Frailty of Māori, Pasifika, and non-Māori/non-Pasifika older people in New Zealand: a national population study of older people referred for home care services

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Abstract

Background: Little is known about the prevalence of frailty in indigenous populations. We developed a frailty index for older New Zealand Māori and Pasifika who require publicly funded support services.

Methods: A frailty index (FI) was developed for New Zealand adults aged ≥65 years who had an interRAI-Home Care assessment between 1 June 2012 and 30 October 2015. A frailty score for each participant was calculated by summing the number of deficits recorded and dividing by the total number of possible deficits. This created a FI with a potential range from 0 to 1. Linear regression models for FIs with ethnicity were adjusted for age and sex. Cox proportional hazards models were used to assess the association between the FI and mortality for Māori, Pasifika, and non-Māori/non-Pasifika.

Results: Of 54,345 participants, 3,096 (5.7%) identified as Māori, 1,846 (3.4%) were Pasifika, and 49,415 (86.7%) identified as neither Māori nor Pasifika. New Zealand Europeans (48,178, 97.5%) constituted most of the latter group. Within each sex, the mean FIs for Māori and Pasifika were greater than the mean FIs for non-Māori and non-Pasifika, with the difference being more pronounced in females. The FI was associated with mortality (Māori SHR 2.53, 95% CI 1.63 to 3.95; Pasifika SHR 6.03, 95% CI 3.06 to 11.90; non-Māori and non-Pasifika SHR 2.86, 95% 2.53 to 3.25).

Conclusions: This study demonstrated differences in FI between the ethnicities in this select cohort. After adjustment for age and sex, increases in FI were associated with increased mortality. This suggests that FI is predictive of poor outcomes in these ethnic groups.

Keywords: Frailty, older persons, interRAI, ethnicity, New Zealand, Māori, Pasifika, New Zealand European

Introduction

Minority ethnic groups (especially indigenous populations) in first world countries often have poorer health than the majority populations (1-3). Barriers relating to cultural and social determinants of health such as language, unemployment, and level of education can influence whether minority groups are able to access health care (4). Understanding frailty in minority ethnic groups may help health services deliver more individualised health care to everyone.

Published studies of ethnicity and frailty have reported poverty and complex comorbidity burden as important drivers of frailty (5-7). A study of 7,439 older Americans living in aged residential care facilities found frailty more prevalent at older ages in racially and ethnic minority groups, and in individuals of lower-income (8). Similarly, in a small cohort of Gurkha welfare pensioners, aged ≥60 years, 46.3% of men and 46.1% of women were frail (5).

In many instances, poverty is associated with frailty in middle-aged adults. For example, frailty is highly prevalent in remote-living middle-aged Aboriginal Australians who subsequently die young (1). A study of middle-aged racially and economically diverse Americans reported frailty associated with reduced survival and poverty. Race was only related to frailty prevalence for the younger participants, and in an unexpected direction with white participants being more likely to be frail than their African American counterparts (7).

A New Zealand study compared the age, sex, and ethnicity of an interRAI cohort of older New Zealanders with a similar aged background population from New Zealand's 2013 census data (9). Māori and Pasifika were over-represented in the interRAI cohort for the 65-84 year age subgroup, compared with the majority New Zealand European subgroup. Generally, Māori and Pasifika people have lower life expectancies and carry a higher burden of chronic health conditions (10,11). They are also less likely than non-Māori/non-Pasifika to seek

health care services (12). This suggests that the frailty of older Māori and Pasifika people may be different from that of the non-Māori/non-Pasifika subgroup.

The aim of this study was to determine if a frailty index (FI) would be a useful tool to help understand frailty of older Māori and Pasifika in New Zealand. To-this-end, we derived and compared frailty indices from the total New Zealand interRAI dataset for Māori, Pasifika, and non-Māori and non-Pasifika, and assessed in each ethnicity the relationship between FI and mortality.

Methods:

Participants

Participants were New Zealand adults aged ≥65 years who had an interRAI-Home Care (HC) assessment between 1 June 2012 and 30 October 2015. All participants consented to their data being used for research and planning purposes. Where a participant had multiple interRAI assessments, only the first assessment was used. Where an individual identified as both Māori and Pasifika, they were excluded from analysis. InterRAI HC assessments are conducted to determine eligibility for publicly funded services; therefore, those who have such as assessment are frailer than the general population of older adults. This includes ~10% of New Zealand's population aged 65 years and older (13). In New Zealand, participants are referred for interRAI-HC assessments by primary care doctors, community nurses, and hospital social workers.

