Tracing temporal trends in dementia incidence over 25 years in central Stockholm, Sweden

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Abstract

Introduction: Recent reports from high-income countries have suggested a declining incidence of dementia.

Methods: Trends in dementia incidence over 25 years among people ≥75 years of age were examined using two population-based cohort studies: the Kungsholmen Project (KP, n = 1473, 1987-1998) and the Swedish National study on Aging and Care in Kungsholmen (SNAC-K, n = 1746, 2001-2013).

Results: We identified 440 (29.9%) and 388 (22.2%) incident dementia cases in the KP and SNAC-K cohorts, respectively. The incidence of dementia declined by 30% (hazard ratio [HR] = 0.70; 95% confidence interval [CI] 0.61-0.80) during the second decade. Adjustment of education, psychosocial working conditions, lifestyle, and vascular diseases did not substantially change the results (HR = 0.77, 95% CI 0.65-0.90). This decline was observed particularly in women and people with elementary education.

Discussion: Our study provides direct evidence of a declining trend in dementia incidence. Improved cognitive reserve and cardiovascular health could partially explain the decline.

Keywords
dementia, incidence, time trends, risk factors, population-based study

1 INTRODUCTION

Owing to the worldwide demographic transition toward an aging population, dementia has become a global public health priority.1 Nowadays, ≈50 million people worldwide are living with dementia, with ≈9.9 million new cases occurring each year.2 Recently, evidence has emerged that dementia incidence may have declined over the past decades in high-income countries.

Investigating the secular trends of dementia incidence is challenging, as any observed trends could be due to methodological variations across time.3 Robust evidence from population-based studies in well-defined geographical areas using consistent diagnostic measures shows a declining age-specific incidence of dementia from the 1980s to 2000s in the United States,4-6 France,7 The Netherlands,8 and the UK,9 although one study from Japan has indicated an increase.10 Yet very few of these studies took into account the underlying factors that might explain the temporal trend.5,6 On the other hand, studies using register-based data have produced conflicting results, with both increasing and decreasing incidence of dementia reported.11-15 These discrepancies are likely due to changes over time in diagnostic criteria and awareness from health professionals.3 In Sweden, we have previously reported prevalence and survival data from two population-based studies that inferred a declining incidence of dementia until the early 2000s.16

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In this study, using two independent longitudinal population-based cohorts in the Kungsholmen district of central Stockholm, Sweden, we aim to (1) investigate whether the incidence of dementia has changed from 1987 to 2013 among people age 75 years and older, and (2) identify factors that could explain, at least partially, the temporal trend.

| METHODS |
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### 2.1 Study population

The study population included participants from two longitudinal population-based cohort studies in the Kungsholmen district of central Stockholm, Sweden: the Kungsholmen Project (KP) and the Swedish National study on Aging and Care in Kungsholmen (SNAC-K).

KP is a community-based longitudinal study of aging and dementia. On October 1, 1987, all 2368 residents, who were 75 years of age or older, living at home or in institutions in the Kungsholmen district of Stockholm, were invited to attend the two-phase designed survey at baseline (1987-1989), and 1810 people (76.4%) eventually participated. Of those, 110 declined to take part in the clinical phase, which aimed at identifying prevalent dementia cases; 225 were diagnosed with definite and questionable dementia, 2 had intellectual disability, and 1473 participants were included in the dementia-free cohort at KP baseline. A total of 172 participants (11.7%) dropped out before the first follow-up. All participants in KP were followed up every 3 years until 1997-1998.

SNAC-K includes people ≥60 years of age, who were living at home or in institutions in the same geographical area as the KP participants. Of all the 5111 people randomly selected from 11 age cohorts, 4590 were alive and eligible, and 3363 (73.3%) participated in the baseline examination (2001-2004). Younger cohorts (60, 66, and 72 years) were followed up every 6 years, and older cohorts (78, 81, 84, 87, and ≥90 years) were followed up every 3 years. Because the KP included only people aged ≥75 years, we included people ≥72 years from the SNAC-K (n = 2059). After excluding people who were diagnosed with definite and questionable dementia (n = 306), people who did not attend clinical examination (n = 6), and people with intellectual disability (n = 1) at baseline, 1746 persons were included in the dementia-free cohort at SNAC-K baseline. A total of 183 subjects (10.5%) dropped out before the first follow-up.

