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Dementia and road traffic accidents among non-institutionalized older people in Denmark

- A Danish register-based nested case-control study

Jindong Ding Petersen[1,2*] Volkert Dirk Siersma[3], René dePont Christensen[1], Maria Munch Storsveen[1], Connie Thurøe Nielsen[2], Mikkel Vass[3], Frans Boch Waldorff[1]

[1]Research Unit for General Practice, Department of Public Health, University of Southern Denmark, Odense, Denmark.

[2] Department of Mental Health Vejle, Mental Health Services in the Region of Southern Denmark, Vejle, Denmark

[3]Research Unit for General Practice and Section of General Practice, Department of Public Health, University of Copenhagen, Copenhagen, Denmark

*Corresponding author, Research Unit for General Practice, Department of Public Health, University of Southern Denmark, J.B. Winsløws Vej 9, 5000 Odense C, Denmark. Phone: +45 65509531. Email: jindong@health.sdu.dk

Abstract

Aim

We used register-based data to estimate the effect of all-type dementia on road traffic accidents (RTAs) risk, combined with comorbidities or sedative medicines, among non-institutionalized older people in Denmark.

Methodology

The source population was all residents in Denmark aged 65 years and older, alive as of January 1, 2008 (n=853,228). Cases were those who had any type of RTA in 2009-2014. Each case was matched for age, sex and geographic location to four to six controls. All-type dementia was ascertained using ICD-10 diagnosis supplemented with prescribed medicine records. Eight chronic diseases were selected to assess comorbidities. Four types of medicines were categorized as sedative medicines for analysis. Conditional logistic regression with adjustment for education and marital status as well as either the number of comorbidities or sedative medication use was performed using STATA software.

Results

Older people with dementia had lower RTAs risk compared to their controls [OR=0.43, 95%CI (0.32-0.60), p<0.001]. Significant interaction was observed between dementia and the number of comorbidities for RTAs estimation.

Conclusions

The significantly lower RTAs risk for older individuals with dementia observed in our study may be due to people with dementia living at home having a lower frequency of outdoor activities, i.e., less exposure to traffic. However, this together with interaction between dementia and comorbidities as well as sedative medications should be investigated further.

Key words

Dementia; road traffic accident; elderly; comorbidity; sedative medicine; public health.

Word count: **3510**

Introduction

Worldwide, about 1.25 million people die and about 20-50 million more are injured each year due to road traffic accidents (RTAs) [1]. Although young people constitute the vast majority of RTAs, older people are more affected by injuries that result in higher fatality rates and higher healthcare usage [2]. As the population ages, older people comprise a greater proportion of road users, for example, as drivers of cars and bicycles, and as pedestrians, which raises public health and safety concerns.

Many factors may contribute to cause RTAs in older people. Age in itself is an important factor, but other factors, such as environmental conditions and chronic diseases, also contribute [3]. An example of the latter is dementia, a neurodegenerative chronic disease which impairs neural functions involved in memory, perception, attention, vision, balance, speed and problem solving, impairments which are important risk factors related to RTAs [4]. As there will be a projected 135 million people suffering from dementia globally by 2050, identifying their risk for RTAs therefore has important implications for health policy and society at large [5].

However, the risk of RTAs for people with dementia remains unclear. Some studies have used driving simulators or caregiver reports and demonstrated that patients with mild dementia, specifically mild Alzheimer's disease (AD), may still be capable of driving safely [6]. Other studies used register reports: one concluded that drivers with dementia may have a higher risk of crashes [7], but two others did not find any significant association [8, 9]. While people with dementia reported (or their caregivers reported) that they still had the capacity to drive, a relatively small proportion of them are on the road [10], and we have not yet identified studies of the risk of RTAs for general road users with dementia.

