Drug burden and its association with falls among older adults in New Zealand

Presented by: Ulrich Bergler, Research Fellow, University of Otago, New Zealand
Researchers: Dr Hamish A Jamieson, Dr. Prasad Nishtala, Richard Scrase, Dr. Joanne Deely, Rebecca Abey-Nesbit, Martin J. Connolly, Dr. Sara Hilmer, Dr Darrell Abernethy, Dr Philip J. Schluter

Overview

- Drug Burden and Falls
- Drug Burden and Hip Fractures
- interRAI based NZ Frailty Index
- Intervention Study on Drug Burden
- Social Factors for admission to aged care
- Questions

Content:

- Introduction
- Method
- Results
- Conclusions
- Acknowledgements

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interRAI™ Home Care in New Zealand

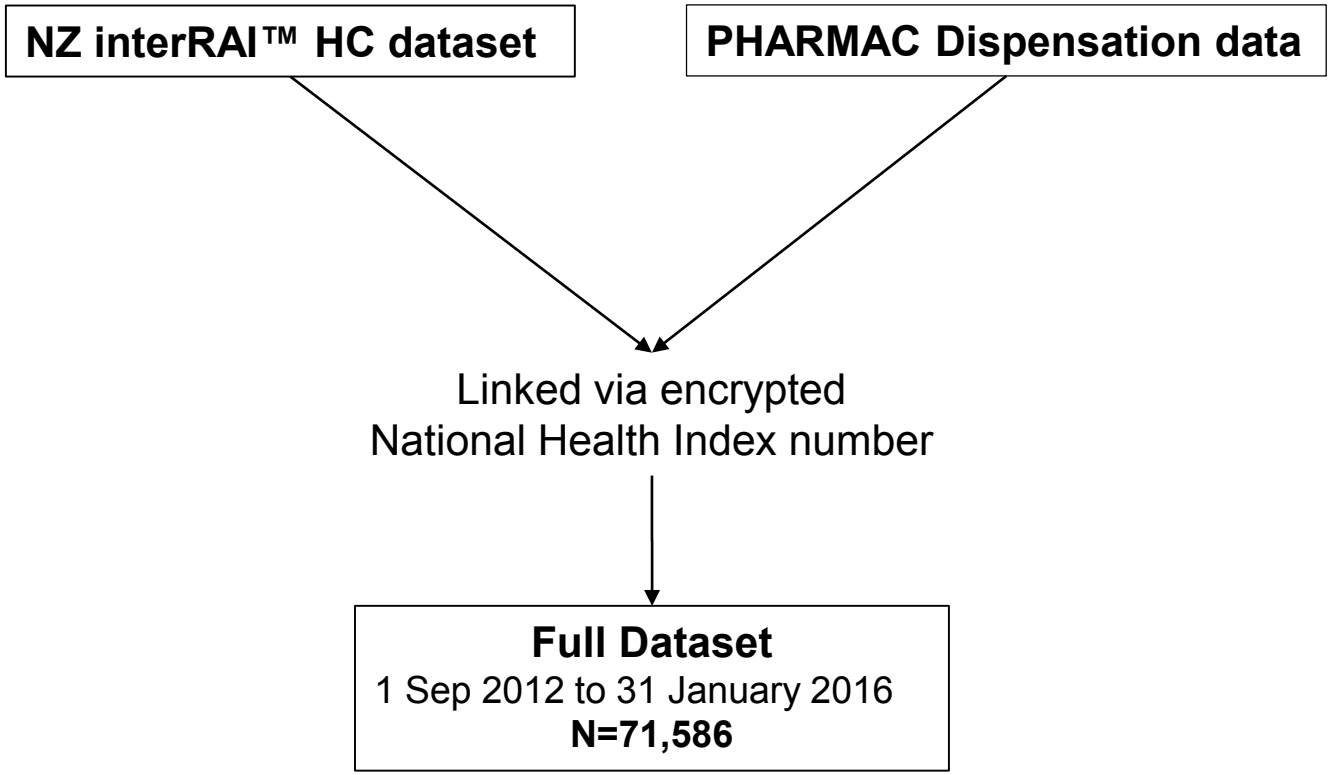
- Mandated since June 2012 for all people seeking publically funded admission into Aged Residential Care (ARC).
- Approx. 160,000 records at the end of 2017, growing by ~30,000 p.a.
- Able to link a multitude of data e.g. mortality, dispensing records, ARC, hospital admissions via a unique National Health Index (NHI) number.
- High data quality demonstrated by Schluter et al 2016

Schluter, P. J., Ahuriri-Driscoll, A. , Anderson, T. J., Beere, P. , Brown, J. , Dalrymple-Alford, J. , David, T. , Davidson, A. , Gillon, D. A., Hirdes, J. , Keeling, S. , Kingham, S. , Lacey, C. , Menclova, A. K., Millar, N. , Mor, V. and Jamieson, H. A. (2016), Comprehensive clinical assessment of home-based older persons within New Zealand: an epidemiological profile of a national cross-section. Australian and New Zealand Journal of Public Health, 40: 349-355. doi:10.1111/1753-6405.12525

Objectives of this research:

To evaluate the association between exposure to anticholinergic and sedative medications and falls in a community dwelling population of older (≥65 years) people, after controlling for potential confounders.

Compilation of research data



Drug Burden Index* (DBI)

- An indicator for the level of adverse side effects of medications.
- Calculated for medicines with anticholinergic and sedative properties

$$DBI = D / (D + \delta)$$

D is the daily dose taken by the individual and
δ is the minimum efficacious dose.

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cumulative Drug Burden Index (cDBI)

- Each participant's cDBI exposure was calculated for the 90-day period prior to the person' interRAI-HC assessment
- The cumulative cDBI exposure for each 90-day interval was calculated using the principles trapezoidal area under the curve as described by S Hilmer et al 2009*.
- The cDBI was partitioned into four groups, namely:
  (i) cDBI = 0;
  (ii) $0 < cDBI \leq 1$;
  (iii) $1 < cDBI \leq 3$; and,
  (iv) $3 < cDBI$

