



Health as a predictor of early retirement before and after introduction of a flexible statutory pension age in Finland



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ARTICLE INFO

Article history:

Received 29 February 2016

Received in revised form

13 April 2016

Accepted 23 April 2016

Available online 24 April 2016

Keywords:

Pension reform

Retirement decisions

Health

Prescription medication

Hospital admissions

Finland

ABSTRACT

Background: Little is known of how pension reforms affect the retirement decisions of people with different health statuses, although this is crucial for the understanding of the broader societal impact of pension policies and for future policy development. We assessed how the Finnish statutory pension age reform introduced in 2005 influenced the role of health as a predictor of retirement.

Methods: We used register-based data and cox regression analysis to examine the association of health (measured by purchases of psychotropic medication, hospitalizations due to circulatory and musculoskeletal diseases, and the number of any prescription medications) with the risk of retirement at age 63–64 among those subject to the old pension system with fixed age limit at 65 (pre-reform group born in 1937–1941) and the new flexible system with 63 as the lower age limit (post-reform group born in 1941–1945) while controlling for socio-demographic factors.

Results: Retirement at age 63–64 was more likely among the post- than the pre-reform group (HR = 1.50; 95% CI 1.43–1.57). This reform-related increase in retirement was more pronounced among those without a history of psychotropic medication or hospitalizations due to circulatory and musculoskeletal diseases, as well as among those with below median level medication use. As a result, poor health became a weaker predictor of retirement after the reform.

Conclusion: Contrary to the expectations of the Finnish pension reform aimed at extending working lives, offering choice with respect to the timing of retirement may actually encourage healthy workers to choose earlier retirement regardless of the provided economic incentives for continuing in work.

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1. Introduction

Efforts to lengthen working lives may face challenges related to health problems among older workers. People with poor physical, mental and self-rated health are more likely to retire early; ill health is a strong predictor of disability retirement in particular, but it also increases the likelihood of other types of early retirement (Leijten et al., 2015; van Rijn et al., 2014). However, labour market participation among older people is influenced not only by individual factors but by institutional factors as well (Börsch-Supan et al., 2009; De Preter, Van Looy and Mortelmans, 2013; Engelhardt, 2012; Gupta et al., 2015). For example, social security

incentives and eligibility ages for different types of pensions contribute to the timing of retirement (Coile, 2015; Gruber and Wise, 2004). While health is an important individual-level predictor of early retirement, institutional factors largely contribute to between-country variation in retirement behaviour (Börsch-Supan et al., 2009; Engelhardt, 2012).

The complex associations of health and pension age policies with the timing of retirement may be approached through the concepts of push and pull factors, which may operate both on the individual and the institutional level (Kohli and Rein, 1991). Health is typically perceived as a push factor, since individuals with poor health are often driven from the labour market involuntarily (Szinovacz and Davey, 2005; van Solinge and Henkens, 2007). They may also prefer to retire early due to a shorter subjective life expectancy (Griffin et al., 2012; Hurd et al., 2004; van Solinge and

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Henkens, 2010) or due to an excess advantage gained from the removal of work-related demands (Kim and Moen, 2002). In contrast, the availability of early retirement options are likely to operate as pull factors inducing retirement on a more voluntary basis. Moreover, retirement decisions may be influenced by the interplay between health status and pension age policies. On the one hand, policies providing better opportunities to choose the timing of retirement — i.e. institutional pull factors — may excessively attract individuals with better health into retirement since they are more likely to afford early retirement and may have better opportunities for taking part in different leisure activities. On the other hand, such policies may allow a larger push of individuals with poorer health and work ability into retirement. It has nevertheless been suggested that individuals with poorer health are likely to exit the labour market early regardless of institutional retirement ages (Bernal and Vermeulen, 2014; Bound et al., 2010; Staubli and Zweimüller, 2013), whereas individuals with better health may be better able to adjust their retirement decisions according to the eligibility criteria for different types of pensions.

In the recent decades policies have been introduced in many countries to lengthen working lives of older workers (OECD, 2015). Pension reforms provide a natural experiment setting for assessing the influence of the institutional context on individual-level retirement decisions. A recent review indicates that changes in the eligibility ages and incentives of the pension system have resulted in changes in actual retirement behaviour (Coile, 2015). However, less is known of how pension reforms affect the labour market decisions of different population groups, although this is crucial for the understanding of the broader societal impact of pension policies and for future policy development. Only few previous studies have assessed the role of health when examining the effects of pension reforms on labour market participation. A US study found no variation by health status in the extent to which pension receipt was postponed as a response to raising of the statutory retirement age (Behaghel and Blau, 2012). An Austrian study, in turn, found that people with better health increased their employment more as a response to raising of the eligibility age for early retirement (Staubli and Zweimüller, 2013). Accordingly, another US study (Bound et al., 2010) and a Dutch study (Bernal and Vermeulen, 2014), based on simulations of incentive-related effects of potential raises in the eligibility age for pensions, have predicted larger increases in employment among people with better health. Health is often strongly associated with socio-demographic factors, which may further modify the effect of pension reforms on labour market participation. However, previous findings on socioeconomic variation in the behaviour responses to pension age reforms have also been mixed (Behaghel and Blau, 2012; Cribb et al., 2014; Hanel, 2010; Hanel and Riphahn, 2012; Mastrobuoni, 2009; Staubli and Zweimüller, 2013).

