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Low Dose Aspirin Usage Among Elderly Australian Residential Aged Care Facility Residents

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Abstract

BACKGROUND:

Several healthcare organisations strongly recommend aspirin usage for high-risk patients to prevent cardiovascular disease. This study retrospectively audited the usage of aspirin as an antiplatelet agent in two cohorts of Australian residential aged care facility (RACF) residents in the Perth, Western Australia (WA) and Sydney, New South Wales (NSW) metropolitan and surrounding areas. The primary objective was to compare the appropriateness of current practice regarding aspirin usage with the National Heart Foundation of Australia (NHF) guidelines. The secondary objective was to identify predictors of aspirin usage and non-usage to permit targeting of 'at risk' groups.

METHODS:

Data on aspirin usage, resident demographics, concurrent drug use and disease states, especially those representing potential predictors of aspirin usage or non-usage, were recorded. Data analysis was performed using independent samples t-testing, χ^2 testing and univariate and multivariate logistic regression analysis.

RESULTS:

Rates of aspirin use were 35.2% and 32.5% in the WA and NSW cohorts, respectively, with no difference between the two groups (p=0.476). Common aspirin dosages were 100mg and 150mg daily. Aspirin prescribing rates for indicated cardiovascular conditions varied from 23.1% to 47.1% in the WA residents. Multivariate logistic regression analyses on the combined data demonstrated male gender (OR=1.46, 95% CI: 1.06-2.01) and concurrent usage of angiotensin receptor blockers (OR=1.61, 95% CI: 1.06-2.45), angiotensin converting enzyme inhibitors (OR=1.78, 95% CI: 1.28-2.46), beta-blockers (OR=1.99, 95% CI: 1.38-2.85), antihyperlipidemics (OR=1.62, 95% CI: 1.14-2.31) and antiarrhythmics (OR=1.57, 95% CI: 1.02-2.41) to be predictors of aspirin usage. Predictors of aspirin non-usage were clopidogrel (OR=0.28, 95% CI: 0.15-0.51) and warfarin usage (OR=0.09, 95% CI: 0.03-0.24).

CONCLUSIONS:

Suboptimal aspirin usage was demonstrated among both cohorts of RACF residents in spite of strong recommendations from national guidelines. Various predictors of aspirin usage and non-usage were identified. Significant efforts should be made to encourage aspirin usage in the elderly 'at risk' population.

Keywords: Aspirin, Residential Aged Care, Guidelines

Introduction

Acetylsalicylic acid, commonly known as aspirin, was discovered more than 100 years ago and was used initially for its analgesic, anti-inflammatory and antipyretic properties. It is only in the past 25 years that its effectiveness as an antiplatelet agent in the prevention of myocardial infarction and ischaemic stroke has been recognised.[1] Aspirin is commonly used as an antiplatelet agent in doses of 75mg to 150mg daily, which have been found to be at least as effective as higher doses.[2] A recent review article, however, recommended that the aspirin dose for cardiovascular disease prevention should be between 75mg and 81mg daily to minimise the risks of gastrointestinal bleeding and other bleeding complications.[3]

Aspirin use for the primary and secondary prevention of cardiovascular events remains one of the most controversial issues in the medical literature, but numerous trials have clearly demonstrated a role for aspirin in a variety of patient groups. In primary prevention, gender effects are apparent, with males benefiting from a 32% reduction (relative to non-aspirin users) in the risk of myocardial infarction and females from a relative 17% reduction in ischaemic stroke.[4] Benefits have also been noted in high risk diabetic patients, although the magnitude of the risk reduction is much lower than in non-diabetic patients.[2, 5] The lower risk reduction in the diabetic subjects might be due to the

dyslipidemia leading to endothelial dysfunction, up-regulation of inflammatory responses and increased platelet turnover.[5, 6]

Aspirin therapy is also effective for secondary prevention of occlusive vascular events in high-risk patients, including patients with myocardial infarction, ischaemic stroke, angina or atrial fibrillation (AF). A recent meta-analysis of antiplatelet therapy, where aspirin was the most commonly used agent, demonstrated a reduction in the combined outcome of any serious vascular event and non-fatal stroke, non-fatal myocardial infarction and vascular mortality. Furthermore, the absolute benefits in various high-risk categories greatly outweighed the absolute risks of major extracranial bleeding.[2]

In view of evidence supporting aspirin usage in the primary and secondary prevention of cardiovascular diseases, various British organisations, the National Heart Foundation of Australia (NHF), the American Heart Association and American Diabetes Association have recommended aspirin for patients at high risk of cardiovascular disease.[7-10] The NHF recommends that all patients with coronary heart disease and other manifestations of atherosclerosis (e.g. stroke and peripheral arterial disease) be prescribed aspirin at 75mg to 150mg per day unless contraindicated.[8, 11] Other authors have refined these recommendations, suggesting that aspirin should only be used for primary prevention of cardiovascular disease in asymptomatic patients who are deemed to be at more than 1% annual risk of cardiovascular disease using standard coronary risk algorithms.[12] Detailed consideration of an individual's cardiovascular risk and potential benefits versus harm are therefore essential before aspirin therapy is prescribed.[9, 12]

