Use of Antihyperlipidemics among Adults with Cardiovascular Disease in the US and England from 2003-2012

BY

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THESIS

Submitted as partial fulfilment of the requirements
for the degree of Master of Science in Public Health Sciences
in the Graduate College of the
University of Illinois at Chicago, 2017

Chicago, Illinois

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This thesis is dedicated to my mother, Veronica Guadamuz, who instilled the love of learning and gave me all the opportunities I enjoy today. This thesis could not have been completed without her support.

ACKNOWLEDGEMENTS

I would like to thank my thesis committee — Dr. Dima Qato, Dr. Anthony LoSasso, and Dr. Martha Daviglus — for their support and guidance. It would have not been possible to complete thesis this without their critical eye and prodding questions. Special thanks to Dima, whose insight, advice, and encouragement was invaluable in every step of the process. Finally, I would like to thank my mother, Veronica Guadamuz, brothers, Javier and Miguel Montero, and partner, Max Schmidt, for their help and support during this grueling process.

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LIST OF ABBREVIATIONS

ACA	Patient Protection and Affordable Care Act
ATP II	Adult Treatment Panel II
BMI	Body mass index
CDC	Centers for Disease Control and Prevention
CVD	Cardiovascular disease
FPL	Federal poverty level
GDP	Gross domestic product
HbA1c	Hemoglobin A1c
HDL	High-density lipoprotein
HSCIC	Health and Social Care Information Center
HSE	Health Survey of England
LDL	Low-density lipoprotein
MI	Myocardial infarction
NCHS	Center for Health Statistics
NHANES	National Health and Nutrition Examination Survey
NHS	National Health Service
NICE	National Institute for Health and Care Excellence
pp	Percent point
UK	United Kingdom
US	United States of America

SUMMARY

Antihyperlipidemics are proven effective for the secondary prevention of cardiovascular disease (CVD). Comparative analysis on the prevalence of antihyperlipidemic use for secondary prevention of CVD has not been completed between the US and England.

Prevalence of antihyperlipidemic use was estimated using the National Health and Nutrition Examination Survey (2003-2004, 2005-2006, 2011-2012) and the Health Survey of England (2003, 2006, 2011). Analyses were restricted to participants over 40-years old with CVD.

Over 70% of English respondents with CVD use antihyperlipidemics (73.2%), compared to 62.3% of American respondents (11.0pp difference, $p=0.10$). Low-income Americans report lower prevalence of antihyperlipidemic use than their English counterparts, 51.8% and 76.5% respectively (24.7pp difference, $p<0.01$). American respondents have reduced odds of using antihyperlipidemics compared to the English (OR 0.73; $p<0.01$). This association persisted after accounting for sociodemographic/economic and CVD risk factors. After accounting for health status the association between country of residence was attenuated. In models restricted to individual country, lower socioeconomic status was associated with significantly reduced odds of using antihyperlipidemics in the US but not in England.

Differences in the use of antihyperlipidemics exist between and within the US and England. Universal health insurance may explain the greater, more equitable use of antihyperlipidemics among respondents with CVD in England compared to the US.

I. INTRODUCTION AND BACKGROUND

A. Introduction

One in three deaths in the United States (US) and England are caused by cardiovascular disease (CVD)[1,2]. Unfortunately, Americans face higher CVD mortality rates than people in England[3]. Secondary prevention of CVD with antihyperlipidemics may contribute to this difference because 40%-50% of MIs and strokes are recurrent[2,4]. Antihyperlipidemics, particularly statins, are safe and effective in the secondary prevention of CVD and are recommended for individuals with cardiovascular disease regardless of cholesterol level[5-7].

Use of antihyperlipidemics for secondary prevention of CVD is common. The Prospective Urban Rural Epidemiology (PURE) household study, which excluded both the US and England, found that in high-income countries 67% of individuals with CVD used statins[8]. In the US, 71% of adults with CVD report using antihyperlipidemics as of 2011-2012[9]. In 1998 only 19.9% of adults who had experience MI or angina used antihyperlipidemics in England—this is the most recent estimate based on a nationally representative survey[10]. Use is probably higher in recent years given that in 2013 12% of women and 16% of men in England used antihyperlipidemics[11].

This study will provide an updated estimate of the use of antihyperlipidemics among individuals with CVD (i.e. secondary prevention) in the US and England. More importantly, this study will examine the differences in the use of antihyperlipidemics between the US and England and provide a case example of two countries with similar development status but differing health care systems.

B. Health Care System Background

To better understand the analyses performed and implications of the results, the US and English health care systems are briefly described.

1. US Health Care System

The US health care system is a multiplayer system in which 66.0% of the population is privately insured, 36.5% is publicly insured, and 10.4% is uninsured as of 2014[12]. Individuals can be both privately and publicly insured so percentages do not sum to 100. Changes due to the Patient Protection and Affordable Care Act (ACA) of 2010, including prohibiting private insurers to deny coverage based on pre-existing conditions and allowing adults under 26 years of age to remain on their parents' insurance plans, have lowered the percentage of uninsured Americans from 16.3% in 2010[13]. Additional changes implemented in 2014 were designed to further reduce the uninsured rate[13]. These changes include[13]:

- expanding Medicaid to individuals with incomes less than 133% of the federal poverty level (FPL) in states that choose to expand;
- providing tax credits for individuals with income between 100% and 400% of the FPL who are not eligible for other affordable coverage;
- and mandating individuals to purchase insurance.

In the private insurance sector, insurance firms have the liberty to negotiate prices paid to providers (reimbursement rates) and the prices paid for medications. Insurance firms also decide which services and medications are covered under their plan. Various organizational structures exist for private insurance schemes, but most are some form of managed care organizations. Managed care organizations limit the providers and facilities beneficiaries can use to control cost and quality. A variety of payment structures exist among private insurance schemes, ranging from fee-for-service to capitation.

Medicaid and Medicare are the largest publicly funded insurance schemes in the US. Medicaid provides insurance for low-income children, pregnant women, some parents, seniors, and individuals with disabilities[14]. Medicaid is a federal and state funded program, therefore eligibility varies by state. For example, 19 states have not expanded Medicaid eligibility to low-income adults after the implementation of the ACA[15]. Each state can set reimbursement rates for services rendered to its beneficiaries and can decide which medications are covered in their state. Federal regulations limits total out-of-pocket costs for Medicaid beneficiaries to 5% of family income; however, specific deductibles and copayment limits vary by family income (see Table 1)[16]. Specific out-of-pocket limits vary by state, within the confines of federal regulations[16].

TABLE I MAXIMUM ALLOWABLE OUT-OF-POCKET COSTS FOR MEDICAID, FY 2013

Deductible	$2.65		
Copayments by Family Income			
	≥100% FPL	**101-150% FPL**	**>150% FPL**
Managed Care	$4.00		
Institutional Care	$75	20% of agency cost	20% of agency cost
Non-institutional Care	$4.00	20% of agency cost	20% of agency cost
Non-emergency use of Emergency Room	$8.00	$8.00	No limit (within 5% total limit)
Medications			
Preferred	$4.00	$4.00	$4.00
Non-preferred	$8.00	$8.00	20% of agency cost

Adapted from Medicaid.gov[16]

Medicare provides insurance for all citizens and permanent residents over 65 years of age. However, this scheme can be expensive and complicated for the individuals. The core of Medicare is hospital-insurance which is provided free of cost to most individuals (Part A)[17]. Part B provides medical insurance for beneficiaries, most beneficiaries pay $104.9 per month for coverage but costs range for $121.8 to $389.8 (2016)[17]. Finally, individuals can pay an additional premium that varies by income to add prescription medication benefits (Part D). If individuals do not enroll in part A, B, or D within the first year of eligibility they may be charged higher premiums for twice the number of years which they did not enroll[17]. Many individuals choose to purchase Medicare Advantage through private insurance firms to supplement and manage their benefits (Part C)[17]. In addition to premiums, all parts of Medicare are subject to deductibles, co-insurance, and/or co-payments[17]. Many states have programs to help low-income individuals afford Medicare premiums and other fees[17]. Nine million individuals are insured by both Medicaid and Medicare (dual eligible)[18].

The US spends more on health than any other country in terms of total expenditure, expenditure as a percentage of gross domestic product (GDP), and expenditure per capita; $3.0 trillion, 17.5%, and $9523, respectively (2014 data)[19]. The US public sector spends $4,197 per capita per year on health, the third largest expenditure in the world[20]. Hospital care, physician and clinical services, and prescription medications account for an additional 32%, 20%, and 10% of US health spending, respectively[21]. Public and private administration of health insurance accounts for 8% of US health spending[21]. Private insurance have disproportionately large administrative costs[21]; Medicare's administrative cost is only has a 2%[22]. Health insurance administration costs that are expected grow 32% between 2014 and 2018[23].

Overall, health care spending grew 5.3% between 2013 and 2014. The cost of all health care services and products increased during this period; however, pharmaceuticals increased at a higher rate–12.2%. Pharmaceuticals in the US are among the most expensive in the world; about 200% more expensive than in the United Kingdom (UK) [20]. In the US, there is no way to leverage the population size to demand lower prices of pharmaceuticals due to the disjointed insurance system and regulatory burdens. For example, Medicare administrators are prohibited from negotiating medication prices with drug manufacturers[24].

The US health care system underperforms most developed nations, including the United Kingdom, in terms of access to care (ability to get next day appointment, getting care after hours), affordability, chronic care management (including preventing complications), and public perception of the health system[25]. The US also underperforms its peers in terms of health outcomes. Life expectancy in the US is lower than the Organisation for Economic Co-operation and

Development average (78.8 years versus 81.2 years)[20]. Several reports suggest that the American underperformance in terms of health outcomes is not due to US demographics, health determinants, or risk factors but a result of an inequitable and inefficient health system[20,26].

2. English Health Care System

In the UK, the majority of health care is provided by the National Health Service (NHS), a public health insurance scheme that is centrally funded through tax revenue and national insurance contributions[27]. National Health Service's founders envisioned a scheme that would provide equitable care for the entire population, provided free at the point of service, and paid for by central financing[27]. After nearly six decades of operation the NHS has retained its founding principles[27].

Health care delivery and health policy for England is the responsibility of the central government (i.e. UK government). The governments of Scotland, Wales, and Northern Ireland have control of the health care and health policy in their respective countries. For the purposes of this study, the focus will be on the English system unless recent data is unavailable, in which case UK data will be discussed. In England, the Department of Health is responsible for the managing the NHS, developing health policies, securing resources, monitoring performance and outcomes, and setting national standards[27]. The National Institute for Health and Clinical Excellence (NICE) is responsible for developing national guidelines related to health promotion and prevention, assessment health technologies, and clinical guidance of care provided by the NHS[27]. Sixty-six percent of providers are privately employed, but most operate within the NHS[25]. Most hospital-based providers are direct employees of the NHS and work in NHS-owned facilities[28].

