideas and explore word choices. This text was then further refined by the authors.[3]

References

1. Manatū Hauora Minister of Health. Methodology Report: New Zealand Health Survey (2008-) [Internet]. 2024 [cited 2024 January 29]. Available from: https://mohlibrary.softlinkhosting.co.nz/liberty/opac/search.do?mode=BASIC&openDetail=true&action=search&queryTerm=uuid%3D%225e0534400a5a01e25cbac58f0002db59%22&operator=OR&_open=1.

2. University of Otago Wellington, Te Whare Whānanga o Otāgo ki Pōneke, Department of Public Health. Socioeconomic Deprivation Indexes: NZDep and NZiDep | Department of Public Health [Internet]. 2023 [cited 2023 June 20]. Available from: https://www.otago.ac.nz/wellington/departments/publichealth/research/hirp/otago020194.html#2018.

3. OpenAI. ChatGPT 3.5 [Large language model] 2024 [cited 2024 February 19]. Available from: https://chat.openai.com/.