Despite the proven benefits of aspirin therapy in reducing cardiovascular risk, aspirin usage in patients with or at risk of cardiovascular disease, especially in community settings, is still lower than desired. Surveys in diabetic populations, either with or without a history of coronary artery disease,

have revealed that only approximately 20% of such patients take regular aspirin.[13,14] Other studies have revealed that only about half of the patients with a history of myocardial infarction, angina or peripheral arterial disease receive antiplatelet therapy.[2] Although one recent study reported an increase in aspirin usage, only 32.8% of high-risk patients were on aspirin.[15]

As age substantially increases cardiovascular risk,[16, 17] it is especially important to ensure that aspirin is appropriately prescribed in older patient populations. Studies in older populations have revealed similar results to those in younger patient groups, including one primary prevention study that found rates of aspirin use of 32% overall and 37% in those at highest cardiovascular risk.[28] Only 22.5% of Australians over 70 years of age screened as part of a recent pilot study were taking aspirin, although this may have represented some degree of under-reporting.[29]

Aspirin usage in the community, including by community-dwelling older patients, thus appears suboptimal. There are, however, currently no published data regarding the use of aspirin among the elderly Australian population residing in residential aged care facilities (RACFs) who, because of their age, are likely to be at significant cardiovascular risk. Based on the rates of usage among their community-dwelling counterparts, it was hypothesised that less than optimal aspirin use may be occurring in this population. This may represent a significant gap between evidence and practice which, if addressed, may improve the clinical outcomes of these patients. This study therefore aimed to audit the usage of aspirin as an antiplatelet agent amongst two populations of RACF residents, in Western Australia (WA) and New South Wales (NSW), to determine the appropriateness of current practice against the NHF guidelines. The secondary objective of the study was to identify the predictors of aspirin usage (including residents' characteristics, and concomitant drugs or co-morbidities suggestive of indications for aspirin therapy) and aspirin non-usage (for example, factors that may predispose a resident to gastrointestinal, intracranial or other bleeding) in these groups. It

was hoped that this would permit recommendations targeted at specific patient groups to be made to promote appropriate aspirin usage in the RACF-dwelling elderly.

Methods

This study was a retrospective audit utilising two available data sets. Part One used a convenience sample of residential medication management review records of 201 WA RACF residents supplied by a single accredited pharmacist. All of the RACFs were within the Perth metropolitan and surrounding area. Part Two of the study involved the de-identified 2007 medication supply records of 791 RACF residents from the Sydney, NSW, metropolitan area which were randomly selected from Manrex, a private company specialised in medication delivery systems. Although the information available from the NSW supply records was not as comprehensive as that included in the WA medication management reviews, analysis of this larger data set was undertaken to validate, and thus confirm the generalisability of, the findings from the WA records, and to contribute statistical power to the results.

All available records were included in the analysis, excepting those of residents who met the exclusion criteria of being less than 65 years of age, or having a documented history of aspirin intolerance or allergy. The minimum age limit was to ensure that the majority of the residents would be at least at moderate risk of a cardiovascular event (i.e. with a 10 – 15% 5 year risk of cardiovascular disease) according to the New Zealand Cardiovascular Risk Calculator.[17] Ethics approval for the study was obtained from the Human Research Ethics Committee of Curtin University of Technology (Approval Number: PH-01-2008).

For the WA residents, data regarding their gender, age, prescriber, RACF location and medical history, including both potential indications for aspirin therapy and possible predictors of aspirin non-usage were recorded. Residents with a history of a cerebrovascular accident (CVA) or transient ischaemic attack (TIA) were documented as having a history of "stroke" for the purposes of data analysis. Information on aspirin usage, including the dosage and combinations, was recorded, as were other medications which might predict aspirin usage or non-usage. These included drugs used in the treatment of cardiovascular disease- antihypertensives (angiotensin receptor blockers (ARBs), angiotensin converting enzyme inhibitors (ACEIs), beta-blockers, dihydropyridine calcium channel blockers (CCBs) and non-dihydropyridine CCBs, thiazides and others), other antiplatelet agents (clopidogrel, ticlopidine and dipyridamole), anticoagulants (warfarin and others), antianginals, antiarrhythmics including digoxin, loop diuretics, aldosterone antagonists and antihyperlipidemics including HMG CoA reductase inhibitors (statins); antidiabetic agents; nonsteroidal anti-inflammatory drugs (NSAIDs) other than aspirin due to the risk of gastrointestinal bleeding associated with their use; and drugs potentially indicating gastrointestinal pathologies- proton pump inhibitors (PPIs), histamine -2 - receptor antagonists (H_2RAs) and antacids. All thiazides and thiazide-like antihypertensives were included in the "thiazides" category while amiloride, clonidine, hydralazine and prazosin were included in the "others" category within antihypertensives. Enoxaparin and heparin were included in "others" category within anticoagulants. For Part Two of the study, only information regarding the NSW residents' age, gender and medication usage was available and was recorded as above.

