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Incidence of Dementia After Age 90 in a Multiracial Cohort

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Abstract

INTRODUCTION: Little is known about dementia incidence in diverse populations of oldest-old, the age group with highest dementia incidence.

METHODS: Incident dementia diagnoses from 1/1/2010–9/30/2015 were abstracted from medical records for 2,350 members of an integrated healthcare system in California (n=1,702 Whites, n=375 Blacks, n=105 Latinos, n=168 Asians) aged >90 in 2010. We estimated race/ethnicity specific age-adjusted dementia incidence rates and implemented Cox proportional hazards models and Fine and Grey competing risk of death models adjusted for demographics and comorbidities in mid- and late-life.

RESULTS: Dementia incidence rates (n=771 cases) were lowest among Asians (89.9/1,000 person-years), followed by Whites (69.9/1,000 person-years), Latinos (105.8/1,000 person-years), and Blacks (121.5/1,000 person-years). Cox regression and competing risk models estimated 28% and 36% higher dementia risk for Blacks versus Whites adjusting for demographics and comorbidities.

DISCUSSION: Patterns of racial/ethnic disparities in dementia seen in younger older adults continue after age 90, though smaller in magnitude.

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Keywords

dementia; disparities; epidemiology; oldest-old; race; ethnicity

Introduction

Life expectancy in the US has steadily increased and the number of people aged 90 plus (i.e. the oldest-old) is projected to quadruple in size from 2.4 million in 2015 to 9.5 million by 2060 (1). This population is increasingly diverse and it is projected that by 2050, 29.7% of individuals 85 and older will identify as a racial/ethnic minority (2). Unfortunately, this age group has markedly high rates of chronic illness and disability with Medicare costs peaking at $16,145 per year for those aged 96 years, double the amount for those 70 years old ($7,566) (3). Dementia is particularly common among the oldest-old, afflicting almost 40% of individuals over 90 (4, 5). However, these estimates are based on predominantly White cohorts. To date, there very little information on the epidemiology of dementia after age 90 in People of Color.

Studies in younger older adults show marked racial/ethnic disparities in dementia risk with Blacks at greatest risk, followed by Latinos, Whites, and lastly Asians (6–9). It is unclear if these inequalities in dementia persist into older age since many dimensions of health inequality attenuate or even reverse in older adults (10–15). For example, studies have shown women to be a lower risk of stroke compared to men until around 70 to 80 years old, at which point risk sex differences disappear or reverse (13–15).

Estimating dementia incidence among a cohort of the old-old that reflects the increasing levels of diversity in this age group and evaluating whether there are racial/ethnic disparities is critical for anticipating future public health needs. Our objective was to estimate dementia incidence in a diverse sample of oldest-old and explore if there are possible racial/ethnic disparities.

Methods

Study population

This study follows members of Kaiser Permanente Northern California (KPNC), an integrated health care system. Members include approximately 30% of the catchment area population and are representative of the area with the exception of individuals in the extremes of the income distribution (16–18). We included 2,350 individuals who were at least 90 years old as of January 1st, 2010 (the beginning of follow-up for dementia incidence) with no prior diagnoses of dementia and participated in at least one Multiphasic Health Checkup (MHC) between 1964 and 1992. The MHCs were a series of optional prepaid check-ups offered to members in San Francisco and Oakland, California. During MHC visits, health questionnaires and clinical measurements collected information on demographics and cardiometabolic health indicators. A prior study found that individuals who participated in the MHC between 1964–1968 were less likely to smoke (19) and therefore MHC participants may be healthier than the general KPNC membership. Death

was obtained through KPNC electronic medical records, California State Mortality File, and Social Security Death records.

Race and ethnicity

Self-reported race and ethnicity were retrieved from KPNC health plan membership databases and collapsed into the following categories: non-Latino Black (Black), non-Latino White (White), Latino, or non-Latino Asian (Asian).

Dementia diagnosis

Incident dementia diagnoses between January 1st, 2010 and Sept 30th, 2015 were obtained from inpatient and outpatient electronic medical records and defined as the following International Classification of Diseases, Ninth Revision (ICD-9) diagnosis codes: Alzheimer's disease (331.0), vascular dementia (290.4x), and other/nonspecific dementia (290.0, 290.1x, 290.2x, 290.3, 294.1, 294.2x, and 294.8). This method is consistent with dementia ascertainment in previous studies in this population (6, 20–23). A similar set of ICD-9 codes has been demonstrated to have a sensitivity of 77% and a specificity of 95% compared with a consensus dementia diagnosis (24).

