Supplementary Material

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Hospital Frailty Risk Score (HFRS)

The HFRS it is a well-validated score derived from routinely collected hospital administration data. It is a weighted sum of 109 three-character ICD-10 diagnostic codes present in a patient's records over the preceding two years. In the validation study, the HFRS ranged from zero to 99 (mean (SD) 9.0 (8.7)) The HFRS is categorized into low risk (<5), intermediate risk (5-15) and high risk (>15).

Diagnostic codes used to calculate the HFRS include infection, cerebrovascular disease, frailty syndromes (such as falls, cognitive impairment and fractures). Rather than including the full list of 109 codes here or in the manuscript, we kindly refer the editors to the list available open access at:

Development and validation of a Hospital Frailty Risk Score focusing on older people in acute care settings using electronic hospital records: an observational study - The Lancet

Table 1: ICD-10 codes for prevalent dementia (for exclusion)

Prevalent dementia (for exclusion)	
F00.0	Dementia in Alzheimer's disease with early onset
F00.1	Dementia in Alzheimer's disease with late onset
F00.2	Dementia in Alzheimer's disease, atypical or mixed type
F00.9	Dementia in Alzheimer's disease, unspecified
G30.0	Alzheimer's disease with early onset
G30.1	Alzheimer's disease with late onset
G30.8	Other Alzheimer's disease
G30.9	Alzheimer's disease, unspecified
F01.0	Vascular dementia of acute onset
F01.1	Multi-infarct dementia
F01.2	Subcortical vascular dementia
F01.3	Mixed cortical and subcortical vascular dementia
F01.8	Other vascular dementia

F01.9	Vascular dementia, unspecified
I67.3	Binswanger disease
F02.0	Dementia in Pick disease
F02.1	Dementia in Creutzfeldt-Jakob disease
F02.2	Dementia in Huntington disease
F02.3	Dementia in Parkinson's disease
F02.4	Dementia in HIV
F02.8	Dementia in other specified disease classified elsewhere
F10.6	Mental and behavioural disorders due to use of alcohol, amnesic syndrome
F10.7	Mental and behavioural disorders due to use of alcohol, residual and late-onset psychotic disorder (alcoholic dementia NOS etc)
A81.0	Creutzfeldt-Jakob disease
F03	Unspecified dementia
F05.1	Delirium superimposed on dementia
G31.0	Circumscribed brain atrophy
G31.1	Senile degeneration of the brain, not elsewhere classified
G31.8	Other specified degenerative diseases of the nervous system

Table 2: ICD-10 codes for delirium

Delirium	
F05.0	Delirium not superimposed on dementia, so described
F05.8	Other delirium
F05.9	Delirium, unspecified
R41.0	Disorientation, unspecified 'Confusion NOS'

Table 3: Forty ICD-10 codes most commonly recorded as primary diagnoses for the total eligible sample (*N* = 626,467)

Rank	**ICD-10 code**	**Count**	**Proportion**	**Diagnosis**
1	H26.9	53909	8.61	Cataracts
2	M17.1	13547	2.16	Osteoarthritis of the knee
3	J18.9	9524	1.52	Pneumonia
4	N39.0	9521	1.52	Urinary tract infection
5	R07.4	8010	1.28	Chest pain
6	I48	7377	1.18	Atrial fibrillation and flutter
7	K92.2	7280	1.16	Gastrointestinal haemorrhage
8	M16.1	7279	1.16	Osteoarthritis of the hip
9	Z50.9	7096	1.13	Rehabilitation
10	Z09.0	6874	1.1	Follow-up after surgery
11	C44.3	6728	1.07	Skin cancer of the face
12	R55	6571	1.05	Syncope and collapse
13	Z08.0	6121	0.98	Follow-up after surgery for cancer
14	Z12.1	5889	0.94	Screening for cancer of gastrointestinal tract
15	I21.4	5717	0.91	Acute subendocardial myocardial infarction
16	I25.11	5280	0.84	Atherosclerotic heart disease
17	I50.0	5224	0.83	Congestive heart failure
18	C61	5194	0.83	Prostate cancer
19	R19.5	5160	0.82	Other faecal abnormalities
20	J44.0	5021	0.8	COPD with acute lower respiratory tract infection
21	K40.90	4983	0.8	Inguinal hernia without obstruction or gangrene
22	N40	4919	0.79	Hyperplasia of prostate
23	G56.0	4693	0.75	Carpal tunnel syndrome
24	K57.30	4565	0.73	Diverticular disease without abscess or perforation
25	K21.9	4087	0.65	Gastro-oesophageal disease with oesophagitis
26	I20.0	4033	0.64	Unstable angina
27	A09.9	3947	0.63	Gastroenteritis/colitis

