

# Aspirin use for cardiovascular disease prevention in the uninsured population

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## Abstract

**Introduction:** Aspirin is an effective anti-inflammatory and antiplatelet agent as an irreversible inhibitor of cyclooxygenase. In 2016, the U.S. Preventive Services Task Force recommended aspirin for primary prevention of cardiovascular disease in patients aged 50–69 years with a 10% or greater 10-year cardiovascular disease risk. Current guidelines for patients with prior myocardial infarction or coronary artery disease recommend aspirin use for the secondary prevention of cardiovascular disease. Due to the lack of literature describing adherence to these recommendations in the uninsured patient population, we studied aspirin use for cardiovascular disease prevention in free medical clinics.

**Methods:** We conducted a cross sectional study of uninsured patients who visited nine free medical clinics in 2016–2017. Data from the records of 8857 patients were combined into a database for analysis. 10-year Framingham risk scores for coronary artery disease were calculated for the 50–69-year-old population to evaluate which patients qualified for aspirin usage. Aspirin use was assessed for patients with prior myocardial infarction or coronary artery disease.

**Results:** In total, 1443 patients met the criteria to take aspirin for primary prevention of cardiovascular disease, but just 17% of these patients aged 50–59 years were on the medication. About 15% of the patients aged 60–69 years were taking aspirin. Of the 297 patients who had prior myocardial infarction or coronary artery disease, 50% were taking aspirin for secondary prevention.

**Conclusion:** Among the uninsured population, there are low rates of aspirin use for risk reduction of cardiovascular disease. This study demonstrates that improvements are needed to increase adherence to current guidelines and address barriers uninsured patients may face in maintaining their cardiovascular health.

## Keywords

Aspirin, coronary artery disease, cardiovascular disease, medically uninsured, primary prevention, secondary prevention

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## Introduction

Cardiovascular disease (CVD) is the leading cause of death in the United States according to 2016 data published by the Centers for Disease Control and Prevention.<sup>1</sup> As an irreversible inhibitor of cyclooxygenase, aspirin is widely prescribed for CVD prevention due to its effectiveness as an anti-inflammatory and antiplatelet agent.<sup>2–4</sup> Long-term use at low doses has additionally been associated with decreased risk of colorectal cancer.<sup>5</sup> In 2016, the U.S. Preventive Services Task Force (USPSTF) recommended aspirin for primary prevention of CVD and colorectal cancer in patients aged 50–69 years with a 10% or greater 10-year CVD risk. Patients who met the risk threshold to take aspirin for CVD prevention would benefit from the protective properties against colorectal cancer as well.<sup>6</sup> Current guidelines from the American Heart Association (AHA) and American College

of Cardiology Foundation (ACCF) recommend aspirin for patients with prior myocardial infarction (MI) or coronary artery disease (CAD) as secondary prevention of CVD.<sup>7</sup>

Currently, no studies have examined the use of aspirin in reducing the risk of CVD in the uninsured population. Several studies have reported the underutilization of aspirin for primary and secondary CVD prevention among the

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general population, without distinguishing patients' insurance status.<sup>8–10</sup> In addition, the cost of medications is a particularly important factor in managing the health of uninsured patients. The cost-effectiveness of aspirin is well documented, augmenting its value in managing CVD in uninsured patients.<sup>11</sup> Throughout this study, we focus on patients' adherence to aspirin because it is an affordable and over-the-counter medication that does not require a doctor's prescription. Other CVD preventive medications, such as statins and anti-hypertensives, require a doctor's prescription, representing an additional barrier for patients who are uninsured and may not be able to afford prescription medications.

To understand the relevance of primary and secondary prevention of CVD among uninsured patients, we first have to understand the overall uninsured population and the role of free medical clinics in providing care to this population. In the United States, 27.5 million individuals (8.5% of the population) did not have health insurance in 2018.<sup>12</sup> Compared to their insured counterparts, uninsured individuals with chronic illnesses are less likely to visit a medical provider and more likely to visit the emergency department for regular medical care.<sup>13</sup> The health care safety net that includes emergency departments and public clinics is supposed to provide medical care for patients who do not have health insurance. However, these sources of medical care still charge their patients, even if they offer lower costs. On the contrary, free medical clinics offer their services at no cost to the patient. They are run as private, nonprofit organizations often staffed with volunteer providers, with most clinics being independent organizations or associated with a hospital. Less than half of the clinics receive financial support from the government, with funding coming from various sources such as private donations or foundations. Most importantly, free clinics provide medical care to almost 2 million individuals.<sup>14</sup> Free clinics only make a small dent in serving the large pool of uninsured patients but studying patients seen at these clinics can offer a glimpse into the health care disparities that uninsured patients face.