Covariates

Prior work has shown that midlife body mass index (BMI), hypertension, and hypercholesterolemia are associated with elevated dementia risk in the KPNC member population (21, 25–27) and the general population (28–31). Sex, educational attainment, and midlife health indicators (height, weight, blood pressure, and cholesterol) were captured during the MHC visit (1964–1992; mean age=53.0 (SD=6.4 years)). If individuals participated in more than one MHC visit, data from the first MHC visit was used to obtain data from as close to midlife as possible. Educational attainment was captured as the highest grade completed and recoded as up to 9th grade, 10–12th grade, trade school, some college, college graduate, or graduate school. Midlife height and weight were used to calculate BMI and individuals with a BMI of at least 30 were classified as obese. High cholesterol was defined as values above 240 milligrams per deciliter. Hypertension status was defined as a systolic blood pressure of 140 or greater or a diastolic blood pressure of 90 or greater (32). The following late-life health conditions were ascertained from electronic medical record between 1996–2009 using ICD-9 codes (Supplemental Table 1): depression, diabetes, stroke, ischemic heart disease, and heart failure.

Statistical Analyses

We examined the distributions of dementia, demographics, and health conditions in mid- and late-life by race/ethnicity. We estimated the age-adjusted incidence rates of dementia overall and by race/ethnicity by standardizing our sample to the 2010 US Census population aged 90 and above. We estimated the 5- and 10-year cumulative incidence of dementia beginning at age 90 for the overall sample and for each racial and ethnic group. The Practical Incidence Estimator macro (33) combines information on dementia incidence with age-specific death rates to obtain these estimates. The cumulative incidence rates were estimated for individuals who survived to age 90 without dementia.

An initial set of Cox proportional hazards models examined the association between race/ethnicity and dementia risk with Whites serving as the reference group. All models adjust for age (as the time scale) and sex. Models were then further adjusted for education. Groups of health indicators from midlife and late-life, both of which may have behaved as mediators, were added to the models separately and then concurrently. We then repeated estimation of the Cox proportional hazards models with Asians as the reference group since prior research in younger older adults have found them to have the lowest risk of dementia (6).

Fine and Gray competing risks models were implemented to estimate the risk of dementia associated with race/ethnicity while accounting for the competing risk of death. Covariates were added in the sequence described above. For all time-to-event models, individuals were followed until date of dementia diagnosis or censored at death, the start of a membership gap lasting more than 90 days, or the end of the study period on September 30th, 2015. Individuals were censored at beginning of a membership gap to minimize the likelihood of dementia diagnoses occurring outside of the KPNC system and therefore not captured in the medical records.

Sensitivity analyses stratified by sex estimated age-adjusted incidence rates, cumulative incidence of dementia, hazard ratios estimated by Cox proportional hazard models, and hazards ratios adjusting for the competing risk of death estimated by Fine and Gray models by sex and race/ethnicity.

Results

The sample was 72% White, 16% Black, 5% Latino, and 7% Asian (Table 1). The mean age at baseline was 93.1 years (standard deviation (SD)=2.6 years). The mean age of dementia diagnosis was 95.5 (SD=2.7) and was similar across racial and ethnic groups: 95.6 (SD=2.6) for Whites, 95.2 (SD=2.7) for Blacks, 95.7 (SD=4.0) for Latinos, 95.3 (SD=2.2) for Asians. Overall, by the end of follow-up, 33% (n=771) developed dementia, 47% (n=1,094) died without a dementia diagnosis, and less than 1% (n=9) had a membership gap greater than 90 days.

The overall age-adjusted incidence rate was 100.5 dementia cases (95% Confidence Interval (CI): 92.8, 108.3) per 1,000 person-years (Table 2). The rate was highest among Blacks (121.5 dementia cases per 1,000 person-years), followed by Latinos (105.8 dementia cases per 1,000 person-years), Whites (69.9 dementia cases per 1,000 person-years), and lastly, Asians (89.9 dementia cases per 1,000 person-years).