Nearly all services are provided by the NHS free of charge; however, patients are charged £8.60 per prescription (£1.00=$1.21 or $10.46 as of Jan 2017)[29]. Pricing schemes exist to help individuals purchase medications at a discount if they have multiple prescriptions. For example, any individual can purchase a certificate that for £104 ($126.60) which covers all prescription medications for a 12-month period[29]. Low-income and low-wealth individuals may receive their prescription medications at free or reduced cost[29]. Additionally, many are exempt from the prescription medication charge, including those who are[29]:

- under 16 and over 60 years of age,
- 16-18 years of age and a full-time student,
- pregnant or have had a baby in the last year,
- have a permanent disability,
- have any of the following medical conditions: permanent fistula, diabetes, myasthenia gravis, hypothyroidism requiring thyroid hormone replacement, epilepsy, cancer, renal failure, or a permanent disability,
- or are admitted as an inpatient.

In 2013, £150.6 billion ($185.9 billion) or 8.8% of GDP was spent by the UK on health—over 83.3% of spending is from the public sector [27,28]. NHS expenditure per capita in England was £2,057 ($2,539) in 2014-2015[28]. Administration accounts for 3% of NHS heath expenditure[28]. The sustainability of the NHS has come into question due to constant deficits; £1.9 billion ($2.3 billion) as of 2015-2016[27,28]. However, NHS has the power to set reimbursement rates, negotiate prices of medications and devices, and promote the use of cost-effective treatments.

The NHS has been rated as the best health care system in terms of efficiency, effectiveness, safety, coordination, patient-centered care, and affordably among eleven highly developed nations, including the US, and it ranked second in terms of equity[30]. Yet, inequality is growing between social classes/income groups due to the health of the rich improving faster than those of poorer social groups[27].

C. Literature Review

1. Use of Medications and Barriers to Access

In the US, 65% women and 56% men use at least one prescription medication[31]. In England, 50% of women and 43% of men use at least one prescription medication[11]. Despite higher prevalence of prescription medication use in the US, Americans have higher rates of unfilled medications due to cost[32].The Commonwealth Fund found that 23.1% of Americans report not filling a prescription or skipping a dose due to cost; only 5.4% of UK respondents reported the same[32]. In fact, this rate is the highest among the seven highly developed countries examined and 10 percent point (pp) higher than in the country with the second highest rate (Australia)[32]. Approximately 13% of Americans pay more than $1,000 out-of-pocket on medications, while in the UK less than 3% of respondents reported the same. Thirty-five percent of Americans with below average income report not filling a prescription or skipping a dose due to cost; the variance by income-level in England is negligible[32].

To ensure equitable access to prescription medications, individuals must have access to affordable care. Unfortunately, average out-of-pocket expenses in the US are ranked first among highly developed nations ($3,442)[20]. For comparison, US out-of-pocket expenditure is more than five times the out-of-pocket expenditure in Canada, the second-highest country[20]. High-income individuals are more likely to see a general practice physician in the US ("pro-rich inequity")[33]. Evidence suggests that access to general practice physicians is relatively equitable in England[33]. However, in both England and the US low-income individuals have poorer health outcomes[27,34]. This is more extreme in the US than most developed countries[34,35].

In studies limited to Americans with CVD risk factors (e.g. elevated cholesterol, diabetes, and hypertension) have found that uninsured individuals are less likely to receive appropriate treatments[36-39]*.* A 2006 study found comparable use medications for the management of diabetes in the US and England; however, uninsured US respondents reported lower use of these medications than the US and England overall[39].

In the US, there is substantial evidence that racial/ethnic minorities have poorer health outcomes and are more likely to lack insurance and access to care[35,40-42]. Insured minorities are less likely to have comprehensive health coverage[40]. In England, racial/ethnic minorities are as likely to use general practitioner services as whites[40]. Researchers also found equitable clinical outcomes among individuals with hypertension, diabetes, and high cholesterol[40]. However, there are inequalities in access to hospital and dental services[40]. Inequities in access to care and health outcomes occur in the US and England; however, they are of greater magnitude in the US.

2. <u>Use of Antihyperlipidemics for Primary and Secondary Prevention of CVD</u>

Antihyperlipidemics are among the most commonly used medications in both countries; 18% of adults in the US and 13% in England use antihyperlipidemics[11,31]. The number of prescriptions dispensed for antihyperlipidemics increased rapidly in the past two decades in the US and England; especially after patent protection ended for simvastatin in the mid-2000s[1,43] Use of antihyperlipidemics among individuals with high total cholesterol has increased by nearly 300% in England and nearly 500% in the US in the past twenty years[44]. Evidence suggests that this increase is associated with the increased medication use among the diagnosed population[44]. Over 80% of Americans with elevated total cholesterol are diagnosed; only half of their English counterparts are properly diagnosed[44]. Of those diagnosed in the US and England, 50% and 70% are treated, respectively[44]. In the US, 71% of adults over 40 years of age with CVD report antihyperlipidemic use (not age-adjusted)[9].

Study results examining racial differences in use of antihyperlipidemics have been mixed. A 2013 study in the US found that non-Hispanic white, black, and Asian respondents report similar prevalence of antihyperlidemic use; Hispanics report markedly lower use[9]. In a similar study, Qato et al. examined use of statins among individuals at high risk for cardiovascular events and found that blacks use statins at a lower prevalence than whites (38% versus 50%; $p < 0.01$)[37]. Conversely, a 2011 studies using National Health Interview Survey data among stroke survivors aged 45-64 years found that prevalence of antihyperlidemic use did not vary by racial/ethnic groups[41]. However, Mexican Americans and African-Americans are more likely to report difficulties affording medications among stroke survivors older than 65 years[41].

Differences in the use of antihyperlidemics also exist by insurance status. In the general US population aged 40-64 years, insured individuals use antihyperlipidemics at three times the prevalence as uninsured individuals (23.9% versus 8.1%; $p<0.01$)[9].

Estimates of antihyperlipidemic use among individuals with CVD in England are outdated. The only estimate based on a nationally representative survey was from 1998 and it reports that only 20% of adults who have experienced an MI/angina used an antihyperlipidemic[10]. A 2005 study based on data collected from general practice offices reported that 80% of men and 70% of women with ischemic artery disease were prescribed statins; the portion of individuals who filled and used these prescriptions is unknown and this estimate cannot account for individuals who do not use or have access to general practices[45]. A 2004 study among patients who were hospitalized for stroke, found that only 54% of English patients with known hyperlipidemia and 21% of those with previous ischemic heart disease were prescribed antihyperlidemics[46].

The number and percent of individuals using medications for the primary and secondary prevention of CVD has increased in England during the past decade[11,39,47-49]. However, there is evidence that disparities in antihyperlidemic use exist. A 2004 study found that general practitioner prescribing rates for medications for coronary heart disease do not correlate with the medical needs of their patients[50]. The authors also found that the percentage of patients of South Asian ethnicity negatively correlates with prescribing of medications for coronary heart disease[50]. Among diabetics, blacks are less likely to be prescribed antihyperlidemics (46.4%) than whites (51.9%) and South Asians (55.1%); blacks had the lowest prevalence of reaching indicating cholesterol targets[49]. There is a dearth of literature exploring sociodemographic/socioeconomic factors and pharmacotherapy for CVD risk factors in England.

D. Research Questions and Hypotheses

This study will examine the following research questions:

1) Among adults with prevalent CVD, how does the secondary prevention with antihyperlipidemic medications vary between the US and England?

   H1: Among adults with prevalent CVD, those residing in England report a higher prevalence of antihyperlipidemic use than Americans.

2) What individual and access to care factors explain the differences in antihyperlipidemic use between the US and English adults with CVD?

   H2: Insurance factors attenuate observed differences in antihyperlipidemic use between the US and England.

3) What factors explain why prevalence of antihyperlipidemic use varies within the US and English adults with CVD?

   H3: Among adults with CVD, sociodemographic and CVD risk factors will account for some of the within county differences in antihyperlipidemic use. Socioeconomic factors have a larger effect in antihyperlipidemic use in the US than in England.

III. METHODS

A. Data Source

Data from US National and Nutrition Examination Survey (NHANES) and the Health Survey of England (HSE) was used for this comparative study. Both are nationally representative household surveys that contain comparable sociodemographic/economic, health status, CVD risk factors, and health care access and medication use measures collected through interviews and physical examinations.

National and Nutrition Examination Survey is sampled from the US civilian, non-institutionalized population and conducted by the Center for Health Statistics (NCHS), part of the Centers for Disease Control and Prevention (CDC)[51]. National and Nutrition Examination Survey oversamples African-Americans, Hispanics, and adults over the age of 60 to allow for population estimates [52]. Computerized, home interviews are conducted as part of NHANES to gather information about various health related metrics[51,52]. Following the home interview, respondents are asked to schedule a physical examination at mobile examination centers[52].

Health Survey of England is sampled from the English population and conducted by NatCen Social Research in the Department of Epidemiology and Public Health of University College London for the Health and Social Care Information Centre (HSCIC)[53]. Health Survey of England oversamples various subpopulations, depending on the focus of the given year[53]. In this study, only the “core” sample of the survey (which focuses on the general population) is included, except in 2004. In 2004, the “booster” sample was included because detailed information about ethnic minorities was captured in a separate dataset[54]. Data collection for HSE is performed in two parts, an interview visit followed by home nurse-visit[53].

B. Measures

1. Dependent Variable

The dependent variable in this analysis is individual use of antihyperlipidemics. Information about use of prescription medications was collected in both surveys. In NHANES, data on medication use was collected during the household interview[55]. Respondents were asked whether they had taken a prescription medication in the last 30 days[56]. Those who answered "yes" were asked to show the interviewer the medication containers for all the medications used[56]. If no container was available, the participant was asked to name the prescription medication[56]. In HSE, data about prescription medications use was collected during the home nurse visit. Health Survey of England respondents were asked nearly identical questions as those in NHANES; however, HSE only captures use of medications in the last 7 days[57]. In England, respondents were also asked if they use over-the-counter statins[57]. Use of antihyperlipidemics is defined as use of statins (or HMG-CoA reductase inhibitors), fibrates, niacin (nicotinic acid), bile sequestrates, and antihyperlipidemic combinations in both countries.

2. Independent Variables

a. Country of Residence

Study respondents from the NHANES were considered US residents and study respondents from the HSE are considered English residents.

b. Cardiovascular Disease

Cardiovascular disease was defined as self-reported history of myocardial infarction (MI), angina, or stroke. It was not possible to determine whether a reported stroke was hemorrhagic or ischemic because neither survey collects data on this distinction. However, most strokes experienced by the survey population are ischemic; 87% of strokes in the United States and 85% of strokes in England are ischemic[2,58].