Instruments and primary measures

The interRAI HC version 9.1 (© interRAI corporation, Washington, D. C., 1994–2009) was used to assess participants. It is a validated comprehensive assessment tool across 20

domains, including mood and behaviour, psychosocial well-being, and diagnosed medical conditions (9,13). In New Zealand, the home care assessment guides individual care planning for all older adults aged ≥65 years who require publicly funded home care services, or who are wanting to enter publicly funded aged residential care (ARC).

During the interRAI HC assessment, individuals may select up to three ethnicities that they identify with. For the purposes of this study, comparisons between ethnicities were made between those who identified as Māori (as one of the three choices) and those who did not identify as Māori (non-Māori), and similarly between Pasifika (as one of the three choices) and non-Pasifika. Pasifika included all who identified as Samoan, Cook Islander, Tongan, Niuean, Tokelauan, Fijian, Pacific peoples not further defined, and other Pacific peoples.

Mortality data was obtained from the Ministry of Health's Mortality Collection data (https://www.health.govt.nz/nz-health-statistics/national-collections-and-surveys/collections/mortality-collection). Everyone who receives health care in New Zealand, is assigned a National Health Index (NHI) number. The NHI is a unique identifier containing information about a person's name, date of birth (https://www.health.govt.nz/our-work/health-identity/national-health-index), and any other important health records. The NHI number links the mortality dataset, the interRAI-HC assessments, and primary and secondary care data in New Zealand.

Derivation of frailty index

The FI used in this study was calculated using a well-described methodology (14), which has been validated in interRAI instruments (15), including the interRAI-HC (16). In summary, frailty indices were calculated by summing the number of deficits recorded for a participant

and dividing by the total number of possible deficits (46) for that participant. Deficits were from the following nine categories: cognition status, communication and vision, mood and behaviour, functional status, continence, health conditions, oral and nutritional status, skin conditions, diagnoses. For individuals with missing variables, the FI was calculated by adjusting the denominator to match the total number of available deficits with a minimum of 30 variables. Anyone who had fewer than 30 variables was excluded from analysis. This created a FI with a potential range from 0 to 1. The full list of questions used in this study is provided in supplementary material Table S1.

Statistical analysis

Reporting of this study was informed by the STROBE guidelines (17). Median frailty indices were compared across select groups such as ethnicity, sex, and age. Graphs of the difference between the mean frailty of Māori and non-Māori, and Pasifika and non-Pasifika were plotted as a function of age. Linear regression models which related FI to ethnicity, age and sex were created. Cox proportional hazards models adjusted for age, sex, Alzheimer's disease, dementia other than Alzheimer's disease, coronary heart disease, chronic obstructive pulmonary disease (COPD), cancer, and diabetes mellitus were used to assess the association between the FI and mortality of the different ethnic groups. Analyses and graphics were performed in IBM SPSS Statistics 25 and R 3.5.2 (18).

Ethics

Ethics permission for this study was granted by the Health and Disability Ethics Committee (HDEC) application 14/STH/140/AM08.

Results:

Demographics

A total of 54,345 participants had interRAI HC assessments during the study period. Of these, 3,096 (5.7%) identified as Māori, with a mean age of 77 (range 65–102) years, and 1,846 (3.4%) identified as Pasifika, with a mean age of 78 (range 65–100) years. There were 12 individuals who identified as both Māori and Pasifika who were excluded from analysis. There were 49,415 individuals (86.7%) who identified as neither Māori nor Pasifika, with a mean age of 82 (range 65–106) years. New Zealand Europeans (48,178; 97.5%) constituted most of the latter group (Table 1). Of note, Māori and Pasifika were more frequently in the 65-74 years age group and less frequently in the 85+ age group than non-Māori/non-Pasifika. By the end of the study 876 Māori (28.3%), 440 Pasifika (23.8%), and 13,207 non-Māori/non-Pasifika (26.7%) people had died.