Statistical analyses were performed using SPSS 15.0 for Windows (Chicago, IL, USA). Baseline characteristics of the RACF residents were analysed using independent samples t-testing for continuous variables and χ^2 testing for categorical variables. Odds ratios for aspirin usage among the RACF residents and their 95% confidence intervals were calculated using univariate and multivariate

binary logistic regression. A p value of less than 0.05 was judged as statistically significant for all analyses.

Results

Part One

Of the initial 201 WA residents, two were excluded as they were less than 65 years old, resulting in a final cohort of 199 residents. The baseline characteristics of the subjects are presented in Table 1. Fourteen of the RACFs were in the Perth metropolitan area, while three were in surrounding areas. The residents were under the care of 70 doctors (an average of 2.8 residents per doctor) which was deemed sufficient to prevent confounding due to prescribing bias. The most common medical conditions among the WA RACF residents were hypertension (n = 108; 54.3%), followed by stroke (n = 52; 26.1%) and ischaemic heart disease (n = 49; 24.6%).

Overall, 70 residents (35.2%) were on either aspirin alone (92.9%) or combined aspirin-dipyridamole (7.1%). The common aspirin dosages used were 100mg and 150mg daily. Apart from one resident who used aspirin at 25mg daily, the dose of aspirin used was as recommended by the NHF guidelines (75mg to 150mg daily).[8] Although the NHF recommends aspirin for all patients with ischaemic heart disease, stroke or peripheral arterial disease,[8] none of these medical conditions which were potential indicators of aspirin usage had a proportion of aspirin usage higher than 50%. Rates of aspirin prescribing varied from 23.1% for diabetics, to 42.9%, 46.2% and 47.1% for those patients with ischaemic heart disease, stroke or peripheral arterial disease, respectively.

There was no significant age difference between aspirin users and non-users (p=0.55), and the location of the RACF also failed to influence aspirin use (p=0.082). Results of the univariate analysis

of the WA data (Table 2) also showed that the resident's age did not affect the odds of aspirin usage. None of the other potential predictors of aspirin usage and non-usage, either concurrent drug therapy or disease states, demonstrated a significant influence on aspirin use in binary logistic regression analyses (WA section of Table 2 and Table 3).

PART TWO

Nineteen of the 791 NSW RACFs residents were excluded as they failed to meet the study's age criteria, giving a final count of 772 residents from 17 different RACFs (Table 1). Similar to the WA residents, no significant age difference was found between aspirin users and non-users (p=0.886) within the NSW cohort.

The rate of aspirin usage in NSW failed to differ from that in WA (p = 0.476), with 251 (32.5%) of the NSW residents using aspirin. Once again, as in WA, the majority (226, 90.0%; p = 0.352) was using aspirin alone. The two common aspirin dosages used by the NSW RACF residents were the same as that of the WA cohort. Apart from one resident who was on aspirin at 25mg daily and three who were on dosages above 150mg daily, the dose of aspirin used was generally as recommended by the NHF.[8] Unlike the WA data, results of the univariate and multivariate analyses (Table 2) showed that males were significantly more likely than females to use aspirin (p=0.021). Residents who were taking ARBs (p=0.030), ACEIs (p=0.001), beta-blockers (p<0.001) or antihyperlipidemics (p=0.026) were also more likely to use aspirin concurrently. However, patients who were taking either clopidogrel (p<0.001) or warfarin (p<0.001) were significantly less likely to use aspirin concurrently.

The characteristics of the WA and NSW residents were compared. There was no significant difference between the gender distributions (p=0.141), and although there was a difference in the ages, both groups were similarly elderly (86.48 years vs 92.13 years, p<0.001). Male NSW RACF residents were more likely than females to use aspirin (38.4% vs 30.5%, p=0.041), however, there was no significant

difference in aspirin usage between the genders of the WA RACF residents (39% vs 34.2%, p=0.562). The aspirin dosages used by RACF residents of both states was generally in accordance to the NHF recommendations[8] but the NSW cohort was prescribed a wider dosage range (25mg to 300mg) than the WA cohort. WA RACF residents were more likely than NSW residents to use aspirin at 150mg daily (9% vs 4.8%, p=0.021), thiazides (11.1% vs 6.2%, p=0.019) and aldosterone antagonists (7.5% vs 4.1%, p=0.047). However, they were less likely than NSW RACF residents to use antianginals (12.1% vs 18.5%, p=0.031) and PPIs, H_2RAs and antacids (38.7% vs 47.4%, p=0.028).