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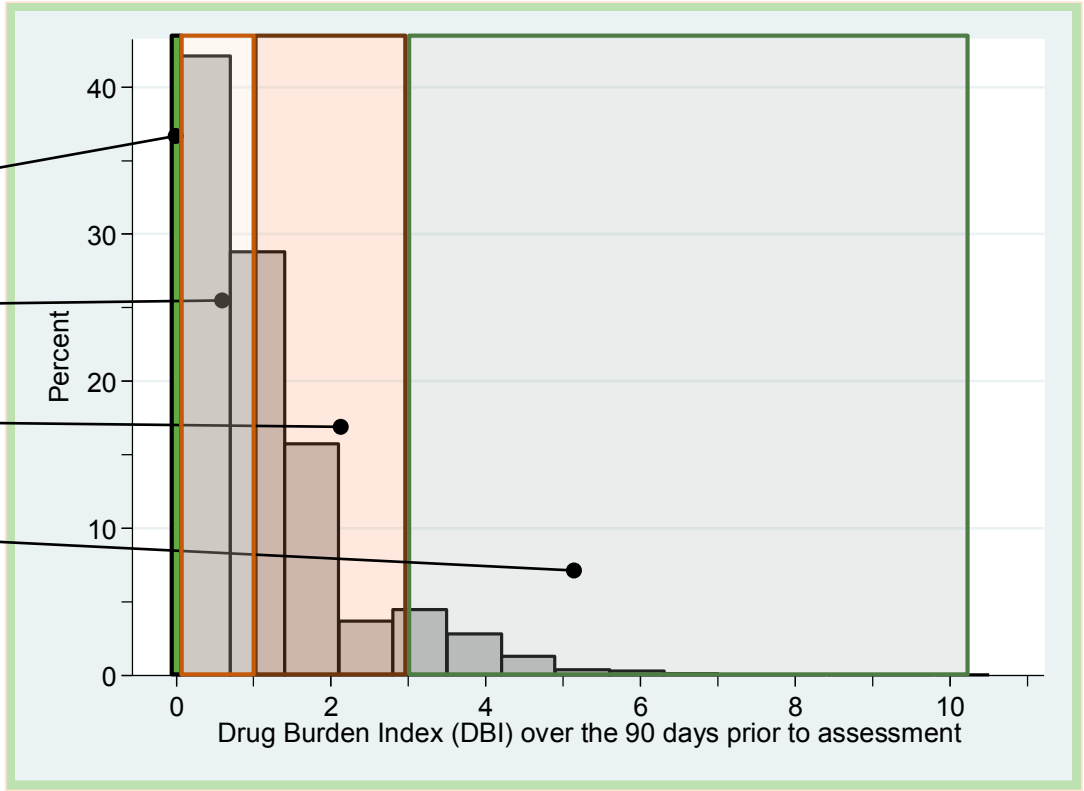
Cumulative DBI – distribution and group size

(i) cDBI=0; n=27,505

(ii) 0<cDBI≤1; n=21,180

(iii) 1<cDBI≤3; n=18,297

(iv) 3<cDBI; n=4,877



Occurrences in different cDBI exposure groups

		No falls in last 90 days		No fall in last 30 days, but fell 31-90 days ago		One fall in last 30 days		Two or more falls in last 30 days	
	n	n	(%)	n	(%)	n	(%)	n	(%)
cDBI = 0	27,505	17,359	(63.1)	3,108	(11.3)	4,339	(15.8)	2,698	(9.8)
0 < cDBI ≤ 1	21,180	12,613	(59.6)	2,353	(11.1)	3,669	(17.3)	2,544	(12.0)
1 < cDBI ≤ 3	18,297	10,089	(55.1)	2,179	(11.9)	3,421	(18.7)	2,607	(14.2)
3 < cDBI	4,877	2,502	(51.3)	578	(11.9)	977	(20.0)	820	(16.8)

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Statistics to define Odd Ratios

- Performed in Stata IC v14.1
- Bivariate regression model developed for main effects
- Multivariate regression & Wald III type Chi-square to test significance of interactions
- Controlling for: age group, sex, ethnicity, cognitive performance, alcohol consumption, smoking status, hearing status, vision status, fatigue, mobility, coronary heart disease, chronic obstructive pulmonary disease, congestive heart failure, depression, body mass index, self-rated health, dizziness, and unsteady gait

Odds ratios for different cDBI exposure groups

	OR Unadjusted		OR Adjusted[a]	
	OR	(95% CI)	OR	(95% CI)
cDBI = 0	1	(reference)	**1**	(reference)
0 < cDBI ≤ 1	1.18	(1.14, 1.22)	**1.11**	(1.07, 1.15)
1 < cDBI ≤ 3	1.41	(1.36, 1.47)	**1.27**	(1.22, 1.32)
3 < cDBI	1.67	(1.58, 1.77)	**1.41**	(1.32, 1.50)

[a] Adjusted for age group, sex, ethnicity, cognitive performance, alcohol consumption, smoking status, hearing status, vision status, fatigue, mobility, coronary heart disease, chronic obstructive pulmonary disease, congestive heart failure, depression, body mass index, self-rated health, dizziness, and unsteady gait

Conclusions

- DBI is independently associated with an increased risk of falls.
- DBI could be an invaluable risk assessment tool for clinicians considering prescribing or deprescribing medications for older people.
- DBI could potentially be automatically calculated on the drug chart.

