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RESEARCH ARTICLE

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Retirement age and disability status as pathways to later-life cognitive impairment: Evidence from the Norwegian HUNT Study linked with Norwegian population registers

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Abstract

Background: Research shows that retirement age is associated with later-life cognition but has not sufficiently distinguished between retirement pathways. We examined how retirement age was associated with later-life dementia and mild cognitive impairment (MCI) for people who retired via the disability pathway (received a disability pension prior to old-age pension eligibility) and those who retired via the standard pathway.

Methods: The study sample comprised 7210 participants from the Norwegian Trøndelag Health Study (HUNT4 70+, 2017–2019) who had worked for at least one year in 1967–2019, worked until age 55+, and retired before HUNT4. Dementia and MCI were clinically assessed in HUNT4 70+ when participants were aged 69–85 years. Historical data on participants' retirement age and pathway were retrieved from population registers. We used multinomial regression to assess the dementia/MCI risk for women and men retiring via the disability pathway, or early (<67 years), on-time (age 67, old-age pension eligibility) or late (age 68+) via the standard pathway.

Results: In our study sample, 9.5% had dementia, 35.3% had MCI, and 28.1% retired via the disability pathway. The disability retirement group had an elevated risk of dementia compared to the on-time standard retirement group (relative risk ratio [RRR]: 1.64, 95% CI 1.14–2.37 for women, 1.70, 95% CI 1.17–2.48 for men). MCI risk was lower among men who retired late versus on-time (RRR, 0.76, 95% CI 0.61–0.95).

Conclusion: Disability retirees should be monitored more closely, and preventive policies should be considered to minimize the dementia risk observed among this group of retirees.

KEYWORDS
aging workforce, dementia, mild cognitive impairment, older workers, work disability

Key points

- In many countries, a significant proportion of people exit the workforce before they are eligible to receive an old-age pension due to disability.
- In a Norwegian population-based cohort study (based on the HUNT Study linked to population registry data), we found that early retirement due to disability—but not early retirement per se—was associated with a higher risk of dementia in later life.
- The cognitive health of people exiting the workforce due to disability should be monitored.
- Studies researching the link between retirement age and later-life cognition should distinguish between different pathways to retirement.

1 | INTRODUCTION

The number of individuals with dementia is predicted to triple within the next 30 years.[1] Given its devasting personal and societal costs and the current lack of effective pharmacological treatments, it is imperative to identify whether lifestyle and health risk behaviors can influence later-life cognitive impairment. The "use it or lose it" hypothesis posits that people can maintain cognitive function by engaging in cognitively-stimulating activities, such as paid work.[2] Some studies suggest that later retirement may protect against cognitive impairment, with findings showing that employment and later retirement are negatively related to dementia,[3–6] and cognitive decline accelerates post-retirement.[7–11] For instance, a Swedish study (N = 63,505) found a 2.9-fold lower risk of dementia among those who retired at age 66+ compared to their peers who retired at age 65.[3] The precise nature of the relationship between retirement age and later-life cognitive impairment is, however, still debated. A primary concern is the overlap between factors that influence whether people retire early, "on time", or late (e.g., poor health, education, wealth[12]) with those related to later-life cognitive impairment.[13] There is also evidence of reverse causality (i.e., cognitive impairment causes people to retire early).[5] Conclusions from a recent systematic review emphasized the need for more knowledge on the association between retirement and age-related cognitive decline.[11]

To date, most retirement research has focused on people who follow the standard, work-to-retirement pathway. In many Western countries, however, many people retire via the "disability pathway", that is, by exiting the workforce via a disability pension prior to becoming eligible for an old-age pension.[14] Failing to account for variation in the pathways to retirement may cloud our understanding of the relationship between retirement age and later-life cognitive impairment.

