Extremity Injuries and Dementia disproportionately increase the Risk for long-term Care at older Age. An Analysis based on German Health Insurance Routine Data.

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Background

Extremity injuries (EI), e.g. due to falls, and dementia are known risk factors for long term care need and mortality. Since they often occur in relation, their combined effects warrant additional attention, because they may present opportunities for targeted intervention.

Data & Methods

Our analyses are based on a random sample of health claims records of 122.000 individuals of persons aged 65+ of Germany's largest public health insurance AOK, covering all diagnoses in the time span between 2004 and 2010. We use multivariate Cox proportional hazard models and calculated state-specific mortality rates and transition rates between the states no care, home care and institutional care, which we use for a set of counter-factual scenarios (and later for a set of prognostic scenarios for Germany).

Results

Dementia and concurrent EI increase the care and mortality risks beyond those caused by dementia alone. Especially lower EI increase both risks. Mortality is highest in institutional care (about 0.4 for men 80-84 and 0.26 for women), and higher in home care (about 0.3 for men 80-84 and 0.17 for women) than without care. The dementia-free counter-factual scenario is more effective in reducing mortality for those without care need than the EI-free scenario, and more effective in reducing the transition from no care to home care. Combining both scenarios, the transition from home to institutional care is reduced beyond the dementia free scenario.

Conclusions

Reducing dementia could decrease the transition into care in general and especially from home care to institutional care, while the reduction of EI could help to decrease the entry into home care and the transition to institutional care for dementia patients. Targeted prevention and treatment of extremity injuries might help to reduce long-term care need in the future, even if a treatment for dementia is not forthcoming.

Extended Abstract

Background

Extremity injuries (EI) due to falls (most often fractures of the lower extremities) and dementia are typical consequences of physical and cognitive decline at older age[1]. They are central risk factors of long-term home or institutional care need for the elderly and for mortality[2,3]. Both are related to one another, as EI are a risk factor for dementia[4], and the EI risk is higher when dementia is present[5]. This warrants paying special attention to the combined effects of both EI and dementia on care need and mortality[6]. We investigate the individual effects of EI and dementia on long term care need and mortality, differentiate between injuries of the lower and upper extremities, and pay special attention to their combined effects. Then, we present transition and mortality rates of a set of counter-factual scenarios that further distinguish between care at home and care in institutions, in which the effects of dementia or EI are removed.

Since the older age groups are growing due to demographic shifts and rising life expectancy, EI and dementia might be experienced by more individuals and thus become even more important drivers for long-term care need and causes of mortality in the future[7]. If EI and dementia disproportionately increase the risk for long term care and mortality when present concurrently, new targeted intervention strategies might prove valuable, e.g. by attempting to decrease EI risk for dementia patients or conversely decreasing dementia risk after EI due to a fall. Thus, long term care need and death might be delayed, which would not only increase the quality of life, but also save costs and relieve health and care insurances.

Data & Methods

Our analyses are based on a random sample of about 122.000 individuals drawn from the health claims records of all insured persons aged 65 and older of Germany's largest public health insurance AOK ("Allgemeine Ortskrankenkasse"), covering the time frame from 2004 to 2010. All insured persons were eligible for the sample, regardless of seeking medical treatment or not. The data covers all in- and outpatient diagnoses and the type of diagnosing physician or specialist, the German long term care level classification ("Pflegestufe"), residence in an institutional long term care facility, dates of birth and death, and gender, among other things. About 25.000 persons entered long-term care, and about 33.800 deaths occurred during the study period.

We use Kaplan-Meier survival analyses and multivariate Cox proportional hazard models to quantify the effects of EI (primarily fractures, wounds, luxations, contusions), dementia (Alzheimer's disease, vascular dementia, Lewy body dementia, and all other/non specified kinds of dementia) and the combination of both on long term care entry (home and institutional) and death, while controlling for a set of comorbidities common at older age, sex and age. Additionally, we calculated state-specific mortality rates and transition rates between the states no care (defined as "no care level, not in care institution), long term home care (care level, not in institution), and long term institutional care for 5 year age-groups for the status quo and three counter-factual scenarios (no dementia, no lower EI, no dementia & no lower EI) using a set of Gompertz proportional hazard models. The obtained results are currently also applied to a set of counter-factual multi-state population projections for Germany.