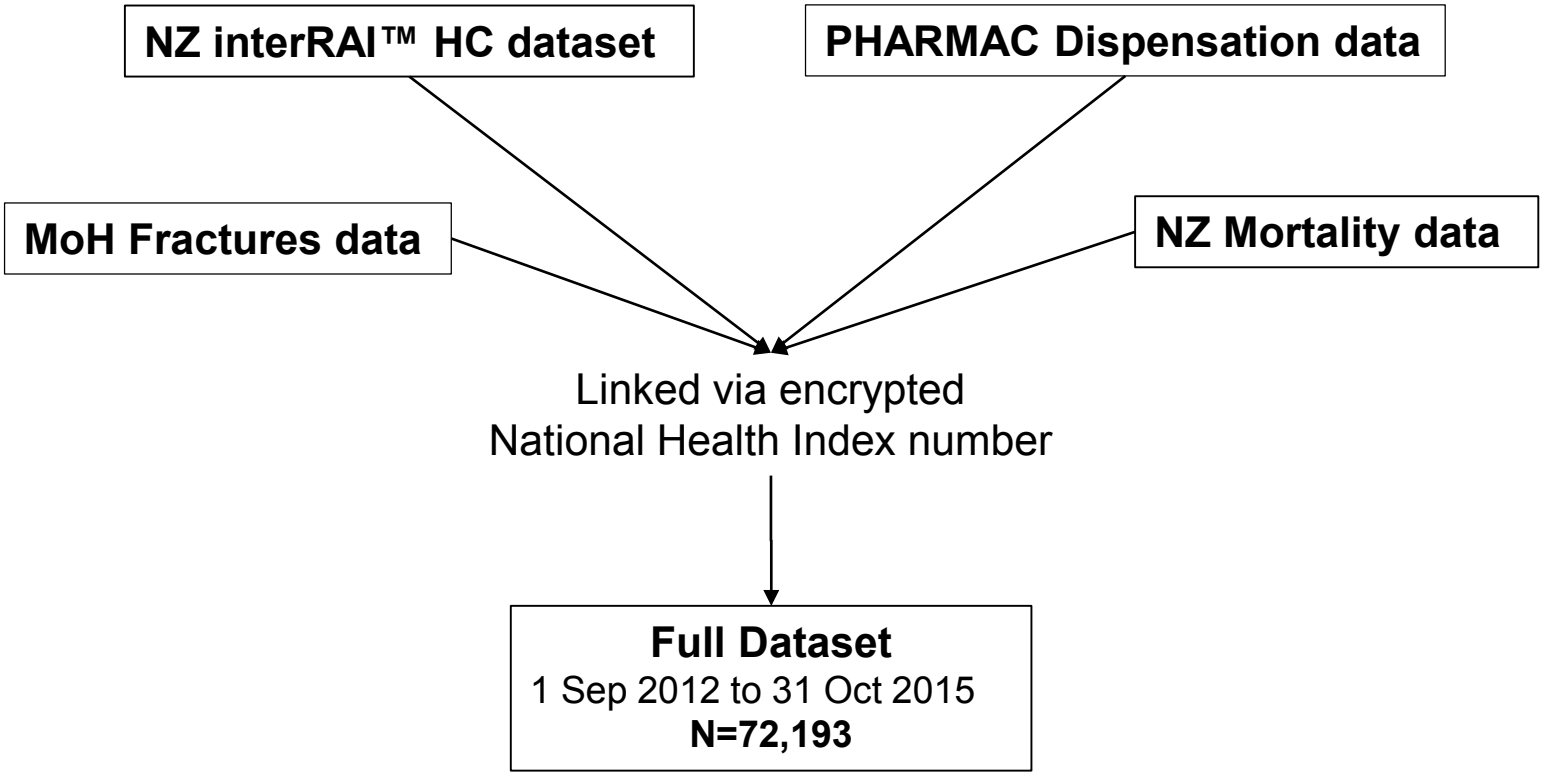
Drug burden and its association with hip fractures among older adults in New Zealand

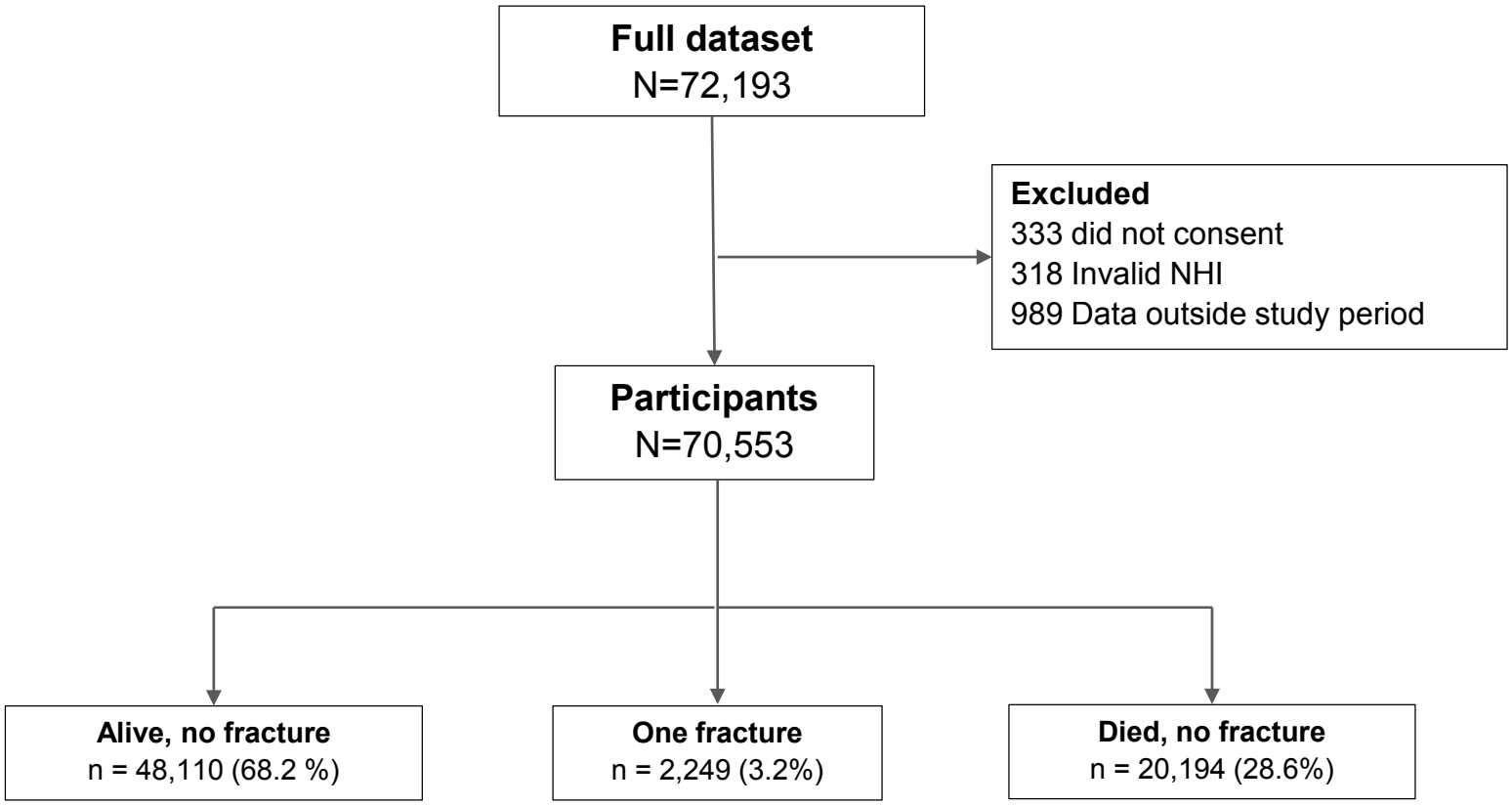
Presented by: Ulrich Bergler, Research Fellow, University of Otago, New Zealand
Researchers: Dr Hamish A Jamieson, Dr. Prasad Nishtala, Dr. Joanne Deely, Rebecca Abey-Nesbit, Dr. Sara Hilmer, Dr Darrell Abernethy, Sarah Berry, Dr Philip J. Schluter, Dr Vincent Mor, Richard Scrase

Objectives of this research:

To evaluate the association between the Drug Burden Index (DBI) and hip fractures when controlling for known factor associated with fractures, in a community dwelling population of older (≥65 years) adults using linked national datasets in New Zealand.