The purpose of this study was to evaluate the rates of aspirin usage among uninsured patients according to USPSTF and AHA/ACCF recommendations for primary and secondary prevention of CVD. USPSTF guidelines include colorectal cancer in their recommendations; however, the focus of our paper is CVD. Our secondary purpose was to assess inappropriate aspirin use by uninsured patients who do not meet criteria for its usage.

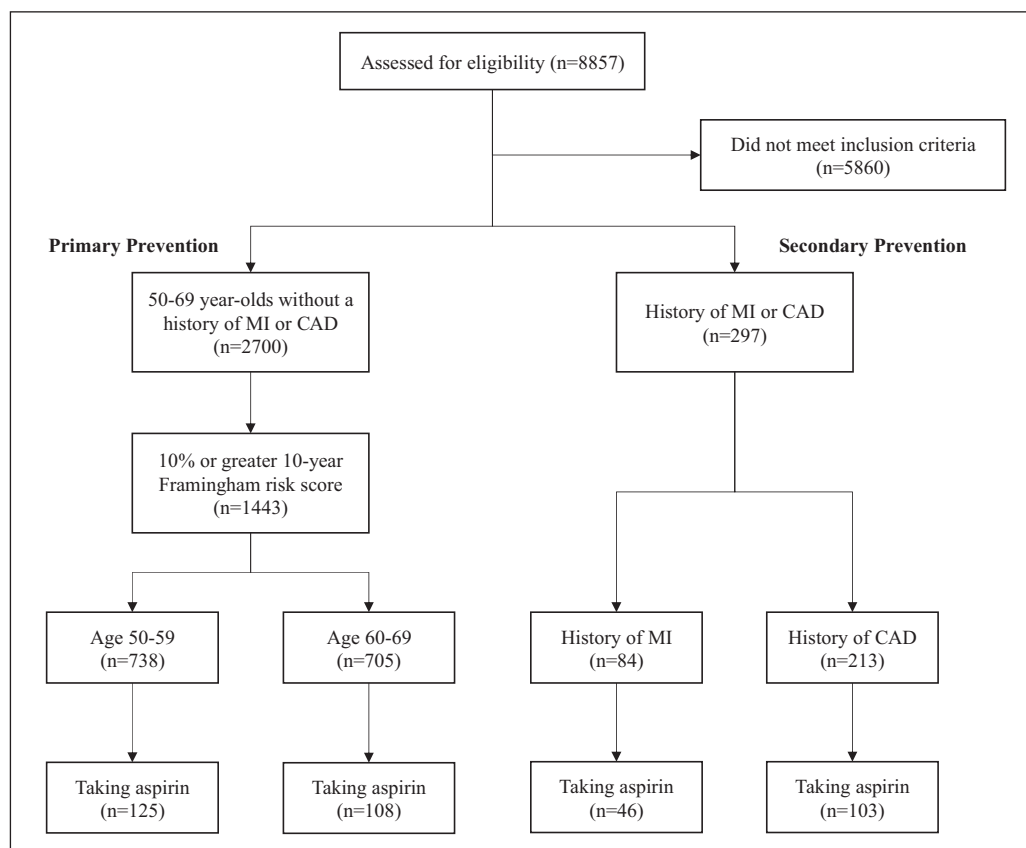
## Methods

We conducted a cross sectional study that included 8857 uninsured patients who visited nine free medical clinics in the Tampa Bay Area between 1 January 2016 and 31 December 2017. We extracted data from every patient that was seen during this time frame. The medical clinics included in this study

only served uninsured patients. The data collected from several different electronic medical record systems were combined into a single database. From this database, we performed a retrospective chart review to assess aspirin use, cardiovascular risk, and demographic data. In total, 50 undergraduate students and 8 medical students conducted the chart review. They were supervised by the primary investigator. Investigators conducting the chart review underwent initial training sessions. Any questions or charts that were in doubt were discussed with the primary investigator. The University of South Florida Institutional Review Board/Human Research Protection Program approved this study.