Greater than 60% of the cohort were females with the percentage of Māori > Pasifika > non-Māori/non-Pasifika (Table 1). Similarly, approximately half of the individuals in each ethnic group were widowed with percentages of Māori > Pasifika > non-Māori/non-Pasifika. Pasifika less frequently lived alone and more frequently lived with family members or relatives than Māori and non-Māori/non-Pasifika (Table 1).

Māori exhibited higher percentages of some co-morbidities than Pasifika and non-Māori/non-Pasifika (Table 1). Alzheimer's disease and other forms of dementia were slightly more prevalent in the Māori and Pasifika groups than the non-Māori/non-Pasifika group. Coronary heart disease was more prevalent in the Māori and non-Māori/non-Pasifika groups than the Pasifika group. Coronary obstructive pulmonary disease was twice as prevalent in Māori compared with Pasifika and non-Māori/non-Pasifika. In contrast, the Pasifika group had the

highest percentage of diabetes mellitus, more than twice as high as non-Māori/non-Pasifika and significantly higher than Māori (Table 1).

Distribution of frailty index

The median FI for the total cohort was 0.25 (range 0–0.90), Figure 1. Table 2 presents the median FIs and interquartile ranges for sex and ethnicity. There was no significant relationship between age and FI for the total cohort. Within each sex, the mean FIs for Māori and Pasifika were greater than the mean FI for non-Māori/non-Pasifika, with the difference being more pronounced in females (figures 2 and 3). In the linear regression model with age, sex, and ethnicity (Māori or non-Māori), Māori were associated with a 0.02 (95% CI 0.01 to 0.02) greater FI than non-Māori. Similarly, in the linear regression model with age, sex, and ethnicity (Pasifika or non-Pasifika), the mean FI for Pasifika was greater than the mean FI for non-Pasifika, Figure 3, and Pasifika were associated with a 0.04 (95% CI 0.03 to 0.04) greater FI. The difference increased with increasing age above 85 years, Figure 3.

Association with mortality

The number of person-years available for this study was 62,881. In three separate models, FI was associated with mortality for each ethnic group as noted in Table 3. After adjustment for age and sex each increase in FI of 0.1 increased the risk of death by 2.53 (95% CI: 1.63 to 3.95) in Māori, 6.03 (95% CI: 3.06 to 11.90) in Pasifika, and 2.86 (95% CI: 2.53 to 3.25) in non- Māori and non-Pasifika.

Discussion.

In this large cohort of community dwellers referred for home care assistance, Māori and Pasifika were younger and frailer than New Zealand Europeans. Frailty increased with age

and as frailty level increased, the risk of mortality also increased. Māori and Pasifika were more frequently in the 65-74 years age group and less frequently in the >85 years age group than non-Māori/non-Pasifika.

Greater mean FIs for Māori and Pasifika than non-Māori/Pasifika are consistent with the higher comorbidities we observed in these two groups (19-21). As an example of poorer health, ischaemic heart disease accounts for 40.2% of Māori deaths in New Zealand in individuals aged ≤65 years compared with 10.5% of New Zealand European deaths (20). Māori have the highest incidence of acute pancreatitis, globally (22). Māori and Pasifika adults are more likely to smoke than non-Māori/non-Pasifika (33% and 23% vs 15%, respectively), and are two to three times more likely to have smoking-related diseases such as COPD (23). There is evidence of a genetic predisposition to a high incidence of adult obesity (47% Māori, 65% Pasifika, vs 32% non-Māori/non-Pasifika) (24,25) and other chronic diseases in Māori and Pasifika. For example, disproportionately high frequencies of chronic kidney disease have been reported for New Zealand Māori and Pasifika (26). Diabetic nephropathy is the major cause of the disease, but there is also evidence of a familial genetic predisposition.

Our observation that Māori and Pasifika more frequently appeared in the 65-74 years age group and less frequently in the >85 years age group is consistent with the shorter life spans reported for these ethnic groups. Current life expectancy at birth in years for New Zealand Māori and Pasifika females is 77.1 and 78.7, respectively, compared with 83.9 for non-Māori/non-Pasifika (21). For males, life expectancy at birth in years for Māori and Pasifika is 73.0 and 74.5, respectively, compared with 80.3 for non-Māori/non-Pasifika (21). The mean ages of Māori and Pasifika subgroups observed in our study are approximately four years older than the life expectancy for males. These findings are consistent with our female

dominated cohort. Possibly some Māori and Pasifika males die without referral for an interRAI assessment.