Of these medications for which the usages differed between the cohorts, only antianginal usage was a significant predictor of aspirin usage in the NSW cohort. This was only in the univariate analysis, however, with no significant predictive value demonstrated in the multivariate analysis. In light of this, and the fact that both populations were similarly elderly, the NSW and WA data were combined for further analysis. The results of the multivariate analysis of the combined data, corrected for location, were, as expected, found to be similar to those from the NSW data due to its larger population (Table 2). Aspirin usage was not affected by age (p=0.571). Males were more likely than female to use aspirin (p=0.021). Patients who were on ARBs (p=0.027), ACEIs (p=0.001), beta-blockers (p<0.001), antianginals (p=0.045) or antihyperlipidemics (p=0.007) were significantly more likely to use aspirin concurrently. Although antiarrhythmic usage was a non-significant predictor of aspirin usage from the univariate analysis, it became a significant predictor of aspirin usage when multivariate analysis was performed (p=0.039). Patients who were on clopidogrel (p<0.001) or warfarin (p<0.001) were significantly less likely to be concurrent aspirin users.

Discussion

The results of this study showed that overall aspirin usage among this study population of 65 years and older RACF residents, more than 80% of who were at least 80 years old, was lower than desired according to the NHF guidelines.[8, 9, 12] This was despite the fact that these residents, by age alone, had at least a 5-10% absolute 5-year cardiovascular risk[17] and according to the NHF guidelines would have been potential candidates for aspirin therapy.[9, 12] Overall aspirin usage for the RACF residents in NSW and WA was only about 30%. Aspirin usage was 23.1% among diabetics, and ranged from 42.9% to 47.1% in secondary prevention.

These results mirrored those of previous studies that have demonstrated that, in spite of strong recommendations by various organisations for aspirin usage to prevent coronary heart disease in high-risk patients,[7-11] its usage by these patients, especially in the community setting, is still low in developed countries.[14, 15, 18]

Stafford et al reported aspirin underutilisation in US ambulatory care for both primary and secondary prevention of cardiovascular disease, with prescribing rates of 32.8% for high risk patients and 11.7% for diabetic patients.[15] The current study, which was based on a more elderly and homogenous population as compared to the patients included in the study by Stafford et al (who were aged from 20 to more than 80 years old), reported a similar percentage of aspirin usage. Considering that the population of this study, based on age alone, would possibly have a higher overall cardiovascular risk, the aspirin usage for the population of this study should in fact have been much higher than that reported by Stafford et al. This might have been counterbalanced by the increased bleeding risk in this elderly study population,[1] however, consideration of which may have contributed to the lower than expected aspirin usage.

This study demonstrated that males were more likely than females to use aspirin among the WA, NSW and combined residents, although the results were not statistically significant for the WA group. Similar results have been found in previous studies involving a rural diabetic population,[14] patients at risk of cardiovascular diseases[15] and patients with documented coronary artery disease.[18] The study by Berger et al which included female participants mainly from the Women's Health Study (WHS) provided supporting evidence for this usage trend.[4]

It is important to note that the WHS overall findings were based on a much younger subject group as compared to this study, with 89.7% of participants younger than 65 years old.[19] Therefore, the findings might not be fully relevant to the RACF residents. However, the subgroup analysis of women age 65 years old and above showed that aspirin usage was associated with significant reduction in major cardiovascular events (RR=0.74, p=0.008), ischaemic stroke (RR=0.70, p=0.05) and even myocardial infarction (RR=0.66, p=0.04) which was not seen in younger age groups.[19] Hence, in light of the available evidence, it would be reasonable to suggest that female patients 65 years and above should be treated with aspirin at least as intensively as the male patients for the primary prevention of cardiovascular disease.

With diabetes as one of the most common chronic disease worldwide[20, 21] and a leading cause of cardiovascular death,[22] the disease and its associated cardiovascular risk factors need to be addressed.[6] In spite of support for aspirin usage by various guidelines and clinical evidence, aspirin usage by diabetic patients is still low. US research revealed that less than a quarter of surveyed diabetic patients with coronary artery disease were on aspirin.[13] A Canadian study reported that only 23% of a rural diabetic population with a mean age of 62.9±12.5 years were antiplatelet (aspirin and/or clopidogrel) users.[14] Although this study population involved the institutionalised diabetic elderly who may have been more frequently followed up by doctors and would have possibly been at

an even higher overall cardiovascular risk because of their advanced age, the proportion of aspirin usage was similar to that reported in the Canadian study. Hence, a significant effort will be necessary to encourage aspirin usage in this population. In the US, various initiatives have been implemented to reduce cardiovascular deaths in diabetic patients, one of which is to increase the proportion of diabetic patients who take aspirin at least 15 times per month from 20% to 30% by 2010.[22]

Results of this study showed that the dosage of aspirin used by the elderly residents was generally in accordance with the NHF guidelines.[8, 9] It was important to note that current evidence supports the use of aspirin at doses between 75mg to 81mg daily. The effects of aspirin at doses lower than 75mg were less certain while any doses higher than 81mg did not suggest better prevention but might be associated with higher risks of gastrointestinal bleeding and other bleeding complications.[2, 3] The rationale for the few RACF residents being prescribed doses outside the NHF recommended range and the disparity between the NHF guidelines and the literature recommendations were not investigated as these issues were beyond the scope of this study.