We recorded age, sex, race, employment status, and history of MI, CAD, cerebrovascular accidents, and gastrointestinal ulcers. We obtained history of MI, CAD, cerebrovascular accidents, and gastrointestinal ulcers from listed patient diagnoses and past medical history. International Statistical Classification of Diseases and Related Health Problems (9th revision; ICD-9) and International Statistical Classification of Diseases and Related Health Problems (10th revision; ICD-10) codes were unavailable because the free clinics do not complete any billing for patient visits. The 10-year Framingham risk scores were calculated using age, low-density lipoprotein (LDL) and high density lipoprotein (HDL) levels, blood pressure, diabetic status, and smoking status.<sup>15</sup> The Framingham risk score predicts the risk of developing hard coronary heart disease (myocardial infarction or coronary death) within 10 years. To determine the 10-year CVD risk, the USPSTF used a calculator derived from the American College of Cardiology and American Heart Association (ACC/AHA) pooled cohort equations.<sup>6</sup> We used Framingham scores because the patient information collected through our chart review did not include all data points required by the pooled cohort equations, specifically total cholesterol levels. The data for total cholesterol were not available, however LDL and HDL cholesterol levels were available for some patients. The Framingham study created a risk calculator that substituted LDL for total cholesterol scores.<sup>15</sup> We used LDL and HDL levels when available and assumed no contribution to the risk score when LDL and HDL levels were unavailable. By assuming no contribution to the risk score, we likely underestimated CVD risk. The pooled cohort equations did not allow us to assume no impact to the risk score when certain data points were missing. Aspirin use was determined by whether patients had low dose aspirin listed on their medications list.

To investigate our primary aim of aspirin use for cardiovascular disease prevention, inclusion criteria were patients aged 50–69 years, history of MI, history of CAD, and patients with aspirin listed in their medications. Patients with a history of gastric ulcer were excluded. We calculated 10-year Framingham risk scores for CAD for only the 50–69-year-old population to determine which patients qualified to take aspirin for primary prevention of CVD and colorectal cancer. The USPSTF recommendation is a class B recommendation



**Figure 1.** Details of sample development. The flowchart depicts the study population and sample sizes for uninsured patients seen at nine free medical clinics between 2016 and 2017.

for 50–59 year olds and a class C recommendation for 60–69 year olds.<sup>6</sup> Class B recommendations indicate that “there is high certainty that the net benefit is moderate or there is moderate certainty that the net benefit is moderate to substantial,” whereas Class C recommendations indicate “at least moderate certainty that the benefit is small” and to offer the intervention to “selected patients depending on individual circumstances.”<sup>16</sup> Our team reviewed records of patients with a 10% or greater risk score to determine whether they were taking aspirin for primary prevention of CVD and colorectal cancer, and records of patients with prior MI or CAD to determine whether they were taking aspirin for secondary prevention of CVD.

The secondary aim of this study was to evaluate inappropriate use of aspirin. We defined inappropriate use of aspirin as patients taking aspirin with no history of MI, CAD, or cerebrovascular accident, having less than a 10% 10-year Framingham risk score, or having gastrointestinal (GI) ulcers. Inclusion criteria were patients with GI ulcers and patients with aspirin listed in their medications. Exclusion criteria were patients aged 50–69 years who had a 10% or greater 10-year Framingham risk score and patients with a history of MI, CAD, or stroke. Although current guidelines from the AHA and American Stroke Association recommend aspirin for patients with a history of ischemic stroke,<sup>17</sup>

increased risk of bleeding, including history of GI ulcers, is a contraindication for aspirin usage.<sup>6</sup> Given the limited dataset, our parameters defining inappropriate aspirin use did not incorporate the various other factors that increase risk of bleeding, such as bleeding disorders, severe liver disease, renal failure, and thrombocytopenia.

### Statistical analysis

Categorical data were presented as frequencies and percentages. The data were analyzed using IBM SPSS software.