Our study is based on data from Norway, where the context allows for considerable heterogeneity regarding retirement age and pathway. Anyone who has lived or worked legally in Norway for at least five years after age 16 is entitled to a retirement pension from the Norwegian state. The normal retirement age in Norway is 67, although collective agreements entitle many public and private sector employees to early retirement from age 62. A considerable proportion of Norwegian residents also leave the labor force before age 67 with a disability pension, which requires at least 50% reduced work capacity certified by a physician. At age 67, the old-age pension replaces the disability pension. More than a quarter (28%) of Norwegians aged 62–67 years receive disability benefits,[15] with musculoskeletal and psychiatric problems being the most frequent health-related reasons for disability.[16] In the current study, we shed light on the relationship between retirement age and later-life cognitive impairment by distinguishing between two different pathways to retirement (via disability or standard retirement) to help disentangle the relationship between retirement age and later-life cognitive impairment. Previous research has found that retirement age is more closely related to dementia and cognitive decline for men than for women.[6,10] Moreover, dementia is more common among women than among men,[17,18] particularly at older ages,[18] whereas mild cognitive impairment (MCI) is more common in men.[18–20] We therefore conduct sex- and diagnosis-specific analyses.

2 | METHODS

2.1 | Design and data sources

We employed a historical cohort design. Our starting point was clinical assessments of dementia and MCI conducted as part of the fourth wave of the Norwegian Trøndelag Health Study (HUNT4 70+, 2017–2019), a longitudinal study of health in the general population. Participants were aged 69–86 years at the time of cognitive assessment. Their HUNT4 70+ data can be linked with their data in the Norwegian population registers using the unique personal identification number assigned to all Norwegian residents. The population registers contain data on the income, employment, and sociodemographic characteristics of the entire population. In the current study, we linked data on participants' later life cognitive status with historical data on participants' employment, income, and sociodemographic characteristics from the population registers, as well as data on their pre-retirement health from HUNT1 (1984-86) and HUNT2 (1995-97).

2.2 | Sample population

All adult residents of the former Nord-Trøndelag County were invited to participate in each of the four waves of HUNT.[21,22] HUNT4 participants aged 70+ years were invited to participate in the HUNT4 70+ sub-study; in total, 9930 (51.2%) individuals aged 69–105 years participated. Our sample was comprised of 7210 HUNT4 70+ participants (a) born 1933–1949 who were (b) employed for at least one year during 1967–2019, (c) employed until age 55+ years, (d) had retired at the time of participation and the cognitive assessment in HUNT4 70+, and for whom (e) data on retirement age and cognitive impairment diagnosis were available (see Figure 1 for the sampling scheme). Participants provided informed, written consent.

3 | MEASURES

3.1 | Retirement age and pathway

Using register data, we defined *retirement age* as the age at which a person received income from a retirement or disability pension and his/her income from paid work dropped below the basic income threshold ("Grunnbeløp") as determined by the Norwegian national insurance scheme. In 2019, the basic income threshold was NOK 98 866 (~10,000 EUR). By using register data, we were able to avoid some of the problems of self-reported retirement age (e.g., social desirability, recall bias, item-non response bias).[23] Norwegian policy allows people to work and receive an old-age pension. Compared to the first year of pension receipt, our definition of retirement age thus allowed us to identify more precisely when people almost or completely stopped working. We classified participants as belonging to one of four retirement pathway groups: disability (retired <67 years, received disability benefits), early standard (retired <67 years, no disability benefits), on-time standard (retired at age 67), or late standard (retired at age 68+ years).

3.2 | Dementia and MCI diagnosis

Each HUNT4 70+ participant was assessed for cognitive impairment by two trained medical doctors, from a group of nine, using a comprehensive protocol (for details on the assessment, see[18]). Following the DSM-5 diagnostic criteria,[24] participants were categorized as having no cognitive impairment, MCI (mild neurocognitive disorder), or dementia (major neurocognitive disorder). Participants were aged 69–86 years at the time of assessment.