Both the KP and SNAC-K were approved by the ethics committee at Karolinska Institutet or by the Regional Ethical Review Board in Stockholm, Sweden. Written informed consent was obtained from all participants or, in case of cognitively impaired persons, from proxies (next of kin or guardians).

### 2.2 Data collection

The KP and SNAC-K followed similar protocols for data collection. At the baseline of KP and SNAC-K, data on demographic characteristics (age, sex, and education), lifestyle factors (eg, smoking, alcohol consumption, and physical activity), work-related factors (eg, work complexity and psychosocial working condition), chronic medical conditions (eg, diabetes and hypertension), use of medications, and global cognitive function were collected through structured interviews, clinical examinations, and psychologic testing following the standard procedures. During each study examination, the examining physician recorded the current use of medications (eg, antihypertensive and anti-diabetic drugs) by inspecting the medication containers brought by the participants, and the Anatomical Therapeutic Chemical Classification System (ATC) codes were used to classify all medications.

Education was measured as the number of years of formal schooling and was categorized as elementary education (<8 years) and above elementary education (≥8 years). Height and weight were measured with light clothes and no shoes. Body mass index (BMI) was calculated as weight (kilograms) divided by height (meters) squared. Arterial blood pressure was measured on the right arm with a sphygmomanometer with the participant in a sitting position. Smoking status was assessed by asking the participants whether they had ever smoked, for how long they had smoked, and the number of cigarettes consumed per day. We categorized the participants as never, former, or current smokers. Alcohol consumption was measured by asking the participants whether they drank alcohol and the frequency of alcohol drinking and was categorized as never or occasionally drinking, and light/moderate and heavy drinking. In KP, information on smoking and alcohol consumption was also gathered at the first follow-up interview if information was missing at baseline. Physical activity was assessed by asking the participants whether they were regularly engaged in any leisure activities.
activities with physical components (eg, walking, gardening, and sports playing), and was categorized into active and inactive. Information on job title, contents, employer, and time span of the longest-held jobs during adulthood was collected through a structured questionnaire. Work complexity scores (ie, with people, data, and things) for the longest-held job in adulthood were recorded according to a validated work complexity matrix, where higher scores indicate greater complexity. Level of psychosocial working condition for longest-held job during adulthood, including job control and job demand, was estimated using a validated job-exposure matrix. Using the median score of job control and demands, participants were then categorized into four groups: high job strain, low job strain, passive job, and active job.

Hypertension was defined as having blood pressure ≥140/90 mm Hg or use of antihypertensive medications (ATC codes C02-C07 for KP and C02-C09 for SNAC-K). Diabetes was ascertained based on self-report, use of antidiabetic medications (ATC code A10 for both KP and SNAC-K), and blood glucose level.

The Stockholm patient registers of job control and demands, participants were examined using structured interviews, clinical examination, laboratory testing, and cognitive testing. The same three-step procedure as in KP was used in the SNAC-K cohort, and repeated the above analyses.

In SNAC-K, all participants were then categorized into four groups: high job strain, low job strain, passive job, and active job. Hypertension was defined as having blood pressure ≥140/90 mm Hg or use of antihypertensive medications (ATC codes C02-C07 for KP and C02-C09 for SNAC-K). Diabetes was ascertained based on self-report, use of antidiabetic medications (ATC code A10 for both KP and SNAC-K), and blood glucose level.

The Stockholm patient registers were linked to both the KP and the SNAC-K databases to ascertain the history of ischemic heart disease, atrial fibrillation, heart failure, and cerebrovascular diseases of participants at baseline.