### Results

Of the 8857 patients, 2700 (30.5%) patients were 50–69 years old, met the USPSTF criteria to take aspirin, and had a negative history of gastric ulcers. In total, 1443 patients (53.4%) had a 10% or greater 10-year Framingham risk score, the threshold to take aspirin for primary prevention of CVD and colorectal cancer. About 297 patients (3.5%) had a history of MI or CAD and a negative history of gastric ulcers, meeting AHA/ACCF criteria to use aspirin for secondary prevention of CVD (Figure 1).

Of the 1443 patients who met the criteria to take aspirin for primary prevention of CVD and colorectal cancer, 738

**Table 1.** Patient characteristics for aspirin use as primary prevention of cardiovascular disease among uninsured patients who visited nine free medical clinics in the Tampa Bay Area in 2016–2017.

Characteristic	50–59-year olds		60–69-year olds	
	Not taking aspirin	Taking aspirin	Not taking aspirin	Taking aspirin
Total, <i>n</i> (%)	613 (83.1)	125 (16.9)	597 (84.7)	108 (15.3)
Sex, <i>n</i> (%)				
Male	316 (82.5)	67 (17.5)	358 (87.1)	53 (12.9)
Female	297 (83.7)	58 (16.3)	239 (81.3)	55 (18.7)
Race/ethnicity, <i>n</i> (%)				
White, non-Hispanic	191 (77.3)	56 (22.7)	103 (72.5)	39 (27.5)
Black	40 (78.4)	11 (21.6)	36 (85.7)	6 (14.3)
Hispanic <sup>a</sup>	179 (84.8)	32 (15.2)	229 (86.1)	37 (13.9)
Asian	14 (87.5)	2 (12.5)	25 (86.2)	4 (13.8)
Other	3 (60.0)	2 (40.0)	3 (100.0)	0 (0)
Not Documented	186 (89.4)	22 (10.6)	201 (90.1)	22 (9.9)
Employment, <i>n</i> (%)				
Employed	153 (79.3)	40 (20.7)	141 (79.7)	36 (20.3)
Unemployed	209 (78.3)	58 (21.7)	161 (82.1)	35 (17.9)
Not Documented	251 (90.3)	27 (9.7)	295 (88.9)	37 (11.1)

<sup>a</sup>Includes Hispanic with no documented race or in combination with another race or races.

**Table 2.** Patient characteristics for aspirin use as secondary prevention of cardiovascular disease among uninsured patients who visited nine free medical clinics in the Tampa Bay Area in 2016–2017.

Characteristic	MI patients		CAD patients	
	Not taking aspirin	Taking aspirin	Not taking aspirin	Taking aspirin
Total, <i>n</i> (%)	38 (45.2)	46 (54.8)	110 (51.6)	103 (48.4)
Sex, <i>n</i> (%)				
Male	28 (45.2)	34 (54.8)	63 (48.1)	68 (51.9)
Female	10 (45.5)	12 (54.5)	47 (57.3)	35 (42.7)
Race/ethnicity, <i>n</i> (%)				
White, non-Hispanic	16 (39.0)	25 (61.0)	315 (72.1)	122 (27.9)
Black	1 (33.3)	2 (66.7)	85 (78.7)	23 (21.3)
Hispanic <sup>a</sup>	11 (50.0)	11 (50.0)	427 (83.7)	83 (16.3)
Asian	1 (50.0)	1 (50.0)	41 (82.0)	9 (18.0)
Other	0 (0)	0 (0)	6 (75.0)	2 (25.0)
Not Documented	9 (56.3)	7 (43.8)	398 (88.8)	50 (11.2)
Employment, <i>n</i> (%)				
Employed	5 (21.7)	18 (78.3)	22 (36.7)	38 (63.3)
Unemployed	20 (51.3)	19 (48.7)	47 (56.6)	36 (43.4)
Not Documented	13 (59.1)	9 (40.9)	41 (58.6)	29 (41.4)

MI: myocardial infarction; CAD: coronary artery disease.

<sup>a</sup>Includes Hispanic with no documented race or in combination with another race or races.

were aged 50–59 years and 705 were aged 60–69 years. The aspirin recommendations are class B recommendation for patients aged 50–59 years and a class C recommendation for patients aged 60–69 years. In the 50–59-year age group, 16.9% of the patients were taking aspirin. In the 60–69-year age group, 15.3% were taking aspirin (Table 1).

Of the 297 patients who met criteria to take aspirin for secondary prevention of CVD, 50.2% were taking aspirin. A total of 54.8% of patients who had a prior MI and 48.4% of patients who had a history of CAD were taking aspirin.