28	L03.11	3893	0.62	Cellulitis of other part of limb
29	E11.39	3879	0.62	Type 2 Diabetes Mellitus
30	G45.9	3870	0.62	Transient Ischaemic Attack
31	K63.58	3827	0.61	Polyp of the colon
32	I20.9	3556	0.57	Angina
33	D50.9	3546	0.57	Iron deficiency anaemia
34	R10.4	3492	0.56	Abdominal pain
35	K59.0	3378	0.54	Constipation
36	I63.9	3368	0.54	Cerebral infarction
37	R19.4	3346	0.53	Change in bowel habit
38	S72.03	3250	0.52	Fractured neck of femur
39	J22	3162	0.5	Acute lower respiratory tract infection
40	R31	3033	0.4	Haematuria

Table 4: ICD-10 codes for incident dementia

New (Incident) Dementia – outcome data	
F00.1	Dementia in Alzheimer's disease with late onset
F00.2	Dementia in Alzheimer's disease, atypical or mixed type
F00.9	Dementia in Alzheimer's disease, unspecified
G30.1	Alzheimer's disease with late onset
G30.8	Other Alzheimer's disease
G30.9	Alzheimer's disease, unspecified
F01.0	Vascular dementia of acute onset
F01.1	Multi-infarct dementia
F01.2	Subcortical vascular dementia
F01.3	Mixed cortical and subcortical vascular dementia
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F01.9	Vascular dementia, unspecified
I67.3	Binswanger disease
F02.0	Dementia in Pick disease
F02.3	Dementia in Parkinson's disease
F03	Unspecified dementia
F05.1	Delirium superimposed on dementia
G31.0	Circumscribed brain atrophy
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Supplementary Analysis – Associations using a 24-month landmark period

Table 5: Delirium episodes and the occurrence of death and dementia using a 24-month landmark period

Outcome	Statistic	Sample	Delirium episodes in landmark period			
			0	1	2	3+
Death	Number at risk	Total	38,940	24,736	7,166	4,315
		Men	17,909	11,487	3,074	1,832
		Women	21,031	13,249	4,092	2,483
	Number of events	Total	12,561	9,789	3,712	2,602
		Men	5,801	4,590	1,634	1,142
		Women	6,760	5,199	2,078	1,460
	Person-years of follow-up	Total	105,364.2	63,763.6	16,697.6	9,273.7
		Men	48,276.7	29,504.1	7,025.0	3,786.3
		Women	57,087.5	34,259.5	9,672.6	5,487.4
	Incidence rate per 100 person-years	Total	11.9	15.4	22.2	28.1
		Men	12.0	15.6	23.3	30.2
		Women	11.8	15.2	21.5	26.6
Dementia	Number at risk	Total	37,859	22,814	6,070	3,252
		Men	17,492	10,719	2,625	1,402
		Women	20,367	12,095	3,445	1,850
	Number of events	Total	2,858	4,239	1,610	1,003
		Men	1,199	1,928	690	444
		Women	1,659	2,311	920	559
	Person-years of follow-up	Total	100,727.8	55,901.8	13,136.2	6,392.0
		Men	46,553.6	26,444.4	5,678.7	2,694.1
		Women	54,174.3	29,457.4	7,457.5	3,697.8
	Incidence rate per 100 person-years	Total	2.8	7.6	12.3	15.7
		Men	2.6	7.3	12.2	16.5
		Women	3.1	7.8	12.3	15.1

Note: Person-years of follow-up was calculated as observation time subsequent to the landmark period.