2.3 | Ascertainment of dementia cases

In KP, a 2-phase procedure was used to identify dementia cases at baseline. In the screening phase, all participants were screened using the Mini-Mental State Examination (MMSE). People who had an MMSE score <24 (n = 314) and a random sample of those who had an MMSE score ≥24 (n = 354) underwent the clinical phase that included comprehensive clinical examinations, laboratory testing, and cognitive testing. During the follow-up phases of KP, all participants were instead directly examined. Dementia diagnosis was made using the criteria of the Diagnostic and Statistical Manual of Mental Disorders, Third Edition, Revised (DSM-III-R) following a validated three-step procedure: two physicians independently made a preliminary diagnosis of dementia, and a third opinion was sought from a senior physician in case of disagreement between the first two diagnoses. In SNAC-K, all participants were examined using structured interviews, clinical examinations, and cognitive testing. The same three-step procedure as in KP was adopted in SNAC-K for the diagnosis of dementia following the DSM-IV criteria. The comparability between the DSM-III-R and DSM-IV criteria was verified in a large SNAC-K subsample with an agreement varying from 90% to 95% depending on the phases. In both KP and SNAC-K, medical records and death certificates of participants who died during the follow-up period were collected and reviewed by physicians to determine whether the participants died with dementia.

2.4 | Statistical analysis

For both the KP and SNAC-K, 10-year follow-up data since the baseline examination were analyzed: 1987-1989 to 1997-1998 for the KP cohort, and 2001-2004 to 2010-2013 for the SNAC-K cohort. We performed logistic regression models to compare the baseline characteristics of the two cohorts, adjusting for age and sex.

Participants were followed up until the diagnosis of dementia, death, or the end of study. People (free of dementia at baseline) who received a diagnosis of dementia during the follow-up examinations or were identified as having died with dementia during the follow-up period were counted as incident dementia cases. For participants who did not develop dementia, the follow-up time was calculated from the baseline interview to the last follow-up contact or death. For participants who developed dementia, follow-up time was calculated as the full time during which the participants were free from dementia plus half of the follow-up time during which dementia developed. Incidence rate was calculated as the number of new dementia cases developed during the entire follow-up period divided by person-years. Thus, the incidence rate is not affected by the length of follow-up of the two cohorts.

We categorized the SNAC-K age groups into 72-78, 81-84, 87, and ≥90 years, as corresponding to the age groups of 75-79, 80-84, 85-89, and ≥90 years in KP, respectively. We used Cox regression models to estimate the hazard ratio (HR) and 95% confidence interval (CI) of incidence rate of dementia in the SNAC-K cohort compared to the KP cohort. To explore to what extent the changes in dementia incidence rate were attributable to education, lifestyle factors, work-related factors, and chronic health conditions, we reported results from three models: model 1 was adjusted for age and sex; model 2 was adjusted for age, sex, and education; and model 3 was additionally adjusted for body mass index (BMI), smoking, alcohol consumption, physical inactivity, work complexity, psychosocial working conditions, hypertension, diabetes, atrial fibrillation, heart failure, ischemic heart disease, and cerebrovascular diseases. Linear mixed-effects models were used to compare the rate of decline in MMSE score between KP and SNAC-K cohorts over the follow-up period, adjusting for age, sex, and education.

In the sensitivity analysis, to completely eliminate the age differences between the KP and SNAC-K cohorts, we matched the age strata of SNAC-K to that of KP (ie, 78, 81, 84, 87, and ≥90 years in both KP and SNAC-K), leaving 400 participants in the KP cohort and 1282 in the SNAC-K cohort, and repeated the above analyses.