3.3 | Potential confounders

Retirement age and pathway are related to a number of socioeconomic, health, occupational, and social factors,[12] many of which are also risk factors for dementia (for a recent review of risk factors for dementia, see[13]). We therefore examined whether the relationship between retirement age and dementia/MCI changed after adjusting for education, occupational physical demands, number of children, midlife marital status, and midlife lifestyle and health (smoking, alcohol consumption, obesity, cardiovascular disease (CVD),

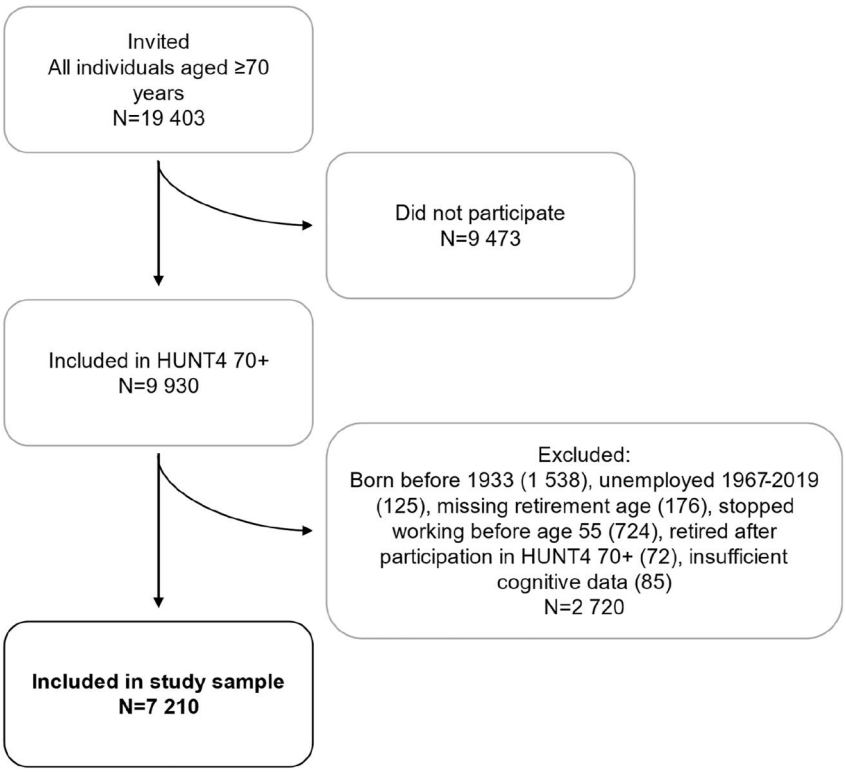

FIGURE 1 Sample selection showing those invited to participate in HUNT4 70+, non-participants, participants included in HUNT4 70+, those excluded from our study sample, and those included in the final study sample (n = 7210).

insufficient physical activity, hypertension, diabetes, having no close friends). Measures are described in Appendix 1.

3.4 | Statistical analyses

Stata v. 17 was used to conduct all analyses. Multiple imputation with 20 iterations was used to impute missing data on exposure and adjustment variables. Inverse-probability weighting (IPW) was used to account for non-response in HUNT4 70+ and to correct for bias due to skewed participation related to age, sex, and education. Details on the imputation and IPW procedures are provided in Appendix 1.

After analyzing the descriptive characteristics of the sample, we checked whether the likelihood of being included in the sample depended on sex. We used linear regression to test whether years in employment and retirement age differed between men and women and logistic regression to examine how sex was related to disability retirement, dementia, and MCI, controlling for age and education.

We then conducted a series of multinomial logistic regression analyses to assess the relationship between dementia/MCI and retirement age for women and men separately. Although MCI is considered an intermediate stage between normal cognition and dementia, most people with MCI will not progress to dementia even after 10 years of follow-up according to a meta-analysis.[25] We therefore used multinomial as opposed to ordinal logistic regression. First, we examined the association by using retirement age as a continuous variable with 1-year increments. The four regression models successively adjusted for measures of potential confounding related to age (grouped as 70–74, 75–79, 80–85) (Model 1); education and occupational physical demands (Model 2); family measures including number of children and marital status (Model 3); and lifestyle and health measures, including smoking, alcohol consumption, obesity, insufficient physical activity, hypertension, diabetes, CVD, and having at least one close friend (Model 4). Interactions between retirement age, sex, disability retirement, and occupational physical demands on the risk of dementia and MCI were tested by adding an interaction term (e.g., sex*retirement age) to Model 1.