The overall 5- and 10-year cumulative incidence of dementia conditional on survival dementia free until age 90 were 22.6% (95% CI: 20.1%, 25.1%) and 36.7% (95% CI: 33.6%, 39.3%), respectively. The cumulative incidence of dementia was consistently highest for Blacks, followed by Latinos, Whites, and Asians (Table 3, Figure 1). The 10-year cumulative incidence of dementia was 10.4 percentage points higher for Blacks (44.6%; 95% CI: 37.4%, 51.5%) than Asians (34.2%; 95% CI: 23.3, 42.4).

After controlling for age and sex, Blacks were at a 26% increased risk of dementia compared to Whites (HR=1.26; 95% CI: 1.05, 1.51; Table 4). Blacks continued to be at elevated risk of dementia compared to Whites even after further adjusting for education and lifecourse health conditions (HR=1.28; 95% CI: 1.06, 1.56). There was no evidence of a difference in dementia risk between Latinos (HR=1.05; 95% CI: 0.75, 1.47) or Asians (HR= 0.98; 95% CI: 0.74, 1.31) compared to Whites in age- and sex-adjusted Cox proportional hazards models. In models further adjusting for education, and lifecourse health conditions, Latinos had a non-significantly elevated risk of dementia compared to Whites (HR=1.12; 95% CI: 0.79, 1.59). The risk of dementia among Asians was very similar to that of Whites after adjusting for demographics and lifecourse health conditions (HR=1.00; 95% CI: 0.75, 1.34). Point estimates of dementia incidence risk for Blacks and Latinos minimally changed when Asians served as the reference group compared to when Whites were the reference group (Supplemental Table 2) and there were no significant differences across racial groups. However, due to the small number of Asians in the sample, these analyses were likely underpowered.

Estimates from the Fine and Gray models accounting for the competing risk of death were qualitatively the same as those from Cox proportional hazards models (Supplemental Table 3). In models adjusting for baseline age, education, sex, and lifecourse health conditions, Blacks had a 36% increased risk of dementia compared to Whites (HR=1.36; 95% CI: 1.11, 1.65). Latinos had a 25% non-significant increased risk of dementia (HR=1.25; 95% CI: 0.87, 1.74). There was no evidence of difference in dementia risk between Asians and Whites (HR=1.03; 95% CI: 0.76, 1.36).

In general, point estimates of risk were higher among women than men but confidence intervals often overlapped (Supplemental Tables 4–7). Race specific results should be interpreted with caution, especially those related to Latinos and Asians as there were few male in those racial groups (33 Latino men and 74 Asian men).

Discussion

Individuals at least 90 years old are the fastest growing segment of the US population and in our diverse sample 33% were diagnosed with dementia over a 6-year period. Dementia incidence impacted 31% to 39% of people across the different racial and ethnic groups. Both age-adjusted incidence rates and cumulative incidence adjusting for competing risk of death were consistently highest for Blacks, followed by Latinos, Whites, and Asians. The 10-year cumulative incidence of dementia was approximately 10 percentage points higher for Blacks than Asians (44.6% vs 34.2%). When evaluating the relative risk of dementia among minority groups compared to Whites, only Blacks were at significantly elevated risk. Blacks had 36% elevated risk of dementia compared to Whites adjusting for sociodemographic, lifecourse health conditions, and competing risk of death. Latinos had 25% higher dementia risk than Whites in models accounting for sociodemographics, lifecourse health conditions, and competing risk of death, but this contrast was not statistically significant. There was no evidence that Asians were at greater or lower risk of dementia compared to Whites.

This study estimated an overall age-adjusted incidence rate 100.5 per 1,000 person-years. Prior estimates of dementia incidence among the oldest old have vary greatly ranging from 56.0 cases per 1,000 person years in the Netherlands (34) to 211.1 cases per 1,000 person years (35) in Germany. Differences in methodology, definitions of the oldest old, population composition, and small subsamples of people at least 90 years old (36–39) may contribute to the variability in estimates. To date, the 90+ Study is the only cohort study exclusively examining dementia among individuals at least 90 years old in the United States (36, 40). The estimated age-adjusted dementia incidence rates in the 90+ Study is 182 cases (95% CI: 153, 215) per 1,000 person years (36). The 90+ Study conducts dementia assessments every six months reducing the likelihood death before dementia ascertainment, which may partially explain the higher age adjusted incidence rate.

Risk factors for dementia after age 90 may vary from risk factors seen in younger older adults. For example, the 90+ Study has shown that age, education, and depression persist as risk factors among the oldest-old while diabetes was not associated with dementia (36). Similarly, midlife hypertension is a well-established risk factor for dementia in younger older adults (20, 41–43) but late-life hypertension appears to be associated with a decreased risk in the oldest-old (44, 45). While these findings are important additional research in ethnically and racially diverse samples are needed.