Comorbidities and use of multiple medications are common among older people with dementia [11, 12]. Various chronic diseases have been identified as risk factors for the development and deterioration of dementia and for accidents [13-15]. Multiple medications, especially sedatives such as antipsychotics, are also related to both dementia and accidents, given that use of such medicines can impair cognition, motor function, and vision [16, 17]. Clearly, dementia concurrent with comorbidities or sedative medications may indicate excess risk for RTAs among the elderly. However, to date, those issues have not been well studied on a national level.

Aim of the study

Using register-based data, this study aimed to identify the RTAs risk for all types of road users due to all-type dementia, combined with comorbidities or sedative medicines, among the non-institutionalized older Danish population.

Methods

Data source

The data for this population-based nested case-control study were extracted from several Danish national registers. Using the unique Civil Registration System (CPR) number assigned to each individual at birth, or to persons who hold a Danish residence permit upon immigration, all national registers can be linked at an individual level. A description of each register used in this study is detailed elsewhere [18]. In brief:

1. The Danish Civil Registration System (CPR) records name, sex, date of birth, home address, marital status and other basic information for all residents of Denmark since 1968.

2. The Danish National Patient Registry (DNPR) contains primary and secondary diagnoses, and inpatient, outpatient, and emergency department contacts of all Danish residents registered from 1995 onward. The International Classification of Diseases version 10 (ICD-10) codes were used in Denmark for disease diagnosis identification records beginning January 1, 1994.
3. The Danish Psychiatric Central Research Register (PCRR) contains inpatient and outpatient psychiatric contacts since 1995.
4. The Danish National Prescription Registry (LMDB) contains nationwide individual-level data on all prescription drugs retrieved from Danish community pharmacies and nursing homes from 1995 onward. The date of dispensing and the dose of the prescribed drugs are recorded in the register using the corresponding Anatomical Therapeutic Chemical (ATC) codes. All drugs are assigned a defined daily dose (DDD) by the World Health Organization (WHO) representing the assumed average maintenance dose per day for a drug used for its main indication in adults.
5. The Population Education Register (PER) includes all individuals receiving education in Denmark, including people who have immigrated to Denmark, and contains information on individuals' highest completed education.
6. The Nursing Home Register (AEPI) contains a yearly indicator, gauged by Statistics Denmark (DST) from peripheral data, of whether a person is a resident of a nursing home.

Study design and population

The source population of this study was all residents in Denmark aged 65 years and older, alive as of January 1, 2008 (n=853,228) using data from the CPR.

Cases

Cases were defined as individuals in the source population who experienced an RTA (any type) between January 1, 2009 and December 31, 2014 (2009-2014) registered in the DNPR with any diagnosis representing a road traffic accident-related injury (ICD-10 codes: DV00-DV89, DV98-DV99). The first date of accident registered in this period was defined as the index date.

Cases were excluded from the study if they: (1) had an RTA between January 1, 2008 and December 31, 2008, (2) resided in a nursing home when the RTA occurred, or (3) were drivers recorded as driving under the influence of alcohol. Furthermore, any second RTA occurring after the first RTA for a case was not included as a second case in the study.

Controls

For each case, four to six controls matched on age, sex and geographic location were selected from the source population by risk-set matching, i.e. any subject is eligible for sampling as a control up until they become a case, and subjects can be sampled as controls for more than one case. Controls were those without an RTA before the case's index date and also not living in a nursing home.

The geographic location of an individual was categorized as one of three groups: large city (Copenhagen and Frederiksberg), medium-sized city (Aarhus, Odense, Aalborg, Esbjerg, Randers, and Kolding), and small cities/rural areas (all other locations except large and medium size cities).

Dementia assessment

An individual was identified with dementia if they met at least one of the following criteria: (1) a dementia diagnosis as the primary or secondary diagnosis in the DNPR or the PCRR (ICD-10 codes: F00.0, F00.1, F00.2, F00.9, G30.0, G30.1, G30.8, G30.9, F01.0, F01.1, F01.2,

F01.3, F01.8, F01.9, F02.0, G31.83, F02.08, F03.9), and/or (2) at least one anti-dementia drug registration in the LMDB (ATC: N06DA01, N06DA02, N06DA03, N06DA04, N06DX01).