Compilation of New Zealand research data





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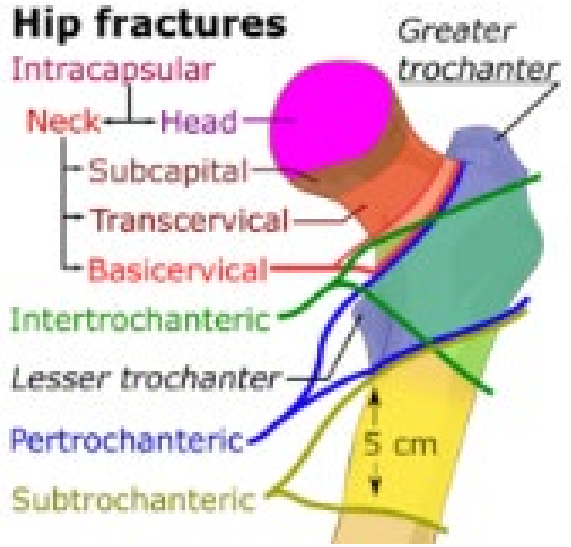
Fractures Data

ICD-10-AM codes:

S720 – fracture of head and neck of femur;
S721 – pertrochanteric fracture;
S722 – subtrochanteric fracture of femur;
S723 – fracture of shaft of femur;

S724 – fracture of lower end of femur;
S728 – other fracture of femur; and
S729 – unspecified fracture of femur.



Drug Burden Index* (DBI)

- An indicator for the level of adverse side effects of medications.
- Calculated for medicines with anticholinergic and sedative properties

$$DBI = D/(D+ \delta)$$

D is the daily dose taken by the individual and
δ is the minimum efficacious dose.

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Cumulative Drug Burden Index (cDBI)

- Each participant's cDBI exposure was treated as a time varying variable
- Partitioned into 90-day intervals over their study duration
- Beginning with the 90 days pre-interRAI-HC assessment.
- The cumulative cDBI exposure for each 90-day interval was calculated using the principles trapezoidal area under the curve as described by S Hilmer et al 2009*.
- The cDBI was partitioned into four groups, namely:
  (i) cDBI = 0;
  (ii) $0 < cDBI \leq 1$;
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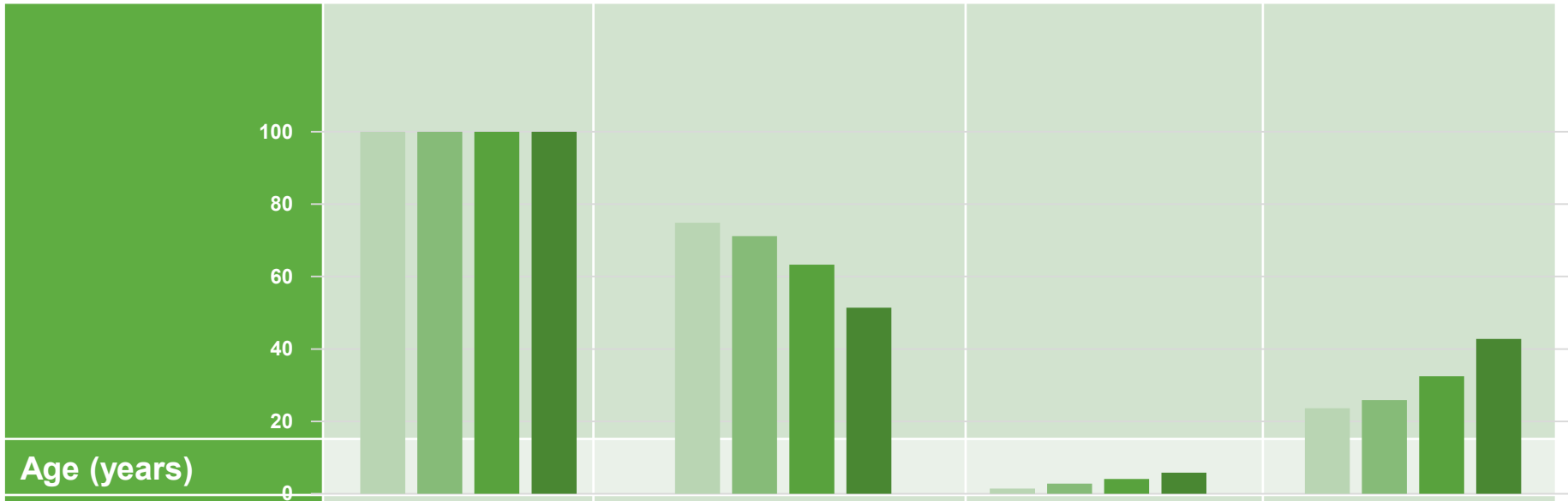
Demographics grouped by survival status

			First Event	
	Total – n (%)	Alive no fracture – n (%)	Fracture – n (%)	Died - n (%)
Age (years)				
65-74	12,175 (100.0)	9,124 (74.9)	174 (1.4)	2,877 (23.6)
75-84	28,999 (100.0)	20,656 (71.2)	820 (2.8)	7,523 (25.9)
85-94	27,048 (100.0)	17,131 (63.3)	1,120 (4.1)	8,797 (32.5)
95+	2,331 (100.0)	1,199 (51.4)	135 (5.8)	997 (42.8)
Gender [a]				
Female	43,048 (100.0)	30,945 (71.9)	1,569 (3.6)	10,534 (24.5)
Male	27,501 (100.0)	17,162 (62.4)	680 (2.5)	9,659 (35.1)
Ethnicity				
Maori	3,814 (100.0)	2,638 (69.2)	41 (1.1)	1,135 (29.8)
Pasifika	2,187 (100.0)	1,622 (74.2)	26 (1.2)	539 (24.6)
NZ European	62,436 (100.0)	42,257 (67.7)	2,134 (3.4)	18,045 (28.9)
Other	2,116 (100.0)	1,593 (75.3)	48 (2.3)	475 (22.4)

