BMJ Open Quality

Identifying and reducing inappropriate aspirin use in primary care

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To cite: Brooker C, Compton R, Babineau T, *et al*. Identifying and reducing inappropriate aspirin use in primary care. *BMJ Open Quality* 2023;**12**:e002457. doi:10.1136/bmjoq-2023-002457

Received 12 June 2023
Accepted 21 September 2023

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ABSTRACT

Objective Recent studies have called into question the safety of aspirin use for the primary prevention of atherosclerotic cardiovascular disease, particularly in older adults. Therefore, the objectives of this study were to (1) develop a systematic approach to identifying patients aged 70 and older taking aspirin for primary prevention, (2) provide patient and provider education about updated literature and recommendations regarding aspirin safety and (3) evaluate the impact of this intervention on aspirin de-prescribing.

Design This was a quality improvement intervention with prospective, longitudinal follow-up.

Setting This study was conducted in two family medicine practices within an academic medical centre.

Participants Patients aged 70 years and older with aspirin listed on the current medication list.

Methods This is an electronic medical record-based chart review and educational intervention based on shared decision-making to reduce inappropriate aspirin use in primary practice. A chart review process was developed to identify the clinical indication for aspirin use. Patients taking aspirin for primary prevention were flagged for the primary care providers to review. Multilevel logistic regression models assessed factors affecting aspirin de-prescribing and longitudinal trend.

Results Of 361 patients aged 70 years or older, 145 (40%) were taking aspirin for primary prevention of atherosclerotic cardiovascular disease. After 9 months, aspirin was deprescribed in 42 (29%) of these patients. Patients seen by their providers during the study period had lower odds of having aspirin on their medication list (OR=0.87, 95% CI: 0.81, 0.94) as compared with patients taking aspirin who were not seen by their healthcare provider.

Conclusion This is the first study to develop and implement a method of identifying potentially inappropriate aspirin use based on recent clinical evidence highlighting the risk of aspirin use for primary prevention in older adults. Future initiatives can leverage existing electronic medical record platforms to efficiently identify patients and expand these efforts to larger patient populations.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ The use of low-dose aspirin for primary prevention of atherosclerotic cardiovascular disease continues despite recent large-scale studies and guideline updates highlighting the risks of therapy in specific patient populations, primarily older adults. In alignment with the updated United States Preventive Services Task Force (USPSTF) guideline, this study sought to establish and evaluate a process for family medicine practices to identify patients who may be taking aspirin inappropriately.

WHAT THIS STUDY ADDS

⇒ Our study demonstrates that providing up-to-date information about aspirin use to elderly patients and shared decision-making during in-person visits reduces inappropriate aspirin use in elderly patients.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ This is the first study to develop an electronic medical record (EMR)-based chat review with shared decision-making to identify and address inappropriate aspirin use in primary care, considering the recent USPSTF guidelines. Our findings can inform future, larger-scale initiatives as more practices work to develop strategies to address updated recommendations for aspirin use. Future studies should seek to develop, implement and validate an EMR-based algorithm to guide patient-specific decision-making.

INTRODUCTION

Aspirin is an old drug with established use in the treatment of pain, inflammation and fever, and it is increasingly used for the prevention of cardiovascular disease (CVD).[1] Based on prior work that elucidated the antiplatelet and antithrombotic effects of aspirin and the underlying processes that promote atherosclerotic plaque rupture, it is not surprising that this drug has become a cornerstone in the immediate therapies used in managing patients with acute coronary syndromes, as well as a measure for secondary prevention.[2] The benefit of using antiplatelet medications such as aspirin for secondary prevention of atherosclerotic CVD has been widely accepted in clinical practice.[3] In addition, the use of aspirin for primary prevention has also been incorporated into clinical practice over the last several decades. Still, more recent studies suggest that the risks and benefits of primary prevention should be more closely investigated.[3]

The clinical use of aspirin for the primary prevention of CVD was of particular interest in the late 1990s and early 2000s. The Physicians' Health Study in 1989 found that aspirin 325 mg taken every other day reduced the risk of first myocardial infarction (MI) by 44% in healthy male patients aged 50 and older.[4] Investigators found an increased risk of haemorrhagic stroke, though this was not statistically significant.[4] Subsequent studies investigated the use of aspirin in reducing CVD when combined with anticoagulants, antihypertensives and vitamin E.[5] In the late 1990s, the Thrombosis Prevention Trial evaluated the efficacy of aspirin 75 mg daily and low-dose warfarin in reducing the risk of ischaemic heart disease in high-risk patients. For aspirin-containing regimens (aspirin plus warfarin or aspirin alone), there was a 20% reduction in total fatal and non-fatal MIs. Notably, intermediate bleeding, namely haematuria, occurred more often in the warfarin plus aspirin group.[6] The authors of the Hypertension Optimal Treatment Trial aimed to determine if low-dose aspirin combined with treatment and lowering diastolic blood pressure reduced the risk of major cardiovascular events. Major cardiovascular events were reduced by 15%, with a 36% reduction in fatal and non-fatal MI in patients with hypertension. There were non-significant decreases in cardiovascular mortality (5%) and overall mortality (7%). Fatal bleeding was similar across groups, but minor bleeding was more frequent in those taking aspirin.[7] Similar results were seen with the Primary Prevention Project in 2001, which evaluated using aspirin in combination with vitamin E in patients aged 65 or older with hypertension, hypercholesterolaemia, diabetes, and a family history of premature cardiovascular events.[8]