Subjects lacking a dementia registration in the DNPR but with a redeemed prescription of an anti-dementia drug in the LMDB were also defined as dementia patients.

To ensure that dementia (exposure) occurred before the date of RTA (outcome), the date of dementia diagnosis or the first redeemed prescription of an anti-dementia drug in the registers had to be before the subject's index date of RTA.

Comorbidity assessment

Comorbidity was assessed by the presence of one or more of eight chronic diseases including type 2 diabetes (T2D) (ICD-10 code: E11), chronic obstructive pulmonary disease (COPD) (ICD-10 codes: J40-J44), ischemic heart disease (IHD) (ICD-10 codes: I20–I25), depression (ICD-10 codes: F32-F33), hypertension (ID-10 codes: I10, I15), stroke (ICD-10 codes: I60-I69), atrial fibrillation (AF) (ICD-10 code: I48), and asthma (ICD-10 code: J45), which are all common among the elderly Danish population [19]. This was aggregated into four categories: 0, 1, 2, or 3 or more (3+) comorbidities.

The identification of chronic diseases was performed similar to the identification of dementia as described as above and in greater detail elsewhere [18].

Sedative medicine

Sedative medicine was defined as the intake of any of four types of medicines: sleeping medicine (ATC: N05C), antipsychotic medicine (ATC: N05A), anti-anxiety medicine (ATC: N05B), and antidepressants (ATC: N06A). For the main analysis, we grouped these medications into three categories: 0, 1, or 2 or more (2+) of any combination of these four types of sedative medicines.

Because sedative medicine has a short half-life, the treatment duration of any of these medicines had to cover the time period 72 hours before the RTA index time for a person to be considered to be on this medicine at the time of the RTA.

We used three indicators registered in the LMDB for this 72-hour interval calculation: the DDD, the number of packages including the number of pills per package, and the date of redemption. One DDD was assumed as one treatment day (24 hours). We chose the 72-hour interval (half-life ranged from 0-72 hours) in order to cover long-acting benzodiazepines

Other covariates

Education levels were grouped in the following categories according to the highest education level in years from the PER: low education (<10 years), medium education (10-12 years), and higher education (>12 years). From the CPR records, marital status was also assessed and grouped into four categories: married (including partnership or cohabitation), divorced (including dissolved partnership), widowed (including partner deceased), and unmarried.

Statistical analyses

The frequency (%) and/or median (range) of socio-demographic characteristics, pre-existing chronic diseases and medications of the groups of cases and controls were summarized as of January 1, 2009. Since a number of controls (n=29) also became cases, we also summarized the total samples.

Using conditional (fixed effects) logistic regression conditioned on the risk sets, odds ratios (ORs) with corresponding 95% confidence intervals (95% CIs) were calculated as the measure of risk of RTAs related to dementia with adjustment for education, marital status, and the number of comorbidities or sedative medicines. All variables used for the main analysis were assessed on the index date of RTA. We tested for interaction between dementia and comorbidities as well as dementia and sedative medicines.

All statistical tests were two-sided and used a significance level of 5%. STATA 14 (Stata Corporation, College Station, TX, USA) was used for all statistical analysis.

Ethical consideration

The Danish Data Protection Agency granted permission for the study data and reviewed ethical considerations (J.no. 2016-41-4674).

Results

The characteristics of cases and controls

Table 1 shows the characteristics of 3,211 cases and 12,527 matched controls on January 1, 2009. In general, individuals who were divorced, widowed or never married represented higher numbers within the case population (12.2%, 24.8%, 5.6%, resp.) than controls (10.3, 22.6, 5.0%, resp.), and there were more individuals with higher education in cases than controls (19.3% vs 17.2%, resp.).

The median number of comorbidities was similar in cases and controls, but slightly more controls had 2 (59.0%) or 3+ chronic diseases (16.2%). There were also more individuals with 2 or 3+ sedative medicines in controls (1.7% and 6.3%, resp.) than in cases (1.2% and 5.1% resp.).