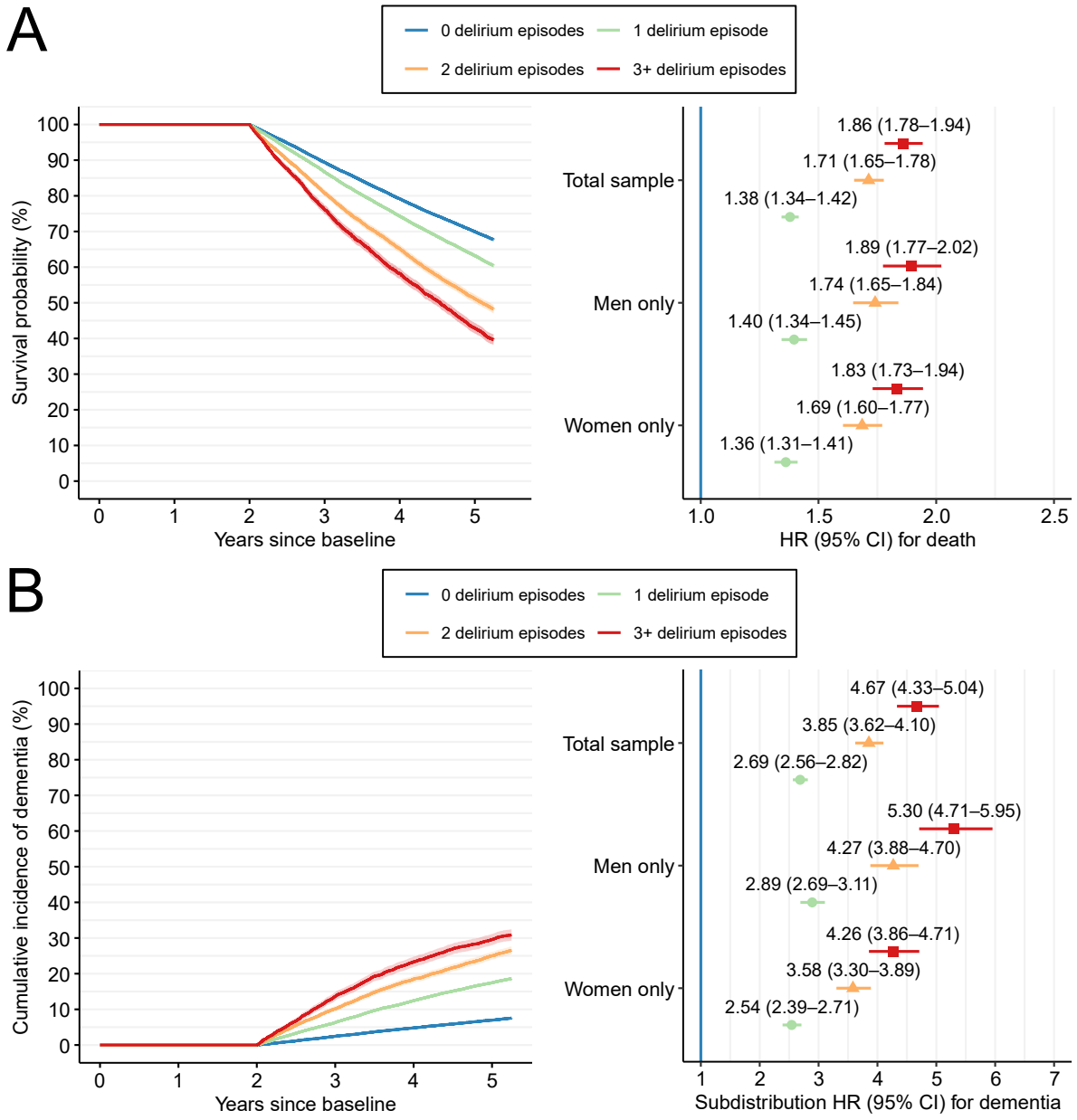


Figure 1A and B. Association of delirium episodes recorded within a 24-month landmark period with (A) death and (B) dementia. Associations presented in forest plots were adjusted for age and gender at baseline, as well as number of hospital episodes recorded within the landmark period.