Multivariate analysis of the combined data showed that beta-blocker usage was the strongest predictor for aspirin usage, followed by the use of ACEIs and ARBs. Other predictors of aspirin usage included antihyperlipidemics (which consisted mostly of statins) and antiarrhythmics (principally digoxin). These results might have been influenced by the effective implementation of guidelines for the long-term management of ischaemic heart disease (IHD) with concurrent aspirin, beta-blockers, ACEIs and statins.[11] Although there is stronger evidence supporting the use of warfarin compared to antiplatelet agents for stroke prevention in AF, the most common form of cardiac arrhythmia, this study suggested that the presence of AF was a moderately strong predictor for aspirin usage.[23] This may be explained by assuming that aspirin was prescribed in preference to warfarin in these elderly residents due to unrecorded contraindications to warfarin therapy, perceived increased risks of cerebrovascular haemorrhage and falls or an unwillingness to undertake the monitoring associated with warfarin therapy.[30] While all of these are potential reasons for choosing aspirin over warfarin in

this elderly population, due to the lack of available information, these hypotheses could not be verified.

Warfarin was a strong predictor of aspirin non-usage as the concurrent usage of these drugs might lead to a significant increase in bleeding risk.[3, 23, 24] Clopidogrel was also a predictor of aspirin non-usage as it is commonly used as an alternative by patients who are aspirin intolerant.[11, 25] Clopidogrel was a weaker predictor of aspirin non-usage than warfarin, however, because it is commonly used concurrently with aspirin for patients with unstable angina, recurrent cardiac events or those who have undergone stent implantation.[11] As noted in Table 1, 15 of the WA residents (7.5%) and 65 (8.4%) of the NSW residents were taking the combination of aspirin and clopidogrel. Counter-intuitively, neither the use of NSAIDs nor PPIs, H_2RAs and antacids proved to be significant predictors of aspirin non-usage, with NSAID usage actually associated with non-significant increases in aspirin usage in all three data sets.

Various limitations of this study must be acknowledged. Throughout this discussion, it has been implied that the failure of a resident to receive aspirin equated to non-compliance with the NHF guidelines and thus suboptimal prophylaxis of cardiovascular disease. Aspirin remains the gold standard for this indication and was thus the focus of this investigation, so clopidogrel use was not routinely recorded. This may have resulted, however, in an under-reporting of compliance with the recommendations by failing to consider clopidogrel as a rational alternative for some patients. This omission is partially ameliorated, however, by the fact that the most common situation where clopidogrel would be prescribed as an alternative to aspirin would be in patients with aspirin intolerance or allergy, which was one of the exclusion criteria for this study.

There were some further logistical limitations to this study. The sample size of the WA cohort may have been too small to provide adequate statistical power to definitively determine the predictors of aspirin usage and non-usage. Convenience sampling, a potentially biased sampling method, was used

to obtain the samples for this study. As the population was homogenous (based on the narrow age distribution), it is believed that this sampling technique would have had minimal adverse effect on the study results. The possibility of prescribing bias could not be ascertained from the NSW data as prescriber information was not available. Based on current GP-to-population ratios provided by the Australian Divisions of General Practice, it can be assumed that the resident to doctor ratio in NSW would have been sufficiently large to minimise any potential effect of prescribing bias on the NSW data.[26] The information collected on the residents' medical histories was reliant on the quality of the data recorded, which may have introduced some inaccuracies. For example, the term "CVA" might have been used for strokes of either ischaemic (a predictor of aspirin usage) or haemorrhagic (a predictor of aspirin non-usage) aetiology. However, this should not have affected significantly the analysis adversely considering that about 80% of Australian stroke patients suffer from ischaemic strokes.[27] The effect of race on aspirin usage could not be investigated as such information was not available from both WA and NSW data. Smoking status and vital statistics of the WA RACF residents such as height, weight and blood pressure readings were also not available. As a result, the relevance of smoking, obesity and refractory hypertension as cardiovascular risk factors and predictors for aspirin usage could not be assessed. Due to this lack of information, plus an inability to assess an individual resident's potential bleeding risk, it was impossible to accurately determine each resident's risk benefit balance in relation to aspirin usage. The effect of other factors, such as individual resident's or prescriber's attitudes towards aspirin use, and the social, educational and economic considerations of drug use within RACFS, could also not be assessed. Such factors could be considered in a future study.