In 2002, the United States Preventive Services Task Force (USPSTF) recommended the consideration of aspirin chemoprevention for patients at high risk for CVD, specifically men aged 40 years and older, postmenopausal women and younger patients with risk factors such as hypertension, diabetes and tobacco use.[9] The American Heart Association (AHA) supported this recommendation but specifically recommended aspirin 75–160 mg daily in patients with a 10-year cardiovascular risk of at least 10%.[10] Similarly, the 2003 update to the Standards of Medical Care for Patients with Diabetes Mellitus recommended aspirin therapy for all adult patients with diabetes and macrovascular disease, with consideration for patients aged 40 years and older with diabetes and one other cardiovascular risk factor.[11]

Results from the Women's Health Study in 2005 led to an update to the AHA guideline 2007 that recommended aspirin therapy for high-risk women aged 65 and older.[12] In 2009, the Antithrombotic Trialists' Collaboration (ATT) completed a meta-analysis of six primary prevention studies evaluating aspirin in patients without diabetes with no history of occlusive disease who had been taking aspirin for at least 2 years. This meta-analysis demonstrated a 12% proportional reduction in major cardiovascular events, particularly non-fatal MI.[13] These findings fueled further updates to USPSTF and AHA recommendations and the development of guideline recommendations from the American College of Chest Physicians. The 2016 USPSTF update took a more detailed approach, outlining recommendations for specific age groups based on the calculated 10-year CVD risk. Low-dose aspirin was recommended for adults aged 50–59 with a CVD risk of at least 10%. For adults aged 60–69 with a CVD risk of at least 10%, clinicians were encouraged to assess risk factors to make an informed decision about aspirin use.[14–16] These guidelines were widely followed in clinical practice until 2018, following the publication of the Aspirin to Reduce Risk of Initial Vascular Events (ARRIVE), A Study of Cardiovascular Events in Diabetes (ASCEND) and Aspirin in Reducing Events in the Elderly (ASPREE) studies.[17–19]

The ARRIVE study was conducted in seven countries and assessed the efficacy of aspirin 100 mg daily in reducing the risk of major CV events for patients at moderate risk, defined as the presence of three or more cardiovascular risk factors in men aged 55 or older and women aged 60 or older. The authors found no significant difference in a composite endpoint of MI, stroke, CV death, unstable angina or transient ischemic attacks (TIA) but did find significantly more gastrointestinal bleeding events in the aspirin group.[17] The ASCEND study evaluated patients with diabetes and included both high-risk and low-risk patient groups. Findings from the ASCEND study demonstrated a reduction in CV events but more frequent bleeding events.[18] Lastly, the ASPREE study investigated the utility of aspirin in prolonging the lives of healthy community-dwelling older adults with no history of vascular disease. There was no difference in a composite endpoint of death, the onset of dementia and persistent physical disability, and the study was terminated early. Notably, this population had an increased risk of all-cause mortality, primarily cancer-related death. Though many types of cancer were observed, there was a higher rate of death from colorectal cancer.[19]

In 2019, the American College of Cardiology and the American Heart Association released updated primary prevention guidelines recommending that providers carefully assess atherosclerotic CVD risk and weigh this against bleeding risk before prescribing aspirin for primary prevention. Furthermore, these guidelines explicitly recommend against low-dose aspirin use for adults aged 70 and older.[20] Though not published at this pilot study initiation, the USPSTF published a draft recommendation in October 2021 encouraging providers to avoid initiating low-dose aspirin for primary CV prevention in patients 60 years and older. In April 2022, the USPSTF published its final recommendations. For adults 40–59 with an ASCVD risk of 10% or greater, aspirin use for primary prevention should be made on a case-by-case basis. For adults aged 60 years and older, aspirin should not be initiated for primary prevention of CVD. Based on the supporting evidence used to generate these recommendations, the USPSTF also highlights that while the benefit of aspirin use is cumulative with time, the net benefit becomes smaller with age due to the increased risk of bleeding and

suggests that it may be reasonable to discontinue aspirin at age 75 years or older. The Task Force does highlight the need for long-term data assessing the effects of low-dose aspirin on bleeding risk and colorectal cancer risk and mortality.[21]

As more data has become available, the benefits, risks and clinical recommendations for using aspirin in primary prevention have become less clear, and the decision to prescribe aspirin has become more individualised. Furthermore, no guidance has been provided on how to best manage patients who were previously prescribed aspirin for primary prevention per previous clinical guidelines. Often, this decision is left to primary care providers, who are in the best position to coordinate complex care for patients and comprehensively manage medications. In light of recent evidence and updated clinical recommendations regarding the safe and appropriate use of aspirin for primary prevention, primary care practices need to develop methods of identifying patients who may be taking aspirin unnecessarily. It is also essential to understand how recent studies and updated recommendations are interpreted by providers and translated into clinical practice.