By the end of our study approximately one-quarter of each ethnicity had died. These findings are consistent with the shorter life expectancy of Māori and Pasifika compared with New Zealand Europeans (21). Other research has found associations between non-cardiovascular diseases, such as gout and inflammatory disorders, and mortality in Māori (27). Associations between increasing frailty, increasing age, and consequently increased risk of mortality have also been reported for other ethnicities (1,28,29). A large retrospective cohort study of 86,133 Taiwanese participants using a FI incorporating 32 deficits established a 5-fold risk of death for severe frailty (adjusted hazard ratio, aHR 4.97; 95% confidence interval, 95% CI 4.49-5.50) at 1 year, after adjusting for age and gender (28). In a study of frailty of 363 Aboriginal Australians aged ≥45 years, Hyde et al. 2016 (1) found frailty associated with mortality (HR 1.9; 95% CI 1.2, 3.1). In that study, frailty was prevalent in 54.9% of adults aged 45-49 years and 63.7% of adults aged 50-59 years and increased to 83.3% in adults aged >80 years. At the end of the first wave of the Australian study, 42.6% of participants who were frail at baseline had died within five to nine years. Māori and Pasifika often present later for care than non-Māori and non-Pasifika leading to twice as many avoidable deaths (17,26). In a comparison of Māori and non-Māori visits to primary care doctors, 43.3% of Māori visits were reported urgent compared with 31.1% of non-Māori (26). In that study, older people were less likely to present for care than younger people and children. While poverty was a factor, other factors included poor rapport between patients and doctors and a lack of understanding of medical advice. The latter is a problem for older people living in cities. While many published studies have randomly sampled older populations, our study differs in that New Zealand interRAI assessments are undertaken only when individuals reach the point of needing assistance at home or admission into aged residential care. In other words, this

cohort differs from a random sample by excluding people who do not perceive a need for assistance. This suggests that the different levels of frailty found for Māori or Pasifika in our study support a later presentation to the health system.

Frailty is also driven by poverty (5,30-32). Māori and Pasifika are more likely to have been born into poverty than non-Māori and non-Pasifika (33). Consequently, they less frequently have health care throughout their lives than non-Māori and non-Pasifika (19,34). The New Zealand Ministry of Health annually reports statistics on access to health care for the different ethnic groups living in New Zealand. In the 2017/2018 New Zealand Health Survey, after adjusting for age and gender differences, Māori and Pasifika adults and children were observed to be twice as likely as non-Māori and non-Pasifika adults and children to not have collected a prescription, due to cost (23).

Low health literacy makes navigating an unfamiliar and complex health system a significant barrier for Māori (30). While equity in health care for Māori and Pasifika is embedded in policy in New Zealand, there is a struggle to put it into practice because cultural and diversity training is not a condition of employment (31). Nonetheless, New Zealand primary and secondary care providers are establishing specific services targeted at improving Māori and Pasifika health throughout their lives. For example, the Canterbury District Health Board has established "Etu Pasifika" (https://www.cdhb.health.nz/health-services/service/maori-pacific-health/), which is a drop-in primary care facility that provides a range of services for families including mental health, and addictions and smoking cessation. Non-governmental organisations are also providing other services targeted at the needs of Māori and Pasifika. For example, Te Puawaitanga provides anti-natal classes for Māori women and their families (http://whanauoraservices.co.nz/). Similar services to these are now in place throughout New Zealand. Frequent engagement with these services will hopefully improve Māori and

Pasifika health, support earlier presentation for care, prevent development of life-threatening diseases, and increase the life expectancy of Māori and Pasifika.

This study's strengths were use of a large cohort from a national interRAI dataset, the dataset's completeness, the comprehensive mandatory training of interRAI assessors, and national health index linkage between the datasets. Nonetheless, the results of the study might not be generalisable outside New Zealand because of the specific makeup of the New Zealand cohort.