Health Survey of England only collected CVD status in the 2003, 2006, and 2011 surveys, thus estimates for the English population are limited to these cycles. For comparative analysis, comparable cycles for were selected for NHANES: 2003-2004, 2005-2006, and 2011-2012.

c. **Cardiovascular Risk Factors**

The Adult Treatment Panel (ATP) II and the NICE guidelines are used to determine major CVD risk factors[5,6,59]. Both agencies establish that hypertension, uncontrolled hypercholesterolemia, obesity, and smoking are major CVD risk factors and define similar benchmarks for these risk factors[5,6,59]. For diabetes, the World Health Organization's benchmark for hemoglobin A1c (HbA1c) levels was used[60].

Hypertension was defined as systolic blood pressure of 140mm Hg or greater, diastolic blood pressure of 90mm Hg or greater, self-reported history of hypertension (excluding gestational hypertension), or use of antihypertensive medication[5,6]. Four readings of blood pressure were provided in NHANES and three were provided in HSE. The first three readings were averaged to determine systolic and diastolic blood pressure. Diabetes was defined as self-reported history of diabetes (excluding gestational diabetes), an HbA1c of 6.5% or greater, or use of antidiabetic medication[60]. Uncontrolled hypercholesterolemia was defined as total cholesterol of 240 mg/DL or greater or high-density lipoprotein (HDL) less than 40mg/dL[6]. However, NICE does not endorse a benchmark for pharmacotherapy based on cholesterol levels[5]. Obesity was defined as a body mass index (BMI) of 30 or greater calculated as: weight in kilograms (kg) divided by height in meters (m) squared ($BMI = \frac{kg}{m^2}$)[5,6].

For consistency with the CDC, current smokers are defined as people who reported smoking at least 100 cigarettes in their lifetime and who reported smoking every day or some days in the US. For consistency with HSCIC, current smokers are defined as a person who responded "yes" to "Do you smoke cigarettes at all nowadays?" in England[61].

d. Sociodemographic/Economic Factors

Measures of race/ethnicity differ between NHANES and HSE because the composition of racial/ethnic minorities vary between the US and England. In the US, race/ethnicity is coded as non-Hispanic white, non-Hispanic black, Hispanic, or other. If a participant self-identifies as Hispanic, she/he was categorized as Hispanic regardless of whether the participant also identifies as another racial/ethnic group. For English respondents, race/ethnicity was coded as white, black, South Asian, or other. In England, the East Asians are categorized as "others"[57]. Hispanic ethnicity is not collected in England. All Asian ethnicities are categorized as "others" in the US. All racial/ethnic categories are mutually exclusive. For many analyses in this study, a binary race variable was used: white or non-white.

In the US, education was categorized as high school or less (0-12 years of schooling), some college (13-15 years of schooling), and college or more ($\geq$16 years of schooling). In England, education is categorized as O-level or equivalent (0-11 years schooling), A-level or equivalent (12-13 years schooling), and a higher educational qualification ($\geq$ 13 years of schooling). These categories are not directly comparable given the differences in education systems in the US and England, however they are meaningful in each country[62,63]. In the pooled analysis of England and the US, educational attainment was coded ordinal: high, middle, or low educational attainment.

In both NHANES and HSE, income was recorded as income categories that are not comparable due to differences in currency, category size, and inflation. Weighted tertiles of income for each cycle/year (to avoid needing to adjust for inflation) were created by:

(1) taking the midpoint of each income category to create a continuous variable[62,63],
(2) adjusting the continuous variable for household size using the Square Root Equivalence Scale[64],
(3) using survey weights to create income tertiles (i.e. high, middle, or low income).

Household income is coded in a similar manner as Banks et al. and Martinson et al.[62,63].

e. **Insurance Status**

National and Nutrition Examination Survey captures granular information about insurance status. Type of insurance for the US was categorized as: any private insurance, publicly insured only, and uninsured. In many analyses a binary category for insurance was used: insured and uninsured. Since the NHS covers nearly every English resident, in pooled analyses of England and the US every English participant was treated as insured[65,66].

C. **Statistical Analysis**

This study was conducted using pooled NHANES data from five consecutive two-year cycles (2003-2004 to 2011-2012) and pooled HSE data from ten one-year cycles (2003 to 2012). Each cycle/year's weights were multiplied by the percentage of the sample accounted for that cycle/year to adjust for differential weighting. Several sets of sample weights were created depending on which portion of the surveys was needed to complete the given analysis. NHANES contains interview and physical exam weights[67] and HSE contains interview, nurse visit, and blood sample weights[68]. Primary sampling unit and strata variables were appended and left unchanged after confirming that NHANES and HSE did not contain any identical primary sampling unit or strata values.

This study was limited to respondents over the 40 years of age or older. Age is top-coded at 80 years in NHANES, thus for a categorical variable is used for age. In analyses examining use of antihyperlipidemics, the sample was restricted to respondents who responded to prescription questions.

Age-adjusted descriptive statistics were used to estimate the prevalence of antihyperlipidemics over time. The 2010 US Census and the 2011 UK Census (limited to residents from England and Wales) data was pooled to derive the "standard population". Significance of trend across time was tested using orthogonal polynomial contrasts, as described by Vittinghoff et al.[69] Differences between categorical variables were determined using chi-squared (χ^2) tests. Differences in continuous variables were determined using t-tests.

Multivariate logistic regressions were used to examine the potential associations of various sociodemographic, health, and health care factors with the use of antihyperlipidemics among individuals with cardiovascular disease. Multivariate logistic regressions are limited to respondents with information on use of antihyperlipidemics. Model fit for models will be assessed using the Hosmer-Lemeshow Goodness-of-fit Chi-squared statistic. Link tests were used to determine if dependent variables were properly specified. All models presented pass model fit and dependent variable specification tests. Casewise deletion was used to address observations with missing variables.

All estimates and 95% confidence intervals were created using Taylor linearization methods to incorporate sample weights that adjust for the complex sampling methods found NHANES and HSE. Analyses were performed with Stata 14[70]. All p-values reported are two-sided.

IV. RESULTS

A. Sample

Due to the extent of missing data in the English database, there are differences in samples sizes per table. Information on what percentage is missing and detailed information on sample size can be found in Table VIII, Appendix A. The sample includes 82,337 respondents older than 40 years of age, 18,118 from the US and 64,219 from England. The number of respondents from the US ranged from 3,056 to 4,135 respondents per two-year cycle. The number of respondents from England ranged from 3,074 to 9,995 per year. In the US, history of cardiovascular disease was collected every cycle from 99.9% of respondents. In England, CVD status was only captured in 2003, 2006, and 2011 with non-missing rates of 99.9%, 82.9%, and 99.7%, respectively. Prescription medication use, which includes antihyperlipidemics, was collected from over 99.9% of respondents in the US but this information was missing from 27.3% of English respondents. Income information was missing from 9.3% of US respondents and 26.6% of English respondents. In England, blood measures (i.e. HbaA1c and cholesterol) are not collected every year. Most analyses are restricted to the 4,873 respondents in the analytic sample that have a history of CVD: 2,408 respondents from the US and 2,465 respondents from England.

B. Respondents

Table II shows the weighted distribution of sociodemographic/economic, insurance, CVD risk factors, and medication characteristics in the US and England in 2011-2012. A majority of respondents are younger than 65 years: 72.2% in the US and 68.0% in England. Women constitute slightly more than half of all respondents. The US has a larger percentage of racial/ethnic minorities (28.5%) than England (8.7%). In the US, 14.5% of respondents were uninsured.

TABLE II SAMPLE CHARACTERISTICS BY COUNTRY OVERALL AND AMONG RESPONDENTS WITH CVD AGED ≥ 40 YEARS—2011-2012[a]

	Respondents, % (95% CI)			
	Overall		with CVD	
	US	England	US	England
Sample size (n)	3,603	5,782	440	637
Age group, years[b]				
40-64	72.2 (70.1, 74.3)	68.0 (66.6, 69.4)[c]	41.4 (35.5, 47.5)	32.7 (28.8, 36.7)[c]
≥ 65	27.8 (25.7, 29.9)	32.0 (30.6, 33.4)[c]	58.6 (52.5, 64.5)	67.3 (63.3, 71.2)[c]
Female	53.0 (50.6, 55.3)	51.6 (50.6, 52.5)	45.5 (39.6, 51.5)	33.2 (28.3, 38.5)[c]
Race/ethnicity[d]				
White	71.5 (63.7, 78.2)	91.3 (89.9, 92.5)	65.9 (55.9, 74.6)	87.5 (81.0, 92.0)
Black	10.7 (6.8, 16.4)	2.3 (1.7, 2.9)	15.7 (10.0, 23.9)	0.5 (0.2, 1.7)
Hispanic	10.9 (7.5, 15.5)	N/A[e]	11.0 (6.4, 18.2)	N/A
Asian	N/A	5.2 (4.1, 6.5)	N/A	7.5 (4.1, 13.5)
Other	6.9 (5.3, 9.1)	1.3 (1.0, 1.6)	7.4 (4.6, 11.7)	4.5 (2.0, 9.8)
Education				
High	30.6 (25.5, 36.2)	33.4 (31.6, 35.2)	18.4 (12.5, 26.4)	22.1 (17.3, 27.9)
Middle	29.4 (26.6, 32.2)	33.7 (32.3, 35.1)[c]	32.0 (23.8, 41.5)	31.6 (25.2, 38.8)
Low	40.0 (35.2, 45.1)	32.9 (31.3, 34.6)[c]	49.6 (43.3, 55.9)	46.2 (39.7, 53.0)
Income				
High	36.1 (30.8, 41.8)	31.5 (29.3, 33.7)	23.4 (15.3, 34.2)	18.1 (12.9, 24.8)
Middle	32.7 (28.8, 36.8)	31.8 (29.8, 33.8)	24.2 (17.8, 32.0)	33.8 (26.6, 41.9)
Low	31.2 (26.6, 36.3)	36.8 (34.7, 38.9)	52.4 (43.8, 60.9)	48.2 (40.5, 55.9)
Insurance				
Private	64.7 (59.7, 69.3)	N/A	43.3 (30.8, 56.7)	N/A
Public	20.9 (17.3, 25.0)	N/A	39.2 (29.2, 50.2)	N/A
Uninsured	14.4 (12.3, 16.9)	N/A	17.5 (10.3, 28.2)	N/A
CVD	10.2 (9.5, 11.0)	9.8 (9.1, 10.5)	N/A	N/A
CVD history				
MI/angina	6.9 (6.2, 7.7)	7.1 (6.5, 7.7)	68.4 (58.5, 76.8)	71.3 (64.7, 77.1)
Stroke only	3.3 (2.7, 4.1)	2.7 (2.3, 3.1)	31.6 (23.2, 41.5)	28.7 (22.9, 35.3)
Diabetes	17.1 (15.2, 19.2)	11.5 (10.4, 12.6)[c]	30.9 (21.8, 41.8)	31.5 (24.0, 40.1)
Hypertension	58.6 (56.2, 60.9)	46.2 (44.6, 47.9)[c]	83.8 (77.0, 88.8)	81.3 (73.3, 87.3)
Uncontrolled hypercholesterolemia	32.0 (29.4, 34.7)	35.2 (33.2, 37.3)	44.4 (35.4, 53.7)	34.6 (25.5, 45.0)
Obese	37.3 (34.3, 40.4)	30.1 (28.5, 31.8)[c]	47.5 (37.2, 57.9)	38.2 (30.5, 46.5)
Current smoker	18.4 (16.6, 20.5)	18.2 (17.0, 19.5)	36.6 (29.9, 43.8)	28.0 (21.9, 35.2)[c]
2 ≥ CVD risk factors	49.8 (47.2, 52.3)	40.5 (38.8, 42.2)[c]	81.1 (74.4, 86.5)	64.1 (55.5, 71.8)[c]
Medication use	72.0 (70.1, 73.8)	63.8 (62.2, 65.4)[c]	92.7 (85.4, 96.5)	93.5 (85.4, 97.3)
Antihyperlipidemic use	28.1 (25.8, 30.6)	21.7 (20.4, 23.0)[c]	62.3 (49.7, 73.4)	73.2 (65.2, 80.0)