Supplementary Analysis – Associations in the total eligible cohort (*N* = 626,467)

Table 6: Delirium and the occurrence of death and dementia in the total eligible cohort (*N* = 626,467)

Outcome	Statistic	Sample	No delirium group	Delirium group
Death	Number at risk	Total	571,256	55,211
		Men	260,091	26,339
		Women	311,165	28,872
	Number of events	Total	100,757	35,377
		Men	47,731	17,403
		Women	53,026	17,974
	Person-years of follow-up	Total	2,731,698.5	171,404.3
		Men	1,237,326.0	77,862.0
		Women	1,494,372.5	93,542.3
	Incidence rate per 100 person-years	Total	3.7	20.6
		Men	3.9	22.4
		Women	3.5	19.2
Dementia	Number at risk	Total	571,256	55,211
		Men	260,091	26,339
		Women	311,165	28,872
	Number of events	Total	33,505	13,966
		Men	13,390	6,219
		Women	20,115	7,747
	Person-years of follow-up	Total	2,683,183.2	151,842.2
		Men	1,220,331.5	70,195.7
		Women	1,462,851.7	81,646.5
	Incidence rate per 100 person-years	Total	1.2	9.2
		Men	1.1	8.9
		Women	1.4	9.5

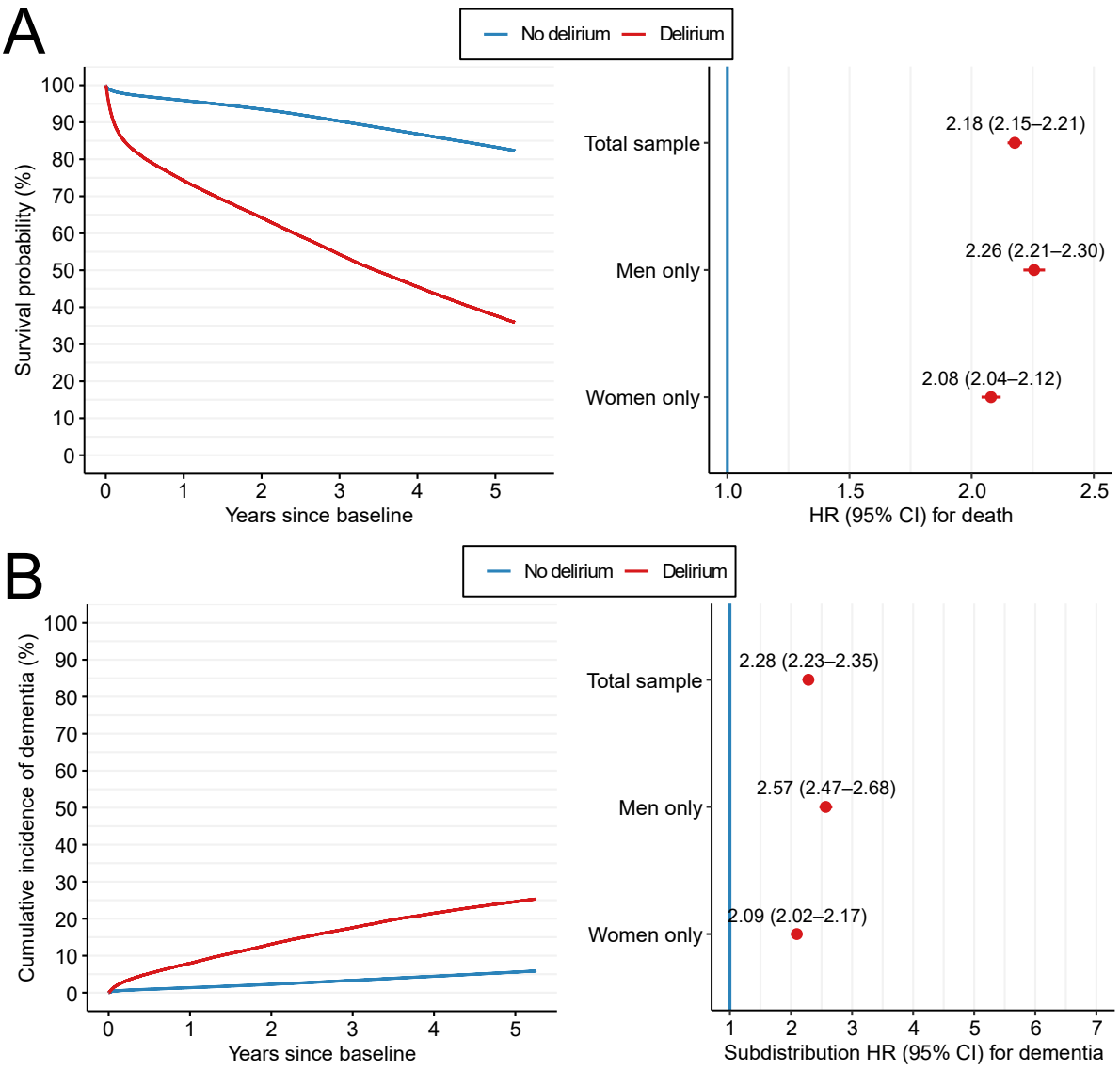
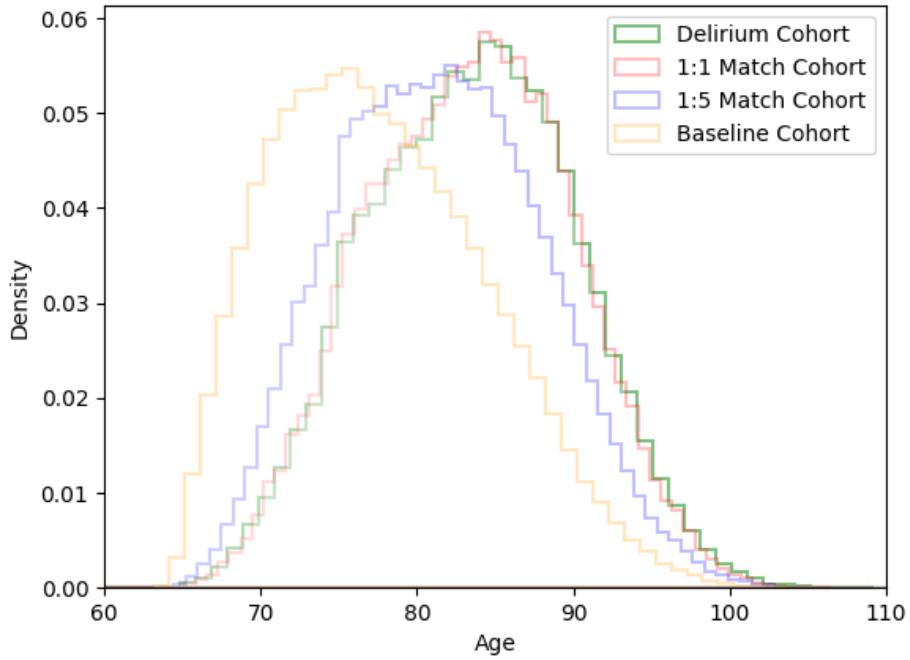


Figure 2A and 2B. Association of baseline delirium group with (A) death and (B) dementia. Associations presented in forest plots were adjusted for age, gender, Hospital Frailty Risk Score, primary diagnosis ICD-10 category, episode length of stay, and ICU length of stay.