Conclusions

In conclusion, this study revealed a substantial gap between the evidence and practice for the care of institutionalised elderly patients at high risk of cardiovascular disease, with suboptimal aspirin usage

among residents in both WA and NSW. Various predictors of aspirin usage and non-usage were identified. It can be seen from this study that significant efforts are required to encourage aspirin usage in the elderly population in accordance with the NHF guidelines. Continuing medical education for doctors may be conducted to maintain a more consistent practice with subsequent research to assess the trends in aspirin usage. Targeted interventions may especially be beneficial in patient subpopulations in which aspirin use is lower than average, including women and diabetics. With these efforts to encourage aspirin usage, it may be possible to reduce the cardiovascular disease and economic burden on this population and society as a whole.

Competing Interests

The authors declare that they have no competing interests.

Authors' Contributions

Professor Jeff Hughes developed the research question and research methodology. Mr Szu Liang Hie undertook the research as part of the requirements for his Master of Clinical Pharmacy Degree. Professor Jeff Hughes supervised the research, and assisted in the production and review of the research manuscript. Miss Leanne Stafford assisted in the supervision of the research, and the drafting and review of the research manuscript.

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References

1. Gorelick PB, Weisman SM. Risk of hemorrhagic stroke with aspirin use. Stroke 2005, 36:1801-1807.

2. Antithrombotic Trialists' Collaboration. Collaborative meta-analysis of randomised trials of antiplatelet therapy for prevention of death, myocardial infarction, and stroke in high risk patients. BMJ 2002, 324:71-86.

3. Campbell CL, Smyth S, Montalescot G, Steinhubl SR. Aspirin dose for the prevention of cardiovascular disease: a systematic review. JAMA 2007, 297:2018-2024.

4. Berger JS, Roncaglioni MC, Avanzini F, Pangrazzi I, Tognoni G, Brown DL. Aspirin for the primary prevention of cardiovascular events in women and men. JAMA 2006, 295:306-313.

5. Sacco M, Pellegrini F, Roncaglioni MC, Avanzini F, Tognoni G, Nicolucci A, et al. Primary prevention of cardiovascular events with low-dose aspirin and vitamin E in type 2 diabetic patients: results of the Primary Prevention Project (PPP) trial. Diabetes Care 2003, 26:3264-3272.

6. Sobel BE. Optimizing cardiovascular outcomes in diabetes mellitus. Am J Med 2007, 120:S3-11.

7. Anonymous. Joint British recommendations on prevention of coronary heart disease in clinical practice: summary. BMJ 2000, 320:705-708.

8. National Heart Foundation of Australia and Cardiac Society of New Zealand. Reducing risk in heart disease 2007. c2006. [updated 2006 Nov; cited 2008 May 01]. Available from: http://www.heartfoundation.org.au/document/NHF/ReducingRisk_HeartDisease_FullGuide_2007.pdf.

9. National Vascular Disease Prevention Alliance. Consensus statement for the prevention of vascular disease. Aust Fam Physician 2004, 33:235-239.

10. American Diabetes Association. Standards of medical care in diabetes-2008. Diabetes Care 2008, 31:S12-54.

11. Acute Coronary Syndrome Guidelines Working Group. Guidelines for the management of acute coronary syndromes 2006. MJA 2006, 184:S9-29.

12. Hung J. Aspirin for cardiovascular disease prevention. MJA 2003; 179:147-152.

13. Stafford RS. Aspirin use is low among United States outpatients with coronary artery disease. Circulation 2000, 101:1097-1101.

14. Klinke JA, Johnson JA, Guirguis LM, Toth EL, Lee TK, Lewanczuk RZ, et al. Underuse of aspirin in type 2 diabetes mellitus: prevalence and correlates of therapy in rural Canada. Clin Ther 2004, 26:439-446.

15. Stafford RS, Monti V, Ma J. Underutilization of aspirin persists in US ambulatory care for the secondary and primary prevention of cardiovascular disease. PLoS Med 2005, 2:e353.

16. Asia Pacific Cohort Studies Collaboration. The impact of cardiovascular risk factors on the age-related excess risk of coronary heart disease. Int J Epidemiol 2006, 35:1025-1033.

17. New Zealand Cardiovascular Risk Calculator. [updated 2004 Feb; cited 2008 April 10]. Available from: http://www.nps.org.au/resources/Health_Professional_Tools/nz_cardiovascular_risk_calculator.pdf.

18. Califf RM, DeLong ER, Ostbye T, Muhlbaier LH, Chen A, LaPointe NA, et al. Underuse of aspirin in a referral population with documented coronary artery disease. Am J Cardiol 2002, 89:653-661.

19. Ridker PM, Cook NR, Lee I-M, Gordon D, Gaziano JM, Manson JE, et al. A randomized trial of low-dose aspirin in the primary prevention of cardiovascular disease in women. N Engl J Med 2005, 352:1293-1304.

20. World Health Organization. Diabetes. c2006 [updated 2006 Sep; cited 2008 May 01]. Available from: http://www.who.int/mediacentre/factsheets/fs312/en/.