We would like to mention several potential limitations of this study. The self-identification as Māori or Pasifika is subjective and we assume based on cultural identity. Māori people are Polynesians who arrived in New Zealand over the recent 700 years and adapted to life in New Zealand. The Pacific people of this study are Polynesians from six or more different Pacific Islands (countries) who we presume immigrated to New Zealand. The study cohort was not representative of all New Zealanders over the age of 65 years.[9] Only older people who are in consideration for publicly-funded home care or aged residential care receive an interRAI assessment. Consequently, the frailty index is a tool that could help provide health care for people who have had an interRAI assessment. It is not applicable to the general population. Barriers to navigating an unfamiliar health system often lead to Māori/Pasifika presenting later for care than non-Māori/Pasifika. This could potentially have led to an ethnicity selection bias in our study. To obtain an interRAI assessment an individual needs to self-present to a health practitioner, be referred for the assessment, and agree to the assessment.

In cases where variables were missing, readjusting the number of deficits in the denominator of the FI calculation may potentially have introduced some bias towards higher FIs. However, we would expect any bias to have been negligible. In contrast, where a participant

had multiple HC assessments over time, only the first assessment was used, which may have influenced the dataset towards lower FIs.

Conclusion

By using frailty indices in a population of older people referred for home care services, this study found community-dwelling older Māori and Pasifika younger and frailer than New Zealand Europeans. A combination of a higher incidence of chronic diseases and a lifetime of poverty may account for higher levels of frailty at younger ages in many Māori and Pasifika with consequent decreased life expectancy.

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Conflicts of Interests

The authors have no conflicts of interest.

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Figure Legends

Figure 1. Density plot of frailty index of all individuals.

Figure 2. At each age, the difference between the mean frailty index of Māori and the mean frailty index of Non-Māori. Circles above the centre line ("0.00") indicate a greater mean frailty index in Māori. Panel (A) Male, (B) Female. The area of each circle is proportional to the number of Māori of each age and sex.

Figure 3. At each age, the difference between the mean frailty index of Pasifika and the mean frailty index of Non-Pasifika. Circles above the centre line ("0.00") indicate a greater mean frailty index in Pasifika. Panel (A) Male, (B) Female. The area of each circle is proportional to the number of Pasifika of each age.

Table 1. Demographic and comorbidity distributions across different ethnic groups

	Total n (%)	Māori n (%)	Pasifika n (%)	Non-Māori and non-Pasifika n (%)
Age Mean ± SD	82.0 (7.4)	77.0 (6.9)	78.0 (7.1)	82.4 (7.3)
65-74	11,179 (20.6)	1,319 (42.6)	712 (38.6)	9,151 (18.5)
75-84	24,306 (44.7)	1,403 (45.3)	855 (46.3)	22,056 (44.6)
85+	18,860 (34.7)	374 (12.1)	279 (15.1)	18,208 (36.8)
Sex[a]				
Male	20,598 (37.9)	1,095 (35.4)	692 (37.5)	18,815 (38.1)
Female	33,744 (62.1)	2,001 (64.6)	1,154 (62.5)	30,597 (61.9)
Marital Status				
Never married	2,142 (3.9)	133 (4.3)	49 (2.7)	1,960 (4.0)
Married/civil union/defacto	21,984 (40.5)	930 (30.0)	741 (40.1)	20,316 (41.1)
Widowed	25,993 (47.8)	1,610 (52.0)	929 (50.3)	23,460 (47.5)
Separated	1,130 (2.1)	179 (5.8)	47 (2.5)	905 (1.8)
Divorced	2,702 (5.0)	169 (5.5)	51 (2.8)	2,483 (5.0)
Other	394 (0.7)	75 (2.4)	29 (1.6)	291 (0.6)
Living Arrangements[b]				
Alone	26,597 (48.9)	1,186 (38.3)	277 (15.0)	25,138 (50.9)
Spouse/partner only	18,043 (33.2)	624 (20.2)	290 (15.7)	17,130 (34.7)
Spouse/partner and others	1,967 (3.6)	217 (7.0)	343 (18.6)	1,408 (2.8)
Child (Not spouse/partner)	5,893 (10.8)	747 (24.1)	719 (38.9)	4,432 (9.0)
Other relatives	1,301 (2.3)	286 (9.3)	204 (11.5)	804 (1.6)
Non-relatives	543 (1.0)	36 (1.2)	5 (0.3)	502 (1.0)
Alzheimer's Disease[c]				
Diagnosis present	4,159 (7.7)	258 (8.3)	150 (8.1)	3,754 (7.6)
No diagnosis	50,184 (92.3)	2,838 (91.7)	1,696 (91.9)	45,659 (92.4)

