Selective Migration and Mortality in a Socially Deprived Area of Denmark, 1968-2017

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Introduction

Social disparity in health is a topic of increasing concern even in high income countries [1]. Denmark is considered to be a homogenous country and among the happiest people in the world [2,3]. It is therefore surprising that Denmark actually has large disparities in health, e.g. from a life expectancy of 77.4 years in the south-eastern, rural municipality of Lolland to a life expectance of 83.1 in the suburban municipalities Gentofte and Rudersdal north of the capital, Copenhagen [4].

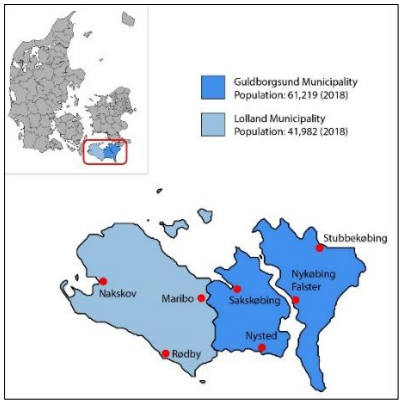

Figure 1. Map of Lolland-Falster.

Lolland municipality and the neighbouring municipality of Guldborgsund together cover two larger and several smaller islands called Lolland-Falster, with a total population of 100,000 in 2018 (Figure 1) [5]. The poor health situation in Lolland-Falster was illustrated in the recently published Danish National Health Profile 2017, where inhabitants from Lolland-Falster ranked high compared to the rest of Denmark on risk factors, such as smoking, overweight, psychological stressors, and lack of exercise [6]. A recent analysis by the Economic Council of the Labour Movement found that people living in Lolland-Falster on average had lower socioeconomic status than the rest of Denmark [7].

In light of the presently low life expectancy and low socioeconomic status in Lolland-Falster, we raise the question: Whether Lolland-Falster makes people sick or whether sick people move to Lolland-Falster?

Methods

Materials

The study population included the entire Danish population using individual level data from the Central Population Register (CPR) 2 April 1968 to 31 December 2017.

From 1 January 1971 to 3 December 2017, we retrieved complete address history from the CPR with exact moving dates from the Danish Health Data Authority.

For each year from 1968 to 1970, we retrieved cross-sectional CPR-datasets from the Danish National Archive. Thus, for 1968-1970 only one address was reported per person per year on 2 April 1968, 12 June 1969 and 13 April 1970, respectively. Moving was coded if a person had a new address in 1969, 1970 or 1 January 1971 compared to the previous year. Moving date was coded as the mid-day between the data collection day for the previous year and the data collection day in the year where the new address was observed.

Statistical analysis

The data was analysed for 10-year calendar periods; 2 April 1968 to 31 December 1977, 1 January 1978 to 31 December 1987, 1 January 1988 to 31 December 1997, 1 January 1998 to 31 December 2007, 1 January 2008 to 31 December 2017.

Persons were categorised according to where they lived at the start of the 10-year period; Lolland-Falster or the rest of Denmark. Persons born during a 10-year period were categorised according to where they lived at birth. We then followed all the persons during the time they lived in Lolland-Falster and the rest of Denmark, respectively (see Figure 2).

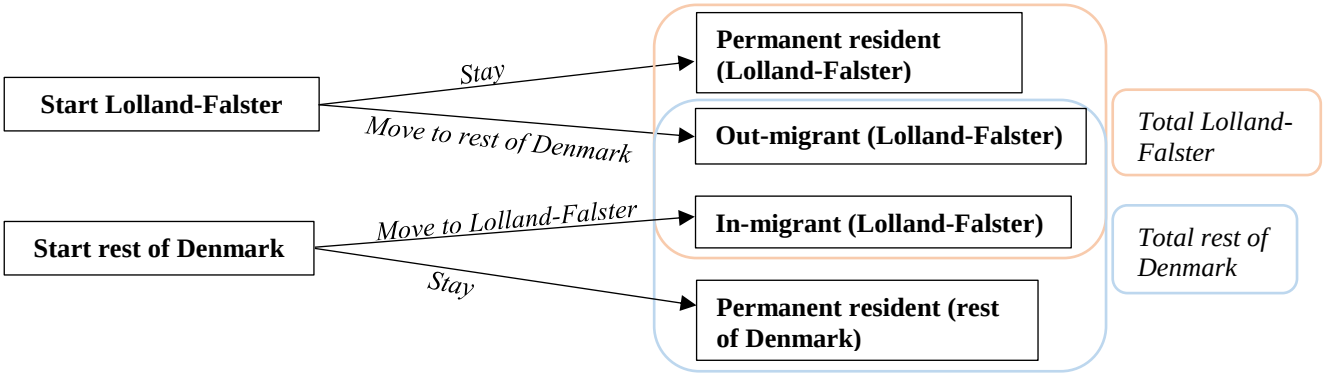

Figure 2. Categorisation of migration groups.

We calculated person-years for each person in each migration group. A person would contribute with person-years in a specific group from the start of the 10-year period or from birth and stop contributing when they moved, died, emigrated or went missing in the CPR. Thus, a person could contribute with person-years in different groups during the 10-year period if they moved.

We excluded people moving to Denmark from another country during a 10-year period, but included them in the next 10-year period if they lived in Denmark at the start of that period. However, as the CPR was established in 1968, it was only possible to identify people immigrating to Denmark from 1969 onwards. A person missing or with missing municipality code at the beginning of a 10-year period was categorised as starting in the first valid municipality code they lived in during the period, and were excluded if no valid municipality code was registered during the period. We excluded 148 participants because of missing information on date of birth or sex.