21. Australian Institute of Health and Welfare. How many people have diabetes? In: Diabetes - Australian facts 2008. Canberra: Australian Institute of Health and Welfare

2008. p. 8-17.

22. U.S. Department of Health and Human Services. Diabetes. In: Healthy People 2010. Washington, DC: U.S. Government Printing Office; 2000. p. 1-40.

23. Mant J, Hobbs FDR, Fletcher K, Roalfe A, Fitzmaurice D, Lip GYH, et al. Warfarin versus aspirin for stroke prevention in an elderly community population with atrial fibrillation (the Birmingham Atrial Fibrillation Treatment of the Aged Study, BAFTA): a randomised controlled trial. Lancet 2007, 370:493-503.

24. Buresly K, Eisenberg MJ, Zhang X, Pilote L. Bleeding complications associated with combinations of aspirin, thienopyridine derivatives, and warfarin in elderly patients following acute myocardial infarction. Arch Intern Med 2005, 165:784-789.

25. Anonymous. Ischaemic heart disease. NPS Prescribing Practice Review 2005; 31:61-64.

26. Primary Health Care Research & Information Service. Key division of general practice characteristics 2006-2007. c2008. [updated 2008 May; cited 2008 May 01]. Available from: http://www.phcris.org.au/products/asd/keycharacteristic/KeyDGPstatistics.xls

27. Australian Institute of Health and Welfare. The diseases. In: Heart, stroke and vascular diseases—Australian facts 2004. Canberra: AIHW and National Heart Foundation of Australia 2004. p. 18-56.

28. Rodondi N, Vittinghoff E, Cornuz J, Butler J, Ding J, Satterfield S et al. Aspirin use for the primary prevention of coronary heart disease in older adults. Am J Med 2005, 118:1288e1-e9.

29. Nelson MR, Reid CM, Ames DA, Beilin LJ, Donnan GA, Gibbs P, et al. Feasibility of conducting a primary prevention trial of low-dose aspirin for major adverse cardiovascular events in older people in Australia: results from the ASPirin in Reducing Events in the Elderly (ASPREE) pilot study. Med J Aust 2008, 189(2):105-9.

30. National Prescribing Service Limited. Antiplatelet and anticoagulant therapy in stroke prevention. Prescribing Practice Review 44, March 2009.

Tables

Table 1: Baseline characteristics of elderly RACF residents from Western Australia and New South Wales

	WA (n=199)*	NSW (n=772)*	P value**
Demographics			
Mean age (years) (SD)	86.5 (7.8)	92.1(11.2)	<0.001
Male	41 (20.6)	198 (25.6)	0.141
Female	158 (79.4)	574 (74.4)	
Aspirin usage			
Any aspirin	70 (35.2)	251 (32.5)	0.476
Aspirin only	65 (32.7)	226 (29.3)	0.352
Aspirin-dipyridamole	5 (2.5)	30 (3.9)	0.354
Daily dose of aspirin			
50 mg	4 (2.0)	29 (3.8)	0.225
100 mg	47 (23.6)	180 (23.3)	0.928
150 mg	18 (9.0)	37 (4.8)	0.021
Others	1 (0.5)	6 (0.7)	-
Current medical conditions			
Ischaemic heart disease	49 (24.6)	Not available	
History of stroke	52 (26.1)	Not available	
Heart failure	37 (18.6)	Not available	
Atrial fibrillation	38 (19.1)	Not available	
Peripheral arterial disease	17 (8.5)	Not available	
Hyperlipidemia	31 (15.6)	Not available	
Hypertension	108 (54.3)	Not available	
Diabetes mellitus	39 (19.6)	Not available	
Active or history of GI bleeding/PUD	3 (1.5)	Not available	
GORD	30 (15.1)	Not available	

History of intracranial haemorrhage	4 (2.0)	Not available	
Concurrent medications			
Antihypertensives			
ARBs	25 (12.6)	94 (12.2)	0.882
ACEIs	56 (28.1)	190 (24.6)	0.244
Beta blockers	43 (21.6)	134 (17.4)	0.166
Dihydropyridine CCBs	18 (9.0)	99 (12.8)	0.207
Non-dihydropyridine CCBs	4 (2.0)	27 (3.5)	0.148
Thiazides	20 (10.1)	48 (6.2)	0.019
Others	1 (0.5)	13 (1.7)	-
Antiplatelets			
Clopidogrel	15 (7.5)	65 (8.4)	0.687
Dipyridamole	1 (0.5)	5 (0.6)	-
Anticoagulants			
Warfarin	10 (5.0)	51 (6.6)	0.412
Others	0 (0.0)	18 (2.3)	-
Other medications			
Antidiabetics	19 (9.5)	98 (12.7)	0.224
Antianginals	24 (12.1)	143 (18.5)	0.031
Antiarrhythmics	19 (9.5)	117 (15.2)	0.102
Loop diuretics	56 (28.1)	214 (27.7)	0.982
Aldosterone antagonists	13 (6.5)	32 (4.1)	0.047
NSAIDs, excluding aspirin	14 (7.0)	49 (6.3)	0.924
Antihyperlipidemics	42 (21.1)	172 (22.3)	0.811
PPIs, H_2RAs and antacids	79 (39.7)	370 (47.9)	0.028

*Data are number (%) unless otherwise indicated.