Second, to simplify our results, we assessed the relationship between dementia/MCI and the disability, early standard, and late standard retirement groups relative to the on-time standard retirement group (reference). We analyzed women and men separately, statistically controlled for age, and then adjusted for potential confounders in successive models as described above.

We report the relative risk ratios (RRR) and 95% confidence intervals (CI) for dementia and MCI associated with 1) retiring one life year later, or 2) disability, early standard, and late standard retirement relative to on-time standard retirement.

To check the robustness of the findings, we re-ran the analyses using only complete cases (i.e., without multiple imputation) and without IPW (n = 4 885, 67.8%). To reduce the potential influence of reverse causation, we also re-ran analyses based on only those participants who had retired more than five years prior to participation in HUNT4 70+ (n = 5 856, 81.2%) (cf.[6]).

4 | RESULTS

Table 1 displays the characteristics of the sample population. At age 69–86, n = 687 (9.5%) participants were diagnosed with dementia and an additional n = 2548 (35.3%) were diagnosed with MCI. More than one quarter (28.1%) of the sample population retired early via the disability pathway.

Of the HUNT4 70+ participants born 1933–1949 who had cognitive data and who retired before participation in HUNT4 70+ (n = 8217), 214 (2.6%) women versus 16 (0.2%) men were excluded because they had worked for less than one year in 1967–2019. A further 1060 (12.9%) women versus 353 (4.3%) men were excluded because they stopped working before age 55. Women included in the study sample worked on average 8.6 fewer years and retired on average 0.5 years earlier than men, both $p < 0.001$. Women were also more likely than men to retire via the disability pathway in an age- and education-adjusted model, odds ratio 1.38, 95% CI 1.24–1.54. In age- and education-adjusted

TABLE 1 Characteristics of the sample population, stratified by sex and retirement pathway.

	Standard retirement (*n* = 5186)		Disability retirement (*n* = 2024)	
	Women (*n* = 2480)	Men (*n* = 2706)	Women (*n* = 1156)	Men (*n* = 868)
Registers				
Age in 2018, mean (SD)	76.0 (4.2)	76.1 (4.1)	76.3 (4.1)	76.3 (4.1)
Education, n (%)				
Primary	453 (18.3)	399 (14.8)	337 (29.2)	246 (28.3)
Secondary	1382 (55.7)	1513 (55.9)	607 (52.5)	522 (60.1)
Tertiary	645 (26.0)	794 (29.3)	212 (18.3)	100 (11.5)
Married, n (%)	2199 (88.7)	2404 (88.8)	1001 (86.6)	754 (86.9)
No. of children, *n* (%)				
0	123 (5.0)	181 (6.7)	41 (3.6)	81 (9.3)
1–3	1881 (75.9)	2122 (78.4)	858 (74.2)	621 (71.5)
4+	476 (19.2)	403 (14.9)	257 (22.2)	166 (19.1)
Age at retirement, mean (SD)	66.7 (2.5)	66.8 (2.7)	61.5 (3.0)	61.5 (3.0)
Years employed 1967–2019, mean (SD)	31.9 (9.1)	40.1 (5.3)	26.5 (8.4)	34.8 (5.7)
Occupational physical demands, *n* (%)				
Low	871 (35.1)	1009 (37.3)	258 (22.3)	168 (19.4)
Intermediate	527 (21.3)	1095 (40.5)	295 (25.5)	429 (49.4)
High	1015 (40.9)	587 (21.7)	527 (45.6)	254 (29.3)
HUNT1 & HUNT2				
Hypertension, n (%)	1001 (40.4)	1398 (51.7)	471 (40.7)	489 (56.3)
Daily smoking, n (%)	588 (23.7)	668 (24.7)	366 (31.7)	263 (30.3)
Insufficient physical activity, n (%)	1057 (42.6)	912 (33.7)	551 (47.7)	341 (39.3)
Obese, n (%)	345 (13.9)	264 (9.8)	222 (19.2)	156 (18.0)
High alcohol consumption, n (%)	132 (5.3)	306 (11.3)	38 (3.3)	89 (10.3)
Diabetes, n (%)	28 (1.1)	41 (1.5)	22 (1.9)	32 (3.7)
CVD, n (%)	24 (1.0)	78 (2.9)	30 (2.6)	74 (8.5)
No close friends, n (%)	27 (1.1)	85 (3.1)	21 (1.8)	35 (4.0)
HUNT4 70+				
Dementia, n (%)	190 (7.7)	229 (8.5)	135 (11.7)	133 (15.3)
MCI, n (%)	784 (31.6)	984 (36.4)	400 (34.6)	380 (43.8)