Note: [a] 4 records missing

Demographic [Age] grouped by survival status



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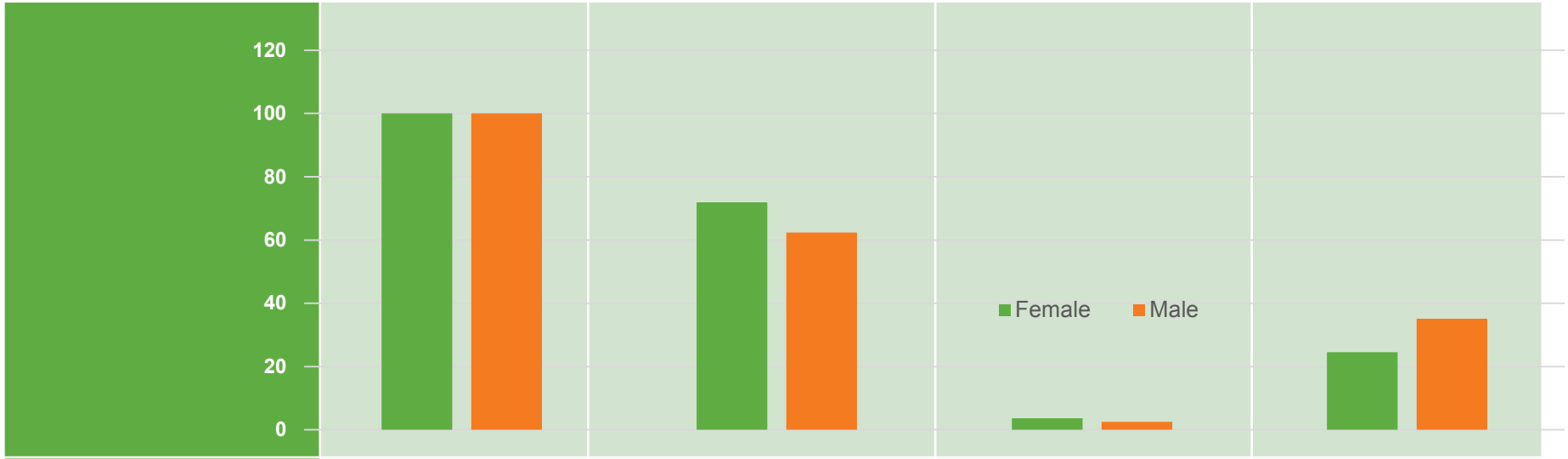
Demographic [Sex] grouped by survival status

	Total – n (%)	Alive no fracture – n (%)	Fracture – n (%)	Died - n (%)
				
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Male	27,501 (100.0)	17,162 (62.4)	680 (2.5)	9,659 (35.1)

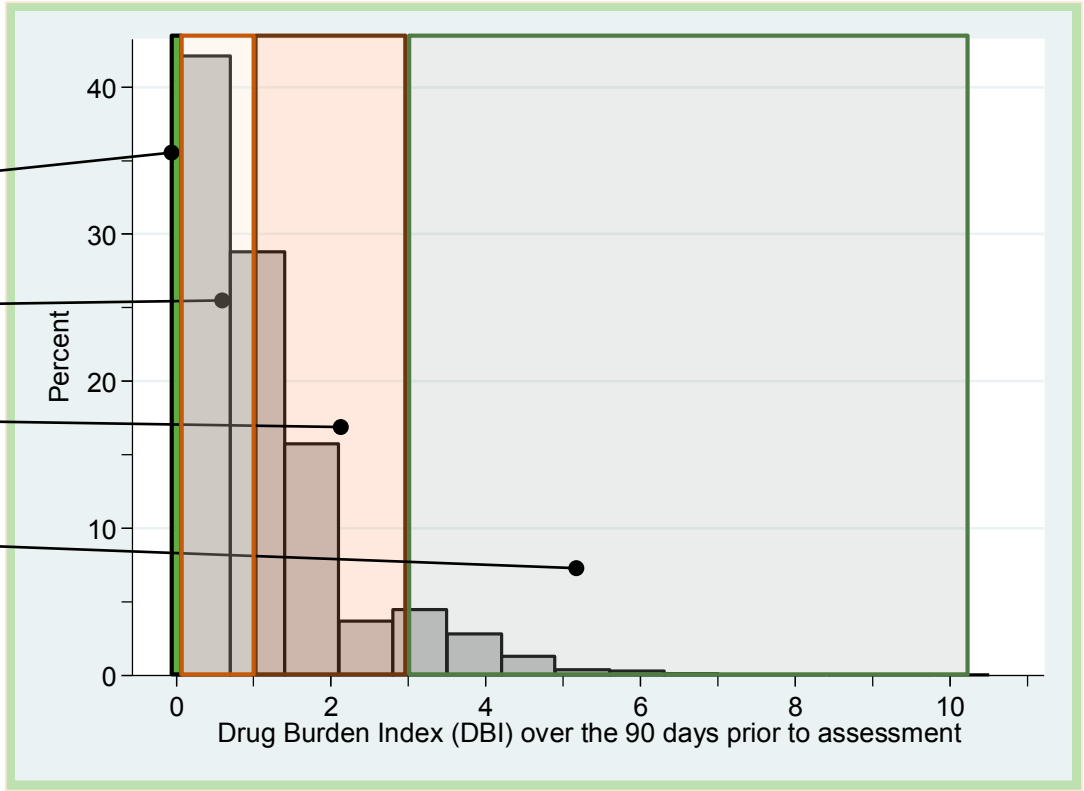
Cumulative DBI – distribution and group size

(i) cDBI=0; n=29,111

(ii) 0<cDBI≤1; n=20,791

(iii) 1<cDBI≤3; n=16,600

(iv) 3<cDBI; n=4,051



cDBI Exposure over 3 years in 90 day intervals

Time from assessment (days)	N	(%)	median	(Q1, Q3)
Baseline	70,553	(100.0)	0.93	(0.0, 1.81)
90	59,192	(83.9)	0.94	(0.0, 1.83)
180	51,303	(72.7)	0.93	(0.0, 1.81)
270	44,669	(63.3)	0.93	(0.0, 1.81)
360	39,090	(55.4)	0.93	(0.0, 1.82)
450	33,280	(47.2)	0.93	(0.0, 1.83)
540	27,384	(38.8)	0.93	(0.0, 1.84)
630	22,129	(31.4)	0.93	(0.0, 1.84)
720	17,429	(24.7)	0.94	(0.0, 1.85)
810	12,162	(17.2)	0.94	(0.0, 1.86)
900	7,649	(10.8)	0.94	(0.0, 1.87)
990	4,351	(6.2)	0.95	(0.0, 1.90)
1,080	1,871	(2.7)	0.96	(0.0, 1.90)

Competing Risk Regression Analysis

- Performed in Stata IC v14.1
- Survival case = alive and no fracture during study period
- Hazard = hip fracture
- Competing hazard case = death
- Controlling for: age, sex, ethnicity, body mass index (BMI), cognitive performance, dementia, congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD), depression, diabetes mellitus, urinary incontinence, alcohol consumption, smoking status, hearing status, vision status, fatigue, mobility, wandering, seasonality (a time covariable), and supplementation of bisphosphonates, vitamin D, and calcium supplementation.

