

Sex differences in the risk of receiving potentially inappropriate prescriptions among older adults

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Abstract

Objectives: to measure sex differences in the risk of receiving potentially inappropriate prescription drugs and to examine what are the factors that contribute to these differences.

Design: a retrospective cohort study.

Setting: community setting of British Columbia, Canada.

Participants: residents of British Columbia aged 65 and older ($n = 660,679$).

Measurements: we measured 2013 period prevalence of prescription dispensations satisfying the American Geriatrics Society's 2012 version of the Beers Criteria for potentially inappropriate medication use in older adults. We used logistic regressions to test for associations between this outcome and a number of clinical and socioeconomic factors.

Results: a larger share of women (31%) than of men (26%) filled one or more potentially inappropriate prescription in the community. The odds of receiving potentially inappropriate prescriptions are associated with several clinical and socioeconomic factors. After controlling for those factors, community-dwelling women were at 16% higher odds of receiving a potentially inappropriate prescription than men (adjusted odds ratio = 1.16, 95% confidence interval = 1.12–1.21). Much of this sex difference stemmed from women's increased odds of receiving potentially inappropriate prescriptions for benzodiazepines and other hypnotics, for tertiary tricyclic antidepressants and for non-selective NSAIDs.

Conclusion: there are significant sex differences in older adults' risk of receiving a potentially inappropriate prescription as a result of complex intersections between gender and other social constructs. Appropriate responses will therefore require changes in the information, norms and expectations of both prescribers and patients.

Keywords: *inappropriate, Beers criteria, older adults, sex and gender, socioeconomic disparities, older people*

Introduction

Despite known risks, potentially inappropriate prescribing is relatively common, with several studies across North America and Europe reporting 20% or greater prevalence of potentially inappropriate medication use among community-dwelling older adults [1–4]. Studies have found certain factors—such as patient age, health status and the number of prescription drugs they are taking—to be positively associated with the risk of receiving potentially inappropriate

prescriptions [1–7]. Studies have also reported sex differences in exposure to potentially inappropriate medications; however, some studies have found that sex differences are moderated and in some cases reversed, when patient age health status or income are taken into account [7–13].

In this study, we document sex differences in older adults' risk of receiving potentially inappropriate prescriptions in British Columbia, Canada. We draw on comprehensive, population-based linked healthcare datasets that include information about residents' age, health, income and ethnicity. This allows

us to measure sex differences in the risk of receiving potentially inappropriate prescriptions and to examine clinical and socio-economic factors that contribute to these differences.

Methods

Study design and setting

This is a retrospective study of outpatient prescription drug purchases by residents of British Columbia who were aged 65 and older in 2013. All subjects were covered under British Columbia's universal, public health insurance program for medical and hospital care, and all were eligible for coverage under British Columbia's universal, public drug benefit plan, under which deductibles are set in relation to household income.

Data sources and cohort

We obtained de-identified linked health datasets from Population Data BC, with approval of relevant data stewards and the University of British Columbia's Behavioural Research Ethics Board [14–16]. The datasets included administrative records of all prescription drug dispensations, fee-for-service physician visits and hospitalisations for all residents aged 65 or older in 2013, except military veterans, registered First Nations, and inmates of federal penitentiaries (which collectively make up ~4% of the population). To accurately measure period prevalence of medicine use, we excluded individuals who lived in British Columbia for <275 days in 2013.

Variables

We measured period prevalence of calendar year 2013 prescription dispensations satisfying the American Geriatrics Society's 2012 version of the Beers Criteria for potentially inappropriate medication use in older adults [17]. We implemented the Beers criteria for drug type, dose, duration and, where relevant, medical conditions (Table 2 of the 2012 publication).

Health status and medical conditions relevant to the Beers criteria were identified through diagnosis codes in medical and hospital records. A primary diagnostic code (ICD-10) is contained in records of every fee-for-service billing for primary and speciality care. Records of each hospitalisation contain up to 25 diagnostic codes. We gauged overall health status using counts of major Aggregated Diagnostic Groups (ADGs of the John Hopkins ACG case-mix adjustment system, version 10.0) that have been validated for studying health services and pharmaceutical use [18, 19].

We defined polypharmacy as the use of drugs from five or more different drug classes defined by the third level of the World Health Organisation's Anatomical Therapeutic Chemical drug classification system [20]. We defined patients who visited five or more different physicians in the year as having many providers of medical care.

Datasets contained validated household-specific income data for 78% of our study population and neighbourhood-based proxy incomes for the remaining 22% [21]. We assigned

ethnicity using a validated algorithm to identify surnames of the dominant ethnic minorities in British Columbia: Chinese (40% of minorities) and South Asians (26%) [22, 23]. Finally, we categorised neighbourhood urbanisation based on the population density of the Local Health Area in which people lived.

Statistical analyses

We compute study population characteristics and χ^2 tests for significance across groups. We ran sex-stratified and sex-pooled logistic regressions to test for associations between the binary exposure measure (prevalence of one or more potentially inappropriate prescription) and explanatory variables selected based on established models of health services utilisation and sex- and gender-based analyses [24–27]. After testing for collinearity between explanatory variables and goodness of fit, our models included measures of sex, age, health status, concomitant drug use (polypharmacy), the number of physicians providing care, income, marital status, ethnicity and level of neighbourhood urbanisation. We also tested interactions between an individual's sex and other explanatory variables that theory predicts may have sex-specific effects: specifically, age, health status, income and ethnicity [26]. For all analyses, a value of $P < 0.05$ was considered statistically significant. All analyses were performed using Stata version 13.1 (College Station, TX, USA) and SAS version 9.3 (SAS Institute, Cary, NC, USA).