[a] US estimates are from the NHANES 2011-2012 cycle. English estimates are from the HSE 2011 cycle.
[b] Analysis of age groups are not age-adjusted.
[c] Difference between countries was significant at P<0.05.
[d] Racial/ethnic groups in the US and England are not comparable. In the US, Asians are categorized as "other". Hispanic ethnicity was not collected in England. The composition of ethnic composition of racial groups vary between seemingly comparable groups in the US and England.

Prevalence of CVD is similar in the US (10.2%) and England (9.8%); Table IX, Appendix B shows that the prevalence of CVD is declining in both countries (P=0.11 in the US and P<0.05 in England). Americans report significantly higher prevalence of diabetes, hypertension, obesity, and multiple risk factors than English respondents (all P<0.01). Americans report higher prevalence of medication use and antihyperlipidemic use than English respondents; 72.0% and 28.1% compared to 63.8% and 21.7%, respectively (both P<0.01).

Among respondents with CVD, a majority are over 65 years of age. However, Americans respondents are younger than their English counterparts; 41.4% of Americans with CVD are under 65 versus 32.7% of English respondents (P<0.05). Women make up a larger portion of respondents with CVD in the US (45.5%) than in England (33.2%) (P<0.05). In both countries, approximately half of respondents with CVD belong to the lowest education and income tertiles. In the US, 17.5% of respondents with CVD are uninsured. Americans with CVD report significantly higher prevalence of multiple risk factors than their English counterparts; 81.1% and 62.8%, respectively (P<0.01). Unlike the overall sample, Americans with CVD report significantly higher prevalence of smoking than the English; 36.6% and 28.0%, respectively (P<0.01). Nearly all US and English respondents with CVD report medication use; 92.7% and 93.5%, respectively.

C. <u>Trends and Differences in the Prevalence of Antihyperlipidemic Use</u>

Use of antihyperlipidemics among respondents with CVD has increased from 2003-2004 to 2011-2012 in both countries; from 38.5% to 62.3% in the US and from 46.4% to 73.2% in England (see Table III, both P<0.001). Similar increases were experienced among patients who experienced MI/angina and stroke. (Use of antihyperlidemics has also increased in the general population; Figure 3, Appendix C).

Table IV depicts the prevalence antihyperlipidemic use among respondents with CVD overall and by sample characteristics in 2011-2012. English respondents report an 11.0pp higher prevalence of antihyperlidemic use than US respondents (p=0.10). English respondents

TABLE III TRENDS IN ANTIHYPERLIPIDEMIC USE AMONG RESPONDENTS WITH MI/ANGINA, STROKE, AND CVD—2003-2012[a]

		Prevalence of Use, % (95% CI)			
		2003-2004	**2005-2006**	**2011-2012**	***P***
US	**Sample size, n**	537	436	453	
	MI/Angina	39.9 (33.9, 46.1)	53.9 (47.2, 60.5)	67.8 (55.0, 78.4)	<0.001
	Stroke	30.8 (22.9, 40.0)	32.9 (26.9, 39.5)	47.6 (38.3, 57.2)	0.025
	Stroke only	25.3 (18.5, 33.7)	30.0 (21.9, 39.5)	45.2 (35.7, 55.0)	0.010
	CVD	38.5 (32.8, 44.6)	46.7 (40.9, 52.6)	62.3 (49.4, 73.6)	<0.001
England	**Sample size, n**	879	551	421	
	MI/Angina	56.2 (48.9, 63.2)	69.6 (64.1, 74.7)	83.1 (75.1, 88.9)	<0.001
	Stroke	35.7 (27.0, 45.4)	52.5 (41.5, 63.3)	60.4 (50.6, 69.5)	<0.001
	Stroke only	30.9 (21.9, 41.6)	44.8 (35.6, 54.4)	53.1 (41.0, 64.9)	<0.001
	CVD	46.4 (40.7, 52.2)	60.1 (51.6, 68.1)	73.2 (65.2, 80.0)	<0.001

report higher use of antihyperlipidemics than American respondents across most sample characteristics examined. The largest difference reported was among low-income respondents, 51.8% of Americans and 76.5% of English low-income respondents use antihyperlipidemics; a 24.7pp difference (p<0.01). No statistically significant differences were found in middle- and high-income respondents. Americans with diabetes and hypertension report lower use of antihyperlipidemics (72.6% and 63.2%) than English respondents (88.7% and 81.4%; both P<0.05).

Within both countries, respondents who only experienced a stroke report lower use of antihyperlipidemics than respondents who have experienced an MI angina (US: 45.2% versus 67.3%, England 53.1% versus 83.1%, P<0.01). Similarly, respondents ages 40-64 years report lower use of antihyperlipidemics than respondents over 65 years of age (US: 58.1% compared to 72.3%, England 71.9% compared to 76.5%, P<0.01). In the England, low-income respondents report the highest use of antihyperlidemics (76.5%), followed by high- (73.0%) and middle-

[a] US estimates are from the NHANES 2003-2004, 2005-2006, and 2011-2012 cycles. English estimates are from the HSE 2003, 2006, and 2011 cycles.

TABLE IV PREVALENCE OF ANTIHYPERLIPIDEMIC USE AMONG RESPONDENTS WITH CVD BY COUNTRY AND SAMPLE CHARACTERISTICS—2011-2012[a]

	Prevalence of Use % (95% CI)		**Difference in Prevalence (US-England)**
	US	**England**	
Sample Size (n)	439	417	
Overall	62.3 (50.2, 74.3)	73.2 (65.8, 80.6)	-11.0 (-25.1, 3.2)
Age group, years[b]			
40-64	58.1 (42.1, 74.2)[c]	71.9 (61.7, 82.1)	-13.7 (-32.8, 5.3)
≥ 65	72.3 (65.6, 79.0)	76.5 (71.1, 81.9)	-4.2 (-12.9, 4.4)
Gender			
Female	63.0 (52.9, 73.1)	71.6 (62.3, 80.9)[c]	-8.6 (-22.3, 5.2)
Male	61.1 (50.1, 72.1)	76.3 (67.8, 84.9)	-15.2 (-29.2, -1.3)
Race[d]			
White	66.0 (48.2, 83.9)[c]	66.1 (58.8, 73.3)	0.0 (-19.3, 19.2)
Non-white	57.0 (46.0, 67.9)	84.8 (77.6, 92.0)[e]	-27.8 (-40.9, -14.8)
Education			
High	69.5 (53.2, 85.8)	69.3 (57.1, 81.6)[c]	0.2 (-20.2, 20.6)
Middle	62.3 (50.1, 74.4)	69.9 (58.1, 81.8)	-7.7 (-24.7, 9.3)
Low	60.7 (48.3, 73.0)	78.2 (68.7, 87.7)	-17.6 (-33.1, -2.0)
Income			
High	70.8 (56.1, 85.6)	73.0 (65.4, 80.7)[c]	-2.2 (-18.9, 14.5)
Middle	72.6 (67.6, 77.6)	64.4 (51.2, 77.5)	8.2 (-5.8, 22.3)
Low	51.8 (43.3, 60.4)	76.5 (66.2, 86.8)[e]	-24.7 (-38.1, -11.3)
Insurance			
Any private	77.2 (61.2, 88.0)[c]		N/A
Public only	58.1 (45.9, 69.3)		N/A
Uninsured	41.9 (32.1, 52.4)		N/A
CVD History			
MI/angina	67.8 (56.2, 79.4)[c]	83.1 (76.2, 90.0)[c]	-15.3 (-28.8, -1.8)
Stroke only	45.2 (35.7, 54.7)	53.1 (40.9, 65.3)	-7.9 (-23.4, 7.6)
Diabetes			
No	59.0 (42.9, 75.1)[c]	66.5 (57.5, 75.5)[c]	-7.5 (-25.9, 10.9)
Yes	72.4 (62.7, 82.1)	88.7 (83.8, 93.7)[e]	-16.3 (-27.2, -5.4)
Hypertension			
No	41.3 (22.2, 60.5)[c]	45.6 (32.6, 58.6)[c]	-4.2 (-27.4, 18.9)
Yes	63.2 (52.5, 73.9)	80.2 (72.3, 88.0)[e]	-16.9 (-30.2, -3.6)
Uncontrolled hyper-cholesterolemia			
No	60.4 (50.3, 70.6)[c]	74.8 (63.7, 85.9)[c]	-14.4 (-29.5, 0.7)
Yes	67.0 (57.4, 76.6)	70.2 (64.1, 76.2)	-3.2 (-14.5, 8.2)
Obese			
No	58.6 (40.0, 77.2)[c]	69.3 (59.6, 79.0)[c]	-10.7 (-31.7, 10.2)
Yes	69.0 (60.3, 77.7)	69.4 (60.8, 78.0)	-0.4 (-12.6, 11.9)
Current Smoker			
No	66.0 (55.6, 76.4)	77.2 (69.8, 84.6)	-11.2 (-23.9, 1.6)
Yes	56.5 (46.4, 66.5)	67.2 (54.4, 79.9)	-10.7 (-26.9, 5.5)
No. of risk factors			
0 or 1	42.5 (27.2, 57.9)[c]	64.3 (52.0, 76.7)[c]	-21.8 (-41.5, -2.1)
≥2	65.6 (53.6, 77.6)	77.4 (68.2, 86.7)	-11.9 (-27.0, 3.3)