Note: The HUNT Study, Norway. HUNT: Trøndelag Health Study; The four surveys were: HUNT1: 1984–1986; HUNT2: 1995–1997; HUNT4 70+: 2017–2019. Abbreviations: CVD, cardiovascular disease; MCI, mild cognitive impairment.

models, a higher proportion of men (n = 362, 10.1%) than women (n = 325, 8.9%) were diagnosed with dementia, RRR 1.38, 95% CI 1.16–1.63. Similarly, a higher proportion of men (n = 1 184, 32.6%) than women (n = 1 364, 38.2%) were diagnosed with MCI, RRR 1.39, 95% CI 1.26–1.54.

4.1 | Delaying retirement and risk of dementia and MCI

The two-way interactions between retirement age and the disability pathway (p = 0.005) and between sex and the disability pathway (p = 0.040) were statistically-significant predictors of dementia. For MCI, there were statistically significant two-way interactions between retirement age and sex (p = 0.020), retirement age and the disability pathway (p = 0.007), and between sex and the disability pathway (p = 0.018). There were no statistically significant interactions between retirement age and occupational physical demands on either dementia or MCI (all ps > 0.05).

Given the above interactions between retirement age, sex, and the disability pathway, further analyses were stratified by both sex and retirement pathway. For men who retired via the disability pathway, each year of postponed retirement was associated with a lower risk of dementia after adjusting for potential confounders (Model 4: RRR 0.92, Table 2). Retiring one life year later via the on-time or late standard pathway was associated with a lower risk of MCI for men, also after adjusting for potential confounders (Model 4: RRR 0.92, Table 2), but was not associated with dementia risk. For women, retiring one life year later via the disability pathway was not associated with a lower risk of dementia or MCI after adjusting for potential confounders (Model 4). Retiring one life year later via the early standard pathway to retirement was unrelated to either dementia or MCI in women and men (Table 2).

4.2 | Comparison of retirement pathway groups

Figure 2 and Table S1 (Appendix 2) display the results of the multinomial logistic regression analyses of the relationship between retirement group (disability, early standard [<67 years of age], late standard [after 67 years of age]; reference: on-time standard [at 67 years of age]) and dementia/MCI risk. The disability retirement group had an increased risk of dementia compared to the on-time standard group (Figure 2, Table S1). Results were similar for women and men and were apparent after adjusting for potential

TABLE 2 Relative risk ratio (RRR) and 95% confidence intervals (CI) for later-life dementia and MCI associated with retiring one life year later when following different retirement pathways, by sex.