In Finland the statutory pension system was modified in 2005 replacing the prior fixed old-age pension limit of 65 with a flexible pension age between 63 and 68. The central goal of the reform was to ensure the sustainability of the pension system and to promote longer working lives (Börsch-Supan, 2005; Uusitalo and Nivalainen, 2013). The new system provides economic incentives for continuing in work at ages 63–67 with a pension accrual rate of 4.5% of annual earnings (1.5% until the age of 52 and 1.9% at age 53–62). The previous rates were 1.5% until the age of 59 and 2.5% at age 60–64. However, some prior analyses have shown that the effect of the increased accrual rate on longer working lives may be partly diluted by other changes made to the pension system, and that retirement at age 63–64 actually increased as an unintended consequence of the reform (Uusitalo and Nivalainen, 2013). Furthermore, already within the old system, retirement before age 65 was available (see the Methods section for more details). Thus,

any reform-related increase in the incidence of retirement at age 63–64 is likely to be partly driven by other factors such as psychological and social changes in retirement norms. Previous literature suggests that individuals tend to retire at perceived standard retirement ages (Gruber and Wise, 2004; van Erp et al., 2014; van Vuuren, 2014). The new flexible pension system in Finland may have widened the normative age of retirement or even reduced it from age 65 towards 63 (Börsch-Supan, 2005).

A comprehensive understanding of the consequences of the new flexible pension system would help to assess the implications of future pension reforms. It remains unclear whether the influence of the 2005 reform varied by different population groups, e.g. whether the increase in retirement at age 63–64 was more common among people with better or poorer health. The two previous studies that have investigated the effect of pension age reforms on subsequent labour market participation among people with different health statuses used singular measures of health based either on self-reported health (Behaghel and Blau, 2012) or the number of sick leave days (Staubli and Zweimüller, 2013). Their findings have been mixed and based on reforms raising the eligibility age for pensions. The role of health may be different in the context of Finland in which a possibility to take earlier retirement was offered through introduction of a flexible pension age. Using nationally representative register data, we examined the association of health with transition to retirement through any route among individuals subject to the old and new pension systems in Finland before and after 2005. Utilizing individual-level records of prescription medication and hospital admissions, we considered various objective measures of health, including purchases of psychotropic medication, hospitalizations due to circulatory diseases, hospitalizations due to musculoskeletal diseases, and the number of any prescription medications. While the last measure reflects a more general health status, the first three are indications of common health conditions that drive people prematurely from the labour market. Musculoskeletal diseases, mental disorders, and circulatory diseases are the three most common diagnostic causes of disability retirement among older workers in Finland (Finnish Centre for Pensions & The Social Insurance Institution of Finland (2015)).

More specifically, we examined

1. Whether different health measures are associated with retirement at age 63–64
2. Whether the risk of retirement was different before and after the pension reform introducing flexible pension age, and
3. Whether the reform-related change in retirement varied by the different health measures (or, to put it differently, whether the association of the different health measures with retirement changed between the period before and after the reform).

2. Materials and methods

2.1. Study population and pension reform status

We used longitudinal register data from various administrative sources linked by Statistics Finland by means of unique personal identification numbers. The data comprise a nationally representative 11% random sample of the population permanently residing in Finland at the end of any of the years 1987–2007. In addition, the sample has been supplemented with a random oversample of persons who died, so that 80% of all deaths in the study period are included. Because of the different sampling probabilities among the deceased and the living, analytical weights were used in the analyses. The data include longitudinal information on labour market

participation, purchases of prescription medication, cause-specific hospital admissions, and socio-demographic factors until the end of 2009.

For this study we included successive birth cohorts that reached retirement age before and after the statutory old-age pension reform which replaced the prior fixed age limit of 65 with a flexible age range between 63 and 68. The study design is described in Fig. 1. In order to assess the reform-related change in the risk of retirement, we divided the study population into the pre-reform group born in 1937–1941 (reached age 63 before the 2005 reform) and into the post-reform group born in 1941–1945 (reached age 64 after the reform). Those born in 1941 were subject to the old pension system in 2004 as they reached age 63 and to the new system in 2005 as they reached age 64. For those born in 1941 reform status was therefore used as time varying by updating the pre-reform status to post-reform status at the end of year 2004.

We only included people who participated in the labour force at baseline, i.e. at the end of the year they were 62 years old ($N = 21\,305$, 34.7% of the total population from these cohorts), including the employed (those in both full- and part-time paid employment) and the unemployed (those registered as active job seekers, therefore excluding unemployment pensioners). Following the secular trend of longer working lives, participation in the labour force at baseline steadily increased across successive birth cohorts, ranging between 26.9% and 45.7% among those born in 1937 and 1945. The prevalence of the exclusion criteria did not vary consistently across the birth cohorts, but prior retirement due to disability (48.0% and 42.5% among the 1937 and 1945 birth cohorts) and unemployment (28.4% and 25.1%) tended to become less common, whereas other early retirement (6.2% and 7.8%), early or occupation-specific old-age retirement (14.3% and 19.6%), and being outside the labour force for other reasons than retirement (3.1% and 4.9%) tended to become more common over time (see the Follow-up of retirement section for more information on pension types).