Results

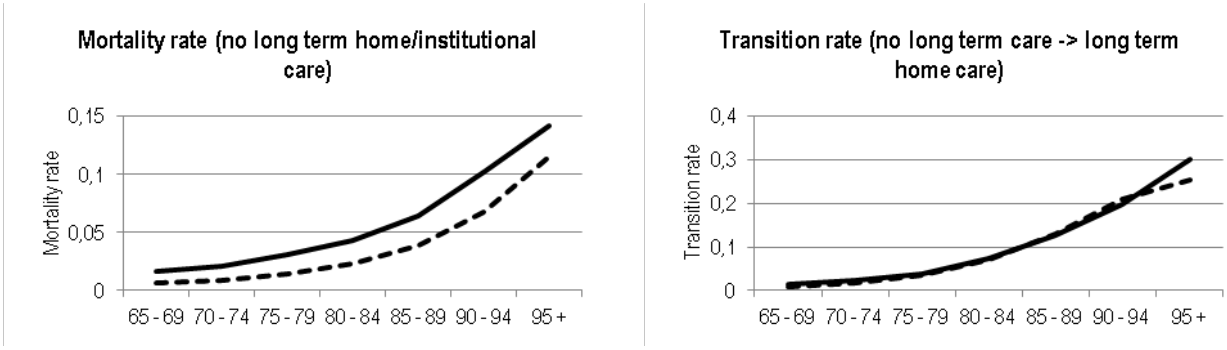
The effects of EI and dementia on care need and mortality risk are shown in Table 1. Without concurrent dementia, EI of the lower and both extremities increase the long term care risk by 14% and 40% (HR: hazard ratio. Lower EI: HR=1.14, $p<0.001$; both EI: HR=1.40, $p<0.001$). We find a comparable effect of lower EI (21% higher) and both EI (20% higher) on mortality (Lower EI: HR=1.21, $p<0.001$; both EI: HR=1.20, $p<0.001$). Dementia alone is a strong risk factor for both long term care (HR=3.86, $p<0.001$) and death (HR=2.33, $p<0.001$). Taking the interaction of EI and dementia into account, long term care risk is higher than that caused by dementia alone for all types of EI (lower EI: HR=5.25, $p<0.001$; upper EI: HR=4.98, $p<0.001$; both EI: HR=6.24, $p<0.001$) when EI and dementia are present together. Concurrent with dementia, even upper EI, which do not increase

care risk without dementia, increases care risk more than dementia alone. Summarily, when EI and dementia are both present, the care risk is higher than the additive effect of EI and dementia, suggesting a synergistic effect. The interaction between EI and dementia shows a comparable pattern for death. The mortality risk is higher for all types of EI when dementia is present as well (lower EI: HR=4.11, p<0.001; upper EI: HR=3.35, p<0.001; both EI: HR=4.10, p<0.001), again with the inclusion of upper EI, that does not increase the mortality risk on its' own.

		Long term care		Death	
Extremity injuries (EI)	Dementia	HR	p	HR	p
No EI (reference category)		1.00		1.00	
Lower EI		1.14	***	1.21	***
Upper EI		1.00		1.01	
Both EI		1.40	***	1.20	***
	Dementia (ref.: no dementia)	3.86	***	2.33	***
No EI	no dementia (reference category)	1.00		1.00	
Lower EI	no dementia	1.14	***	1.36	***
Upper EI	no dementia	0.93		1.06	
Both EI	no dementia	1.53	***	1.46	***
Lower EI	dementia	5.25	***	4.11	***
Upper EI	dementia	4.98	***	3.35	***
Both EI	dementia	6.24	***	4.10	***

Table 1: Hazard ratios for long term care entry and death. Non-interaction model (top) controls for age, sex and comorbidities, interaction model (bottom) controls for age and sex. Source: AOK claims data, own calculations.

Figure 1 shows state-specific yearly mortality and transition rates between no care, long term home care and long term institutional care for 5-year age groups (transition from care to no care is not possible). Mortality is higher for individuals in long term institutional care (about 0.4 for men 80-84 and 0.26 for women) than in home care (about 0.3 for men 80-84 and 0.17 for women). Regardless of care status, mortality is generally higher for males than females. For individuals without care need, mortality increases steadily with age, doubling roughly every 10 years (0.04 for men 84-84, 0.02 for women). In care, mortality remains more or less constant between 70 – 85 years and increases in the higher age groups. In home and institutional care, the mortality rate decreases from the youngest age group to the next, because at the – in terms of care need – relatively young age of 65-69 years, only individuals with severe medical conditions already have a care level. The transition into care level (top right) is virtually identical for males and females up to age 94, and only from age 85 onwards is the rate higher than 0.1. The transition from no care directly to institutional care is very rare, because usually, the person receives a care level before moving into an institution. The transition from home care to institutional care happens faster for women (between 0.15 and 0.20 between 75-89) than for men (between 0.12 and 0.16 between 79-89), because this is usually linked to the absence of the partner as most frequent caregiver: at older age females (often widows) more often than men at older age do not have a potential care givers available.