The differences in dementia risk present in this sample of KPNC members 90 and above are consistent with patterns of racial/ethnic disparities in dementia seen in younger older adults though the differences are not as large in our older sample. A study conducted among 274,543 KPNC members ages 64 and older, found that the absolute 25-year risk of dementia at age 65 was greatest among Blacks (38%), followed by Native Americans (35%), Latinos (32%), Whites (30%), Asians (28%), and lastly Pacific Islanders (25%) (6). The study showed elevated relative risk of dementia among Blacks, American Indian and Alaska Natives, Latinos, and Whites compared to Asians adjusting for age and sex (6). Other studies including fewer racial/ethnic groups in their sample have also demonstrated elevated dementia risk among Latinos and Blacks compared to Whites (5, 7–9).

The underlying causes of racial and ethnic disparities in dementia risk in younger older adults and the oldest-old are unclear. Furthermore, as risk factors for dementia can differ by age, the underlying drivers of inequality may not be the same between the younger and older age groups. Early-life adversity and differences in educational attainment and quality may contribute to racial inequalities in dementia rates (46, 47). Early-life adversity and educational attainment could affect dementia risk in late-life by increasing or decreasing levels of cognitive reserve (i.e. protective biological changes in the brain that may delay cognitive impairment). However, adjusting for educational attainment in our study did not attenuate racial disparities among the oldest-old. We did not have markers of early-life adversity or educational quality available and were unable to adjust for these early-life factors. Vascular health is another important dementia risk factor that one may speculate contributes to racial disparities in dementia risk among the oldest-old. In our study, midlife hypertension and high cholesterol were significantly more common among Blacks than Whites (hypertension: 54% vs 35%; high cholesterol: 43% vs 37%) but there were no significant differences in the prevalence of late-life stroke, ischemic heart disease, or stroke.

Adjusting for midlife or late-life vascular health did not explain the racial disparity in dementia risk in our study; Blacks continue to be at elevated risk of dementia even after controlling for hypertension, hyperlipidemia, stroke, ischemic heart disease, and heart failure. It is also unclear to what extent, if any, apolipoprotein E (APOE) ε4 contributes to racial/ethnic disparities in dementia risk among the oldest-old. Research among younger older adults has identified APOE ε4 as a strong genetic risk factor for late onset Alzheimer's disease (48, 49). APOE ε4 is more common among Blacks than Whites but the relative risk of dementia associated with this genetic variant is greater among Whites than Blacks (50, 51). Furthermore, prior work in other samples have found that the association between APOE e4 and dementia risk is weak in the oldest-old (52–54) making it an unlikely driver of racial/ethnic disparities. Unfortunately, this study doesn't include data on APOE status and we are unable to examine the role of this genetic variate on dementia risk in the oldest-old.

It is unclear if difference in neuropathology between Blacks and Whites exist and could account for these disparities. The few studies examining possible Black-White differences in neuropathology in younger older adults have had mixed results with reports of vascular dementia (55) or mixed pathology (56) as more common among Blacks than Whites and reports of no differences in AD pathology (57–60). The 90+ study has demonstrated that brain pathology after age 90 is unique among the oldest-old with a high frequency of hippocampal sclerosis, microinfarcts, and white matter disease (61). Yet it's unknown if this unique pathological signature extends to Black, Asian, or Latino oldest-old and how, if at all, it may explain differences in rates of dementia. Establishing neuropathology in racial/ethnic minorities over 90 years old is essential both for understanding etiology and establishing preventative measures.