2.2. Measurement of health

For mental health we used information on purchases of prescribed psychotropic medication among the study population obtained from the reimbursement register of the Social Insurance

Institution of Finland. The Anatomical Therapeutic Chemical (ATC) classification codes were used to include psycholeptics (N05) and psychoanaleptics (N06, excluding anti-dementia drugs N06D). Medication data was available since 1995 and could thus be observed for each birth cohort since age 58. For circulatory and musculoskeletal health we used information obtained from the hospital discharge records of the National Institute for Health and Welfare. Based on the International Classification of Diseases (ICD-9 for year 1995 and ICD-10 for years 1996–2009), we identified hospitalizations due to diseases of the circulatory system (390–459, I00–I99) and diseases of the musculoskeletal system and connective tissue (710–739, M00–M99). We used dichotomous health measures according to whether a study person had any purchases of psychotropic medication, any hospitalizations due to circulatory diseases or any hospitalizations due to musculoskeletal diseases between ages 58 and 62. The measures were used as time varying by updating the health status at age 63 in the case that new medication purchases or hospitalizations occurred.

Measurement of medication use was based on information on the number of any prescription medication purchases obtained from the reimbursement register. Among the study population 90.3% had at least one purchase between ages 58 and 62. We calculated mean annual number of purchases during these ages. We then split the variable into two groups around the median value (range 3.6–5.1 for cohorts born in 1937–1945, respectively) calculated separately for the individual birth cohorts in order to account for the secular increase in the number of prescription medication purchases.

2.3. Measurement of socio-demographic factors

Marital status, education, and unemployment were measured at baseline at age 62. Marital status included the categories 1) never married, 2) married, 3) divorced, and 4) widowed. Education included the categories 1) tertiary, 2) secondary, and 3) primary education. Unemployment was based on information on main economic activity. Marital status and unemployment were used as time varying by updating the status at age 63.

Information on occupational social class was available in five-year intervals between 1970 and 2005. For each birth cohort and follow-up year we used the most recent available information

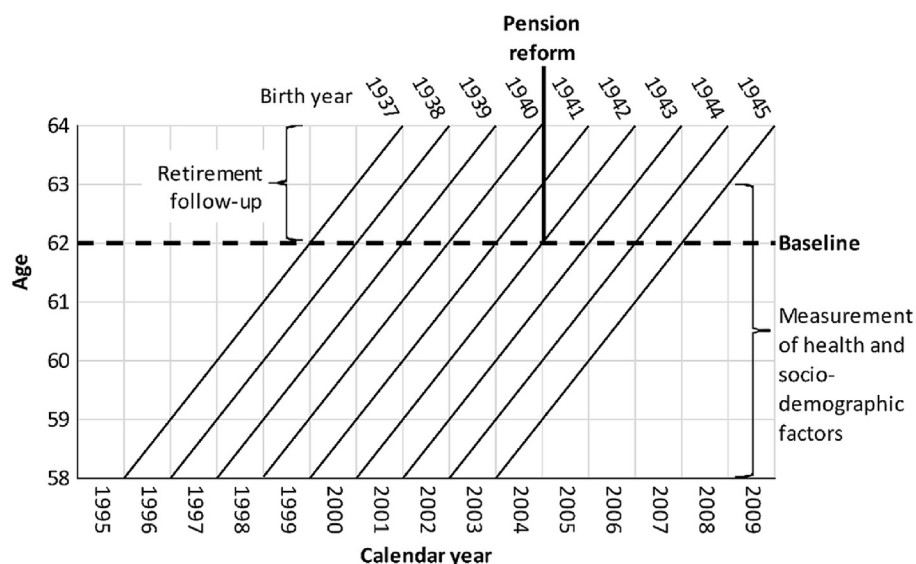


Fig. 1. A Lexis diagram of the study design.

mainly from the years 2000 and 2005, depending on the cohort. Previously recorded data was used for those with unavailable information on social class in these years, e.g. for the unemployed. The classes included 1) upper non-manual employees, 2) lower non-manual employees, 3) manual workers, 4) entrepreneurs, and 5) other/missing.

Income was measured in terms of household disposable income per consumption unit, consisting of the individual income of all household members including wages, capital income, and income transfers, taking taxes into account. For data-protection reasons, the highest 3% of incomes were combined and given a constant of 1.25 times the minimum income in this group. Total household disposable income was divided by the number of consumption units in order to adjust for household size. The first adult in the household was given the consumption unit value 1.0, all other adults the value 0.5, and all children aged 0–13 the value 0.3. We calculated the average annual household disposable income per consumption unit at age 60–62. The measure was then divided into income quintiles.