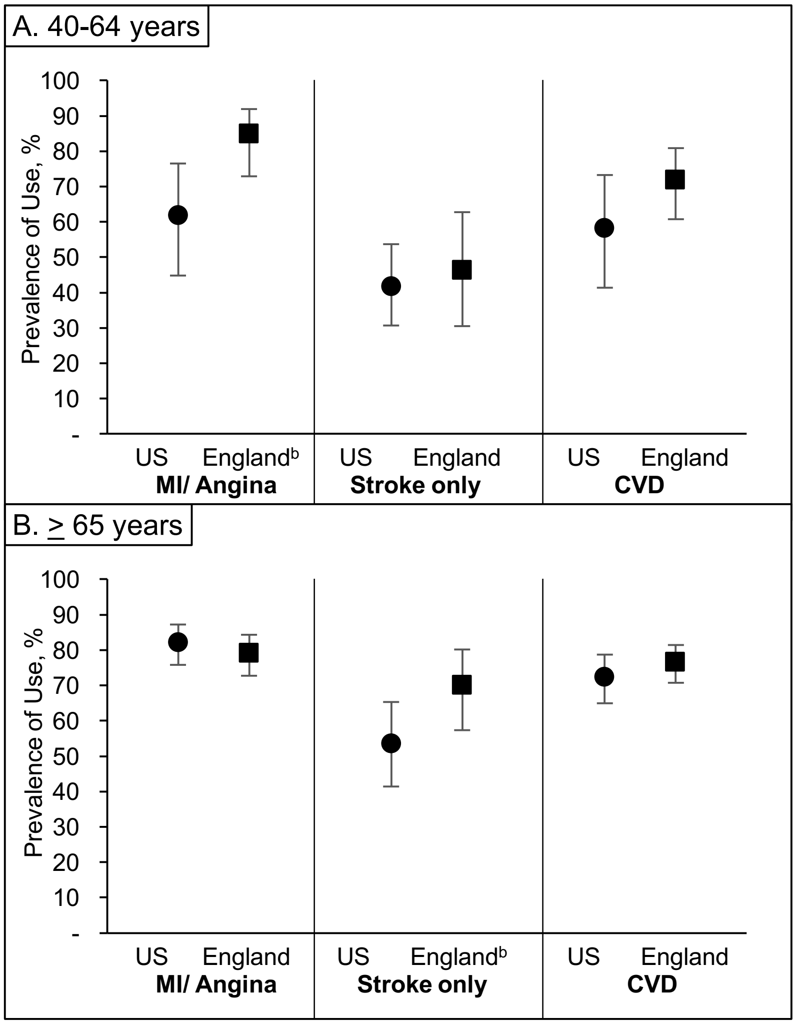
[a] US estimates are from the NHANES 2011-2012 cycle. English estimates are from the HSE 2011 cycle.
[b] Analysis of age groups are not age-adjusted.
[c] Differences between characteristic strata (within country) significant at $P<0.05$
[d] Racial/ethnic groups in the US and England are not comparable. For this analysis, individuals who self-identify as black, Hispanic, Asian, or other racial/ethnic group were grouped as "non-white".
[e] Difference between countries was significant at $P<0.05$.

income respondents (64.4%; P<0.01). In the US, low-income respondents report the lowest use of antihyperlidemics but differences between strata are not statistically significant. Non-white respondents report significantly lower use of antihyperlidemics than white respondents in the US (57.0% versus 66.0%; P<0.01). In the US, uninsured respondents report lower use antihyperlipidemics (41.9%) than privately insured (77.2%) or publicly insured respondents (58.1%; P<0.01).

Figure 1 reports prevalence in the use antihyperlipidemics among respondents with CVD by country, by type of CVD history, and by age group. Among respondents younger than 65 years, those who have experienced MI/angina in the US report lower use of antihyperlipidemics than their English counterparts; 61.9% and 84.8%, respectively (p<0.01). Similar differences were found among respondents who have only experienced a stroke and CVD overall, but were not statistically significant. Among respondents older than 65 years, Americans and English respondents that have experienced MI/angina report similar prevalence of antihyperlipidemic use; 82.2% and 79.0%, respectively. However, significant differences in use antihyperlipidemics were present among respondents that have experienced only a stroke; 53.6% of Americans use antihyperlipidemics compared to 70.0% of English respondents (p<0.05).

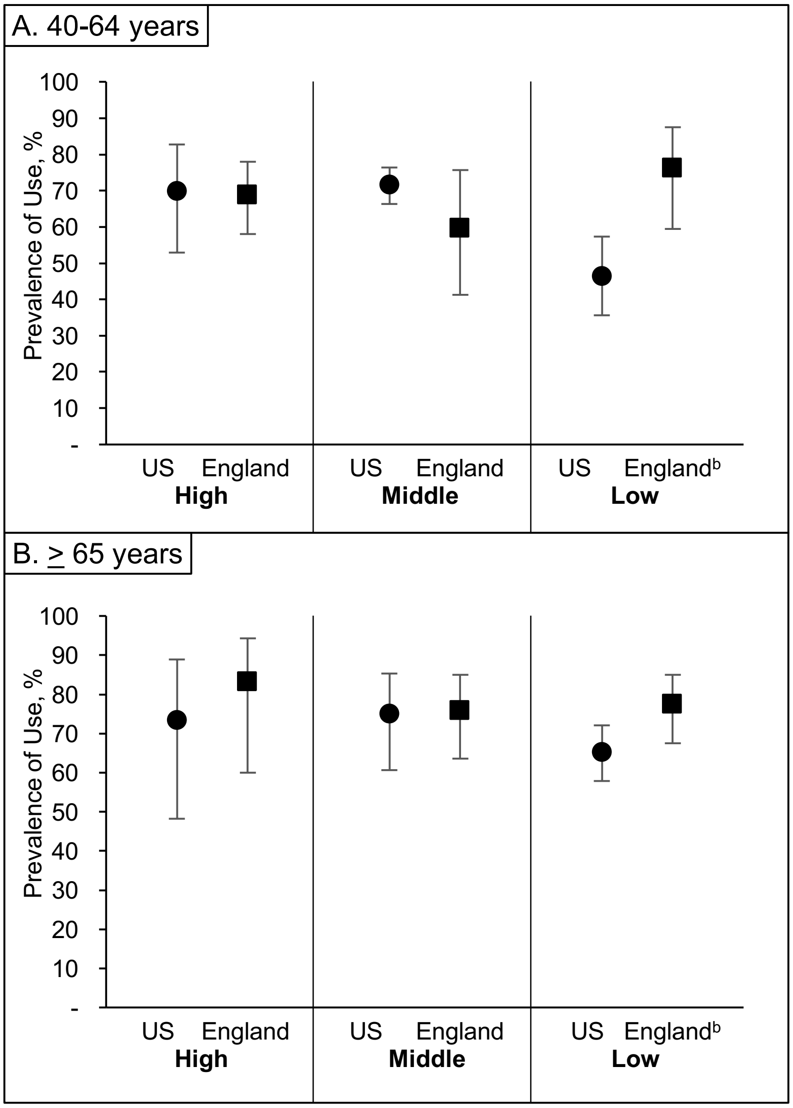
Use of antihyperlipidemics was also examined by income tertile and age group among respondents with CVD (see Figure 2). Among respondents ages 40-64 years of low-income US respondents 46.3% report the use of antihyperlipidemics compared to 76.2% of English respondents (P<0.05). Similar differences were found among respondents older than 65 years; 65.3% in the US versus 77.4% in England (p<0.05). No significant differences were found among middle- and high-income respondents. Use of antihyperlidemics has increased between 2003-2004 and 2011-2012 in all the age/income strata examined except middle-income, 40-64 year olds in England (see Table X, Appendix D).

FIGURE 1 Use of antihyperlipidemics among respondents CVD in the US and England, by CVD condition and age group—2011-2012[a]



[a] US estimates are from the NHANES 2011-2012 cycle. English estimates are from the HSE 2011 cycle.
[b] Difference between countries was significant at $P<0.05$.

FIGURE 2 Use of antihyperlipidemics among respondents with CVD in the US and England, by age and income group—2011-2012[a]



[a] US estimates are from the NHANES 2011-2012 cycle. English estimates are from the HSE 2011 cycle.
[b] Difference between countries was significant at P<0.05.

D. Factors Associated with Differences in Antihyperlipidemic Use

Table V displays multivariate analyses examining antihyperlipidemic use among respondents with CVD. Americans with CVD have half the odds of using antihyperlipidemics compared their English counterparts (adjusted OR: 0.46; P<0.01). This association remained significant after accounting for age, gender, CVD history, select CVD risk factors, ethnicity/race, education, and income (Model 2); however, the magnitude of association decreased (adjusted OR: 0.74; P<0.05). After the inclusion of insurance status, the association became marginally significant (adjusted OR: 0.77; P=0.06).

Table VI presents factors associated with antihyperlipidemic use among respondents with CVD in the US. Compared to younger respondents, respondents older than 65 years have increased odds of using antihyperlipidemics in all models examined (adjusted OR range from 1.50 to 1.78; all P<0.01). Males are more likely to use antihyperlipidemics than females in all models examined (adjusted OR range from 1.52 to 1.74; all P<0.01), as were diabetics compared to non-diabetics (adjusted OR range from 2.08 to 2.74; all P<0.01). Compared to respondents who have experienced an MI/angina, respondents who have only experienced a stroke have reduced odds of using antihyperlipidemics in all models examined (adjusted OR range from 0.49 to 0.52; all P<0.01).