Noticeably, more employed patients were taking aspirin for secondary prevention than unemployed patients. Among those who had prior MI, 78.3% of employed patients were taking aspirin compared to 48.7% of unemployed patients. Among those with a history of CAD, 63.3% of employed patients were taking aspirin compared to 43.4% of unemployed patients (Table 2).

To assess the inappropriate use of aspirin, we excluded 1443 patients aged 50–69 years who had a 10% or greater 10-year Framingham risk score, 297 patients with a history

of MI or CAD, and 144 patients with a history of stroke. About 205 (2.9%) of the remaining 6973 patients were inappropriately taking aspirin. In total, 39 (30.2%) of 129 patients with history of GI ulcers were taking aspirin, despite an increased risk of bleeding.

## Discussion

Our results demonstrate suboptimal rates of aspirin use in the prevention of CVD according to current guidelines. Although 53.4% of uninsured patients met criteria to be on an aspirin regimen for primary prevention, only 16.1% of them were taking the medication. Among uninsured patients with a history of MI or CAD, 50.2% were taking aspirin.

Previous studies reported underutilization of aspirin for the primary and secondary prevention of CVD in the general population. One study reported 40.9% of patients were told by their physician to take aspirin for primary prevention, with 79% complying. Comparably, 75.9% of patients were told by their physician to take aspirin for secondary prevention, with 89.9% complying.<sup>10</sup> Despite the seeming underuse of CVD risk score calculators, such as the Framingham risk score calculator, providers may be considering the risk of GI bleeding and hemorrhagic stroke associated with an aspirin regimen when evaluating patients. A low dose aspirin regimen was found to increase the risk of GI bleeding by 58% and hemorrhagic stroke by 27% in patients using the medication for primary prevention of CVD.<sup>18</sup> Consideration of the bleeding risks could play a role in the under-prescription of aspirin.

Within the general population, aspirin use is lower than that recommended by current guidelines. Our results showed that uninsured patients had even lower rates of use than those among the general population, as reported in other studies. These findings bring up the question of why uninsured patients have suboptimal rates of aspirin use. Lack of health insurance and a low socioeconomic status have been associated with medication non-adherence.<sup>19,20</sup> However, there is limited information regarding provider prescribing patterns in free medical clinics. A combination of poor medication adherence and provider prescribing patterns could be a possible explanation for the discrepancy between aspirin use among the uninsured and general patient populations.

Financial status may play a role in adherence to medical treatments, as our results demonstrated a higher percentage of employed patients took aspirin for secondary prevention than unemployed patients. In the United States, lack of health insurance and low financial status are often associated with each other; however, there is likely further stratification among uninsured patients into financially stable and financially unstable individuals. When looking at countries with universal health coverage, there is evidence that being employed or having a high income is significantly associated with increased medication adherence.<sup>21–23</sup> This suggests that being unemployed may be an additional barrier to aspirin use among uninsured patients.

We also found inappropriate use of aspirin. Among patients in our study, 2.9% did not meet guideline criteria but were taking aspirin. This result contrasts with that from a previous study using a national database, which reported that 11.6% of patients were inappropriately taking aspirin for primary prevention of CVD.<sup>24</sup> However, that study used older guideline criteria that defined inappropriate aspirin use as an aspirin regimen in patients with a less than 6% 10-year risk of a CVD event. The 4% difference in guideline criteria could account for the variance in frequency. The association between lack of health insurance and medication non-adherence could also contribute to the lower rate of inappropriate aspirin use among uninsured patients compared to the general population.

The results of our study highlight the need to educate uninsured patients and their providers of the value of aspirin and current clinical guidelines regarding its use. Aspirin is an inexpensive preventive measure; thus it is a valuable and cost-effective tool to prevent CVD in the uninsured population. Among a patient population that already faces a significant socioeconomic disadvantage, the consequences of cardiovascular disease can be financially devastating. The medical costs associated with hospitalization for cardiovascular events have been calculated to exceed the financial means of most uninsured individuals, exacerbated by lost income during hospitalization.<sup>25</sup> However, adhering to a daily aspirin regimen can prevent such a catastrophic expense. There are potential educational strategies to combat the issue of nonadherence to aspirin guidelines. The National Heart, Lung, and Blood Institute reported that educational outreach visits, along with audit and feedback strategies, were effective methods to improve clinical practice guideline implementation.<sup>26</sup> These interventions could be used in free medical clinics to address the suboptimal rates of aspirin use. Further studies are needed to improve our understanding of the discrepancy in rates of aspirin use between uninsured patients and the general population. Emphasis should be placed on developing solutions to minimize the gap between these two populations.