Hazard ratios for different cDBI exposure groups

	Alive, no fracture		Fracture		Died		SHR Unadjusted		SHR Adjusted[a]	
	n	(%)	n	(%)	n	(%)	SHR	(95% CI)	SHR	(95% CI)
cDBI=0	20,274	(69.6)	893	(3.1)	7,944	(27.3)	1	(reference)	**1**	(reference)
0<cDBI≤1	14,306	(68.8)	687	(3.3)	5,798	(27.9)	1.11	(1.00, 1.23)	**1.12**	(1.01, 1.24)
1<cDBI≤3	11,051	(66.6)	544	(3.3)	5,005	(30.2)	1.24	(1.12, 1.38)	**1.32**	(1.18, 1.47)
3<cDBI	2,479	(61.2)	125	(3.1)	1,447	(35.7)	1.28	(1.08, 1.52)	**1.52**	(1.28, 1.81)

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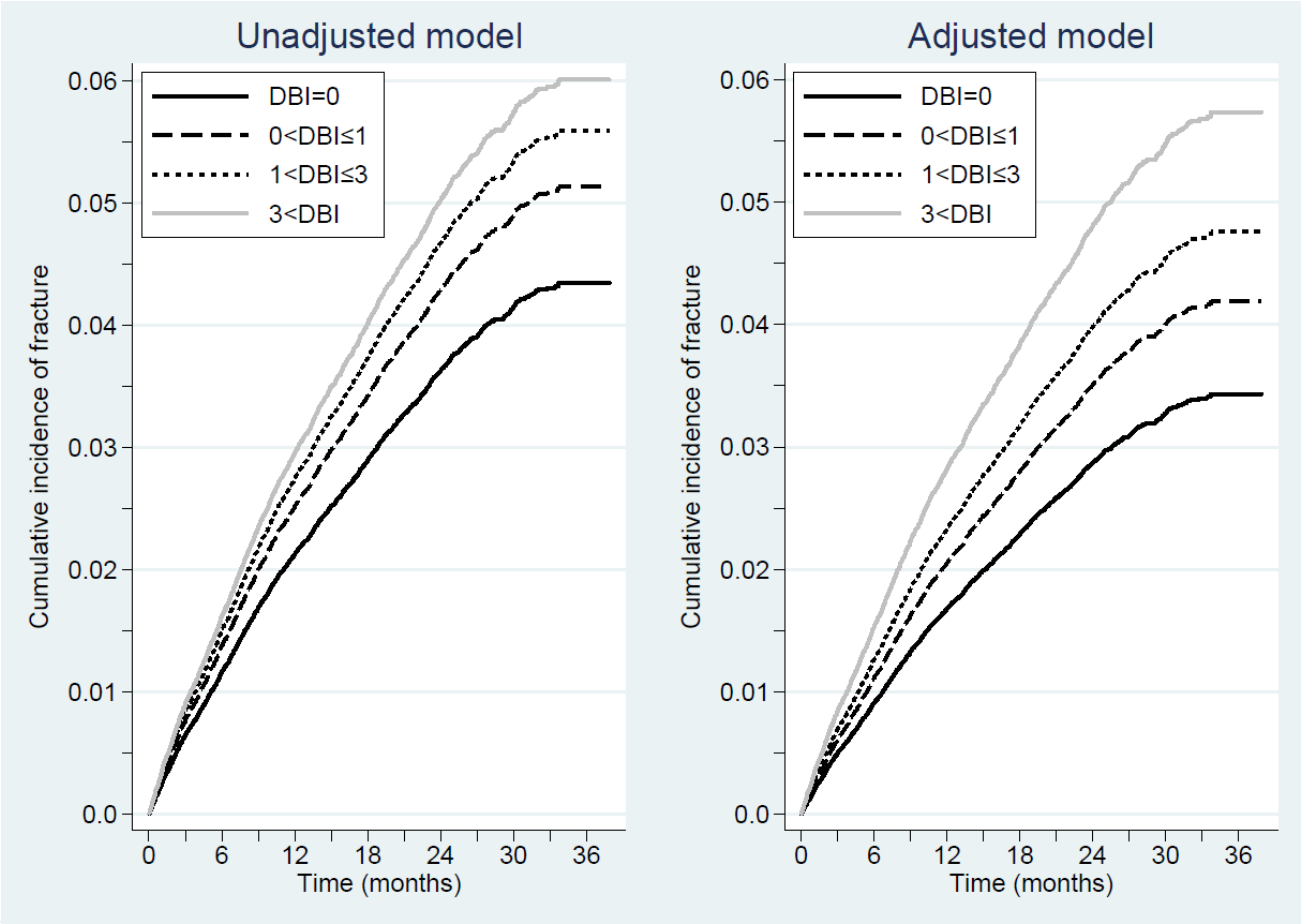
[a] Adjusted for: age, sex, ethnicity, body mass index (BMI), cognitive performance, dementia, congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD), depression, diabetes mellitus, urinary incontinence, alcohol consumption, smoking status, hearing status, vision status, fatigue, mobility, wandering, seasonality (a time covariable), and supplementation of bisphosphonates, vitamin D, and calcium supplementation.

Dose – Response Relationship



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Conclusions

- After taking into account confounding factors, cDBI indicates a hazard for hip fractures, both by cDBI level and by exposure duration.
- De-prescribing based on cDBI is to be researched as an intervention.

Acknowledgements

Hamish A. Jamieson, PhD. (Otago, New Zealand)
Prasad Nishtala, PhD. (Otago, New Zealand)
Richard Scrase, PostGradDip Geront. Nurs. (CDHB, New Zealand)
Joanne M Deely, PhD. (Otago, New Zealand)
Rebecca Abey, MSc. (Otago, New Zealand)
Sarah N. Hilmer, PhD. (Sydney, Australia)
Sarah Berry, MD. (Harvard, USA)
Vincent Mor, PhD. Professor of Medical Science, (Brown, USA)
Philip J. Schluter, PhD. (Canterbury, New Zealand)

† Darrell R. Abernethy, PhD, MD. Drug Safety Office of Clinical Pharmacology FDA, Baltimore, USA.