Mortality is racially and ethnically patterned in the US. The age-adjusted death rate from 1999–2016 for individuals younger than 85 years old was 780.5 deaths per 100,000 Blacks compared to 567.03 deaths per 100,000 Whites, 419.7 deaths per 100,000 Latinos, and 294.2 deaths per 100,000 Asians (62). Given that mortality rates before age 85 are highest among Blacks, it is possible that Blacks who survive into their 90s are healthier than their White counterparts. This hypothesis is supported by the fact that mortality rates after age 85 are higher among Whites than Blacks. Among individuals over 85 years old, the death rate was 12,171.0 per 100,000 Blacks and 14,062.6 per 100,000 Whites (62). Selective survival may then partially explain the smaller magnitude of racial and ethnic disparities in dementia risk across the oldest-old Blacks and Whites compared to younger older adults. A previous study among KPNC members showed an increased risk in dementia among older Latinos compared to older Asians (6). In the present study, however, we did not find a difference in risk across these two ethnic/racial groups. This may be partially explained by the smaller increase in death rates across Latinos younger vs older than 85 compared to Asians in those age groups. The age adjusted mortality rate for Latinos younger than 85 is 42.7% greater than their Asian counterparts. In contrast, the mortality rate for Latinos 85 and older is 13.9% greater than Asians 85 and older (10,522.0 deaths per 100,000 Latinos ages 85 and above; 9241.8 deaths per 100,000 Asians ages 85 and above) (62). Projections of how changing patterns in longevity and risk factors by race/ethnicity will impact future dementia need to be estimated.

The greatest strengths of this study are its diversity and large sample size enabling us to estimate incidence rates separately for Whites, Blacks, Latinos, and Asians. In addition, a wide range of mid- and late-life health conditions were collected prospectively through the MHC and electronic medical records allowing us to adjust for factors associated with dementia risk. Finally, estimates of cumulative incidence and hazard ratios estimated by the Fine and Grey competing risk models accounted for competing risk of death, a probable source of bias in estimates of dementia risk among the oldest-old.

Although this study has several strengths, there are several noteworthy limitations. We obtained dementia diagnosis from electronic medical records, which may result in some misclassification among individuals who do not seek care. This may partially explain why our estimated age-adjusted incidence rate among Whites is much lower than those estimated in the 90+ Study (97 vs 182 incident dementia cases per 1,000 person-years cases) (36), which conducts dementia assessments every six months reducing the likelihood of death before dementia ascertainment. Differential under-diagnosis by clinicians across racial/ethnic groups may artificially inflate or mask true racial/ethnic differences in risk. Although we adjusted for a wide range of mid- and late-life health conditions, we did not adjust for use of medications or other health behaviors that may impact late-life dementia risk. Lack of neuroimaging data and postmortem pathology data restricted our ability to examine risk of dementia subtypes and possible differences in pathology across racial/ethnic groups. Although heterogeneity in culture and experiences exists within racial and ethnic groups, we were unable to examine possible inequalities in dementia incidence within the racial and ethnic groups. We were unable to adjust for early-life adversity, education quality, and APOE status.

The oldest-old age group is the fastest growing segment of the population. By 2060, the number of people in oldest-old age group is estimated to quadruple and one third of this population is projected to be People of Color (1). These findings provide an important first examination of incidence of dementia in oldest-old Black, Asian, and Latino and possible patterns of racial disparities in dementia in the oldest-old. Important next steps include population-based studies with greater numbers of Asians and Latinos and including other racial/ethnic groups; investigations of lifecourse risk and protective factors for dementia; more frequent dementia assessments given the high mortality rate; and state-of-the art neuroimaging and neuropathological evaluations. Such investigations, currently non-existent in ethnically diverse oldest-old, will provide much needed information to help understand dementia disparities among the oldest-old. Given the rapid growth of People of Color after age 90, and the marked increase in overall population longevity, there is an urgent public health need to understand brain health during the very late life stages among people who represent the diversity of the United States.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Research in context

Systematic review: A review of the literature using PubMed found marked racial/ethnic disparities in rates of dementia among younger older adults. However, the vast majority of research examining dementia among those over age 90 is conducted among predominantly White samples. It is unclear whether racial/ethnic disparities in dementia persist after age 90.

Interpretation: Patterns of racial/ethnic disparities in dementia seen in younger older adults continue after age 90. Blacks had the highest rates of dementia followed by Latinos, Whites, and lastly Asians. These estimates provide an important foundation for understanding the burden of racial disparities in dementia among the oldest-old, the fastest growing segment of the population.

Future directions: Additional research is needed to identify the drivers of racial and ethnic inequalities in dementia among individuals over 90 years old. Examining lifecourse risk factors is a necessary step in identifying potential targets of interventions aimed at decreasing dementia incidence at all ages.