The objectives of this study were to (1) develop an electronic medical record (EMR)-based systematic method for identifying patients aged 70 and older taking aspirin for primary prevention, (2) provide patient and provider education about updates to recommendations for aspirin use in primary prevention and (3) evaluate the impact of the intervention on aspirin use. In addition, the results of this study provide valuable information for other primary care practices looking to develop methods of identifying patients who may benefit from an assessment of the safety of aspirin use.

METHODS

This was a single-centre, longitudinal study conducted by the Department of Family Medicine at the University of Virginia Health System, Virginia, USA. This study was led by a multidisciplinary team including a physician, nurse practitioner, pharmacist, physician resident, medical student and statistician. In March 2021, data were collected from two outpatient family medicine practices using patient panel reports from the EMR reporting workbench. Patients were included if aged 70 years or older, based on results of the ASPREE study, with aspirin listed on the current medication list in the EMR. To narrow down the patient population to those only prescribed aspirin for cardiovascular indications, we excluded patients taking aspirin-containing medications such as aspirin–salicylamide–caffeine and aspirin–acetaminophen–caffeine for other indications such as headache treatment. Patients identified to be on daily aspirin for primary prevention were followed up within 3, 6 and 9 months postintervention, and analysis was done to determine the number of patients who had aspirin removed from their medication lists and the trend in deprescribing inappropriate aspirin use. This quality improvement initiative was approved by the Institutional Review Board for Health Sciences Research (Study #22937).

Table 1 Chart review process for determining aspirin use indication

Indication	Definition
Primary prevention	**Patient has no history of clinically significant ASCVD, including any of the following:** MI: STEMI or NSTEMI Angina: stable or unstable Revascularisation Stroke or TIA Peripheral vascular disease Atherosclerosis on catheterisation, <50% stenosis
Secondary prevention	**Patient has a history of clinically significant ASCVD, including any of the following:** Myocardial Infarction (MI): ST Elevation MI (STEMI) or Non ST Elevation MI (NSTEMI) Angina: stable or unstable Revascularisation Stroke or TIA Peripheral vascular disease Atherosclerosis on catheterisation, ≥50% stenosis
Other	Aspirin prescribed for a unique indication
Unknown	Indication unclear after thorough chart review

ASCVD, atherosclerotic cardiovascular disease; MI, myocardial infarction.

Objective 1: develop an EMR-based systematic approach for identifying patients aged 70 years and older

Before the chart review, primary and secondary prevention definitions were developed in consultation with a cardiology pharmacist (table 1). Clinically significant atherosclerotic cardiovascular disease (ASCVD) was defined as a history of MI, stable or unstable angina, revascularisation, stroke or transient ischaemic attack, peripheral vascular disease or presence of atherosclerosis on catheterisation with at least 50% stenosis in any area.[22] Primary prevention was defined as aspirin use with no history of ASCVD. Secondary prevention was defined as aspirin use with a history of ASCVD documented in the medical record. An indication of 'other' was selected when aspirin was prescribed for a unique indication unrelated to ASCVD history or risk and documented in the chart by a provider. An indication of 'unknown' was used when the indication for aspirin use was not documented in the medical record.

A chart review was conducted to identify the indication for aspirin use. First, the current medication list was reviewed to confirm that aspirin was present as a prescription or a patient-reported medication. Patients with high-dose aspirin on their medication list were flagged for review by their primary care provider (PCP). We included patients

Table 2 Specialty comment phrases used to communicate with primary care provider

Indication	Phrase
Primary prevention	Per chart review, it appears that the patient is taking low-dose aspirin for primary prevention. Please discuss risks vs benefits with the patient and consider discontinuation of therapy.
Secondary prevention	No specialty comment is needed.
High dose	Per chart review, the patient is taking high-dose daily aspirin. Please consider decreasing to low-dose daily aspirin if appropriate or discontinuing therapy if no longer indicated.
Other	Please discuss the need for low-dose aspirin therapy.
Unknown	Per chart review, there is an unclear indication for low-dose aspirin. Please discuss risks vs benefits with the patient.

with aspirin 325 mg listed on their current medication list, understanding that some patients studied may have been (1) prescribed high-dose aspirin in previous years per different clinical recommendations or for a different indication or (2) taking aspirin but with the incorrect dosing documented on the medication list. There are rare instances in which a patient will be taking aspirin 325 mg daily, and we wanted to capture these patients for further review by the provider. Patients taking low-dose aspirin 81 mg daily were reviewed further to determine the indication for aspirin use. Next, the team reviewed the problem list in the EMR to identify common indications for aspirin use. This was followed by using the search function to quickly find pertinent chart notes with detailed documentation. To confirm a primary prevention indication, an additional chart review was performed to confirm no history of ASCVD. Once the clinical indication was determined, this was documented using standard phrases in the Specialty Comments section of the EMR for provider reference (table 2). Specialty Comments were chosen as this section of the EMR is generally referenced during the precharting process or at the time of the patient visit. Phrases were written to alert the provider about aspirin use and encourage shared decision-making and deprescribing, if appropriate, during the visit encounter.