2.4. Follow-up of retirement

The follow-up of retirement at age 63–64 was based on annual information on main economic activity. Statistics Finland compiled this variable through a multistage process using information on e.g. labour force participation, sources of income, and the receipt of social security benefits. The classification prioritizes labour force participation, thereby classifying working part-time pensioners as being employed. The employed primarily include individuals taking part in pension insured paid employment for any amount of time during the last week of a given calendar year. For wage earners aged 63–64, taking out a pension insurance has been obligatory under both the old and the new pension systems, whereas for same-aged entrepreneurs, the insurance became voluntary under the new system. After the reform, non-insured entrepreneurs aged 63–64 may not be classified as being employed unless, for example, entrepreneurship constitutes their main source of income. We defined retirement to occur in the calendar year a study person's main economic activity changed from employment or unemployment to retirement. For 89.1% of those who retired we could determine the exact date of the transition based on records of pension episodes derived from the Finnish Centre for Pensions and the Social Insurance Institution of Finland. For the rest we defined retirement to occur in the middle of the calendar year (e.g., since working pensioners were already receiving pensions before they exited the labour force, the onset of pension episodes could not always be used to determine the timing of their retirement transition).

Within the new flexible pension system most retirement occurs through statutory old-age retirement, whereas before the reform retirement at age 63–64 could occur through various types of retirement, including disability pensions, unemployment pensions, special pensions for farmers, and early or occupation-specific old-age pensions (Supplementary Table 1). A more specific description of the Finnish pension types before and after the reform is provided in Supplement 1. Most importantly, retirement at age 63–64 was a widely available option both before and after introduction of the flexible pension age. Furthermore, each additional year in employment increases the pension accrual in both the old and the new pension systems, although the reform somewhat reduced the magnitude of the incentives to continue working past ages 63 and 64 and increased the work incentives only at older ages (Uusitalo and Nivalainen, 2013).

Over the follow-up years no other major pension reforms affecting those aged 63–64 were conducted in Finland. However,

early retirement options around age 60 were somewhat reduced for cohorts born in 1944/1945 and later (Finnish Centre for Pensions & The Social Insurance Institution of Finland (2015)). This may lead to variation in the baseline characteristics at age 62 among individual birth cohorts. Based on characteristics measured in this study, we found that cohorts born in 1944–1945 had a higher prevalence of mental ill health than earlier post-reform birth cohorts. This may, however, be attributable to an increasing secular trend in the prescription of psychotropic medication. The retirement patterns of cohorts born in 1944–1945 may also be influenced by the financial crisis as these cohorts reached age 63 or 64 in 2008. We therefore performed sensitivity analyses in which immediate (born in 1941–1943) and later (born in 1944–1945) post-reform groups were examined separately.

Our retirement outcome did not capture pension receipt among people who were still participating in the labour market. This may have implications for the results, because working while receiving part-time pensions has become more common across the birth cohorts (receipt of part-time pensions at baseline increased from 13.6% among those born in 1937 to 22.5% among those born in 1942 after which the increasing trend levelled off). We may also overestimate retirement among entrepreneurs within the new flexible pension system because of the above mentioned changes in pension insurance policy. Moreover, our retirement outcome excluded exit from employment through other pathways than pension receipt. At the time of the old system with a statutory pension age of 65, early retirement and unemployment were alternative routes for exit from employment at age 63–64. We therefore performed sensitivity analyses using two additional definitions of retirement, including 1) the onset of any pension receipt among those who participated in the labour force and did not receive pensions at baseline and 2) any exit from employment (change in the main economic activity from employment to some other status) among those who were employed at baseline.

2.5. Statistical methods

Cox proportional hazards regression analysis was used to follow up retirement at age 63–64. A study person was censored at emigration, death, or labour force exit due to other reasons than retirement. We calculated hazard ratios (HRs) and their 95% confidence intervals (CIs) for the different health measures and reform status after simultaneous adjustment for the health measures and adjustment for socio-demographic factors. We then tested interactions between each health measure and reform status. We also performed the above mentioned sensitivity analyses for these interactions, i.e. examined immediate and later post-reform groups separately and used different definitions of the retirement outcome. We present the interaction results for each health measure using the pre-reform group with better health (no mental, circulatory, and musculoskeletal ill health, and below median medication use) as the reference group for all other combinations of health and reform status groups. We also calculated %-differences of the HRs by reform status $[(HR_{\text{post-reform}} - HR_{\text{pre-reform}})/HR_{\text{pre-reform}} \times 100]$ within each health status group and by health status $[(HR_{\text{poorer health}} - HR_{\text{better health}})/HR_{\text{better health}} \times 100]$ within each reform status group. Men and women were pooled in the analyses as the associations between the health measures, reform status, and retirement did not vary significantly by gender.