Mortality Rate Ratios (MRR) were calculated using Poisson regression in SAS 9.4. The MRR was calculated for 10-year periods according to migration group adjusted for 5-year age-groups and sex. The reference group was the total population in the rest of Denmark (Figure 2).

Results

In total, the study included 9,403,306 persons and 2,830,786 deaths. During the study period, the number of persons residing in Lolland-Falster decreased. The number of people living in Lolland-Falster from 1968 to 1977 (permanent residents + in-migrants) was in average 120,058 persons. While, from 2008 to 2017 it was 96,607.

Table 1. Mortality Rate Ratio (MRR) of migration groups in Lolland-Falster. The reference group was the total population in the rest of Denmark. Adjusted for 5-year age-groups and sex.

	Total population Lolland-Falster	Permanent residents	In-migrants	Out-migrants
2018-2027				
Expected MRR*		1.16		
2008-2017				
Average population number (% of total)	105,921.70 (100%)	89,701.02 (84.69%)	6905.92 (6.52%)	9314.76 (8.79%)
MRR (95% CI)	1.21 (1.20-1.23)	1.20 (1.18-1.22)	1.46 (1.35-1.59)	1.51 (1.40-1.63)
Expected MRR*		1.12		
1998-2007				
Average population number (% of total)	115,448.31 (100%)	97,701.35 (84.63%)	8971.08 (7.77%)	8775.89 (7.60%)
MRR (95% CI)	1.12 (1.10-1.14)	1.10 (1.08-1.11)	1.59 (1.49-1.71)	1.42 (1.31-1.54)
Expected MRR*		1.05		
1988-1997				
Average population number (% of total)	122,025.52 (100%)	104,464.93 (85.61%)	8853.34 (7.26%)	8707.25 (7.14%)
MRR (95% CI)	1.06 (1.05-1.08)	1.05 (1.05-1.07)	1.27 (1.19-1.37)	1.28 (1.17-1.40)
Expected MRR*		1.01		
1978-1987				
Average population number (% of total)	127,798.42 (100%)	111,918.78 (87.57%)	7897.23 (6.18%)	7982.41 (6.25%)
MRR (95% CI)	1.02 (1.01-1.04)	1.01 (1.00-1.03)	1.21 (1.11-1.32)	1.16 (1.05-1.27)
Expected MRR*		0.93		
1968-1977				
Average population number (% of total)	134,649.64 (100%)	110,648.22 (82.17%)	9410.22 (6.99%)	14,591.20 (10.83%)
MRR (95% CI)	0.99 (0.98-1.01)	0.97 (0.95-0.99)	1.30 (1.19-1.42)	1.17 (1.09-1.26)
Expected MRR*		-		

*The expected MRR for permanent residents was based on the MRR and proportion of permanent residents, in-migrants and out-migrants during the previous 10-year period.

In-migrants constituted approx. 6-8% of the total population of Lolland-Falster in each of the 10-year periods 1968-1977 to 2008-2017. Out-migrants constituted a more varying part of the total population of Lolland-Falster from 10.83% in 1968-1977 to 6.25% in 1978-1987.

In 1968-1987, the total population of Lolland-Falster had a mortality in line with that of the rest of Denmark, but from 1978 onwards an excess mortality developed which by 2008-2017 had accounted to an MRR of 1.21 (95% CI: 1.20-1.23). As by far the majority of the population in Lolland-Falster were permanent residents, their pattern followed that of the total population of Lolland-Falster. During the entire 50-year study period, in-migrants of Lolland-Falster had an excess mortality compared with the rest of Denmark ranging from 1.21 (95% CI: 1.11-1.32) in 1978-1987 to 1.46 (95% CI: 1.33-1.59) in 2008-2017. However, the persons moving away from Lolland-Falster also had an excess mortality compared with the rest of Denmark ranging from 1.16 (95% CI: 1.05-1.27) in 1978-1987 to 1.51 (95% CI: 1.40-1.63) in 2008-2017 (Table 1).

Roughly estimated, given that, the MRR for the permanent residents in 1968-1977 was 0.97; and there was an inflow of 6.99% of people with an MRR of 1.30 and an outflow of 10.83% with an MRR of 1.17, thus an MRR of 0.93 would be expected for 1978-1987. Yet, the observed MRR in the next decades was 1.01 (Table 1). Similarly, for the next decades, the observed MRR for the permanent residents was systematically higher than the expected MRR based on the population moving in and out during the past decade.

Discussion

The permanent residents of Lolland-Falster had the same mortality as people in the rest of Denmark from the start of our study period in 1968 until 1987. From 1988 onwards, the excess mortality developed starting with 5% in 1988-1997 to 10% in 1998-2007 and being 20% in 2008-2017.

Our data also showed that people moving to Lolland-Falster had a higher mortality than the rest of Denmark, but so was the case for people moving away from Lolland-Falster. This pattern prevailed during the 50-year study period.

With a rough estimation based on the percentages of in- and out-migrants and their respective MRR, population movement, alone, could not explain the excess mortality of permanent residents in Lolland-Falster compared with that of the rest of Denmark. Our data thus point to a real relative deterioration of mortality in Lolland-Falster during the 50-year study period. We will analyse these calculations with sex and age-specific calculations to pinpoint subgroups affected by these changes.

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