Objective 2: develop and provide educational materials for providers and patients about updates to recommendations for aspirin use in primary prevention

Provider education

The team provided a project overview and introduction to the Department of Family Medicine in April 2021. The clinical pharmacist provided a grand-rounds presentation in June 2021, which included a historical review of aspirin use and education about the more recent studies that review the safety of aspirin use for primary prevention. While this project was piloted at two family medicine clinics, meetings were held with other locations to provide updates and a summary of the completed departmental work. Providers were educated about their role in assessing the safety of aspirin use and encouraged to reference the Specialty Comments section in the EMR after the team completed the chart review process.

Patient education

The patient education effort aimed to communicate changes in aspirin prescribing guidelines and to prompt shared decision-making discussions with providers. Patient education materials were developed as PowerPoint slides (figure 1) and shared via television monitors in the clinic waiting area. In addition, paper flyers were displayed in all clinical examination rooms (figure 2). The information was written to target a fifth-grade reading level and included suggested questions to ask providers, general indications for aspirin use, contraindications for aspirin use, and recommendations for other health behaviours to lower CVD risk.

Objective 3: implementation and evaluation of impact of the intervention on aspirin use

Chart review was completed in March 2021, and Specialty Comments were entered into the EMR in April 2021. Intervention implementation began in April 2021. Follow-up analyses were conducted in July, September and December 2021. Removal of aspirin from the current medication list indicated medication discontinuation, implying that shared decision-making led to the deprescribing of inappropriate aspirin therapy.

We used the χ^2 test to examine if there was a significant decrease in the proportion of patients with aspirin on their medication list at each follow-up point compared with baseline. Multilevel logistic models (MLMs) estimated the odds that a patient still had aspirin on their medication list, accounting for covariates including whether the patient had an appointment with their PCP during the study period (based on the last visit date at each time point), gender, race and age. MLM can capture random variation due to multiple sample dimensions (eg, across occasions). Multiple observations from the same sampling unit (eg, multiple measures from the same person) will produce dependent residuals; MLM offers a flexible strategy for models with these dependencies, including using random effects that may vary across sampling units.[23] Given that participants were followed over time with four observations per participant, a multilevel model adequately accounts for the unexplained variability of the nested data. Three models were fitted with the removal of aspirin from the medication list as the

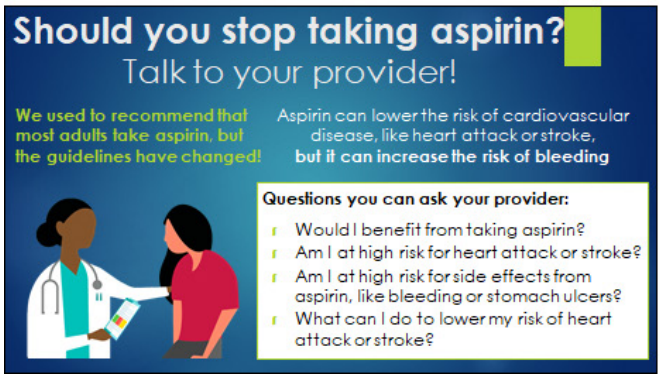

Figure 1 Lobby powerpoint slides displayed in the lobby waiting area.

dependent variable. Model 1 does not include covariates; Model 2 includes cluster-level covariant (clinic); Model 3 consists of the variables from Model 2 and individual-level covariates (age, sex, race, clinic visit during the study period). We used the Akaike information criterion to evaluate the goodness of fit of the models.[24] Using the power Logistic function in R, our estimated power was adequate (>0.8). Statistical analyses were performed using R V.4.1.1 using the lme4 package for multilevel modelling.

Patient and public involvement statement

We did not directly involve patients and the public in the study's conception, design and conduction, primarily because the research focused on a thorough chart review and education process. However, we designed educational materials placed in the waiting area lobby and all clinic examination rooms for patient viewing and reading.

RESULTS

Initially, 361 patients with aspirin on their current medication list were identified and included in the chart review process. Approximately 40% (n=145) of these patients were taking aspirin for primary prevention of ASCVD, including patients taking higher doses than 81 mg. Table 3 summarises the indications for aspirin use at each clinic.

Of the 145 patients identified as taking aspirin for primary prevention, 85 (59%) were female and 60 (41%) were male. Most patients (n=87, 64%) were white; one quarter (n=35, 26%) were black or African American. The mean age was 75.4 years (SD=5.4). See table 4

Figure 3 shows the proportion of patients who had aspirin removed from their medication list throughout the pilot study and how results differed depending on whether a patient was seen by their PCP in Family Medicine during the study period. When controlling for patient characteristics, clinic clustering and time of last visit, patients had lower odds of having aspirin on their medication list at each subsequent time point (table 5). This was significant at 3 months (OR=0.88, 95% CI: 0.77 to 0.91), 6 months (OR=0.87, 95% CI: 0.80 to 0.93) and 9 months (OR=0.84, 95% CI: 0.77 to 0.91).