3. Results

For the pre-reform group there was a decreasing trend in retirement by age 63 and by age 64 across the individual cohorts born after 1938 (Fig. 2). Increased retirement for the post-reform

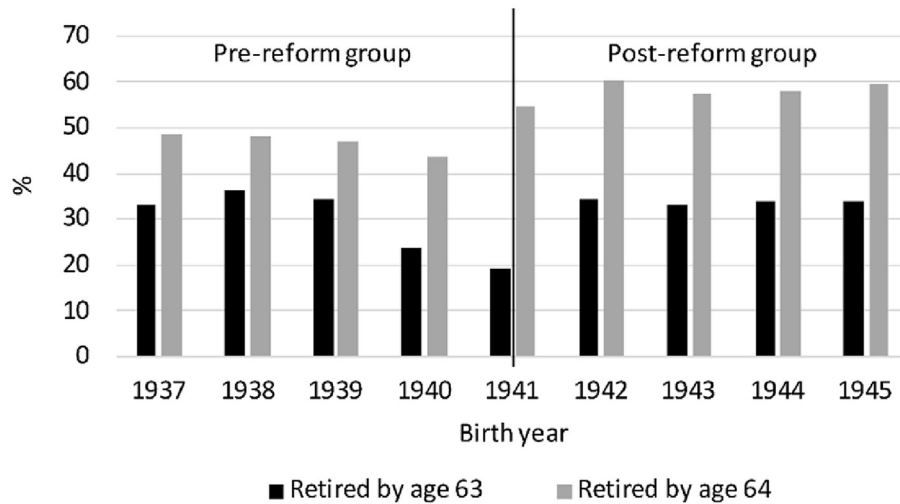


Fig. 2. Percentage retired by age 63 and 64 by birth year in the pre- and post-reform groups.

group contributed to a clear break in this trend. There was no consistent trend in retirement across the individual birth cohorts in the post-reform group, but each of them was nevertheless more likely to retire by age 64 than the cohorts in the pre-reform group.

The differences between the pre- and the post-reform groups in baseline health status were small (Table 1). While secular health improvements have likely contributed to the increasing labour force participation at age 62 and subsequently to the increasing percentage of people included in the study across the original birth cohorts (see the Methods section for more details), little health change could be observed across the cohorts selected into the baseline study population. Among the whole study population 18.6% had a history of psychotropic medication and 9.1% and 9.9% had a history of hospitalizations due to circulatory and musculoskeletal diseases, respectively, in the five years prior to baseline. Those in the post-reform group were more likely to be better educated and employed, have a non-manual social class, and belong to higher household income quintiles than those in the pre-reform group (Table 1). This is likely to be related to the secular trend toward higher educational attainment, non-manual occupational structure, higher employment participation among older workers, and higher levels of income. About 1–2% of the study population had missing information on social class and household income. These groups were included in the analyses as separate categories.

The retirement rate (per person-year) at age 63–64 was 0.31 for the pre-reform group and 0.45 for the post-reform group (Table 1). Overall, retirement was more common among those with poorer mental, circulatory and musculoskeletal health as well as among those with above median medication use. However, the increase in the retirement rate for the post-reform group was larger among those with better health status, which lead to smaller differences in the retirement rate by health status among the post-than the pre-reform group. This finding was generally consistent across individual birth cohorts at least when examining relative differences in the retirement rate by health status (Supplementary Fig. 1). By way of exception, the difference by mental health was relatively large among those born in 1944, and the difference by circulatory health was relatively small among those born in 1940. On the average, the differences in the retirement rate by mental and circulatory health were somewhat smaller among the immediate than the later post-reform group.

The magnitude of the increase in the retirement rate for the post-reform group varied not only by health, but also by various socio-demographic factors (Table 1). The increase was larger among men and among marital status groups other than the divorced. The increase was also larger among the more disadvantaged social groups, i.e. the less educated, manual workers, those with lower household income, and the unemployed. In addition, the relative increase was especially large among the entrepreneurs, who originally had very low retirement rates.

In analyses including all birth cohorts, mental, circulatory and musculoskeletal ill health as well as above median medication use were each associated with a higher risk of retirement at age 63–64 (Table 2, Model 1). These associations somewhat attenuated after simultaneous adjustment for the health measures (Model 2). The effect of additional adjustment for reform status and socio-demographic factors was mixed (Model 3). After all adjustments, those with poorer health status still had 8–11% higher risks of retirement. The post-reform group had a 50% higher risk of retirement than the pre-reform group.

Table 3 presents results for the interaction between each health measure and reform status. The increase in the risk of retirement for the post-reform group was larger among those with better health (52.1–67.9%) than among those with poorer health (26.7–35.3%). As a result the difference in the risk of retirement by health status, i.e. those with poorer health having a higher risk, was smaller in the post-reform group (0.4–4.7%) than in the pre-reform group (18.4–25.9%). In the post-reform group, none of the differences by health status were statistically significant. Sensitivity analyses showed results of a similar direction regardless of whether immediate or later post-reform groups were examined (Supplementary Table 2). However, those with better health had a somewhat lower risk of retirement in the later than in the immediate post-reform group, whereas among those with poorer health the risk varied less between the different post-reform groups. The increase in the risk of retirement between the pre-reform group and the later post-reform group was nevertheless still larger among those with better health (42.1–57.2%) than among those with poorer health (24.0–34.1%), although the interactions were generally not as strong as for the immediate post-reform group. Accordingly, the differences in the risk of retirement by health status were still smaller for the later post-reform group (1.6–11.7%) than for the pre-reform group (18.4–25.8%), whereas for the

Table 1
Distribution of the study population at baseline (% and unweighed N) and retirement during follow-up at age 63–64 (rate per person year) by health status and socio-demographic factors among the pre- and post-reform groups.