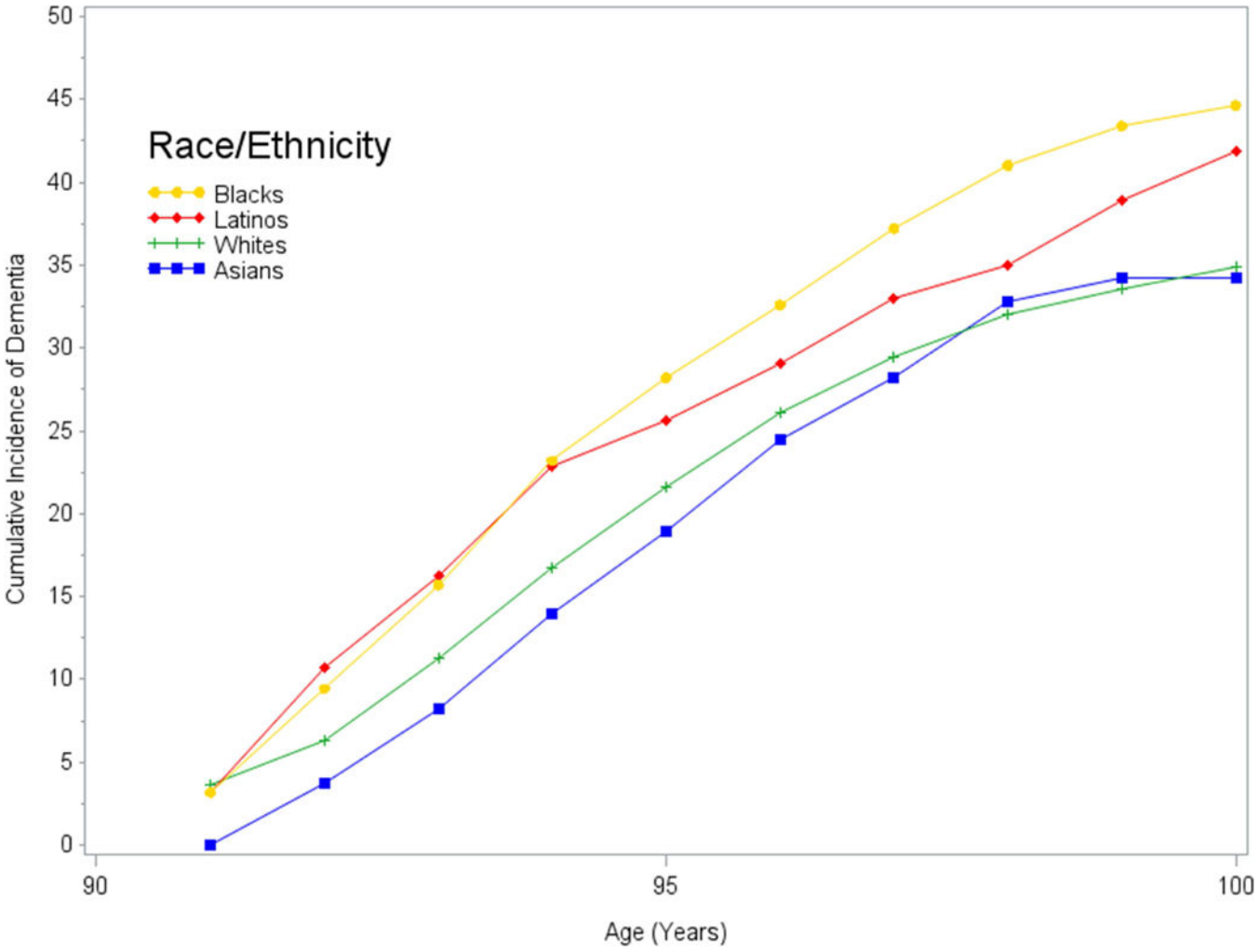

Figure 1.
Cumulative incidence of dementia conditional on survival until age 90 by race/ethnicity

Table 1.