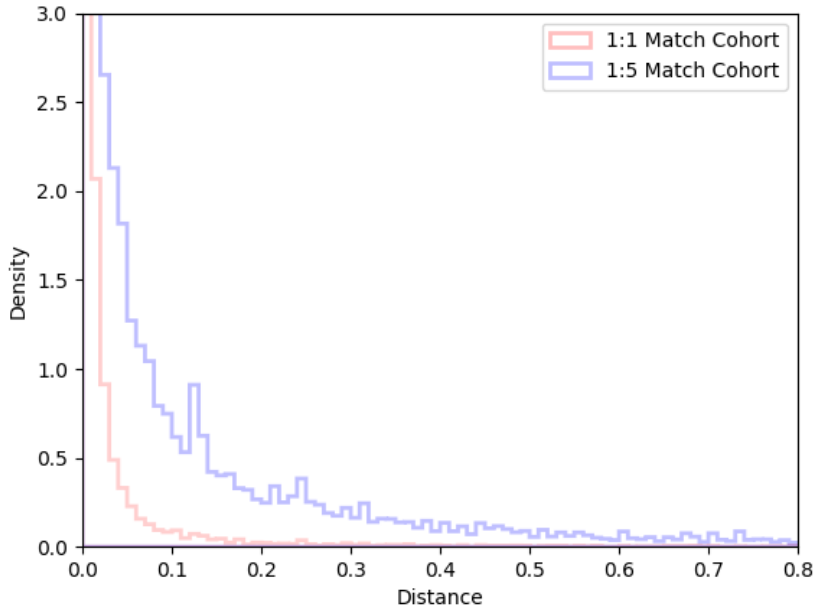
Figure 3A and 3B: Density plots of 1:1 and 1:5 matching for delirium and no delirium groups for A) age and B) overall matching distance.

A:



Note: baseline cohort = total eligible sample (N = 626,467)

B:



STROBE Statement Checklist

	Item No	Recommendation	Manuscript Page/s
Title and abstract			
	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1, 2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study design	4	Present key elements of study design early in the paper	3, 4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3-5
Participants	6	(*a*) *Cohort study* Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	4, 5
		(*b*) *Cohort study* For matched studies, give matching criteria and number of exposed and unexposed	4
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4,5
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement).	4,5

	Item No	Recommendation	Manuscript Page/s
		Describe comparability of assessment methods if there is more than one group	
Bias	9	Describe any efforts to address potential sources of bias	5, 6
Study size	10	Explain how the study size was arrived at	4, 5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	5, 6
		(*b*) Describe any methods used to examine subgroups and interactions	5, 6
		(*c*) Explain how missing data were addressed	NA
		(*d*) *Cohort study* If applicable, explain how loss to follow-up was addressed	5, 6
		(*e*) Describe any sensitivity analyses	5, 6
Results			
Participants	13*	(*a*) Report numbers of individuals at each stage of study eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	4, 5
		(*b*) Give reasons for non-participation at each stage	NA
		(*c*) Consider use of a flow diagram	5
Descriptive data	14*	(*a*)Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7, 8
		(*b*) Indicate number of participants with missing	NA

	Item No	Recommendation	Manuscript Page/s
		data for each variable of interest	
		(*c*) *Cohort study* Summarise follow-up time (eg average and total amount)	9
Outcome data	15*	*Cohort study* Report numbers of outcome events or summary measures over time	9
Main results	16	(*a*) Report the numbers of individuals at each stage of the study eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	4-9
		(*b*) Give reasons for non-participation at each stage	NA
		(*c*) Consider use of a flow diagram	5
Other analyses	17	Report other analyses done eg analyses of subgroups and interactions, and sensitivity analyses	10,11
Discussion			
Key results	18	Summarise key results with reference to study objectives	11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	14
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	15
Generalisability	21	Discuss the generalisability (external validity) of the study results	14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original	17

	Item No	Recommendation	Manuscript Page/s
		study on which the present article is based	