Furthermore, patients seen for an appointment in Family Medicine clinics during the study period had lower odds of having aspirin on their medication list (OR=0.87, 95% CI: 0.81 to 0.94) compared with patients not seen at these clinics. There were no significant differences in outcomes by patient age, sex, or race.

DISCUSSION

The opportunity for population health management in primary care, specifically related to medication management and safety, is significant. Medication management in primary care involves assessing therapeutic

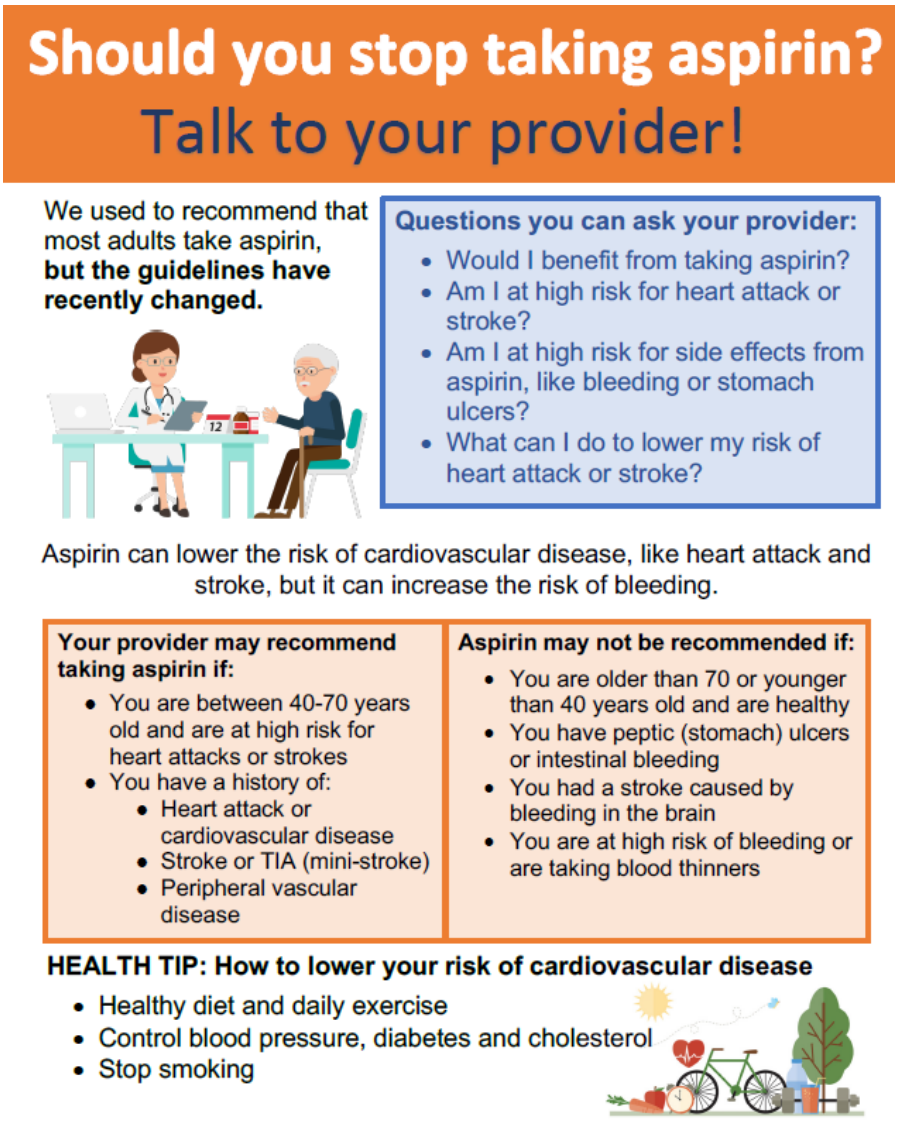

Figure 2 Patient education flyer: a copy of this flyer was posted in all patient examination rooms.

appropriateness, effectiveness, safety and adherence. This thorough assessment facilitates the identification of medication-related problems that can significantly impact care plans and clinical outcomes. This is particularly important as healthcare providers are challenged to manage patients with multimorbidity and polypharmacy. Unfortunately, when updates are made to clinical guidelines and recommendations affecting large populations of patients, it is often difficult to identify those at risk and implement practice-wide changes. To our knowledge, this

Table 3 Indication summary

	Primary Care Center, Charlotteville, USA (n=264)	Family Medicine and Specialty Care, Crozet Virginia, USA (n=97)
Primary prevention	91 (34.5)	50 (51.5)
High dose, primary prevention	3 (1.1)	1 (1)
Secondary prevention	127 (48.1)	36 (37.1)
High dose, secondary prevention	4 (1.5)	1 (1)
Other	13 (4.9)	6 (6.2)
Unknown	11 (4.2)	2 (2.1)
High dose, unknown	1 (0.4)	–
Not taking	11 (4.2)	1 (1)
Deceased	3 (1.1)	–