We handled missing data in the covariates (ie, BMI, smoking, alcohol consumption, work complexity, psychosocial working condition, and hypertension) using multiple imputations by chained equations with 15 chained datasets, where variables predictive of the missing data were included in the imputation model. Because the proportion of missing at baseline is higher in KP than in SNAC-K, an indicator of the two cohorts was included in the imputation model as a predictive variable of missing, in addition to age, sex, education, physical activity, vascular disorders, and cerebrovascular diseases. In the sensitivity analyses, we used three additional methods to handle the missing data to verify whether results differed from those from the multiple-imputation method: (1) the missing values were assigned a dummy value, (2) the missing values were assigned the worst scenario, and (3) the missing values were assigned the best scenario. All data were analyzed using Stata Statistical Software 15.0 (StataCorp LLC, TX).
| Characteristics                              | KP cohort (n = 1473) | SNAC-K cohort (n = 1746) | OR (95% CI) for SNAC-K vs KP |
|---------------------------------------------|----------------------|--------------------------|----------------------------|
| Drop-outs before the first follow-up        | 172 (11.7)           | 183 (10.5)               | 0.88 (0.70-1.09)            |
| Age (years), mean (SD)                      | 81.4 (4.9)           | 80.5 (7.0)               | 0.98 (0.97-0.99)            |
| Age groups, years                           |                      |                          |                            |
| 75-79                                       | 620 (42.1)           | 905 (51.8)               | 1.00 (reference)           |
| 80-84                                       | 479 (32.5)           | 403 (23.1)               | 0.58 (0.49-0.69)           |
| 85-89                                       | 262 (17.8)           | 141 (8.1)                | 0.38 (0.30-0.48)           |
| ≥90                                         | 112 (7.6)            | 297 (17.0)               | 1.90 (1.49-2.42)           |
| Women                                       | 1112 (75.5)          | 1182 (67.7)              | 0.70 (0.60-0.82)           |
| Education level                             |                      |                          |                            |
| Elementary school (<8 years)                | 745 (50.6)           | 372 (21.3)               | 1.00 (reference)           |
| Above elementary (≥8 years)                 | 721 (48.9)           | 1366 (78.2)              | 3.66 (3.14-4.28)           |
| BMI (kg/m²), mean (SD)                      | 23.6 (3.6)           | 25.2 (4.1)               | 1.11 (1.08-1.13)           |
| Smoking, n (%)                              |                      |                          |                            |
| Non-smoker                                  | 788 (53.5)           | 918 (52.6)               | 1.00 (reference)           |
| Former smoker                               | 173 (11.7)           | 617 (35.3)               | 2.84 (2.32-3.46)           |
| Current smoker                              | 131 (8.9)            | 194 (11.1)               | 1.17 (0.91-1.49)           |
| Alcohol consumption, n (%)                  |                      |                          |                            |
| Never or occasional drinker                 | 319 (21.7)           | 762 (43.6)               | 1.00 (reference)           |
| Light/moderate and heavy drinker            | 734 (49.8)           | 979 (56.1)               | 0.47 (0.40-0.56)           |
| Physical activity, n (%)                    |                      |                          |                            |
| Inactive                                    | 733 (49.8)           | 609 (34.9)               | 1.00 (reference)           |
| Active                                      | 740 (50.2)           | 1137 (65.1)              | 1.76 (1.52-2.05)           |
| Work complexity, n (%)                      |                      |                          |                            |
| With people                                 | 1.9 (1.5)            | 2.3 (1.6)                | 1.20 (1.14-1.28)           |
| With data                                   | 2.7 (1.4)            | 3.4 (1.5)                | 1.44 (1.35-1.54)           |
| With things                                 | 2.3 (1.9)            | 2.3 (2.1)                | 1.01 (0.97-1.05)           |
| Psychosocial working condition, n (%)       |                      |                          |                            |
| High job strain                             | 164 (11.1)           | 199 (11.4)               | 1.00 (reference)           |
| Low job strain                              | 242 (16.4)           | 327 (18.7)               | 1.11 (0.85-1.45)           |
| Passive job                                 | 289 (19.6)           | 209 (12.0)               | 0.59 (0.45-0.80)           |
| Active job                                  | 218 (14.8)           | 901 (51.6)               | 3.45 (2.67-4.47)           |
| Hypertension, n (%)                         | 1306 (88.7)          | 1465 (83.9)              | 0.64 (0.52-0.79)           |
| Diabetes, n (%)                             | 88 (6.0)             | 190 (10.9)               | 1.85 (1.42-2.41)           |
| Ischemic heart disease, n (%)               | 146 (9.9)            | 193 (11.1)               | 1.14 (0.90-1.43)           |
| Heart failure, n (%)                        | 165 (11.2)           | 160 (9.2)                | 0.83 (0.66-1.04)           |
| Atrial fibrillation, n (%)                  | 75 (5.1)             | 145 (8.3)                | 1.77 (1.32-2.37)           |
| Cerebrovascular diseases, n (%)             | 101 (6.9)            | 123 (7.0)                | 1.05 (0.80-1.38)           |
| MMSE score, mean (SD)                       | 26.6 (2.6)           | 28.2 (2.2)               | 1.44 (1.38-1.51)           |