On January 1, 2009, a total of 0.6% of cases had dementia, while 1.2% of controls had dementia. Of other chronic diseases, both cases and controls had distributions similar to the total sample. More controls had hypertension (65.3%) than cases (63.2%), but more cases had IHD (69.0%) than controls (65.3%).

Dementia and RTAs

On the index date, 43 and 378 individuals had dementia in the case and control populations, respectively. Compared to people without dementia, individuals with dementia had a 57% lower risk of RTA [OR=0.43, 95%CI (0.32-0.60), p<0.001] adjusted for education, marital status and comorbidities (Table 2).

A significant interaction between dementia and the number of comorbidities was observed (interaction p=0.0032). We further analysed the interaction effect and found a lower RTA risk with zero comorbidity (OR=0.38), and a large increased RTA risk with one comorbidity (OR=1.48); however, with two or more (2+) comorbidities, the effect vanished (OR=0.96).

By adjusting for the sedative medications instead of the comorbidity, the RTAs risk for dementia remained the same [OR=0.43, 95%CI (0.31-0.59), p<0.001] (Table 3). However, older people who had taken one or more sedative medicines had a higher RTA risk as compared to those who had not taken such medicines. No significant interaction was observed between dementia and the use of the sedative medicines for the effect of RTAs (p>0.05).

Discussion

Using register data, this study assessed non-institutionalized Danish older people and found a 57% lower RTA risk in people with dementia compared to their matched controls. This finding was contradictory to what we had hypothesized [18]. However, our result cannot be interpreted as indicative of a protective effect for RTAs, and may instead relate to lower rates of daily outdoor activity among the population of dementia patients living at home.

Epidemiology studies measuring the exact frequency of daily outdoor activities for home-dwelling patients with dementia are sparse. A Danish study using a caregiver questionnaire reported that among patients living at home with mild AD, fewer than 40% visited others or

had social activities outside their home more than once per week, and nearly 30% never left their home for social activities [20].

Another study used semi-structured interviews with 22 people with early to moderate dementia and their caregivers and also reported that dementia impacts the frequency of outdoor activity, and limits both the time (to less than one hour) and the areas visited to those that were most familiar, for instance, supermarkets [21].

Furthermore, a study using an infrared sensor to measure the outdoor activity of people with dementia over a period of one year indicated a significantly lower number of outings compared to the control group of people without dementia (8.8 vs. 17.3, $p<0.01$) [22].

Although dementia is associated with impaired cognitive functions, communication deficits, and other emotional and behavioural changes which may influence social relations, caregivers' emotional reactions and the stress of safely caring for such patients may also be a reason for limiting the frequency of outdoor activities of patients [23]. A study has also suggested that people with dementia may voluntarily restrict their mobility under some circumstances, as possibly due to the nature of the disease they may lose interest in previously enjoyable activities; hence, withdrawal from such activities may even be a symptom or precursor of dementia [24]. In addition, sufficient social supports may also have an effect on RTAs risk in Denmark. An example is the home visits by health professionals provided to patients at no cost, which may result in decreased exposure to traffic between home and health clinics or hospitals.

Research on RTAs risk for older people with dementia on a national level has rarely been conducted. In a study among older Australian citizens [25], Meuleners and Hobday observed that older people with dementia experienced fewer transport-related injuries (2.6%) than those without dementia (5.6%), which is in accordance with our study. However, the Australian study did not analyse the injury risk by dementia alone, as in our study.

In addition to the studies discussed above, the majority of other studies have investigated the risk of being a driver with dementia and the risk for RTAs. A systematic review of 23 studies revealed that although drivers with dementia were poor performers in driving skills that were either tested or reported, they did not actually result in higher crash rates [26]. Notably, many of the studies included in this review used either driving stimulators or caregiver reports for measuring crashes; register-based crash report data has seldom been studied. We used real-life RTA cases that were registered in the hospital emergency room system, a method which allowed us to include older people not only as drivers but also as pedestrians, passengers, and other road users in Denmark from 2009-2014.