Aging Well - National Science Challenge
Ministry of Health
Dr. Brigette Meehan and Jason Theobald Technical Advisory Services
Canterbury Healthcare of the Elderly Education Trust
Canterbury District Health Board (CDHB)

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Canadian interRAI Conference 2018

Winner of the Canadian interRAI Conference 2018

INNOVATION AWARD

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inter RAI 2018 Conference

Wellness for Life – A Priority for All

Current Research – New Zealand Frailty Index to identify patients for deprescribing

Presented by: Ulrich Bergler, Research Fellow, University of Otago, New Zealand
Researchers: Dr Hamish A Jamieson, Dr Prasad Nishtala, Rebecca Abey-Nesbit, Dr John Pickering, Dr Derelie Mangin, Dr Philip J. Schluter, Richard Scrase

Introduction

- Currently within the interRAI there is no measure of overall frailty
- Researchers from the University of Queensland, Brisbane developed a frailty index using the acute care interRAI assessment
- The index was derived following a cumulative deficit model
- Our aim was to create a frailty index using similar methods to the Brisbane team, but using questions from the interRAI Home Care assessment

Method

Questions from assessment were selected (51 deficits across 49 variables)

Answers to each question were recoded and assigned a deficit value between 0 and 1

Deficits were added up for each individual and divided by the total number of deficits to get a frailty index

The relationship between frailty level and outcomes such as mortality and entrance to ARC was assessed

Mean frailty level for age, sex and ethnic groups were also assessed

Working on a version that is applicable to the HC and LTC assessments

Results

Mean age of participants was 82.1 years

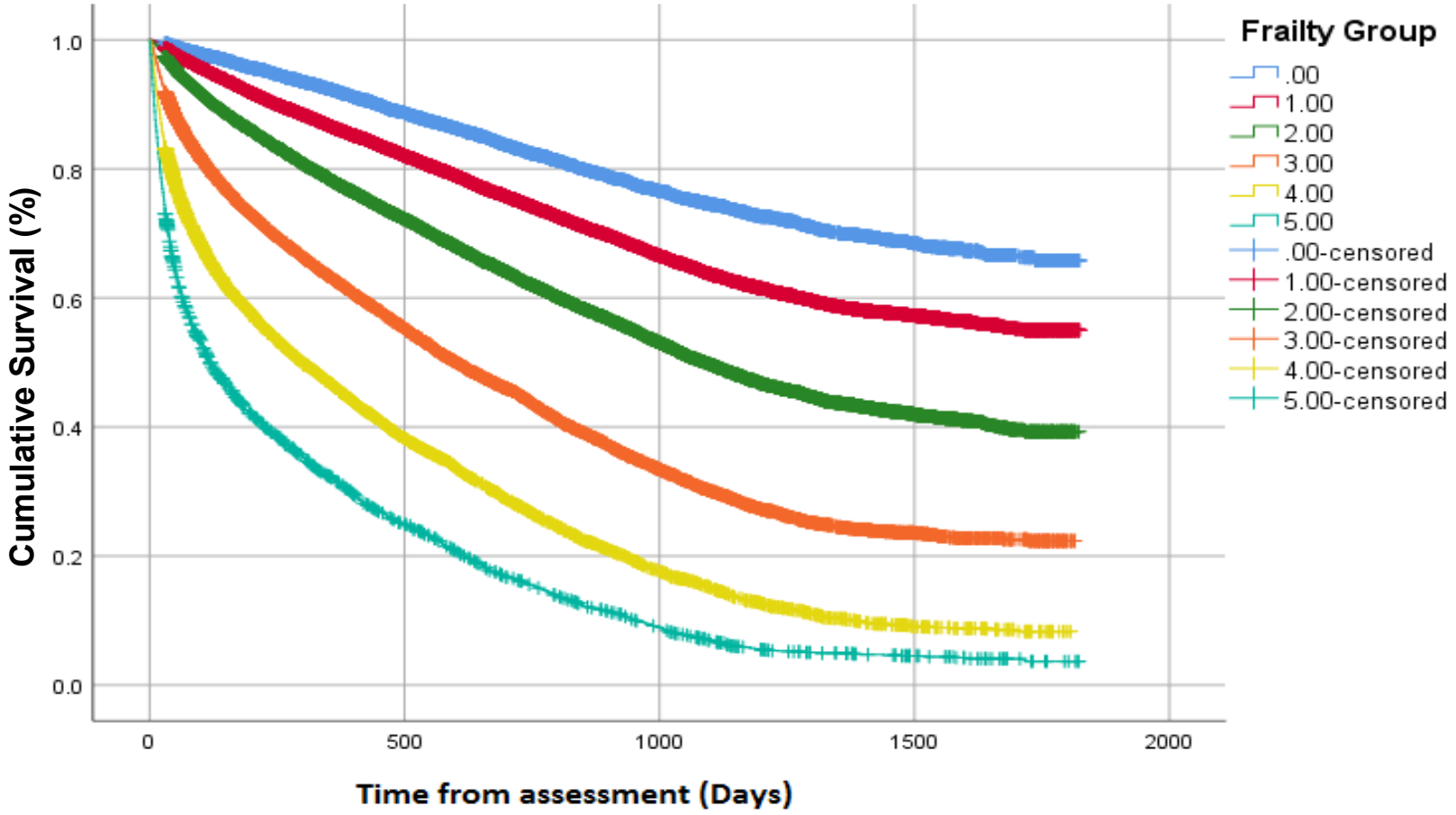
60.2% were female

The average frailty index was 0.22 (Range 0 to 0.79)

Those who had a higher frailty score were more likely to die and those with a lower frailty level were more likely to enter ARC

There were significant differences between mean frailty and age group, sex and different ethnic groups

Frailty and mortality



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Deprescribing RCT

RCT to test deprescribing using DBI and NZ-FI

Pharmacist deprescribing assessment is provided to the patient's GP.

HRC funded project in collaboration with Canterbury District Health Board.

Also involved is the South Canterbury District Health Board.

Aim is to demonstrate the use of the NZ Frailty Index and DBI can be used to identify older adults who could benefit from a deprescribing intervention.

Study has started with expected trial to complete mid 2020.

The influence of social factors on admission to aged residential care facilities in New Zealand

Presented by: Ulrich Bergler, Research Fellow, University of Otago, New Zealand
Researchers: Dr Sally Keeling, Dr Hamish A Jamieson, Rebecca Abey-Nesbit, Ulrich Bergler, Dr Philip J. Schluter, Richard Scrase

Objectives of this research:

Evaluate the influence of social factors on admission to aged residential care (ARC) facilities using the New Zealand database of interRAI™ Home Care assessments.

Constructs

This project explored four key components of “reduced social engagement” identified in research literature:

- Living alone,
- Negative social interactions,
- Perceived loneliness, and
- Carer stress.