BMI, body mass index; MMSE, Mini-Mental State Examination; OR, odds ratio; SD, standard deviation.

*Adjusted for age and sex.

**p < 0.05.

*Missing data in education level accounts for 0.5% in KP and 0.5% in SNAC-K; missing data in BMI accounts for 13.0% in KP and 6.9% in SNAC-K; missing data in smoking accounts for 25.9% in KP and 1.0% in SNAC-K; missing data in alcohol consumption accounts for 28.5% in KP and 0.3% in SNAC-K; missing data in work complexity and psychosocial working condition accounts for 38.0% in KP and 6.3% in SNAC-K.
3 | RESULTS

At baseline, the KP cohort included more women and were less educated than the SNAC-K cohort (Table 1). After adjusting for age and sex, participants in the SNAC-K cohort were less likely to consume alcohol, more likely to be physically active, more likely to be former smokers but not current smokers, more likely to have active jobs, and had higher work complexity score as compared to those in the KP cohort (for all, \( p < 0.05 \)). More people had diabetes and atrial fibrillation and fewer had hypertension in the SNAC-K cohort than in the KP cohort (for all, \( p < 0.05 \)), whereas the proportions of participants with ischemic heart disease, heart failure, and cerebrovascular diseases were not statistically different between the two cohorts.

Over the 10-year follow-up period, 440 (29.9%) of 1473 participants in the KP cohort developed incident dementia from 1987-1989 to 1997-1998, and 387 (22.2%) of 1746 persons in the SNAC-K cohort developed incident dementia from 2001-2004 to 2010-2013 (Table 2). Overall, the incidence rate of dementia was significantly lower in the SNAC-K cohort than in the KP cohort, after adjusting for age and sex (HR = 0.70, 95% CI 0.61-0.80), corresponding to an annual reduction of 3.0% in dementia risk. Further adjusting for education, lifestyle factors, work-related factors, and chronic diseases did not substantially change the result (HR = 0.77, 95% CI 0.65-0.90) (Table 3). The rate of decline in MMSE score was significantly slower over the follow-up period in the SNAC-K than in the KP cohort after adjusting for age, sex, and education (\( \beta \) coefficient = 0.13, 95% CI 0.04-0.22) (Fig. S1).

When stratified by age group and birth cohort, the incidence of dementia was virtually lower in the later born cohorts than in the earlier born cohorts for age groups of 75-79, 80-84, and 85-89 years, but not \( \geq 90 \) years (Fig. 1). Cox regression models controlling for demographic factors, lifestyle factors, work-related factors, and chronic diseases showed that the incidence rate of dementia was lower in the SNAC-K cohort (2001-2013) than in the KP cohort (1987-1998) across all age groups, except for the age group \( \geq 90 \) years where the incidence of dementia was unchanged. A decrease in the incidence rate of dementia was seen in both sexes and across education groups; in the multi-adjusted Cox regression models, the incidence rate of dementia was significantly lower in the SNAC-K cohort than in the KP cohort among women (HR = 0.71, 95% CI 0.59-0.86) and in people with elementary education (HR = 0.57, 95% CI 0.43-0.75) (Table 3).