In terms of comorbidity, we found significant interaction between dementia and comorbidities for effect on RTAs. Comparing people with zero and one comorbidity, the interaction effect was significantly different: a lower RTA risk with zero comorbidity (OR=0.38) and a large increase for RTA risk with one comorbidity (OR=1.48); and then, as mentioned above, this interaction effect vanished for those with two or more (2+) comorbidities (OR=0.96). Using our dataset, we were unable to explain this finding, as we had expected that an increase in the number of comorbidities would result in an even lower risk of RTAs due to greater restrictions on mobility for those with several comorbidities and hence a lower chance of RTA. However, it is possible that individuals with one chronic disease may need to visit general practitioners and hospitals more frequently and this may increase the risk of RTAs. By contrast, people with multiple chronic diseases may require caregivers to coordinate or conduct a multitude of such activities outside of the home, and caregivers presumably function to lower the risk of RTAs. Since the design and variables examined in this study cannot provide a meaningful explanation of this observed phenomenon, further studies should investigate and verify this difference in interaction in order to better understand its significance.

In our cohort, over 17% of individuals had taken the selected sedative medicines on January 1, 2009 and 6% had taken three or more. Any use of sedative medicine on the index date was a significant independent risk factor for traffic accidents, which is in agreement with many studies [27], but is also contrary to others [28].

However, the interaction between the number of sedative medicines and dementia for RTAs was not significant, i.e. the effect of sedative medicine on traffic accidents was not different between people with and without dementia. This was also contrary to our expectation, as we had expected that patients with dementia would experience a stronger sedative effect than someone without dementia [18]. Moreover, dementia patients are potential inappropriate medication users, both for prescribed and over the counter medications [29]. However, using the register-based data, we were unable to capture the intake of over the counter medicines that may play a role in traffic safety, either alone or interacting with dementia or prescribed medications.

This study population was people 65+ years at baseline. In Denmark, although the retirement age was 65 years in 2008, a certain number of older people indeed continue to work past that age. We found that people with higher education were represented at higher numbers in traffic accidents and this may be due to the fact that highly-educated people tend to stay on the job market longer and therefore may be exposed to traffic more frequently [10].

There are some limitations in our study and potential underreporting of RTAs is one of them. DST acknowledges that underreporting of RTAs occurs even in the population-based register, especially for accidents involving only slight injuries/damages and for low-impact car accidents without injuries. In fact, all the injuries caused by RTAs assessed in our study were severe enough to require medical attention or treatment, although some RTAs were registered as minor injuries. However, our study is not the only one affected by underreporting of RTAs, as one other study using state records acknowledged similar circumstances [30]. Nevertheless,

using case-control study design we were careful throughout the study design process to minimize the risk of under-detection of such very minor accidents.

We measured RTAs as one risk category, but drivers, pedestrians, and other road users with dementia may present different levels of risks of RTAs, and further studies of this nuance should be considered.

Another limitation may be inaccuracy in nursing home residency status that we retrieved for the present study. A validation study found that DST misclassified some individuals as nursing home residents or community dwellers [31]. However, as the proportion of nursing home residents was relatively small (2%, data available upon request) in our study population, such misclassification from DST presumably had a minor impact on our overall conclusions. Further studies may consider obtaining nursing home residents' information directly from municipalities.

Severity and different types of dementia may cause different magnitudes of accident risk [32-34], and different types of dementia pathologies may overlap and be co-occurring [35]. Due to the low validity of subtypes of dementia and lack of severity assessment in the register data utilised [36], we only analysed all-type dementia in this study. Given the advancements in diagnostic methods that have improved diagnosis of subtypes of dementia, future studies that include subtypes as a category of investigation should also be considered. In the context of national register data, time elapsed since the first dementia diagnosis could be a good proxy for onset and thus severity of dementia.