**p values refer to chi-squared testing, except for mean age which is t-testing

Table 2: Odds ratios (with 95% CIs) for aspirin usage among WA and NSW RACF residents based on concurrent medications using binary logistic regression analysis

	WA	NSW		Combined (WA and NSW) (corrected for location)	
Concurrent Medications	**Univariate**	**Univariate**	**Multivariate**	**Univariate**	**Multivariate**
Age (per year)	1.01 (0.97-1.05)	1.00 (0.99-1.01)	-	1.00 (0.99-1.01)	-
Male gender	1.23 (0.61-2.50)	1.42 (1.01-1.99)[a]	1.53 (1.07-2.18)[a]	1.38 (1.02-1.88)[a]	1.46 (1.06-2.01)[a]
ARBs	1.53 (0.66-3.58)	0.64 (0.41-1.00)[a]	1.70 (1.05-2.74)[a]	1.55 (1.05-2.30)[a]	1.61 (1.06-2.45)[a]
ACEIs	1.28 (0.68-2.43)	1.86 (1.32-2.60)[c]	1.88 (1.29-2.73)[c]	1.73 (1.29-2.34)[c]	1.78 (1.28-2.46)[c]
Beta-blockers	0.86 (0.42-1.77)	2.47 (1.69-3.61)[c]	2.53 (1.67-3.82)[c]	1.94 (1.39-2.71)[c]	1.99 (1.38-2.85)[c]
Dihydropyridine CCBs	0.69 (0.23-2.01)	1.48 (0.96-2.29)	-	1.30 (0.87-1.93)	-
Thiazides	1.26 (0.49-3.24)	1.67 (0.93-3.02)	-	1.55 (0.95-2.55)	-
Clopidogrel	0.92 (0.30-2.79)	0.44 (0.23-0.85)[a]	0.25 (0.12-0.50)[c]	0.52 (0.30-0.91)[a]	0.28 (0.15-0.51)[c]
Warfarin	-	0.21 (0.08-0.54)[c]	0.12 (0.05-0.33)[c]	0.17 (0.07-0.43)[c]	0.09 (0.03-0.24)[c]
Antidiabetics	0.32 (0.09-1.13)	1.51 (0.98-2.34)	-	1.21 (0.81-1.81)	-
Antianginals	1.21 (0.46-2.71)	1.49 (1.02-2.16)[a]	-	1.42 (1.01-2.01)[a]	-
Antihyperlipidemics	1.51 (0.76-3.04)	1.65 (1.16-2.34)[b]	1.57 (1.06-2.33)[a]	1.62 (1.18-2.22)[b]	1.62 (1.14-2.31)[b]
Antiarrhythmics	1.76 (0.68-4.55)	0.98 (0.64-1.51)	-	1.11 (0.75-1.63)	1.57 (1.02-2.41)[a]

NSAIDs excluding aspirin	1.42 (0.47-4.26)	1.11 (0.60-2.04)	-	1.21 (0.71-2.06)	-
PPIs, H2RAs and antacids	0.70 (0.38-1.29)	0.95 (0.71-1.29)	-	0.89 (0.68-1.17)	-

Data expressed as odds ratio (95% CI). None of WA RACF residents was taking concurrent warfarin and aspirin. Multivariate binary logistic regression was not conducted for WA data as none of the variables showed significant results from univariate binary logistic regression.

[a]$p<0.05$; [b]$p\leq0.01$; [c]$p\leq0.001$

Table 3: Odds ratios (with 95% CIs) for aspirin usage among WA residents based on current medical conditions using binary logistic regression analysis

Medical Conditions	Univariate
Age (per year)	1.01 (0.97-1.05)
Male gender	1.23 (0.61-2.50)
Ischaemic heart disease	1.55 (0.80-2.99)
Previous stroke, TIA	1.88 (0.99-3.60)
Heart failure	1.52 (0.74-3.16)
Atrial fibrillation	1.26 (0.61-2.60)
Peripheral arterial disease	1.72 (0.63-4.68)
Hypertension	1.31 (0.73-2.36)
Hyperlipidemia	1.65 (0.76-3.58)
Diabetes mellitus	0.49 (0.22-1.10)
Active or history of GI bleeding/PUD	3.77 (0.34-42.27)
GORD	0.76 (0.33-1.76)
Data expressed as odds ratio (95% CI). None of the odds ratio for the current medical conditions is statistically significant.	