	Pre-reform group			Post-reform group		
	%	N	Retirement rate	%	N	Retirement rate
Ill health status						
Mental						
No	81.0	8669	0.29	81.8	8621	0.44
Yes	19.0	2105	0.38	18.2	1910	0.49
Circulatory						
No	90.8	9699	0.30	90.9	9557	0.45
Yes	9.2	1075	0.36	9.1	974	0.47
Musculoskeletal						
No	90.6	9782	0.30	89.7	9462	0.45
Yes	9.4	992	0.39	10.3	1069	0.49
Medication use						
≤median	50.8	5448	0.26	49.8	5248	0.44
>median	49.2	5326	0.35	50.2	5283	0.47
Socio-demographic factors						
Gender						
Men	51.6	5878	0.26	52.3	5554	0.45
Women	48.4	4896	0.36	47.7	4977	0.46
Marital status						
Never married	7.9	959	0.31	8.1	852	0.46
Married	70.6	7419	0.31	68.8	7241	0.47
Divorced	14.3	1638	0.30	17.0	1800	0.39
Widowed	7.1	758	0.32	6.1	638	0.46
Education						
Tertiary	27.6	2848	0.40	33.7	3535	0.42
Secondary	25.5	2726	0.30	29.6	3117	0.47
Primary	46.9	5200	0.26	36.7	3879	0.47
Social class						
Upper non-manual	18.4	1918	0.44	21.8	2283	0.40
Lower non-manual	28.3	2946	0.41	30.3	3166	0.49
Manual	31.6	3527	0.31	29.8	3164	0.52
Entrepreneur	20.8	2281	0.11	17.4	1838	0.38
Other/missing	0.9	102	0.03	0.8	80	0.14
Household income						
1st quintile (highest)	11.3	1133	0.27	26.8	2817	0.40
2nd quintile	15.0	1550	0.35	23.7	2499	0.46
3rd quintile	18.8	1981	0.35	20.4	2144	0.49
4th quintile	24.1	2581	0.36	16.0	1685	0.50
5th quintile (lowest)	28.8	3298	0.25	12.0	1276	0.46
Missing	1.9	231	0.07	1.1	110	0.22
Unemployment						
No	86.9	9229	0.31	88.9	9356	0.43
Yes	13.1	1545	0.30	11.1	1175	0.74
Total	100.0	10 774	0.31	100.0	10 531	0.45

Table 2
Health and reform status as predictors of retirement at age 63–64.

	Model 1		Model 2		Model 3	
	HR	95% CI	HR	95% CI	HR	95% CI
Ill health status						
Mental						
No	1.00		1.00		1.00	
Yes	1.17	(1.12–1.23)	1.11	(1.06–1.17)	1.11	(1.06–1.17)
Circulatory						
No	1.00		1.00		1.00	
Yes	1.10	(1.03–1.17)	1.05	(0.99–1.12)	1.08	(1.01–1.15)
Musculoskeletal						
No	1.00		1.00		1.00	
Yes	1.17	(1.10–1.24)	1.13	(1.06–1.20)	1.11	(1.04–1.18)
Medication use						
≤median	1.00		1.00		1.00	
>median	1.16	(1.12–1.21)	1.12	(1.07–1.17)	1.08	(1.03–1.12)
Reform status						
Pre-reform	1.00				1.00	
Post-reform	1.49	(1.43–1.55)			1.50	(1.43–1.57)

Model 1: health measures and reform status individually.

Model 2: all health measures.

Model 3: all health measures, reform status, gender, marital status, education, social class, household income, and unemployment.

immediate post-reform group these differences were negligible and even slightly reverse (−1.0–6.5%).

Sensitivity analyses also showed results of a similar direction regardless of whether retirement was defined as exit from the labour force through pension receipt (our primary definition for which results were presented in Table 3), the onset of any pension receipt (Supplementary Table 4), or any exit from employment (Supplementary Table 4): the increase in the risk of retirement for the post-reform group was consistently larger among those with better health. For circulatory health, however, the interactions based on the latter two definitions of retirement were not statistically significant, which was partly caused by smaller baseline study populations in these analyses (Supplementary Tables 3 and 4). Overall, the reform-related increase in retirement was somewhat larger when retirement was defined as the onset of any pension receipt (Supplementary Table 3) and smaller when retirement was defined as any exit from employment (Supplementary Table 4).

Interactions between socio-demographic factors and reform status were statistically significant and in line with the above mentioned descriptive results (Supplementary Table 5).

Table 3
Interactions between health and reform status as predictors of retirement at age 63–64.