Conclusion

Non-institutionalized older people with dementia in Denmark have a lower risk of RTAs, which could be due to less-frequent activities outside of the home. However, the interaction

between dementia and comorbidities as well as sedative medications should be investigated further.

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Jindong Ding Petersen (JDP) wrote the manuscript. Volkert Dirk Siersma (VS) advised and drafted the statistical analysis. René dePont Christensen (RC) and Maria Munch Storsveen (MMS) conducted the statistical analysis. Connie Thurøe Nielsen (CTN) and Mikkel Vass (MV) gave academic suggestions for the project. Frans Boch Waldorff (FBW) initiated the project concept and was senior advisor for JD Petersen. JDP, VS, RC, and FBW discussed and finalized analysis methods. All the authors interpreted the study results and contributed the manuscript. All authors approved the manuscript for publishing.

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Declaration of conflicting interests

The authors declare that there are no conflicts of interest.

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Tables

Table 1: Characteristics of cases with matched controls for age, sex, and geographic location on January 1, 2009.

	All	Case	Control
	n=15709	n=3211	n=12527[a]
Socio-demographic factors			
Age (*median) (range)*	77.8 (6.0) (69.0-103.0)	77.8 (6.0) (69.0-97.0)	77.8 (6.1) (69.0-103.0)
Age group, *n (%)*			
65-69	14 (0.09)	3 (0.09)	11 (0.09)
70-74	5785 (36.83)	1174 (36.56)	4630 (36.96)
75-79	4291 (27.32)	871 (27.13)	3422 (27.32)
80-84	3352 (21.34)	685 (21.33)	2674 (21.35)
>=85	2267 (14.43)	478 (14.89)	1790 (14.29)
Sex, *n (%)*			
Male	8725 (55.54)	1781 (55.47)	6964 (55.59)
Female	6984 (44.46)	1430 (44.53)	5563 (44.41)
Civil status, *n (%)*			
Married/cohabiting	9602 (61.12)	1846 (57.49)	7778 (62.09)
Divorced	1675 (10.66)	391 (12.18)	1287 (10.27)
Widowed	3626 (23.08)	795 (24.76)	2834 (22.62)
Never married	806 (5.13)	179 (5.57)	628 (5.01)
Education, *n (%)*			
<10 years	7134 (44.46)	1448 (45.09)	5700 (45.50)
10-12 years	5144 (32.75)	1012 (31.52)	4140 (33.05)
>12 years	2767 (17.61)	620 (19.31)	2152 (17.18)
Geographic location, *n (%)*			
Large cities	12084 (76.92)	2468 (76.86)	9637 (76.93)
Medium-sized towns	2608 (16.60)	535 (16.66)	2079 (16.60)
Small towns/rural	1017 (6.47)	208 (6.48)	811 (6.47)
Chronic diseases, n (%)			
Dementia	171 (1.09)	18 (0.56)	153 (1.22)
Type 2 Diabetes	564 (3.59)	115 (3.58)	449 (3.58)
COPD	3190 (20.31)	672 (20.93)	2523 (20.14)
IHD	11081 (70.54)	2215 (68.98)	8885 (65.27)
Depression	3197 (20.35)	656 (20.43)	2544 (20.31)
Hypertension	10189 (64.86)	2028 (63.16)	8176 (65.27)
Stroke	6187 (39.39)	1257 (39.15)	4940 (39.43)
Atrial fibrillation	8124 (51.74)	1648 (51.32)	6488 (51.79)
Asthma	3293 (20.96)	694 (21.61)	2604 (20.79)
Comorbidity[b] (*median) (range)*	2.93 (1.99) (0.00 - 9.00)	2.90 (2.02) (0.00 - 8.00)	2.93 (1.99) (0.00 - 9.00)
Quantity of comorbidity[c], *n (%)*			
0	3118 (19.85)	663 (20.65)	2463 (19.66)
1	822 (5.23)	182 (5.67)	644 (5.14)
2	2533 (16.12)	510 (15.88)	2026 (16.17)
3+	9236 (58.79)	1856 (57.80)	7394 (59.02)
Medicine use, n (%)			
Polypharmacy[d]	112 (0.71)	15 (0.47)	97 (0.77)
Sleeping medicine	811 (5.16)	162 (5.05)	652 (5.20)
Antipsychotic medicine	65 (0.41)	9 (0.28)	56 (0.45)
Anti-anxiety medicine	317 (2.02)	62 (1.93)	255 (2.04)
Antidepressants	1047 (6.66)	181 (5.64)	868 (6.93)
Quantity of sedative medicine[e], *n (%)*			
0	12917 (82.23)	2695 (83.93)	10245 (81.78)
1	1588 (10.11)	312 (9.72)	1281 (10.23)
2	253 (1.61)	39 (1.21)	214 (1.71)
3+	951 (6.05)	165 (5.14)	783 (6.28)