In the sensitivity analyses, we matched the age strata of the SNAC-K cohort to that of the KP cohort, and the results were comparable to those from the main analyses reported above. Furthermore, when missing values were handled using different methods, the results were consistent with those from the multiple imputations.

4 | DISCUSSION

Using data from two longitudinal population-based cohorts in the same geographical area of central Stockholm, we showed that the incidence rate of dementia declined by \( \approx 30\% \) from the late 1980s to the early 2010s in older adults \( \geq 75 \) years. Dementia incidence declined in both sexes and education levels, and the decline was more evident in women and lower-educated people. Complementing the decrease in dementia incidence, a slower decline in global cognitive function in the later born cohort was also detected over the study period, indicating that the cognitive health in older adults has generally improved over the past three decades.

In other Western countries, convincing evidence of trends in dementia incidence is still scarce, as only a few population-based studies used similar study design and diagnostic approach across time to allow meaningful comparisons. The Rotterdam Study showed a lower dementia incidence in the 2000 cohort compared to the 1990 cohort, with an annual reduction of 2.5% in dementia risk, although the decline was not statistically evident. The Framingham Heart Study has also reported a progressive reduction in dementia incidence between late 1970s and early 2010s; another U.S. study supported a declining incidence in African Americans but not in Yoruba from 1992 to 2009. A significant drop in dementia incidence has also been seen in two UK studies from 1990s to 2010s. A recent systematic review and meta-analysis collectively analyzed data from five population-based studies in Western high-income countries and suggested a favorable trend in dementia incidence. Beyond Western countries, studies from Asian populations such as Japan and China showed an increasing incidence of dementia, although the increasing trends were partly attributable to the great heterogeneity in study methodologies.

The current evidence concerning time trends in dementia prevalence in the United States and Western Europe also supports the detected decrease in dementia risk. Most of those studies reported a stable or even decreasing prevalence of dementia. Although dementia prevalence is subject to change in both dementia incidence and survival of dementia patients, given that there is no cure or disease-modifying treatment for dementia, it is likely that the favorable trends of dementia prevalence is partly attributable to a decreasing incidence. Factors underlying the observed decrease in dementia risk are not entirely clear, although several hypotheses have been proposed, including a better management of cardiovascular health and improved education over time in high-income countries. This might have led to a compression of cognitive morbidity in old age, as indicated by previous studies that the disease duration in people with dementia has decreased and the age at dementia onset has increased during the past few decades. Indeed, our results showed a slight increase in the incidence of dementia among the oldest old, which could have reflected a later onset of dementia in the more recent generations. Notably, dementia diagnosis includes not only cognitive but also functional aspects of older adults. Thus, postponing dementia onset by even one year means an additional year of maintained functional ability (despite potential cognitive problems), which is what older people value the most.

When stratified by sex, the incidence of dementia declined in both men and women, although the decline was statistically evident only among women. This might be due partly to the limited statistical power for men in our sample. When stratified by education level, our findings
showed a much greater decrease in dementia incidence in people who had at most 8 years of formal schooling (ie, elementary school) than in those with more education. Only two U.S. studies investigated dementia trends by education level, and showed either significant decline only in people with higher education or same level of decline in all education groups,5,6 contrary to our findings. However, it is difficult to directly compare the education levels between European and American populations because they were categorized and reported differently among previous studies. In our study, it is plausible that people with lower education had more to gain from better lifestyles, working conditions, and leisure activities as well as from better access to health and social welfare than people with higher education, therefore showing a more decrease in dementia risk.