Non-Hispanic blacks and Hispanics have reduced odds of using antihyperlipidemics compared to non-Hispanic whites (adjusted OR 0.48 and 0.57; both P<0.01). These associations persist even after other sociodemographic factors are introduced (Model 2; P<0.01 and P<0.05) and remain statistically significant among non-Hispanic blacks when accounting for insurance (Model 3; P<0.01). Low-income respondents have reduced odds of using antihyperlipidemics compared to high-income respondents (adjusted OR 0.72; P<0.05). These associations persist when other sociodemographic factors are introduced (Model 2; P<0.01), but became insignificant after adjusting for insurance status. Publicly insured and uninsured respondents have reduced odds of using antihyperlipidemics (adjusted OR 0.74 and 0.30; both P<0.01);

TABLE V SOCIODEMOGRAPHIC, CARDIOVASCULAR, AND HEALTH CARE FACTORS ASSOCIATED WITH DIFFERENCES IN ANTIHYPERLIPIDEMIC USE AMONG RESPONDENTS WITH CVD IN THE US AND ENGLAND—2003-2012[a]

	Adjusted OR (95% CI)			
	Model 0[b]	**Model 1[c]**	**Model 2[d]**	**Model 3[e]**
Sample size, n		3,201	2,628	2,539
Cycle/Year				
2003-2004 (2003)	Reference	Reference	Reference	Reference
2005-2006 (2006)	1.56 (1.12, 2.16)[f]	1.61 (1.12, 2.30)[f]	1.71 (1.19, 2.46)[f]	1.69 (1.13, 2.54)[f]
2011-2012 (2011)	2.83 (1.89, 4.25)[f]	3.14 (1.97, 5.00)[f]	3.20 (2.02, 5.08)[f]	3.16 (1.90, 5.25)[f]
Country				
England	Reference	Reference	Reference	Reference
US	0.73 (0.61, 0.87)[f]	0.77 (0.62, 0.95)[f]	0.75 (0.59, 0.96)[f]	0.78 (0.60, 1.03)
Age group, years				
40-64	Reference	Reference	Reference	Reference
$\geq$ 65	1.57 (1.21, 2.03)[f]	1.44 (1.07, 1.94)[f]	1.42 (0.99, 2.05)	1.15 (0.79, 1.65)
Gender				
Female	Reference	Reference	Reference	Reference
Male	1.54 (1.18, 2.02)[f]	1.45 (1.07, 1.96)[f]	1.45 (1.07, 1.96)[f]	1.37 (1.02, 1.85)[f]
CVD history				
MI/angina only	Reference	Reference	Reference	Reference
Stroke only	0.40 (0.31, 0.51)[f]	0.42 (0.32, 0.56)[f]	0.47 (0.34, 0.64)[f]	0.42 (0.30, 0.59)[f]
Diabetes				
No	Reference	Reference	Reference	Reference
Yes	1.92 (1.48, 2.48)[f]	2.21 (1.64, 2.98)[f]	2.41 (1.75, 3.33)[f]	2.76 (1.91, 4.00)[f]
No. of risk factors				
0 or 1	Reference	Reference	Reference	Reference
$\geq$2	0.93 (0.69, 1.25)	0.69 (0.49, 0.97)[f]	0.73 (0.52, 1.04)	0.71 (0.49, 1.04)
Race[g]				
White	Reference		Reference	Reference
Non-white	0.59 (0.46, 0.75)[f]		0.68 (0.50, 0.93)[f]	0.73 (0.53, 1.03)
Education				
High	Reference		Reference	Reference
Middle	0.97 (0.61, 1.56)		1.17 (0.68, 2.00)	1.26 (0.73, 2.17)
Low	1.12 (0.72, 1.76)		1.47 (0.85, 2.54)	1.63 (0.98, 2.71)
Income				
High	Reference		Reference	Reference
Middle	0.91 (0.60, 1.37)		0.95 (0.65, 1.39)	0.95 (0.65, 1.39)
Low	0.72 (0.49, 1.05)		0.68 (0.42, 1.08)	0.70 (0.43, 1.15)
Insurance[h]				
Insured	Reference			Reference
Uninsured	0.29 (0.17, 0.52)[f]			0.32 (0.16, 0.64)[f]

[a] US estimates are from the NHANES 2003-2004, 2005-2006, and 2011-2012 cycles. English estimates are from the HSE 2003, 2006, and 2011 cycles.
[b] Adjusted for cycle/year only.
[c] Adjusted for cycle/year, age, gender, CVD history, and select CVD risk factors.
[d] Adjusted for all variables in "Model 1" plus ethnicity/race, education, and income.
[e] Adjusted for variables in "Model 2" plus insurance status.
[f] Association was significant at P<0.05.
[g] Racial/ethnic groups in the US and England are not comparable. For this analysis, individuals who self-identify as black, Hispanic, Asian, or other racial/ethnic group were grouped as "non-white".
[h] All English respondents were considered as “insured”.

TABLE VI SOCIODEMOGRAPHIC, CARDIOVASCULAR, AND HEALTH CARE FACTORS ASSOCIATED WITH DIFFERENCES IN ANTIHYPERLIPIDEMIC USE AMONG RESPONDENTS WITH CVD IN THE US—2003-2012[a]

	Adjusted OR (95% CI)			
	Model 0[b]	**Model 1[c]**	**Model 2[d]**	**Model 3[e]**
Sample size, n		2,281	2,076	1,925
Cycle/year				
2003-2004	Reference	Reference	Reference	Reference
2005-2006	1.56 (1.11, 2.17)[f]	1.60 (1.11, 2.30)[f]	1.75 (1.20, 2.53)[f]	1.68 (1.12, 2.52)[f]
2007-2008	1.58 (1.23, 2.02)[f]	1.57 (1.16, 2.12)[f]	1.54 (1.10, 2.15)[f]	1.54 (1.05, 2.28)[f]
2009-2010	1.79 (1.30, 2.47)[f]	1.79 (1.23, 2.61)[f]	1.84 (1.22, 2.76)[f]	1.82 (1.17, 2.84)[f]
2011-2012	2.83 (1.87, 4.28)[f]	3.07 (1.90, 4.96)[f]	3.17 (1.98, 5.07)[f]	3.11 (1.88, 5.14)[f]
Age group, years				
40-64	Reference	Reference	Reference	Reference
≥ 65	1.78 (1.45, 2.18)[f]	1.75 (1.41, 2.18)[f]	1.72 (1.33, 2.21)[f]	1.48 (1.14, 1.91)[f]
Gender				
Female	Reference	Reference	Reference	Reference
Male	1.74 (1.44, 2.10)[f]	1.65 (1.35, 2.03)[f]	1.58 (1.28, 1.95)[f]	1.52 (1.22, 1.89)[f]
CVD history				
MI/angina only	Reference	Reference	Reference	Reference
Stroke only	0.49 (0.41, 0.60)[f]	0.52 (0.41, 0.64)[f]	0.52 (0.42, 0.66)[f]	0.50 (0.39, 0.63)[f]
Diabetes				
No	Reference	Reference	Reference	Reference
Yes	2.09 (1.70, 2.56)[f]	2.25 (1.78, 2.83)[f]	2.57 (2.00, 3.30)[f]	2.75 (2.08, 3.63)[f]
No. of risk factors				
0 or 1	Reference	Reference	Reference	Reference
≥2	1.06 (0.84, 1.34)	0.79 (0.60, 1.03)	0.81 (0.61, 1.07)	0.82 (0.62, 1.10)
Ethnicity/race				
White	Reference		Reference	Reference
Black	0.48 (0.39, 0.61)[f]		0.61 (0.46, 0.82)[f]	0.63 (0.47, 0.84)[f]
Hispanic	0.57 (0.42, 0.77)[f]		0.66 (0.47, 0.92)[f]	0.75 (0.52, 1.09)
Other	1.21 (0.80, 1.82)		1.41 (0.89, 2.24)	1.82 (1.12, 2.95)[f]
Education				
High	Reference		Reference	Reference
Middle	0.93 (0.66, 1.31)		0.98 (0.66, 1.46)	0.98 (0.65, 1.47)
Low	1.01 (0.70, 1.45)		1.20 (0.78, 1.87)	1.24 (0.80, 1.91)
Income				
High	Reference		Reference	Reference
Middle	0.98 (0.71, 1.35)		1.03 (0.76, 1.40)	1.13 (0.82, 1.55)
Low	0.72 (0.54, 0.95)[f]		0.68 (0.49, 0.95)[f]	0.81 (0.56, 1.18)
Insurance				
Any private	Reference			Reference
Public only	0.74 (0.59, 0.92)[f]			0.81 (0.62, 1.07)
Uninsured	0.30 (0.19, 0.48)[f]			0.36 (0.21, 0.62)[f]

[a] Estimates are from the NHANES 2003-2004 thru 2011-2012 cycles.
[b] Adjusted for cycle/year.
[c] Adjusted for cycle/year, age, gender, CVD history, and select CVD risk factors.
[d] Adjusted for all variables in "Model 1" plus ethnicity/race, education, and income.
[e] Adjusted for variables in "Model 2" plus insurance status.
[f] Association was significant at $P<0.05$.

this association persists for uninsured respondents in the fully adjusted model (Model 3; adjusted OR 0.36; P<0.01).

Table VII depicts factors associated with antihyperlipidemic use among respondents with CVD in England. Males are more likely to use antihyperlipidemics than females in all models examined (adjusted OR range from 1.45 to 1.61; all P<0.01), as were diabetics (adjusted OR range from 1.65 to 1.74; all P<0.05). Compared to respondents who have experienced an MI/angina, respondents who have only experienced a stroke have reduced odds of using antihyperlipidemics in all models examined (adjusted OR ranges from 0.44 to 0.46; all P<0.01). In logistic regressions only adjusted for cycle/year, low-income respondents have reduced odds of antihyperlipidemic use compared to high-income respondents (adjusted OR 0.69; P=0.06). However, after accounting for sociodemographic and CVD risk factors this association moves towards the null and an association between middle-income earners and reduced antihyperlipidemic use emerges (adjusted OR 0.66; P=0.06). None of the sociodemographic factors included were found to be significantly associated with antihyperlipidemics use.

TABLE VII SOCIODEMOGRAPHIC, CARDIOVASCULAR, AND HEALTH CARE FACTORS ASSOCIATED WITH DIFFERENCES IN ANTIHYPERLIPIDEMIC USE AMONG RESPONDENTS WITH CVD IN ENGLAND—2003-2011[a]

	Adjusted OR (95% CI)		
	Model 0[b]	**Model 1[c]**	**Model 2[d]**
Sample size, n		1,816	1,363
Cycle/year			
2003	Reference	Reference	Reference
2006	2.07 (1.64, 2.62)[e]	2.11 (1.65, 2.70)[e]	2.15 (1.61, 2.88)[e]
2011	3.16 (2.39, 4.17)[e]	3.16 (2.37, 4.22)[e]	2.96 (2.11, 4.16)[e]
Age group, years			
40-64	Reference	Reference	Reference
≥ 65	0.94 (0.76, 1.17)	1.01 (0.81, 1.26)	0.95 (0.73, 1.24)
Gender			
Female	Reference	Reference	Reference
Male	1.61 (1.31, 1.97)[e]	1.49 (1.21, 1.83)[e]	1.45 (1.14, 1.84)[e]
CVD history			
MI/angina	Reference	Reference	Reference
Stroke only	0.44 (0.34, 0.55)[e]	0.46 (0.36, 0.59)[e]	0.44 (0.33, 0.59)[e]
Diabetes			
No	Reference	Reference	Reference
Yes	1.74 (1.33, 2.27)[e]	1.70 (1.24, 2.32)[e]	1.72 (1.20, 2.47)[e]
No. of risk factors			
0 or 1	Reference	Reference	Reference
≥2	1.26 (1.03, 1.55)[e]	1.03 (0.81, 1.30)	0.97 (0.73, 1.27)
Ethnicity/race			
White	Reference		Reference
Black	1.40 (0.45, 4.38)		0.81 (0.20, 3.33)
Asian	1.24 (0.58, 2.65)		1.05 (0.34, 3.28)
Other	0.86 (0.22, 3.40)		2.13 (0.31, 14.69)
Education			
High	Reference		Reference
Middle	0.91 (0.64, 1.29)		0.75 (0.52, 1.06)
Low	0.99 (0.75, 1.30)		0.77 (0.54, 1.10)
Income			
High	Reference		Reference
Middle	0.84 (0.54, 1.29)		0.88 (0.57, 1.37)
Low	0.69 (0.47, 1.02)		0.66 (0.43, 1.03)

[a] Estimates are from the HSE 2003, 2006, and 2011 cycles.
[b] Adjusted for cycle/year.
[c] Adjusted for cycle/year, age, gender, CVD history, and select CVD risk factors.
[d] Adjusted for all variables in "Model 1" plus ethnicity/race, education, and income.
[e] Association was significant at $P<0.05$.