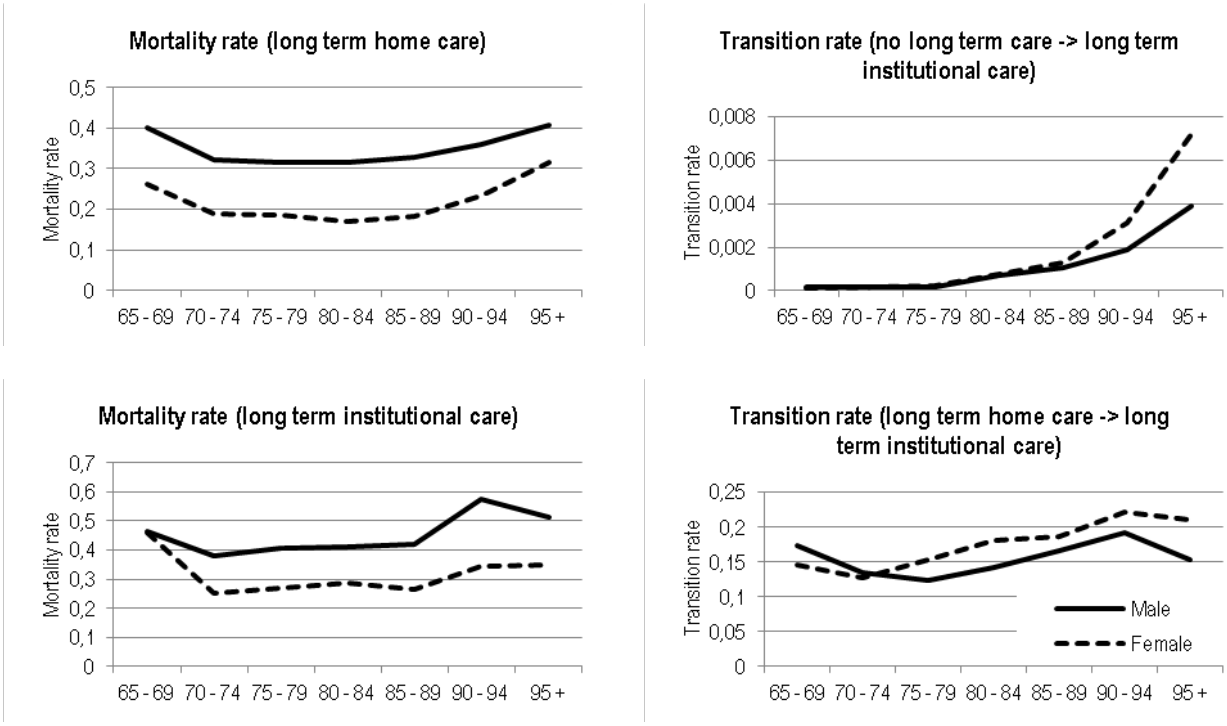
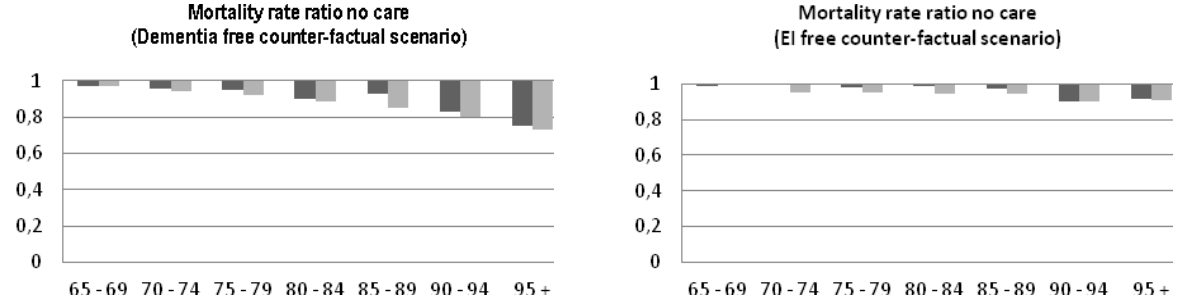


Figure 1: State-specific yearly mortality and transition rates for 5-year age groups by sex. Source: AOK claims data, own calculations.

Figure 2 shows mortality and transition rate ratios for selected states that allow the comparison of three counter-factual scenarios (free from dementia, free from EI and free from both) to the status quo. For instance, a rate ratio of 0.8 would signify a reduction by 20%. In terms of reducing mortality for individuals without a care level, the dementia free scenario (top left) yields about twice the reduction than the EI free scenario (top right). Older age groups and females see a larger reduction (by up to 20%, dementia free scenario; up to 10%, EI free scenario) than younger age groups and men. The transition from no care to home care is also affected in both the dementia free and the EI free scenarios (second row). While the dementia free scenario again yields the larger reduction (up to 27%) with less difference between males and females, its' effect increases and then decreases again with higher age. The reduction in the EI free scenario remains mostly unchanged with higher age and yields up to 13% and generally shows a larger reduction for females. Looking at the transition from home to institutional care in the dementia free scenario (bottom left), removing the effect of dementia again yields sizeable decreases up to 40%, especially for ages 80 and up. The EI free scenario, however, does not provide as much reduction of the transition into institutional care, as is only manages to reduce the transition by about 5% (not shown). However, if the EI free scenario is combined with the dementia free scenario (bottom right), eliminating the combined effect of dementia and EI, the transition from home care to institutional care can be reduced beyond the decrease shown in the dementia free scenario, indicating that even when dementia is present, preventing EI can help to reduce transition into institutional care, often by more than 35%, again mostly higher for females.