The education pattern in our study has changed considerably over time, with 78% of the 2000s SNAC-K population having education above elementary school compared to 49% in the 1980s KP population. Work complexity and the proportion of people with active jobs were also substantially higher in the later born cohorts. This rising level of formal education and improved psychosocial working conditions could have contributed to an increased stock of cerebral
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representatively as possible from the same geographical area 12 years ago. The prevalence of diabetes and atrial fibrillation was slightly higher, which could be early childhood conditions, and other factors such as lifestyle factors, vascular disorders, and cognitive reserve, thus leading to a decreasing incidence of dementia. The prevalence of physical activity, hypertension, and heart failure was lower in SNAC-K than in the KP participants, although the prevalence of diabetes and atrial fibrillation was slightly higher, which is consistent with worldwide statistics. Our study did show that the risk of dementia in the younger-old population, rather than in the oldest-old, could be largely attributable to the improvement in these factors. Nevertheless, our findings suggest that multi-domain interventions that target both lifestyle factors (eg, physical activity and diet) and the management of cardiometabolic disorders (eg, hypertension and diabetes) could be the most efficacious way to improve the physical and mental health in the general population and thereby decrease the risk of dementia in old age. In addition, although public health strategies to reduce the risk of cardiovascular diseases are already in place and have proven effective in many high-income countries, public health interventions are urgently needed in Asian populations such as in China and Japan where the prevalence of diabetes and hypertension is still high. Furthermore, although we took into account the most relevant protective and risk factors for dementia, we could not fully uncover the reasons behind the observed decline. Further studies are warranted to identify other life-course factors that could further explain the decline in dementia risk. Such factors could be early childhood conditions, leisure time physical activities in midlife, and exposure to toxic substances such as air pollution.

The major advantage of this study resides in the stability of clinical and neuropsychological assessments of participants recruited as representatives as possible from the same geographical area 12 years apart. To minimize the potential bias in dementia case ascertainment due to changes in societies’ awareness and improvement of health services, we used similar diagnostic criteria and validated diagnostic procedures to allocate dementia status in both surveys. Moreover, our study had a rare and unique opportunity to identify dementia cases among those who became deceased during the follow-up by performing a comprehensive review of clinical records and death registers, thus minimizing the influence of death on the trend of dementia incidence.

Yet our study is not without limitations. First, the two-phase design in KP could have resulted in an underestimation of prevalent dementia cases at baseline, which might have in turn increased the incidence of dementia during the follow-up where all the KP participants were then directly examined. However, this two-stage study design was used only for the baseline and not for follow-up examinations. Second, sicker people dropping out at baseline and follow-up phases may have led to an underestimation of the incidence of dementia in both surveys. Yet the proportion of non-participants in both KP and SNAC-K are quite low compared to other population-based studies of older adults. The KP has slightly lower non-response rate (24%) at baseline than the SNAC-K (27%), whereas the two studies have very similar drop-out rates at follow-up (11.7% vs 10.5%). Nevertheless, it has been shown that the incidence of dementia is not as affected as the prevalence by non-participation. Third, although we used multiple imputations to impute the missing values in examined factors, a higher proportion of missing in some variables in KP (ie, BMI, smoking, alcohol consumption, and work-related factors) might still have affected the estimates in the regression models. Moreover, although a number of potentially influential factors were taken into account in our analyses, we might not be able to fully account for the contribution of these factors to the declining incidence of dementia owing to their imperfect measurements. Fourth, although the use of antihypertensive drugs and antidiabetic drugs were one of the criteria to identify people with hypertension and diabetes, respectively, we did not consider the use of drugs when identifying people with other vascular disorders. Therefore, it is possible that in the regression models we have missed the treatment of some heart diseases, such as atrial fibrillation and heart failure. This could have led to an underestimation of the extent to which changes in the treatment of vascular disorders explained the temporal trends in dementia incidence. Finally, the high socio-economic status of Caucasians in the Kungsholmen district may limit the generalization of our results in less wealthy communities or other ethnicities.

Taken together, in this population-based cohort study, we showed direct evidence that the incidence of dementia has declined in people aged ≥75 years over 25 years from 1980s to 2010s, especially among women or in people with lower education level. Despite the increasing number of people at risk, our findings provide evidence that the projected burden of dementia in the near future may be more moderate than previously anticipated. Improved cardiovascular health and increased cognitive reserve may only partially explain this positive trend. The role of other factors, such as changes in childhood conditions and midlife social and physical environments, warrants further investigations.
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CONFLICTS OF INTEREST

None declared.

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**SUPPORTING INFORMATION**

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

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