V. DISCUSSION

Cardiovascular disease burden is similar in the US and England; however, Americans with CVD report lower and less equitable use of antihyperlidemics than their English counterparts. Over 70% of English respondents with CVD use antihyperlipidemics (73.2%), compared to 62.3% of American respondents (11.0pp difference, p=0.10). United States respondents have reduced odds of antihyperlipidemic use compared to English respondents (OR 0.72; p<0.01). This association persisted after accounting for sociodemographic, CVD, and insurance factors. In the US, non-white, low-income, and uninsured respondents report lower antihyperlidemic use than white, middle/high-income, and insured respondents, respectively. The opposite is true in England; non-white and low-income respondents report higher antihyperlidemic use than white and middle/high-income respondents, respectively.

A. <u>Inequities in Antihyperlidemic Use between the US and England</u>

Overall, American respondents have higher prevalence of antihyperlipidemic use compared to English respondents. This implies that a higher prevalence of Americans are using antihyperlipidemics for primary prevention of CVD than English respondents. This is expected, given that only 50% of adults with high cholesterol are diagnosed in England[44]. However, the higher use of antihyperlipidemics among respondents with CVD in England compared to the US suggests that people who *need* antihyperlipidemics *in England have greater access.*

Differences in antihyperlipidemic use among respondents with CVD are most notable among low-income individuals; 51.8% of low-income Americans with CVD use antihyperlidemics compared to 76.5% of their English counterparts (P<0.01). This is, in part, due to lower insurance coverage rates among low-income Americans. In the US, disparities in health insurance coverage decline after age 65, when Medicare begins to insure nearly all older adults. As a result, differences between low-income respondents in the US and England are larger among individuals ages 40-64 year than individuals older than 65 (29.8pp compared to 12.1pp). After accounting for health insurance coverage, Americans have reduced odds of antihyperlipidemic use compared to their English counterparts (adjusted OR 0.77; P=0.06). This is unsurprising considering that only privately insured Americans use antihyperlipidemics comparably to their English counterparts (77.2% versus 73.2%, respectively).

The private-public health insurance system in the US has resulted in worse access to health care and mediations when compared to England[20,32]; this partially accounts for the differences in antihyperlipidemic use among adults with CVD in England and the US. Free-of-charge care at the point of service, free medications for certain conditions, and free or reduced cost medications for individuals with low ability to pay in England may further explain the higher use of antihyperlipidemics in this country. Differential geographic access to primary care and pharmacies, cooperation between health care sectors, and individual/societal acceptability of antihyperlipidemics may also contribute to the differences found between the US and England.

B. <u>Inequities in Antihyperlidemic Use within the US and England</u>

Within the US, use of antihyperlipidemics among adults with CVD is not equitable between racial/ethnic and income groups. Black and Hispanic respondents have reduced odds (adjusted OR 0.48 and 0.57, respectively; both P<0.01) and lower use of antihyperlipidemics than white respondents (non-white 57.0%; white 66.0%). Similarly, low-income Americans have reduced of odds of antihyperlipidemic use compared to high-income respondents. After accounting for insurance status, racial/ethnic disparities remain but income differences are attenuated. Publicly insured respondents, which are more likely to be low-income (Medicaid insured) and/or elderly (Medicare insured), have reduced odds of antihyperlipidemic use compared to privately insured respondents.

Studies have found worse access to primary care and pharmacies in communities composed of racial/ethnic minorities and low-income households compared to white and high-income communities[71,72]; this, along with differences in health insurance coverage, may account for the inequities in antihyperlipidemic use found within the US. Minorities, particularly black Americans, also receive lower quality care and differential treatment from physicians[73] that may extend to medication prescribing of antihyperlipidemics.

The Medicaid population faces several barriers to medication access and use. The Medicaid population disproportionately lives in areas with shortages of primary care physicians and, due to low reimbursement rates, physicians are less likely to accept these patients[74]. In addition, medication cost-containment strategies such as co-payment requirements, limits on the number of medications dispensed without prior authorization, and preferred drug lists (Medicaid formularies) may result in lower access to medication and reduced primary and secondary adherence to medications[75-78].

In England, there is no clear evidence of racial inequities between whites and minorities and between high- and low-income respondents. However, low-income respondents report marginally reduced odds of using antihyperlipidemics (adjusted OR 0.66; P=0.07) when compared to their high-income counterparts. English policies, such as: universal health coverage, free prescription medications for certain health conditions, and reduced cost/free prescription medications for low-income individuals, may have resulted in more equitable antihyperlipidemic use compared to the US. However, these polices are not fully addressing income disparities in antihyperlidemic use in England.

C. <u>Age, Gender, Stroke and Antihyperlipidemic Use</u>

In addition to social inequities, differences in antihyperlipidemic use dependent on clinical factors exist. After adjusting for relevant sociodemographic, clinical, and health insurance factors, women and those who have only experienced a stroke have reduced odds of antihyperlipidemic use, compared to men and those who have experienced an MI in both the US and England. In the US, respondents younger than 65 also have reduced odds of antihyperlipidemic use compared to their older counterparts.

Clinical guidelines in both countries recommend antihyperlipidemic use for all individuals with CVD; differences in use by age, gender, and stroke status are unlikely to be a result of guidelines. Differential individual and societal factors for women, stroke survivors, and younger respondents may contribute to differences in antihyperlipidemic *use.* For example, stroke survivors may have a disability that limits their ability to fill, afford, or take antihyperlipidemics. Additionally, physicians may *prescribe* antihyperlipidemics differently for these groups.

D. Clinical, Public Health, and Policy Implications for the US

Antihyperlipidemics reduce CVD-attributable morbidity and mortality[5-7]. Inequities in antihyperlipidemic use may result in inequitable CVD outcomes within and between the US and England.

To increase use and minimize inequities of antihyperlipidemics via clinical practice, American physicians should prescribe these medications equitably and universally (unless contraindicated). Special attention should be paid to clinical groups that underuse antihyperlipidemics, such as: women, stroke survivors, and adults younger than 65. Physicians should also consider the additional burden to antihyperlipidemic use that low-income and racial minority populations face. Physicians have some ability to address economic burdens of antihyperlipidemic use. For example, physicians can prescribe generic medications and direct patients to utilize more affordable pharmacies.

In the public health sphere, non-governmental organizations and governmental agencies, can help clinicians with the suggestions above by providing educational material and updating clinical guidelines (small “p” policies). More importantly, agencies can advocate and lobby for policies that promote preventative services (big “p” policies). Such policies were introduced as part of the ACA by mandating that select preventative screening are covered by all insurers and promoting the medical home model which aims to improve quality and efficiency by delivering comprehensive and patient-centered preventative and primary care[79,80]. Unfortunately, promoting preventative services via insurance provisions may increase inequities between insured and uninsured Americans.

Implementation of the ACA partially addressed this inequity via various provisions that led to a decrease in the number of uninsured Americans; from 41 million in 2013 to 28 million in 2016[81,82]. While politically unfeasible, increasing health insurance coverage should remain a policy priority because can increase equitable access and use of essential medications, such as antihyperlipidemics.

While insurance coverage, or lack thereof, contributes significantly to inequities in medication access and use in the US, other factors discussed above also contribute to inequities. Policy makers need to address inequities in geographic access to primary care providers and pharmacies among low-income and minority populations in the US. Additionally, individual and societal factors that may be difficult to address from health systems perspective, should be considered for research (e.g. social support).

The disparities reported within the US and between the US and England have been found in other non-communicable conditions[39,47]; the implications presented apply to the pharmacotherapeutic management of non-communicable conditions in general.

E. Limitations

This study has several limitations. First, this study is purely observational and no causal inferences can be made. Second, nearly a third of English respondents have missing prescription medication data. However, no significant differences were found among respondents who report prescription medication information compared to those who do not (see Table XI, Appendix F). Casewise deletion was used to manage missing data in this study. Casewise deletion assumes that missingness is completely at random; this is a strong assumption that is probably not met in the HSE. However, in comparison to other traditional methods to manage missingness, such as dummy variable adjustment or conventional imputation, casewise deletion provides less biased estimates and accurate standard errors[83]. Third, CVD diagnosis is self-reported; however, past studies have found a high degree of specificity for self-reports of CVD[8]. Finally, individual antihyperlipidemic medications use were not examined because HSE data is provided at the therapeutic drug class level. As reported in Figure 4, Appendix E, over 90% of antihyperlipidemics used by respondents are statins.

F. Strengths

This study has several strengths. First, this study provides the only comparison of the prevalence of antihyperlipidemics for the secondary prevention of CVD between the US and England. Second, data from two nationally representative household surveys were utilized for this study. This approach avoids the biases related to data from health systems (e.g. use of medications in patients of health centers) and gives a more realistic prevalence of the use of antihyperlipidemics for the secondary prevention of CVD. Finally, this study provides an updated estimate of the use of antihyperlipidemics for the secondary prevention of CVD in England.

G. Conclusion

This study provides nationally representative estimates of antihyperlipidemic use among individuals with CVD in the US and England. Despite the effective of antihyperlipidemics for the secondary prevention of CVD, the US underperforms England in terms of overall use and equitable use of these medications. Disparities in antihyperlipidemic use may result increased CVD-attributable morbidity and mortality in the US, particularly, among low-income and racial minority populations in the US. Policymakers in the US should promote policies that improve overall use and equity of antihyperlipidemic use, such as universal health insurance coverage.