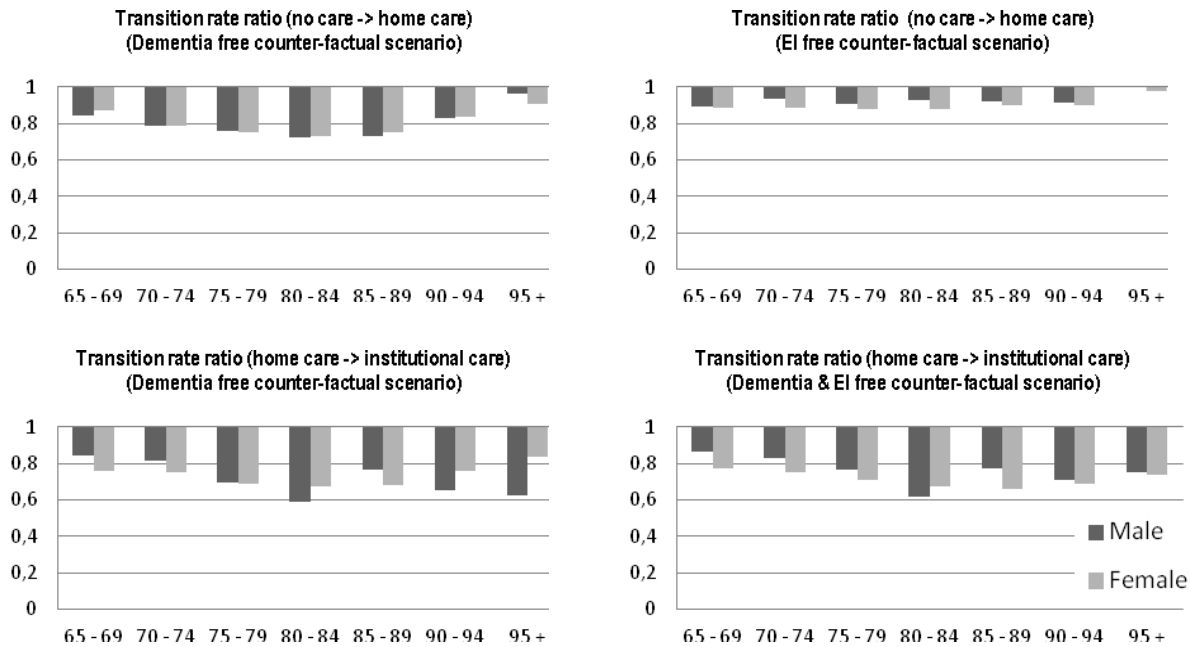


Figure 2: State-specific mortality and transition rate ratios for 5-year age groups by sex. Source: AOK claims data, own calculations.

Conclusions

Due to the aging of large cohorts, more individuals than before are expected to require care, many among them also suffering from dementia. EI and dementia are not only important independent risk factors for long-term care, but can also act as risk factors for each other. If present concurrently, the resulting long-term care risk is higher than that of dementia alone, and thus, entrance into care occurs faster. Separating home care from institutional care, we show in the counter-factual scenarios that preventing EI could reduce the entry into the care system (no care to home care) by up to 12%. The transition from home care to institutional is primarily affected in the dementia free and the dementia and EI free counter-factual scenarios. This suggests that, while dementia is a central factor in the transition to institutional care, avoiding EI can decrease this transition, even when dementia is present.

Additionally, lowering EI would also reduce the first step in the transition into the care system, namely the transition from no care to home care. Since a working treatment for dementia is not in sight, preventing EI, lessening the impact of EI and improving the outlook after an EI could help to reduce long term care need, both at home, and especially in institutions (for patients with concurrent dementia) in the coming decades. This presents an opportunity for using innovative interventional measures, such as assistive technology at home (ambient assisted living) or as a smart personal device, or screening programs to identify increasing EI risk, for instance due to falls. Additionally, positive effects could be expected in terms of increased quality of life, reduced mortality and health care and care services expenditures. The counter-factual population prognosis scenarios we are currently working on will be helpful to shed light on the dimensions of potential non-financial gains and the possible amount of cost reductions.

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