Table 4 Patient demographics

Characteristics	n=145
Sex	
Female	85 (59%)
Male	60 (41%)
Language	
English	129 (89%)
Non-english	16 (11%)
Race	
White or Caucasian	87 (64%)
African American	35 (26%)
Asian	5 (3.7%)
Other	8 (5.9%)
Patients seen by primary care provider during study period (cumulative)	
At 3 months	84 (57.9%)
At 6 months	96 (66.2%)
At 9 months	106 (73.1%)

Table 5 Adjusted OR for likelihood of aspirin removal from medication list

Characteristics	OR	95% CI
Time period		
Baseline	—	—
3 months	0.88*	0.82 to 0.95
6 months	0.87*	0.80 to 0.93
9 months	0.84*	0.77 to 0.91
Seen during the study period		
No	—	—
Yes	0.87*	0.81 to 0.94
Age	1.00	0.99 to 1.01
Sex		
Female	—	—
Male	1.02	0.92 to 1.13
Race		
African American	—	—
Asian	1.09	0.83 to 1.45
Other	0.99	0.80 to 1.24
White or Caucasian	0.99	0.87 to 1.12

*p<0.05.

is the first study to identify a large patient population at risk for adverse medication events and minimise potentially inappropriate aspirin use in older adults, specifically those aged 70 years and older, due to recent changes to clinical recommendations.

This study also demonstrates how, though inconclusive, updated clinical practice guidelines for aspirin use are interpreted and incorporated into practice. This study shows that targeted interventions aimed at identifying this unique patient population and providing provider education about more recent data highlighting potential risks of aspirin use sparked shared decision-making that

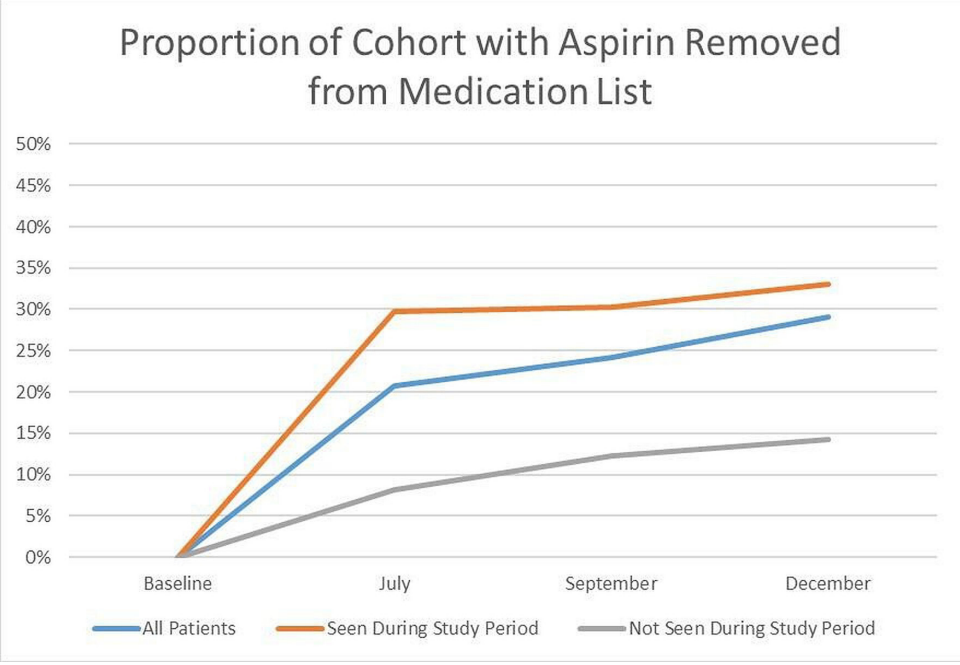

Figure 3 Proportion of cohort with aspirin removed from medication list: at 3 month follow-up, 31 patients (21%) had aspirin removed from their medication list; at 6 months follow-up, 36 patients (24%) had aspirin removed and at 9 months follow-up, 41 (29%) had aspirin removed from their medication list (χ^2=46.9 (3); p<0.001). **NB: this refers to patients seen in Family Medicine during the study period. The patient may have had an appointment in a different health system department or pharmacy in which their medication list was updated.

prompted aspirin discontinuation in situations where risks were determined to outweigh the net benefit. Specifically, this collaborative effort led to aspirin deprescribing for nearly one-third of patients at the two outpatient clinics included in the study. Fundamental steps in the deprescribing process include (1) obtaining a thorough medication history, (2) assessing indication for each medication, (3) assessing eligibility for deprescribing based on appropriateness of therapy, (4) prioritising medications for discontinuation while accounting for benefits, risks, costs and care goals and (5) developing a patient-centred plan for deprescribing that includes monitoring and follow-up.[25] Although there is little data about the impact of deprescribing practices, benefits may include reducing drug–drug interactions, minimising side effects, decreasing medication costs, simplifying medication regimens and improving adherence.[26] While no studies have evaluated the long-term clinical impact of deprescribing aspirin, recent evidence does highlight that there may be more risks associated with aspirin use in older adults. Though clinical outcomes were not assessed, this reduction in aspirin use can be translated to improved medication safety and stronger patient–provider relationships.