The 2019 ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease recommends considering aspirin for primary prevention in patients aged 40–70 years who are at higher CVD risk but not at increased risk of bleeding. New studies demonstrating a lack of benefit have influenced the evolving opinion on the beneficial effects of aspirin on primary prevention of CVD. As a result, the decision to take aspirin for primary prevention can be tailored to patient and provider preferences.<sup>27</sup> Despite the changing views on aspirin, our study indicates that uninsured patients will still be taking aspirin at suboptimal rates unless interventions are implemented.

This study has several limitations. We used Framingham risk scores instead of the pooled cohort equations that are currently used. The Framingham Heart Study derived its equations from studying a predominantly White population.<sup>15</sup>



Thus, Framingham risk calculations may be less appropriate for our study given the significant non-White population of our sample. By assuming no contribution to risk score when LDL or HDL cholesterol levels were missing from the data, we likely underestimated CVD risk for many patients. Our limited dataset did not include comprehensive information regarding factors that can lead to increased risk of bleeding. As a result, it is conceivable that many more patients were inappropriately on low-dose aspirin. The retrospective chart review conducted for this study did not allow us to discern whether physicians discussed potential aspirin regimens with qualified patients. Furthermore, we could not assess whether concerns regarding risk of bleeding were addressed in those conversations or whether patients decided not to adhere to an aspirin regimen. We were unable to account for patients who did not have aspirin listed in their medications and may have been taking it on their own or patients who had aspirin listed in their medications but were not taking it. The results in our study may be generalized to the overall uninsured population in the Tampa Bay Area, Florida, however further studies are warranted due to demographic variations throughout the United States. Finally, we were unable to directly compare uninsured and insured patients in this dataset.

In conclusion, patients without health insurance are taking aspirin for the prevention of CVD at suboptimal rates. Aspirin is underutilized among this population even in comparison to the general population. Further improvements are needed to increase adherence to current guidelines and address barriers uninsured patients may face in maintaining their cardiovascular health.

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### Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### Ethical approval

Ethical approval for this study was obtained from University of South Florida Human Research Protection Program (Pro00023920).

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### Informed consent

Informed consent was not sought for the present study because the information was recorded by the investigator in such a manner that subjects could not be identified, directly or through identifiers

linked to the subjects. The University of South Florida Human Research Protection Program approved a waiver of informed consent.

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### Data assessability statement

The datasets generated and/or analyzed during the current study are not publicly available due to them containing information that could compromise the privacy of research participants.

### References

1. Heron M. Deaths: leading causes for 2016. *Natl Vital Stat Rep* 2018; 67: 1–77.
2. Patrono C, Ciabattini G, Patrignani P, et al. Clinical pharmacology of platelet cyclooxygenase inhibition. *Circulation* 1985; 72: 1177–1184.
3. O'Brien JR. Effects of salicylates on human platelets. *Lancet* 1968; 291: 779–783.
4. Antithrombotic Trialists' (ATT) Collaboration, Baigent C, Blackwell L, et al. Aspirin in the primary and secondary prevention of vascular disease: collaborative meta-analysis of individual participant data from randomised trials. *Lancet* 2009; 373: 1849–1860.
5. Friis S, Riis AH, Erichsen R, et al. Low-dose aspirin or non-steroidal anti-inflammatory drug use and colorectal cancer risk: a population-based, case-control study. *Ann Intern Med* 2015; 163: 347–355.
6. Bibbins-Domingo K, U.S. Preventive Services Task Force. Aspirin use for the primary prevention of cardiovascular disease and colorectal cancer: U.S. Preventive Services Task Force Recommendation Statement. *Ann Intern Med* 2016; 164: 836–845.
7. Smith SC, Benjamin EJ, Bonow RO, et al. AHA/ACCF secondary prevention and risk reduction therapy for patients with coronary and other atherosclerotic vascular disease: 2011 update: a guideline from the American Heart Association and American College of Cardiology Foundation. *Circulation* 2011; 124: 2458–2473.
8. Malayala SV and Raza A. Compliance with USPSTF recommendations on aspirin for prevention of cardiovascular disease in men. *Int J Clin Pract* 2016; 70: 898–906.
9. Stafford RS, Monti V and Ma J. Underutilization of aspirin persists in US ambulatory care for the secondary and primary prevention of cardiovascular disease. *PLoS Med* 2005; 2: e353
10. Mainous AG, Tanner RJ, Shorr RI, et al. Use of aspirin for primary and secondary cardiovascular disease prevention in the United States, 2011–2012. *J Am Heart Assoc* 2014;3: e000989.
11. Gaspoz J-M, Coxson PG, Goldman PA, et al. Cost effectiveness of aspirin, clopidogrel, or both for secondary prevention of coronary heart disease. *N Engl J Med* 2002; 346: 1800–1806.
12. U.S. Census Bureau. Health Insurance Coverage in the United States: 2018. U.S. Census Bureau, <https://www.census.gov/library/publications/2019/demo/p60-267.html> (2019, accessed 26 May 2020).