	Women (n = 3636)		Men (n = 3574)	
	Dementia RRR (95% CI)	MCI RRR (95% CI)	Dementia RRR (95% CI)	MCI RRR (95% CI)
Model 1				
Disability	0.95 (0.89–1.02)	**0.94 (0.91-0.99)**	**0.91 (0.84–0.97)**	**0.95 (0.90-0.99)**
Early standard <67 years	1.09 (0.92–1.28)	1.00 (0.89–1.12)	0.84 (0.69–1.04)	0.92 (0.83–1.03)
On-time or late standard 67+ years	1.05 (0.95–1.17)	1.05 (0.98–1.12)	0.98 (0.90–1.07)	**0.92 (0.87-0.97)**
Model 2				
Disability	0.97 (0.90–1.04)	0.96 (0.92–1.00)	**0.92 (0.85–0.99)**	0.95 (0.91–1.00)
Early standard <67 years	1.11 (0.93–1.31)	1.03 (0.92–1.16)	0.91 (0.73–1.13)	0.98 (0.88–1.09)
On-time or late standard 67+ years	1.06 (0.96–1.17)	1.05 (0.98–1.12)	0.99 (0.90–1.08)	**0.92 (0.87-0.98)**
Model 3				
Disability	0.98 (0.91–1.05)	0.96 (0.92–1.00)	**0.92 (0.85–0.99)**	0.96 (0.91–1.01)
Early standard <67 years	1.10 (0.93–1.31)	1.04 (0.92–1.17)	0.92 (0.74–1.14)	0.99 (0.89–1.11)
On-time or late standard 67+ years	1.07 (0.96–1.19)	1.04 (0.97–1.12)	0.98 (0.90–1.08)	**0.92 (0.87-0.98)**
Model 4				
Disability	0.98 (0.91–1.06)	0.96 (0.92–1.00)	**0.92 (0.85–0.99)**	0.95 (0.91–1.01)
Early standard <67 years	1.07 (0.89–1.28)	1.04 (0.92–1.17)	0.93 (0.75–1.15)	1.00 (0.89-1-12)
On-time or late standard 67+ years	1.07 (0.97–1.19)	1.04 (0.97–1.12)	0.98 (0.90–1.08)	**0.92 (0.86-0.98)**

Note: 95% CI not including 1 are in bold. Potential confounders were added in successive models: age (model 1); education and occupational physical demands (model 2); marital status and number of children (model 3); smoking, high alcohol consumption, obesity, physical inactivity, hypertension, diabetes, CVD, and having at least one close friend (model 4).