This study found that patients who were seen by their PCP during the study period were more likely to have aspirin removed from the medication list than those who were not. However, nearly 15% of patients not seen for an appointment in Family Medicine during the study period had aspirin removed from their medication list by the end of the study. These patients may have been seen in another department or by a pharmacist, which resulted in their medication list being updated or aspirin being deprescribed. It is possible that the education intervention and raising general awareness among patients and providers was still beneficial, even if they did not encounter their PCP. Other studies have demonstrated that pharmacy-led interventions and increasing patients' knowledge and awareness of potentially inappropriate medication use and polypharmacy have the potential to reduce inappropriate medication use.[27 28] Future efforts should consider developing ways to evaluate how updated guideline recommendations are shared and discussed with patients and providers.

There are limitations to the present work worth discussing. First, aspirin is a commonly used, non-prescription medication, and its use may have been underestimated by relying on the EMR. Patients taking daily aspirin may not have it documented in their medication list, making it difficult to assess the prevalence and change in aspirin use. Additionally, we do not know how other factors, including education and discussion about aspirin use outside of our project interventions, influenced aspirin deprescribing. Finally, dependence on a manual chart review process to identify inappropriate aspirin use was a limitation to expanding the project beyond the two pilot clinics. Due to resource constraints, three other outpatient family medicine clinics were not included in this pilot but hold more opportunities for improving medication safety with a target population of nearly 500 additional patients aged 70 and older and almost 2000 patients under age 70.

A notable limitation of the approach described in this study is the limited feasibility of implementation due to its time-consuming chart review process. This points to the need for systems to use the EMR better to facilitate shared decision-making. EMRs inherently improve efficiency, streamline communication among healthcare providers and with patients, provide patient access to vital health information and store large datasets used to drive patient care.

The plan for sustainability is to develop algorithms to identify patients taking aspirin and the associated clinical indication for use, which can aid in the implementation of deprescribing efforts by (1) alerting providers if a patient may be taking aspirin inappropriately and promoting shared decision-making, (2) enabling data tracking to facilitate evaluation and (3) sharing algorithms within and across institutions through linked EMR systems for rapid expansion. Given the recent recommendations regarding aspirin use in individuals aged 60 and over, this is of utmost importance. There is a significant opportunity to feed these data into EMR-based algorithms to facilitate patient-centred clinical decisions. Future studies should aim to build, test and implement EMR-based algorithms for patient identification to support large-scale deprescribing efforts.

CONCLUSION

This practice-based deprescribing study demonstrated an absolute decrease of 29% in potentially inappropriate aspirin use among patients aged 70 or older at 3, 6 and 9 months postintervention follow-up compared with a baseline of patients on aspirin for primary prevention. Piloting this study in primary care clinics, a setting where comprehensive medication management is essential, proved successful. The use of a multifaceted intervention that included provider and patient education facilitated shared decision-making discussions. It highlighted the benefit of using patient–provider relationships to make informed clinical decisions. This work provides an essential first step in developing strategies to align aspirin prescribing practices with updated USPSTF guidelines on a large scale. Future work is needed to create more feasible mechanisms for facilitating deprescribing practices for larger patient populations, including developing creative solutions that use EMRs to guide decision-making.

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Acknowledgements The study was conducted within the Family Medicine Department of the University of Virginia. We acknowledge the contribution of Kimberley S. Bednar, DNP, MSN, RN through editing and approval of the manuscript.

Contributors CB, SRB, RC and TB conceptualised the study. SRB developed the evaluation plan. SRB and CB performed the literature review and statistical analysis. Both CB and SRB drafted the manuscript. CAN edited and updated the manuscript. LL, CAN and RC provided feedback on the manuscript. CB was responsible for the overall project as guarantor. All authors reviewed and approved the final version.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This quality improvement initiative was approved by the Institutional Review Board for Health Sciences Research.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. All data that support the findings of this study are available from the corresponding author upon request.