Ill health status; reform status	HR	95% CI	Difference by reform status, % ^a	Difference by health status, % ^b	P-value for interaction ^c
Mental					
No; pre-reform	1.00				0.000
No; post-reform	1.56	(1.48–1.64)	55.8		
Yes; pre-reform	1.25	(1.15–1.36)		25.0	
Yes; post-reform	1.63	(1.52–1.75)	30.4	4.7	
Circulatory					
No; pre-reform	1.00				0.045
No; post-reform	1.52	(1.45–1.59)	52.1		
Yes; pre-reform	1.18	(1.06–1.32)		18.4	
Yes; post-reform	1.57	(1.44–1.71)	32.5	3.1	
Musculoskeletal					
No; pre-reform	1.00				0.003
No; post-reform	1.53	(1.46–1.61)	53.4		
Yes; pre-reform	1.26	(1.13–1.40)		25.9	
Yes; post-reform	1.60	(1.47–1.73)	26.7	4.0	
Medication use					
≤median; pre-reform	1.00				0.000
≤median; post-reform	1.68	(1.58–1.79)	67.9		
>median; pre-reform	1.25	(1.16–1.33)		24.5	
>median; post-reform	1.69	(1.58–1.80)	35.3	0.4	

Adjusted for all health measures, gender, marital status, education, social class, household income, and unemployment.

^a $[(HR_{\text{post-reform}} - HR_{\text{pre-reform}})/HR_{\text{pre-reform}} \times 100]$ calculated within each health status group.

^b $[(HR_{\text{poorer health}} - HR_{\text{better health}})/HR_{\text{better health}} \times 100]$ calculated within each reform status group.

^c Interaction between each health measure and reform status.

4. Discussion

4.1. Main results and their interpretation

We found that the likelihood of retirement at age 63–64 was 50% higher among people who became subject to the new flexible statutory pension system with a lower age limit at 63 than among people who were subject to the old system with a fixed statutory pension age at 65. Since retirement at age 63–64 was possible through various pension types already before the reform, and since there was no considerable reform-related change in the economic incentives for continuing in work past ages 63 and 64 (Uusitalo and Nivalainen, 2013), the observed behaviour change was likely to be driven by a reduction in the normative retirement age from 65 towards 63 (Börsch-Supan, 2005). The reform led to earlier retirement regardless of health status, but the change was more pronounced among people with better mental, circulatory and musculoskeletal health as well as among people with below median level medication use. As a result, poor health became a weaker predictor of retirement at age 63–64 after introduction of the flexible pension age that offers more choice with respect to the timing of retirement. In absolute terms, however, people with poorer health still retire a little bit earlier. A lower statutory retirement age thus appears to excessively pull healthy individuals into retirement, whereas individuals with poorer health are pushed out of the labour market through any available retirement type.

Previous studies on reforms that raised the eligibility age for pensions have found either no variation in the behaviour response by health status (Behaghel and Blau, 2012) or larger response among people with better health (Staubli and Zweimüller, 2013). Consistent with our finding on larger responsiveness to the pension age reform among healthier individuals, the study from Austria found that raising of the eligibility age for early retirement resulted in a larger employment increase among people with better health, because people with poorer health continued to exit the labour market through other routes (Staubli and Zweimüller, 2013). Several studies suggest that pension age reforms have resulted in changes in the incidence of alternative exit routes from the labour market such as claiming disability or unemployment benefits

(Atalay and Barrett, 2015; Cribb et al., 2014; Duggan et al., 2007; Staubli and Zweimüller, 2013; Vestad, 2013). In the context of the present study as well as in other contexts where various exit routes are widely available, changes in the eligibility ages for particular types of pensions may have limited influence on employment participation among individuals with poorer health, because they are likely to be pushed out of the labour market early regardless of institutional retirement ages. Previous studies have shown that poor health increases the likelihood of experiencing involuntary retirement (Szinovacz and Davey, 2005; van Solinge and Henkens, 2007). Given that individuals with better health make retirement decisions on a more voluntary basis, they are more likely to be pulled into retirement in accordance with institutional and normative changes in retirement ages. Our finding of a larger reform-related increase in retirement at age 63–64 among people with better health might also be related to their better socioeconomic resources which make early retirement affordable and enable different leisure activities during retirement. However, this explanation seems unlikely, because the retirement response to the reform was larger among individuals in lower rather than in higher socioeconomic positions and the effects of health were not largely accounted for by socioeconomic factors.

The present study indicates that the Finnish pension reform of 2005 had unintended consequences that are contrary to the original expectations of promoting longer working lives: not only did the reform considerably increase retirement at age 63–64, it encouraged earlier retirement particularly among individuals who would have been likely to otherwise have several healthy working years ahead of them. Our findings therefore give at least partial justification to future pension reforms. The Finnish parliament has already accepted a bill presented by the government on a pension reform that will come into effect as of the beginning of 2017. The lower age limit of statutory retirement will be gradually raised to 65 years after which it will be linked to life expectancy (Reipas and Sankala, 2015). However, it should be kept in mind that even though introduction of the flexible pension age increased early retirement particularly among people with better health, in absolute terms people with poorer health still retire earlier, and they are likely to have limited opportunities to extend their working lives

regardless of institutional retirement ages.