[a]29 control individuals also became cases.

[b]The sum of the chronic diseases including type 2 diabetes (T2D), chronic obstructive pulmonary disease (COPD), ischemic heart disease (IHD), depression, hypertension, stroke , atrial fibrillation (AF), and asthma assessed on January 1, 2009.

[C]Any combination of the chronic diseases listed in (b) assessed on January 1, 2009.

[d]Any use of five or more medications by a patient on January 1, 2009.

[e]Any combination of sleeping, antipsychotic, anti-anxiety, and antidepressant medicine assessed on January 1, 2009.

Table 2: Dementia (all-type) for the risk of road traffic accidents (RTAs) (2009-2014) adjusted for marital status, education, and the number of comorbidities[a].

	Road traffic accidents		
	OR	**95% CIs**	**p-value**
Dementia (all-type)	0.43	0.32-0.60	<0.001
Marital status			
Married/cohabiting	ref		
Divorced	1.30	1.15-1.47	<0.001
Widowed	1.21	1.09-1.34	<0.001
Never married	1.21	1.02-1.44	0.033
Education			
<10 years	ref		
10-12 years	0.98	0.89-1.07	0.668
>12 years	1.15	1.03-1.28	0.010
Not available	0.92	0.75-1.14	0.448
Comorbidity[b]			
0	ref		
1	0.98	0.80-1.22	0.887
2	0.97	0.84-1.13	0.718
3+	0.95	0.85-1.07	0.386

[a]All variables included in this table were based on the index date of RTA.

[b]Comorbidity in this analysis was calculated based on any combination of eight chronic diseases including type 2 diabetes (T2D), chronic obstructive pulmonary disease (COPD), ischemic heart disease (IHD), depression, hypertension, stroke , atrial fibrillation (AF), and asthma by the index date of RTA.

OR=Odds ratio, 95% CIs=95% confidence intervals.

Table 3: Dementia (all-type) for the risk of road traffic accidents (RTAs) (2009-2014) adjusted for marital status, education, and the number of sedative medicines taken[a].

	Road traffic accidents		
	OR	**95% CI**	**p-value**
Dementia (all-type)	0.43	0.31-0.59	<0.001
Marital status			
Married/cohabiting	ref		
Divorced	1.30	1.15-1.47	<0.001
Widowed	1.21	1.09-1.34	<0.001
Never married	1.22	1.02-1.45	0.028
Education			
<10 years	ref		
10-12 years	0.98	0.90-1.08	0.701
>12 years	1.16	1.04-1.29	0.009
Not available	0.93	0.75-1.14	0.479
Sedative medicine[b]			
0	ref		
1	1.17	1.04-1.30	0.006
2+[c]	1.26	1.14-1.39	<0.001

[a]All variables included in this table were based on the index date of RTA.

[b]Sedative medicine in this analysis was calculated based on any combination of four types of medicine including sleeping medicine (ATC: N05C), antipsychotic medicine (ATC: N05A), anti-anxiety medicine (ATC: N05B), and antidepressants (ATC: N06A) by the index date of RTA.

[c]Any combination of two sedative medicines listed in (b).

OR=Odds ratio, 95% CIs=95% confidence intervals.