Dementia other than Alzheimer's[c]				
Diagnosis present	7,030 (12.9)	501 (16.2)	340 (15.4)	6,195 (12.5)
No diagnosis	47,313 (87.1)	2,595 (83.8)	1,506 (81.6)	43,128 (87.5)
Coronary Heart Disease[c]				
Diagnosis present	17,290 (31.8)	1,136 (36.7)	413 (22.4)	15,743 (31.9)
No diagnosis	37,053 (68.2)	1,960 (63.3)	1,433 (77.6)	33,670 (68.1)
Chronic Obstructive Pulmonary Disease[c]				
Diagnosis present	8,656 (15.9)	879 (28.4)	305 (16.5)	7,477 (15.1)
No diagnosis	45,687 (84.1)	2,217 (71.6)	1,541 (83.5)	41,936 (84.9)
Cancer[c]				
Diagnosis present	7,256 (13.4)	359 (11.6)	127 (6.9)	6,770 (13.7)
No diagnosis	47,087 (86.6)	2,737 (88.4)	1,719 (93.1)	42,643 (86.3)
Diabetes Mellitus[c]				
Diagnosis present	11,315 (20.8)	1,124 (36.3)	848 (45.9)	9,345 (18.9)
No diagnosis	43,028 (79.2)	1,972 (63.7)	998 (54.1)	40,068 (81.1)

[a]3 values missing, [b]1 value missing, [c]2 values missing

Table 2. Median frailty indices among different groups

	Median frailty index	Interquartile range
Sex		
Male	0.26	0.18, 0.36
Female	0.25	0.178, 0.34
Ethnicity		
Māori	0.26	0.18, 0.36
Pasifika	0.28	0.19, 0.28
Non-Māori & non-Pasifika	0.25	0.17, 0.34

Table 3. Adjusted hazard ratios for frailty associated with mortality

	Adjusted Hazard Ratios (95% CI)
Māori	
Frailty Index (per 0.1)	2.53 (1.63 to 3.95)
Age (per year)	0.99 (0.99 to 1.01)
Male	1 Reference
Female	0.98 (0.99 to 1.01)
Alzheimer's (no diagnosis)	1 Reference
Alzheimer's (diagnosis)	0.79 (0.61 to 1.03)
Dementia (no diagnosis)	1 Reference
Dementia (diagnosis)	0.90 (0.75 to 1.08)
Coronary Heart Disease (no diagnosis)	1 Reference
Coronary Heart Disease (diagnosis)	1.05 (0.91 to 1.20)
COPD (no diagnosis)	1 Reference
COPD (diagnosis)	0.98 (0.87 to 1.15)
Cancer (no diagnosis)	1 Reference
Cancer (diagnosis)	1.45 (1.21 to 1.72)
Diabetes mellitus (no diagnosis)	1 Reference
Diabetes mellitus (diagnosis)	0.93 (0.81 to 1.07)
Pasifika	
Frailty Index (per 0.1)	6.03 (3.06 to 11.90)
Age (per year)	0.99 (0.98 to 1.01)
Male	1 Reference
Female	0.98 (0.80 to 1.19)
Alzheimer's (no diagnosis)	1 Reference
Alzheimer's (diagnosis)	0.92 (0.63 to 1.35)
Dementia (no diagnosis)	1 Reference
Dementia (diagnosis)	0.57 (0.45 to 0.73)
Coronary Heart Disease (no diagnosis)	1 Reference
Coronary Heart Disease (diagnosis)	0.97 (0.78 to 1.22)
COPD (no diagnosis)	1 Reference
COPD (diagnosis)	0.98 (0.87 to 1.15)
Cancer (no diagnosis)	1 Reference
Cancer (diagnosis)	1.45 (1.21 to 1.72)
Diabetes mellitus (no diagnosis)	1 Reference
Diabetes mellitus (diagnosis)	0.93 (0.81 to 1.07)
Non-Māori and non-Pasifika	
Frailty Index (per 0.1)	2.86 (2.53 to 3.25)
Age (per year)	1.00 (0.99 to 1.01)
Male	1 Reference
Female	0.95 (0.92 to 0.98)
Alzheimer's (no diagnosis)	1 Reference
Alzheimer's (diagnosis)	0.78 (0.72 to 0.83)
Dementia (no diagnosis)	1 Reference
Dementia (diagnosis)	0.79 (0.75 to 0.83)
Coronary Heart Disease (no diagnosis)	1 Reference
Coronary Heart Disease (diagnosis)	1.00 (0.97 to 1.04)