4.2. Methodological considerations

We used a nationally representative population sample based on longitudinal register data with no self-reporting bias or loss to follow-up. The large dataset allowed for examination of the association between health and retirement before and after the Finnish old-age pension reform. The examined health measures were based on objective information on both mental and physical health and they ranged from measures on the use of prescription medication to more severe ones based on hospitalizations.

Our study population included individuals who were still participating in the labour force at age 62, which is around one third of the total population in the examined birth cohorts. Due to selection effects, older workers are on the average healthier than the same-aged population in general. Despite the fact that our study population was highly selected in terms of health, we found a large difference by health status in the effect of the pension age reform on retirement. Health might play an even larger role if pension age reforms were applied to younger age groups or to populations in which it is more common to continue working until older ages.

We measured retirement based on register-based information on exit from the labour force through pension receipt. Previous studies that have examined how reforms lowering the eligibility age for pensions influence labour market participation have shown that the findings may depend on whether the outcome measure is based on pension receipt or employment participation (Baker and Benjamin, 1999; Börsch-Supan and Schnabel, 1999; Vestad, 2013). Our sensitivity analyses indicate that the reform-related increase in retirement at age 63–64 was somewhat larger when the onset of any pension receipt was considered and smaller when any exit from employment including unemployment was considered. The possibility to take earlier retirement within the new flexible system thus appeared to slightly increase gradual exit from the labour market in the form claiming statutory pension benefits while continuing in employment and to partly substitute unemployment as a work exit route. The results nevertheless followed a similar pattern regardless of the retirement definition used, suggesting that the reform also influenced full retirement and that it did not solely substitute previously existing work exit routes with new ones. Accordingly, Norwegian findings indicate that a reform lowering the eligibility age for retirement resulted not only in increased pension receipt but also decreased employment participation (Vestad, 2013). On the contrary, Canadian findings indicate that a reform lowering the eligibility age for retirement had little employment effects, because increased pension receipt was mostly restricted to individuals who were likely to have had limited labour market participation even if the eligibility age had not been lowered (Baker and Benjamin, 1999).

The influence of pension reforms on labour market behaviour may depend on the prevailing social security system. Scandinavian countries tend to have relatively generous benefits, and exit from employment is typically connected with the onset on benefit receipt. Overall labour market conditions may also play a role. For example, a study from Estonia suggests that the recent economic recession diminished the effect that a pension age reform had on exit from the labour market during the 2000s (Puur et al., 2015). Our sensitivity analyses indicate that among people with better health, the likelihood of retirement at age 63–64 was actually somewhat smaller for the later post-reform group who reached the eligibility ages of the new flexible pension system during the financial crisis than for the immediate post-reform group who had become subject to this system before the crisis (while controlling

for prior unemployment and other socio-demographic factors). This may reflect the general trend towards longer working lives across successive birth cohorts in Finland (Leinonen et al., 2015). This may also reflect partial reversal of the behaviour trend following a temporary reform-related increase in retirement. However, for people with poorer health we found no corresponding decrease in retirement for the later post-reform group. Employment prospects during the recession of the late 2000s may have been particularly poor among individuals with poorer health, contributing to early retirement among this group. A previous study using data from 27 European countries suggests that the economic recession contributed to a larger increase in unemployment among people with than without mental health problems (Evans-Lacko et al., 2013).

Despite adjustment for a wide range of socio-demographic factors and performing sensitivity analyses that separately examine immediate and later post-reform groups, our models do not necessarily account for potential confounding of changes in labour market conditions, the work environment, or other societal factors which may have contributed to non-reform-related differences in retirement behaviour between the pre- and post-reform groups. The effect of the 2005 Finnish pension reform on increased retirement at age 63–64 has been previously established (Uusitalo and Nivalainen, 2013). However, it remains unclear whether the observed differences in the role of health as a predictor of retirement before and after the reform are partly explained by changes in unobserved factors that are unrelated to the reform. Sudden changes around year 2005 that would largely bias the results are nevertheless unlikely.

5. Conclusions

Poor health is likely to be a weaker predictor of retirement in pension systems that offer choice with respect to the timing of statutory retirement. Contrary to the expectations of the Finnish pension reform to extend working lives, a lower eligibility age for statutory retirement appears to encourage early retirement particularly among healthier individuals regardless of a system that provides strong economic incentives for continuing in work. Since one of the unintended consequences of the reform turned out to be excess increase in early retirement among healthy people who are likely to otherwise have good potential for continuing in work, stricter pension eligibility criteria may be needed in order to achieve longer working lives. However, future policy development should also take into account that in absolute terms those with poorer health are still more likely to retire earlier, and they may not be able to extend their working lives regardless of the policy environment.

Acknowledgements

This study was supported by the Academy of Finland, the Finnish Centre for Pensions, and the Joint Committee for Nordic Research Councils for the Humanities and the Social Sciences (project no.219643/F10). We are grateful to Statistics Finland, the Finnish Centre for Pensions, the Social Insurance Institution of Finland and the National Institute for Health and Welfare for making the data available to us. TC is supported by the UK Economic and Social Research Council (ES/J019119/1).

Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.socscimed.2016.04.029>.

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