Baseline characteristics by race/ethnicity

	Overall	White	Black	Latino	Asian
	N (%) or mean (SD)	N (%) or mean (SD)	N (%) or mean (SD)	N (%) or mean (SD)	N (%) or mean (SD)
N	2350 (100)	1702 (72.4)	375 (16.0)	105 (4.5)	168 (7.2)
Incident Dementia	771 (32.8)	537 (31.6)	145 (38.7)	37 (35.2)	52 (31.0)
Demographics					
Age at MHC visit (years; mean (SD))	53.0 (6.4)	52.7 (6.2)	53.1 (6.5)	54.8 (7.2)	54.6 (7.1)
Age at start of dementia follow-up in 2010 (years; mean (SD))	93.1 (2.6)	93.1 (2.6)	92.9 (2.5)	92.8 (2.8)	92.8 (2.5)
Male	815 (34.7)	576 (33.8)	132 (35.2)	33 (31.4)	74 (44.1)
Education					
≤9th grade	231 (9.8)	110 (6.5)	72 (19.2)	34 (32.4)	15 (8.9)
10–12th grade	704 (30.0)	461 (27.1)	155 (41.3)	31 (29.5)	57 (33.9)
Trade school	<230	186 (10.9)	<15	<15	16 (9.5)
Some college	<388	291 (17.1)	54 (14.4)	<15	28 (16.7)
College graduate	<247	171 (10.1)	36 (9.6)	<15	25 (14.9)
Graduate school	353 (15.0)	315 (18.5)	20 (5.3)	<15	<15
Missing	<222	168 (9.9)	25 (6.7)	15 (14.3)	<15
Midlife health conditions					
Obesity	171 (7.3)	92 (5.4)	62 (16.5)	<15	<15
High cholesterol	904 (38.5)	628 (36.9)	161 (42.9)	51 (48.6)	64 (38.1)
Hypertension	899 (38.3)	589 (34.6)	203 (54.1)	44 (41.9)	63 (37.5)
Late-life health conditions					
Depression	621 (26.4)	489 (28.7)	77 (20.5)	26 (24.8)	29 (17.3)
Diabetes	482 (20.5)	293 (17.2)	113 (30.1)	31 (29.5)	45 (26.8)
Stroke	664 (28.3)	504 (29.6)	92 (24.5)	27 (25.7)	41 (24.4)
Ischemic heart disease	853 (36.3)	605 (35.6)	141 (37.6)	42 (40.0)	65 (38.7)
Heart failure	664 (28.3)	475 (27.9)	116 (30.9)	30 (28.6)	43 (25.6)

Notes: Percentages are shown as column percentages.

Table 2.

Age-adjusted incidence rates (aIR) per 1,000 person-years by race/ethnicity*

Group	Dementia Cases	Person-Years	aIR (95% CI)
Overall	771	7,002	100.5 (92.8, 108.3)
Whites	537	5,042	96.9 (87.9, 106.0)
Blacks	145	1,108	121.5 (100.3, 142.6)
Latinos	37	332	105.8 (69.1, 142.5)
Asians	52	519	89.9 (64.5, 115.9)

*Age standardized to the 2010 US Census population 90 and above

Table 3.

Cumulative incidence of dementia (95% confidence interval) by race/ethnicity conditional on survival without dementia until age 90 and accounting for competing risk of death

	Overall	White	Black	Latino	Asian
	Cumulative Incidence (95% CI)	**Cumulative Incidence (95% CI)**	**Cumulative Incidence (95% CI)**	**Cumulative Incidence (95% CI)**	**Cumulative Incidence (95% CI)**
5-year risk	22.6 (20.1, 25.1)	21.6 (18.6, 24.5)	28.2 (22.0, 34.6)	25.6 (14.3, 37.0)	18.9 (10.7, 26.0)
10-year risk	36.7 (33.6, 39.3)	34.9 (31.4, 38.1)	44.6 (37.4, 51.5)	41.9 (26.1, 54.3)	34.2 (23.3, 42.4)

Table 4.

Hazard ratios (95% CI) relating race/ethnicity and risk of dementia estimated with Cox proportional hazards models

Adjusted for:	White	Black	Latino	Asian
Age, sex	Ref	1.26 (1.05, 1.51)	1.05 (0.75, 1.47)	0.98 (0.74, 1.31)
Age, sex, education	Ref	1.27 (1.05, 1.53)	1.09 (0.77, 1.54)	0.96 (0.72, 1.29)
Age, sex, education, midlife health conditions	Ref	1.24 (1.02, 1.50)	1.11 (0.78, 1.56)	0.96 (0.72, 1.28)
Age, sex, education, late-life health conditions	Ref	1.32 (1.09, 1.60)	1.11 (0.79, 1.58)	1.01 (0.75, 1.34)
Age, sex, education, mid- and late-life health conditions	Ref	1.28 (1.06, 1.56)	1.12 (0.79, 1.59)	1.00 (0.75, 1.34)

Notes: Age as time scale. Midlife health conditions include obesity, hypertension, and high cholesterol. Late-life health conditions include depression, diabetes, stroke, ischemic heart disease, and heart failure. Models do not adjust for competing risk of death.