	Adjusted Hazard Ratios (95% CI)
COPD (no diagnosis)	1 Reference
COPD (diagnosis)	1.08 (1.03 to 1.13)
Diabetes mellitus (no diagnosis)	1 Reference
Diabetes mellitus (diagnosis)	0.98 (0.94 to 1.03)

Figure 1

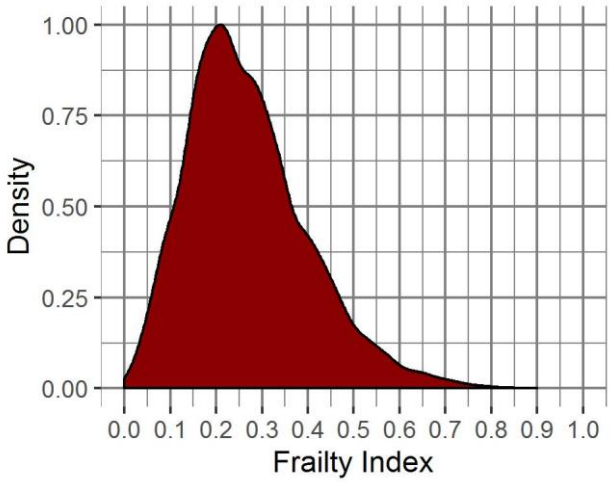

Figure 2

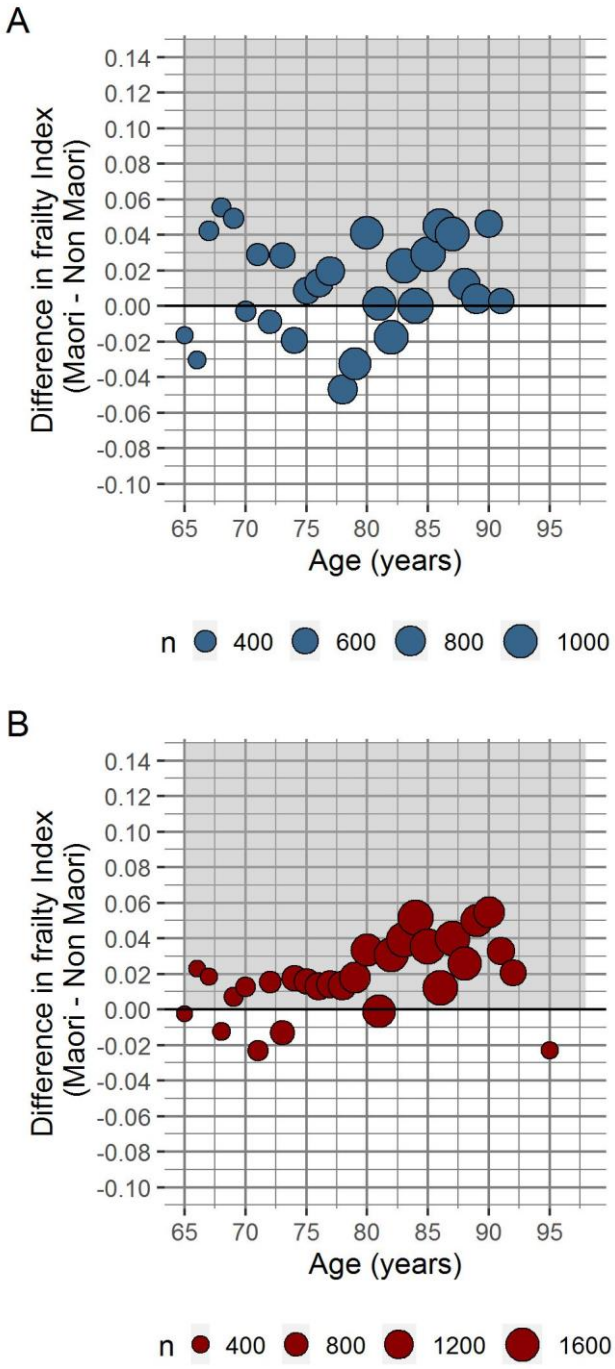

Figure 3