Conceptualization of Variables

	Individual's perception	Surrounding environment
Tension	Experiences tension => **Negative Interaction**	Carer experiences stress => **Carer Stress**
Isolation	Experiences isolation => **Perceived Loneliness**	Physical isolation => **Lives Alone**

Lives Alone & Loneliness

	interRAI data used	recoding
	iA12a Living Arrangement	2,3,4,5,6,7,8 => 0 = Lives with others 1 => 1 = Lives alone
	iF1d Loneliness	0 = Not lonely 1 = Lonely

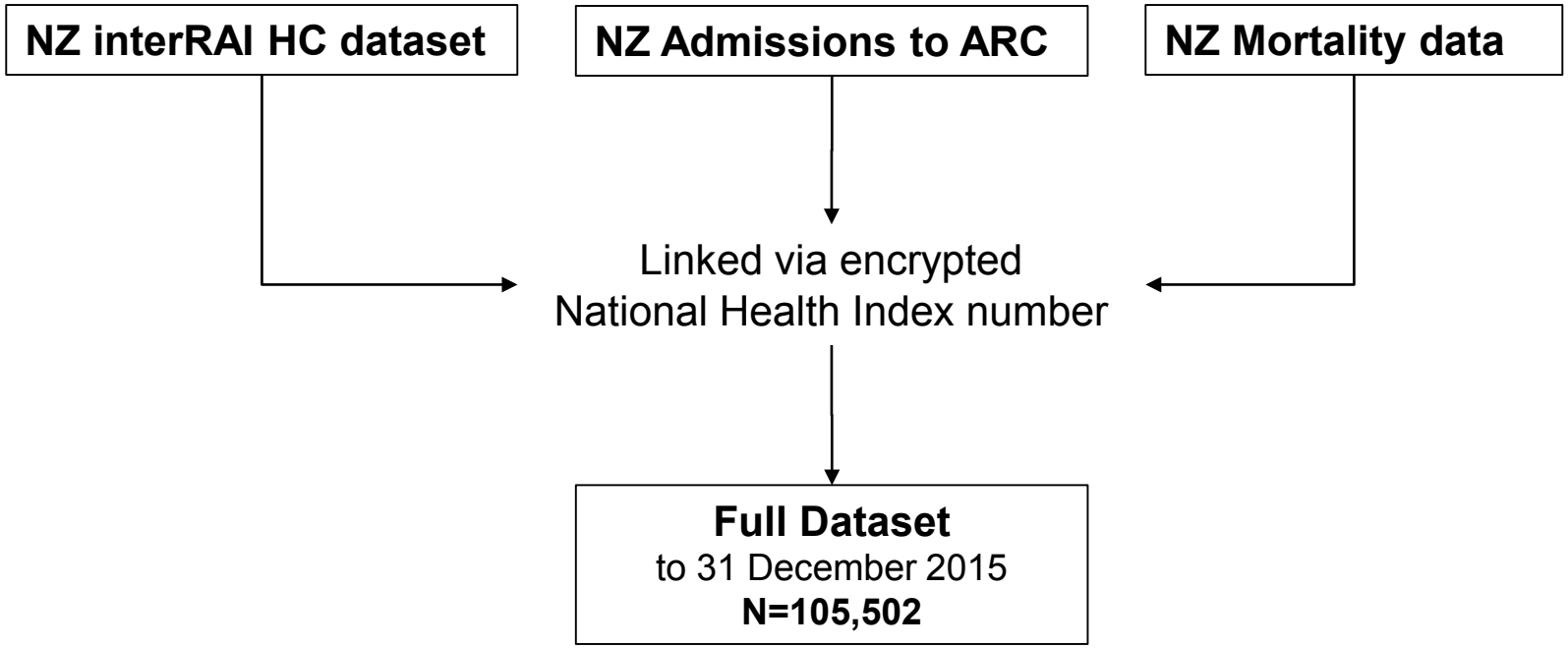
Carer Stress

	interRAI data used	recoding
	iF7d Family / friend feeling overwhelmed by person's illness iP2a Informal helper unable to continue caring activities iP2b Primary informal helper expresses feelings of distress, anger or depression	iF7d = 1 | iP2a = 1 | iP2b = 1 => 1 = Carer stress all others =>0 = No carer stress

Negative Interaction

	interRAI data used	recoding
	iF1e conflict or anger with family or friend iF1f fearful of family member iF1g neglected – abused – mistreated	iF1e > 0 | iF1f > 0 | iF1g > 0 => 1 = Negative interaction occurred, all other => 0 = No negative interaction

Research data



Statistical Analyses

- Descriptive statistics in SPPS v23
- Competing Risk Regression Analysis in Stata IC v14.2

  with controlling for age, gender, ethnicity, cognitive impairment, Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL), continence, living alone, timed walk, falls, and depression.

Associations of all four social variables

	Loneliness	Negative Interaction	Carer Stress
Negative Interaction	0.06	1	
Carer Stress	0.01	0.16	1
Lives Alone	0.19	-0.06	-0.22

Φ test for strength of association, $p<0.001$

Key Outcome - Competing risk regression hazard

	Unadjusted Model		Adjusted model*	
	Subhazard Ratio	(95% CI)	Subhazard Ratio	(95% CI)
NO	1	Reference	1	Reference
YES				
Living Alone	0.86	(0.83, 0.89)	**1.43**	(1.37, 1.50)
Carer Stress	1.52	(1.47, 1.58)	**1.28**	(1.23, 1.34)
Negative Interaction	1.31	(1.24, 1.38)	**1.22**	(1.15, 1.30)
Loneliness	1.20	(1.15, 1.25)	**1.18**	(1.13, 1.24)

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* Controlled for age, gender, ethnicity, cognitive impairment, Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL), continence, living alone, timed walk, falls, and depression.

Conclusions

- Living Alone and Loneliness are hazard factor leading to increased admission to ARC.
- Living Alone and Loneliness are independent factors.
- Carer Stress and Negative Interaction as operationalized from interRAI HC data are strong hazards for admission to ARC.
- All four predictors allow interventions to be developed and applied.
- Interactions between variables warrant further analysis.

Acknowledgements

Dr. Hamish A Jamieson (CDHB & UO) & Dr. Sally Keeling (UO) - Co Principal Investigators
Rebecca Abey-Nesbit MsC (CDHB)
Ulrich Bergler MsC (UO)
Prof. Dr. Philip J. Schluter (UC)
Richard Scrase (CDHB)
Dr. Brigette Meehan and Jason Theobald (TAS)

Aging Well - National Science Challenge
Canterbury Healthcare of the Elderly Education Trust
Canterbury District Health Board – CDHB

Uli Anderson (TAS)

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