13. Wilper AP, Woolhandler S, Lasser KE, et al. A national study of chronic disease prevalence and access to care in uninsured U.S. adults. *Ann Intern Med* 2008; 149: 170–176.
14. Darnell JS. Free clinics in the United States: a nationwide survey. *Arch Intern Med* 2010; 170: 946–953.
15. Wilson PW, D’Agostino RB, Levy D, et al. Prediction of coronary heart disease using risk factor categories. *Circulation* 1998; 97: 1837–1847.
16. Grade Definitions —U.S. Preventive Services Task Force, <https://www.uspreventiveservicestaskforce.org/Page/Name/grade-definitions> (accessed 13 May 2019).
17. Kernan WN, Ovbiagele B, Black HR, et al. Guidelines for the prevention of stroke in patients with stroke and transient ischemic attack. *Stroke* 2014; 45: 2160–2236.
18. Whitlock EP, Burda BU, Williams SB, et al. Bleeding risks with aspirin use for primary prevention in adults: a systematic review for the U.S. Preventive Services Task Force. *Ann Intern Med* 2016; 164: 826–835.
19. Mochari H, Ferris A, Adigopula S, et al. Cardiovascular disease knowledge, medication adherence, and barriers to preventive action in a minority population. *Prev Cardiol* 2007; 10: 190–195.
20. Wamala S, Merlo J, Bostrom G, et al. Socioeconomic disadvantage and primary non-adherence with medication in Sweden. *Int J Qual Health Care* 2007; 19: 134–140.
21. Park Y-H, Kim H, Jang S-N, et al. Predictors of adherence to medication in older Korean patients with hypertension. *Eur J Cardiovasc Nurs* 2013; 12: 17–24.
22. Aarnio E, Martikainen J, Winn A, et al. Socioeconomic inequalities in statin adherence under universal coverage. *Circ Cardiovasc Qual Outcomes* 2016; 9: 704–713.
23. Lemstra M, Blackburn D, Crawley A, et al. Proportion and risk indicators of nonadherence to statin therapy: a meta-analysis. *Can J Cardiol* 2012; 28: 574–580.
24. Hira RS, Kennedy K, Nambi V, et al. Frequency and practice-level variation in inappropriate aspirin use for the primary prevention of cardiovascular disease: insights from the National Cardiovascular Disease Registry’s Practice Innovation and Clinical Excellence registry. *J Am Coll Cardiol* 2015; 65: 111–121.
25. Khera R, Hong JC, Saxena A, et al. Burden of catastrophic health expenditures for acute myocardial infarction and stroke among uninsured in the United States. *Circulation* 2018; 137: 408–410.
26. Chan WV, Pearson TA, Bennett GC, et al. ACC/AHA special report: clinical practice guideline implementation strategies: a summary of systematic reviews by the NHLBI Implementation Science Work Group: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *J Am Coll Cardiol* 2017; 69: 1076–1092.
27. Arnett DK, Blumenthal RS, Albert MA, et al. 2019 ACC/AHA guideline on the primary prevention of cardiovascular disease: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Circulation* 2019; 140: e596–e646.