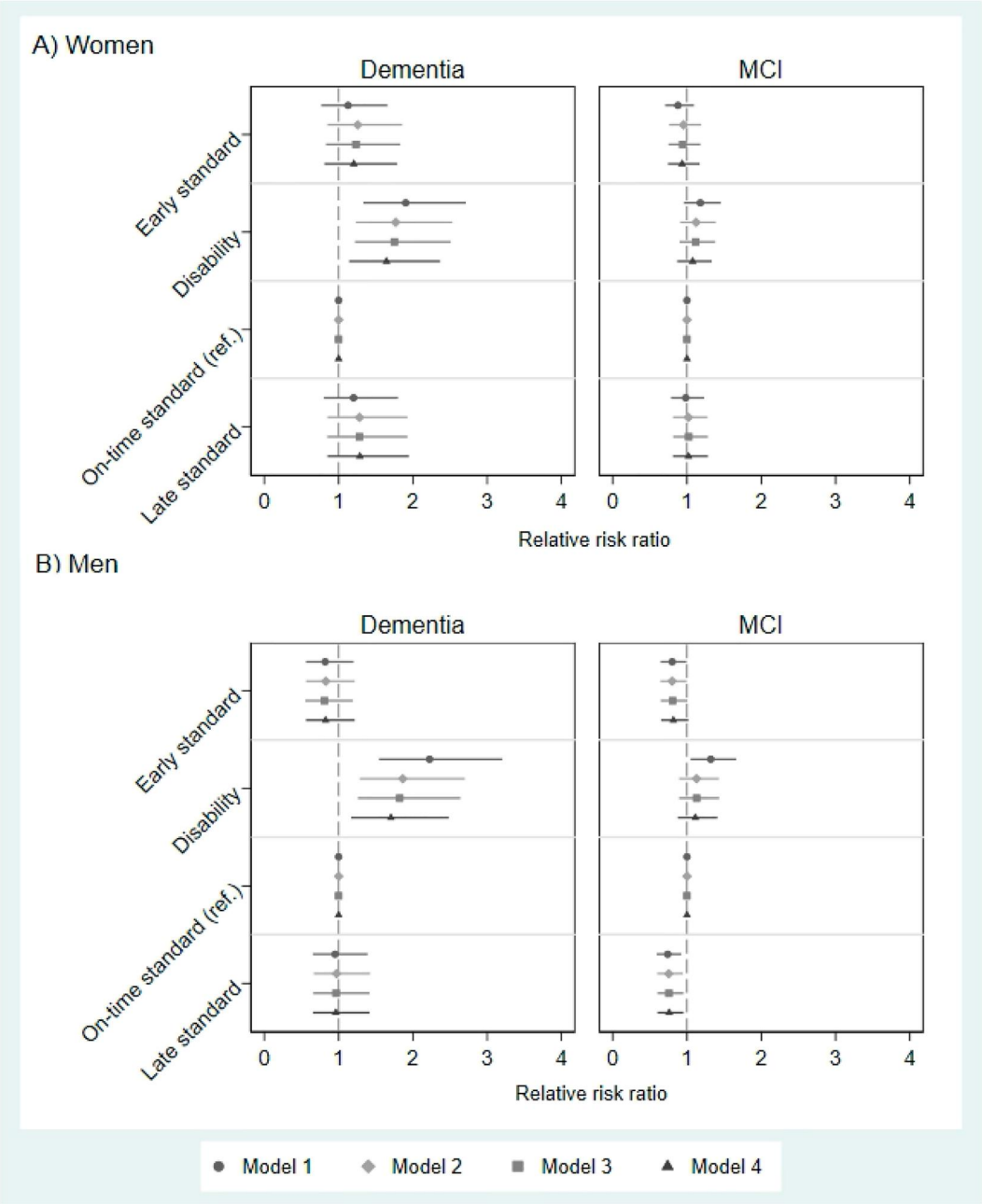

FIGURE 2 Results from multinomial logistic regression showing relative risk ratios with corresponding 95% confidence intervals for the associations of retirement pathway with dementia and MCI risk in (A) women and (B) men. On-time standard retirement served as the reference category. Analyses were performed on a multiple imputed dataset and were IPW weighted. Potential confounders were added in successive models: age (Model 1); education and occupational physical demands (Model 2); marital status and number of children (Model 3); smoking, high alcohol consumption, obesity, physical inactivity, hypertension, diabetes, CVD, and having at least one close friend (Model 4).

confounders (Model four; women: RRR 1.64, 95% CI 1.14–2.37; men: RRR 1.70, 95% CI 1.17–2.48). For men, the late standard group had a lower risk of MCI than the on-time standard group, also after adjusting for potential confounders (Model four; RRR 0.76, 95% CI 0.61–0.95). There was no evidence that dementia risk differed between the late standard and on-time standard groups for women or men. There was also no evidence that dementia/MCI risk differed between the early and on-time standard groups after adjusting for potential confounders (Figure 2, Table S1).

The pattern of the results of the supplementary analyses based on (a) the complete cases without IPW and (b) only those participants who retired more than five years prior to participation in HUNT4 70+ were largely consistent with the results described above. Some effects that were statistically significant in the main analyses were not statistically significant in the supplementary analyses, which is not wholly unexpected given the smaller sample sizes. The full results of the supplementary analyses are available in Appendix 2.

5 | DISCUSSION

In this historical cohort study, we found that early retirement via the disability pathway - but not early retirement via the standard pathway - was associated with a higher risk of later-life dementia for women and for men. The association between disability retirement and later-life dementia remained even after adjusting for a range of potential confounders. Later retirement via the standard pathway was associated with a reduced MCI risk in men but was not associated with a lower dementia risk. We interpret our results as an indication that the overall association between retirement age and later-life dementia is primarily driven by an increased risk of later-life dementia among those who exit the workforce early (i.e., prior to becoming eligible for an old-age pension) due to work disability. Many Western countries, including Norway,[26] have reduced incentives for early retirement. The current results suggest that reducing early retirement without improving people's underlying work ability is unlikely to meaningfully affect the incidence of later-life cognitive impairment (see also[27]). Here we note that work ability depends on both an individual's physical and mental capacities, and also on the specific demands and resources of their work context. Our results also suggest that the cognitive health of people who exit the workforce due to disability should be monitored more closely, as they appear to be at higher risk for later-life dementia. People who exit the workforce due to disability may be an appropriate target group for interventions that reduce the modifiable risk factors for later-life cognitive impairment (e.g., physical inactivity, smoking).