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REFERENCES

1 Vainio H, Morgan G. Aspirin for the second hundred years: new uses for an old drug. *Pharmacol Toxicol* 1997;81:151–2.
2 Fuster V, Sweeny JM. Aspirin: a historical and contemporary therapeutic overview. *Circulation* 2011;123:768–78.
3 Baigent C, Blackwell L, Collins R, *et al*. Aspirin in the primary and secondary prevention of vascular disease: collaborative meta-analysis of individual participant data from randomised trials. *Lancet* 2009;373:1849–60.
4 Steering Committee of the Physicians Health Study Research Group.Final report on the aspirin component of the ongoing physicians' health study. *N Engl J Med* 1989;321:129–35.
5 de Gaetano G, Collaborative group of the primary prevention project. Low-dose aspirin and vitamin E in people at cardiovascular risk: a randomized trial in general practice. *Lancet* 2001;357:89–95.
6 The medical research Council's general practice research framework. Thrombosis prevention trial: randomised trial of low-intensity oral anticoagulation with warfarin and low-dose aspirin in the primary prevention of ischaemic heart disease in men at increased risk. *Lancet* 1998;351:233–41.
7 Hansson L, Zanchetti A, Carruthers SG, *et al*. Effects of intensive blood-pressure lowering and low-dose aspirin in patients with hypertension: principal results of the hypertension optimal treatment (HOT) randomised trial. *Lancet* 1998;351:1755–62.
8 de Gaetano G, Collaborative Group of the Primary Prevention Project. Collaborative group of the primary prevention project. low-dose aspirin and vitamin E in people at cardiovascular risk: a randomised trial in general practice. *Lancet* 2001;357:89–95.
9 USPSTF. Archived: aspirin use to prevent cardiovascular disease and colorectal cancer: preventive medication. United States Preventive Services Taskforce; 2002. Available: https://www.uspreventiveservicestaskforce.org/uspstf/recommendation/aspirin-use-prevent-cardiovascular-disease-colorectal-cancer-preventive-medication-2002
10 Pearson TA, Blair SN, Daniels SR, *et al*. AHA guidelines for primary prevention of cardiovascular disease and stroke: 2002 update: consensus panel guide to comprehensive risk reduction for adult patients without coronary or other atherosclerotic vascular diseases. *Circulation* 2002;106:388–91.
11 American Diabetes Association. Standards of medical care for patients with diabetes mellitus. *Diabetes Care* 2003;26 Suppl 1:S33–50.
12 Mosca L, Appel LJ, Benjamin EJ, *et al*. Evidence-based guidelines for cardiovascular disease prevention in women. *Circulation* 2004;109:672–93.
13 Baigent C, Blackwell L, Collins R, *et al*. Aspirin in the primary and secondary prevention of vascular disease: collaborative meta-analysis of individual participant data from randomised trials. *The Lancet* 2009;373:1849–60.
14 Dehmer SP, Maciosek MV, Flottemesch TJ, *et al*. Aspirin for the primary prevention of cardiovascular disease and colorectal cancer: a decision analysis for the U.S. *Ann Intern Med* 2016;164:777–86.
15 Guirguis-Blake JM, Evans CV, Senger CA, *et al*. Aspirin for the primary prevention of cardiovascular events: a systematic evidence review for the U.S. *Ann Intern Med* 2016;164:804–13.
16 Chubak J, Whitlock EP, Williams SB, *et al*. Aspirin for the prevention of cancer incidence and mortality: systematic evidence reviews for the U.S. *Ann Intern Med* 2016;164:814–25.
17 Gaziano JM, Brotons C, Coppolecchia R, *et al*. Use of aspirin to reduce risk of initial vascular events in patients at moderate risk of cardiovascular disease (ARRIVE): a randomised, double-blind, placebo-controlled trial. *Lancet* 2018;392:1036–46.
18 ASCEND Study Collaborative Group. Effects of aspirin for primary prevention in persons with diabetes mellitus. *N Engl J Med* 2018;379:1529–39.
19 ASPREE Investigator Group. Study design of ASPirin in Reducing Events in the Elderly (ASPREE): a randomized, controlled trial. *Contemporary Clinical Trials* 2013;36:555–64.
20 Arnett DK, Blumenthal RS, Albert MA, *et al*. 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:e596–646.
21 USPSTF. Final recommendation statement, aspirin use to prevent cardiovascular disease: preventive medication. United States Preventive Services Taskforce. Available: https://www.uspreventiveservicestaskforce.org/uspstf/recommendation/aspirin-to-prevent-cardiovascular-disease-preventive-medication#bootstrap-panel--7 [Accessed 8 Aug 2022].
22 Cannon CP, Brindis RG, Chaitman BR, *et al*. ACCF/AHA key data elements and definitions for measuring the clinical management and outcomes of patients with acute coronary syndromes and coronary artery disease: a report of the American College of Cardiology Foundation/American Heart Association task force on clinical data standards (writing committee to develop acute coronary syndromes and coronary artery disease clinical data standards). *Circulation* 2013;127:1052–89.
23 Hoffman L, Stawski RS. Persons as contexts: evaluating between-person and within-person effects in longitudinal analysis. *Research in Human Development* 2009;6:97–120.
24 Holden JE, Kelley K, Agarwal R. Analyzing change: A primer on Multilevel models with applications to nephrology. *Am J Nephrol* 2008;28:792–801.
25 Halli-Tierney AD, Scarbrough C, Carroll D. Polypharmacy: evaluating risks and deprescribing. *Am Fam Physician* 2019;100:32–8.
26 Reeve E, Shakib S, Hendrix I, *et al*. The benefits and harms of deprescribing. *Med J Aust* 2014;201:386–9.
27 Martin P, Tamblyn R, Benedetti A. Effect of a pharmacist-led educational intervention on inappropriate medication prescriptions in older adults: the D-PRESCRIBE randomized clinical trial [Internet]. JAMA. Clinical Pharmacy and Pharmacology, Available: https://jamanetwork.com/journals/jama/fullarticle/2714531 [Accessed 1 Feb 2022].
28 Achterhof AB, Rozsnyai Z, Reeve E, *et al*. Potentially inappropriate medication and attitudes of older adults towards deprescribing. *PLOS ONE* 2020;15:e0240463.