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APPENDICES

APPENDIX A

Table VIII PERCENT OF RESPONDENTS REPORTING SELECT VARIABLES BY COUNTRY, SURVEY COMPONENT/ WEIGHT, AND CYCLE/YEAR[a]

	Component /Weight	Variable	2003-2004	2005-2006	2007-2008	2009-2010	2011-2012
US (NHANES)	**Total**		**3,299**	**3,056**	**4,025**	**4,135**	**3,603**
	Interview	Race/Ethnicity	100.0%	100.0%	100.0%	100.0%	100.0%
		Income	92.8%	93.8%	90.5%	88.2%	88.9%
		Insurance	95.4%	95.5%	96.8%	96.6%	96.1%
		Smoking Status	99.8%	99.9%	99.9%	100.0%	99.8%
		CVD	99.5%	99.5%	99.3%	99.4%	99.6%
		Use of Prescription Medications	99.8%	99.7%	99.9%	99.9%	99.9%
	Exam	Obesity	91.4%	93.6%	93.9%	96.0%	93.7%
		Uncontrolled Hypercholestermia	88.6%	91.0%	90.2%	91.7%	87.8%
	Interview & Exam	Hypertension	99.8%	99.9%	100.0%	100.0%	99.9%
		Diabetes	99.9%	99.9%	99.9%	100.0%	99.9%
	Participants w/CVD		**523**	**426**	**531**	**488**	**440**

	Component/ Weight	Variable	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
England (HSE)	**Total**		**9,414**	**3,226**	**7,570**	**9,358**	**4,527**	**9,995**	**3,074**	**5,665**	**5,782**	**5,608**
	Interview	Race/Ethnicity	99.8%	99.8%	99.6%	99.8%	99.8%	99.7%	99.7%	99.8%	99.6%	99.6%
		Income	79.7%	71.7%	50.7%	76.8%	72.9%	75.8%	77.9%	76.0%	76.5%	77.0%
		Smoking Status	99.8%	99.5%	99.7%	99.8%	99.9%	99.8%	99.8%	99.9%	99.7%	99.8%
		CVD[a]	99.9%	N/A	N/A	82.9%	N/A	N/A	N/A	N/A	99.7%	N/A
	Nurse/Blood	Use of Prescription Medications	78.6%	55.6%	74.9%	76.3%	74.3%	73.2%	72.8%	68.7%	68.2%	69.9%
		Obesity	87.1%	79.5%	80.6%	84.3%	85.7%	84.3%	85.1%	82.7%	81.1%	82.7%
		Uncontrolled Hypercholestermia	59.9%	38.2%	29.0%	56.5%	N/A	52.1%	54.1%	49.6%	48.8%	52.5%
	Interview & Nurse/Blood	Hypertension	100.0%	100.0%	100.0%	96.2%	87.0%	86.9%	100.0%	100.0%	100.0%	100.0%
		Diabetes	100.0%	100.0%	100.0%	93.1%	55.7%	79.4%	100.0%	100.0%	100.0%	100.0%
	Participants w/CVD		**1,105**	N/A	N/A	**723**	N/A	N/A	N/A	N/A	**637**	N/A

[a] In England, CVD status was only collected in 2003, 2006, and 2011.

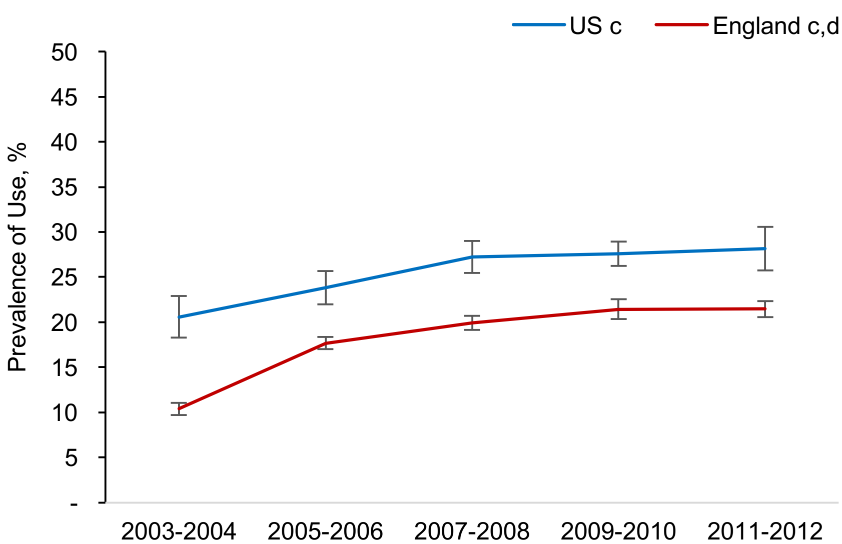
APPENDIX B

Table IX TRENDS IN PREVALENCE OF STROKE, MI/ANGINA, AND CVD IN THE US AND ENGLAND— 2003-2012[a]

		Prevalence, % (95% CI)			
		2003-2004	**2005-2006**	**2011-2012**	***P***
US	**MI/Angina**	9.1 (7.5, 11.0)	6.6 (7.9, 9.4)	6.9 (7.7, 6.2)	0.045
	Stroke	4.3 (3.6, 5.2)	3.9 (4.8, 5.9)	4.2 (5.1, 3.5)	0.920
	CVD	12.2 (10.5, 14.2)	9.8 (11.4, 13.1)	10.2 (11.0, 9.4)	0.105
England	**MI/Angina**	8.4 (7.9, 9.0)	7.5 (8.1, 8.8)	7.1 (7.7, 6.5)	0.001
	Stroke	3.6 (3.2, 3.9)	3.3 (3.8, 4.2)	3.8 (4.4, 3.3)	0.610
	CVD	10.8 (10.2, 11.5)	10.0 (10.7, 11.4)	9.8 (10.5, 9.1)	0.018

APPENDIX C

Figure 3 Prevalence of antihyperlipidemic use in the US and England — 2003-2012[bcd]



[a] US estimates from the NHANES 2003-2004, 2005-2006, and 2011-2012 cycles. English estimates from the HSE 2003, 2006, and 2011 cycles.
[b] US estimates are from the NHANES 2003-2004 thru 2011-2012 cycles. English estimates from the HSE 2003 to 2012 cycles.
[c] Trend statistically significant at *P*<0.01.
[d] Difference between countries was significant at *P*<0.01 in 2011-2012.

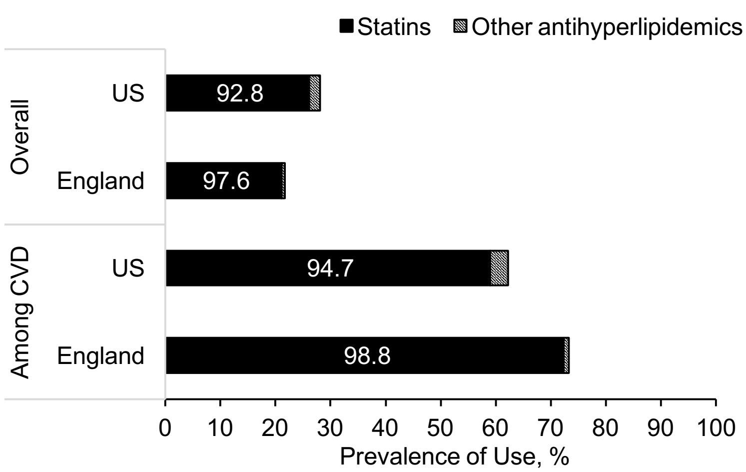
APPENDIX D

Table X TRENDS IN ANTIHYPERLIPIDEMIC USE AMONG RESPONDENTS WITH CVD, BY AGE AND INCOME GROUP— 2003-2012[a]

			Prevalence, % (95% CI)			
			2003-2004	**2005-2006**	**2011-2012**	***P***
US	**40-64 years**	**High**	42.9 (28.7, 58.4)	45.4 (37.9, 53.1)	69.8 (52.9, 82.7)	0.027
		Middle	37.9 (24.1, 54.1)	38.0 (23.7, 54.8)	71.6 (66.3, 76.4)	0.141
		Low	27.7 (23.8, 31.8)	35.1 (27.8, 43.1)	46.3 (35.6, 57.4)	0.012
	≥65 years	**High**	40.6 (30.6, 51.3)	72.9 (56.7, 84.6)	73.3 (48.3, 89.0)	0.022
		Middle	54.8 (43.7, 65.3)	65.3 (53.9, 75.2)	75.0 (60.6, 85.4)	0.037
		Low	42.6 (33.3, 52.5)	67.7 (61.6, 73.2)	65.3 (57.9, 72.0)	0.001
England	**40-64 years**	**High**	57.0 (40.4, 72.2)	48.7 (33.0, 64.7)	68.9 (58.0, 78.0)	0.132
		Middle	53.2 (38.7, 67.3)	61.7 (53.2, 69.5)	59.6 (41.3, 75.6)	0.618
		Low	41.9 (30.1, 54.6)	56.4 (34.3, 76.3)	76.2 (59.4, 87.5)	0.001
	≥65 years	**High**	66.6 (45.3, 82.8)	61.1 (42.1, 77.2)	83.3 (60.0, 94.3)	0.255
		Middle	51.5 (42.2, 60.8)	81.1 (72.0, 87.8)	75.9 (63.5, 85.0)	0.012
		Low	48.1 (43.1, 53.2)	66.0 (58.1, 73.2)	77.4 (67.5, 85.0)	<0.001

APPENDIX E

Figure 4 Prevalence of antihyperlipidemic use overall and among respondents with CVD in the US and England by type of antihyperlipidemic/percentage of statin users among antihyper-lipidemic users— 2011-2012[b,c]



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[a] US estimates are from the NHANES 2003-2004, 2005-2006, and 2011-2012 cycles. English estimates are from the HSE 2003, 2006, and 2011 cycles.
[b] US estimates are from the NHANES 2011-2012 cycle. English estimates are from the HSE 2011 cycle.
[c] Less than 0.5% of English respondents use of over the counter statins overall and no respondents with CVD report their use.

APPENDIX F

Table XI SAMPLE CHARACTERISTICS BY AVAILABILITY OF PRESCRIPTION MEDICATION INFORMATION AMONG RESPONDENTS WITH CVD IN ENGLAND— 2011[a,b]

	Respondents, % (95% CI)	
	Available	**Missing**
Sample size (n)	417	220
Age (mean), years	69.8 (68.4, 71.1)	70.3 (68.6, 72.1)
Female	32.5 (26.3, 39.4)	33.5 (25.5, 42.6)
Non-white	12.8 (7.5, 20.8)	10.2 (5.6, 17.6)
Education		
Low	48.7 (40.1, 57.4)	41.7 (32.9, 51.0)
Middle	29.7 (22.0, 38.8)	36.1 (25.4, 48.4)
High	21.6 (15.7, 29.0)	22.2 (14.0, 33.5)
Income		
Low	49.6 (40.5, 58.8)	41.8 (33.4, 50.8)
Middle	36.0 (27.4, 45.6)	30.0 (17.9, 45.7)
High	14.4 (9.8, 20.7)	28.2 (16.3, 44.1)
CVD history-stroke only	30.4 (23.4, 38.4)	25.6 (16.9, 36.7)
Diabetes	61.8 (53.3, 69.6)	56.4 (46.7, 65.7)
2 ≥ CVD risk factors	30.7 (23.5, 38.9)	18.7 (12.6, 26.9)

[a] Estimates are from HSE 2011 cycle.
[b] No significant differences between respondents with available and missing prescription information were found.

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