The observed associations between disability retirement and dementia could be linked to several health-related mechanisms. For instance, psychiatric disorders such as major depressive disorder have been linked to a higher dementia risk,[28] although it is worth noting that depression also may be a part of the prodromal phase of dementia.[28,29] Multimorbidity, including neuropsychiatric, cardiovascular, sensory impairment, and cancer multimorbidity, is also linked to a higher dementia risk.[30] Although we did not have data on the reason for disability in our study population, both psychiatric and cardiovascular diseases are common causes of disability among individuals aged 60–67 in Norway.[16]

We did not find consistent evidence that retirement age was related to cognitive impairment for women and men who followed the standard pathway to retirement. There was, however, some indication that an older age of retirement among men retiring via the standard pathway after age 67 years was related to a lower risk for MCI. The stronger relationship between retirement age and men's later-life cognition is consistent with previous studies.[6,10] Gender differences in post-retirement activities could potentially explain our findings (i.e., retired women might be more likely to engage in activities that stimulate cognitive health than retired men),[10] although this requires further investigation.

The present study has a number of strengths, including the large and diverse general population sample, rich survey data from three time points starting in 1984, register data on retirement age and sociodemographic characteristics, and thorough clinical assessments of dementia and MCI in the whole study sample. Nevertheless, the present study also has several limitations. Our sample was limited to those younger than age 86, which probably explains why the prevalence of dementia was not higher among the women in our sample.[18] More women than men were excluded from the sample due to insufficient employment data, and stay-at-home women (and men) were also excluded. This may imply that our sample of women are not necessarily representative of the population of women aged 69–85 in Norway. Our results may not generalize to other countries due to differences in, for instance, disability and old-age retirement policies and benefits or norms for post-retirement life. A recent study found that post-retirement memory decline was faster in countries characterized by less generous welfare systems.[31] Our results may not generalize to future generations given changes in the nature of work (increasing automatization, shift toward less physically demanding work)[32,33] and the increase in women's education and workforce participation. Further, excluding participants who retired within 5 years of the cognitive assessment did not modify our main findings, but we cannot rule out the possibility of reverse causality. Although no participants were excluded due to health issues, individuals who chose not to participate in the HUNT Study had, on average, higher mortality and higher prevalence of several chronic diseases than participants,[34] suggesting that health-related selection bias may be present. We focused on the overall association between retirement age and cognitive impairment. It is presumed, however, that the consequences of working and retirement on later-life health and cognition depends on many different individual, occupational and societal factors,[35] such as education,[36] psychosocial working conditions,[37] and the cognitive demands of the job.[38,39] Future research should explore whether there are particular subgroups for whom, or conditions under which, early or later retirement causally affects later-life cognitive impairment.

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CONFLICT OF INTEREST STATEMENT

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

DATA AVAILABILITY STATEMENT

The data used for this study were derived from The Trøndelag Health Study (HUNT), https://www.ntnu.edu/hunt. Any research group with a Principal Investigator affiliated with a Norwegian research institute can apply for access to analyze HUNT data. This means that research groups from non-Norwegian countries must find a collaboration partner in Norway to be able to use HUNT material. Each project needs to be approved by the HUNT Data Access Committee (DAC), Regional Committee for Medical and Health Research Ethics, and in some cases also the Data Inspectorate. Due to participant confidentiality, participant data are not publicly available.

ETHICS STATEMENT

This study was approved by the HUNT study board of directors and the Regional Committee for Medical and Health Research Ethics. All participants in the HUNT Study gave a written informed consent upon participation.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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