Results

Table 1 describes the characteristics of the study population. A total of 660,679 persons aged 65 and older resided in British Columbia for at least 275 days during 2013. Women made up just over half of this population (54%). A larger share of women (31%) than of men (26%) filled one or more potentially inappropriate prescription in 2013. Women in our study population were more likely to be over age 85, reside in a long-term care facility, fill prescriptions for five or more different types of drug and have incomes in the lowest quintile—all of these characteristics were associated with higher crude prevalence of filling one or more potentially inappropriate prescription. Men in our study population had relatively poor health status, which was associated with higher crude prevalence of potentially inappropriate prescriptions.

Tables 2 and 3 list adjusted odds ratios from logistic regression analyses for the population living in the community setting (results for residents of long-term care facilities are in the Supplementary data, Appendix, available in *Age and Ageing* online). Excluding interaction terms, women had 23% higher odds of receiving one or more potentially inappropriate prescription than men after adjusting for all other clinical and socioeconomic factors (AOR = 1.23, 95% CI = 1.22–1.25). Including interaction terms that allow sex to modify the effects of age, health status, income and ethnicity, women had 16% higher adjusted odds of receiving a potentially inappropriate prescription than men (AOR = 1.16, 95% CI = 1.12–1.21). Model specification tests favoured the inclusion of the interaction terms.

Table 1. Study population characteristics, older British Columbians, 2013

Variable	Women			Men			Women and men		
	<i>n</i>	%	Prevalence of PIP (%)	<i>n</i>	%	Prevalence of PIP (%)	<i>n</i>	%	Prevalence of PIP (%)
Population	357,165	100	31	303,514	100	26	660,679	100	28
Age ^a									
65–74	186,947	52	29	177,307	58	24	364,254	55	27
75–84	110,563	31	33	94,723	31	29	205,286	31	31
85+	59,655	17	30	31,484	10	27	91,139	14	29
Health status ^a									
0 Major ADGs	147,192	41	20	110,343	36	15	257,535	39	18
1 Major ADG	106,297	30	33	91,219	30	27	197,516	30	30
2–3 Major ADGs	87,272	24	41	84,065	28	35	171,337	26	38
4+ Major ADGs	16,404	5	52	17,887	6	45	34,291	5	48
Residing in long-term care ^a	13,462	4	42	6,100	2	42	19,562	3	42
Polypharmacy (5+ drug classes) ^a	164,022	46	50	128,174	42	45	292,196	44	48
Many providers (5+ physicians)	212,080	59	39	180,179	59	33	392,259	59	36
Income quintile ^a									
Lowest	91,676	26	35	45,065	15	31	136,741	21	34
Second	70,849	20	32	56,699	19	28	127,548	19	30
Third	69,576	19	29	63,471	21	25	133,047	20	27
Fourth	68,129	19	27	70,154	23	24	138,283	21	26
Fifth	56,935	16	29	68,125	22	24	125,060	19	26
Relationship status ^a									
Single	189,878	53	31	83,744	28	27	273,622	41	30
Marriage-like relationship	167,287	47	30	219,770	72	26	387,057	59	27
Ethnicity									
European and other	313,925	88	32	266,904	88	26	580,829	88	29
Chinese	31,045	9	20	25,784	8	21	56,829	9	21
South Asian	12,195	3	31	10,826	4	29	23,021	3	30
Neighbourhood urbanisation ^a									
Metropolitan	224,523	63	30	182,905	60	25	407,428	62	28
Mixed urban/rural	108,229	30	33	96,513	32	27	204,742	31	30
Rural	24,413	7	32	24,096	8	27	48,509	7	29

PIP, one or more potentially inappropriate prescription.

^aDifferences in population characteristics statistically significant at $P = 0.05$.

For women and for men, being sicker, receiving polytherapy and receiving care from five or more doctors all increased the adjusted odds of filling one or more potentially inappropriate prescription. Being older was associated with lower adjusted odds of receiving a potentially inappropriate prescription. Tests for interactions between sex and age found that the protective effect of age was slightly greater for women than for men. Interactions between sex and health status were not statistically significant.

As shown in Table 3, higher income was associated with lower odds of filling potentially inappropriate prescriptions for men but not for women. Being married reduced the odds that a man would receive a potentially inappropriate prescription (AOR = 0.92, 95% CI = 0.89–0.94), but did not have a significant effect on those odds for women. Ethnicity had statistically significant effects on the odds that a woman received a potentially inappropriate prescription, but no statistically significant effects for men. For women, having a Chinese surname reduced the odds of receiving a potentially inappropriate prescription by 25% (sex-stratified AOR = 0.75, 95% CI = 0.73–0.78), having a South Asian surname reduced those odds by 17% (sex-stratified AOR = 0.83, 95% CI = 0.79–0.87). Tests for interactions between sex and ethnicity

confirmed that being female significantly modified the effects of ethnicity.

Table 4 presents sex-stratified prevalence of exposure to leading types of drugs on the Beers list among community-dwelling British Columbians over age 65 in 2013. It also lists odd ratios of such exposures for women (compared with men) after adjusting for age, health status, polypharmacy, receipt of prescriptions from multiple doctors, income, marital status, ethnicity and neighbourhood urbanisation. (Results for the population residing in long-term care facilities are in the Supplementary data, Appendix, available in *Age and Ageing* online.) By far, the potentially inappropriate medications most frequently prescribed for older adult British Columbians were benzodiazepines and other non-benzodiazepine hypnotics (e.g. eszopiclone) for long-term use. A greater proportion of women (12.9%) than men (8.4%) were prescribed 90 or more days' worth of these medicines in 2013. Women had 55% greater adjusted odds of such long-term hypnotic use than men (AOR = 1.55, 95% CI = 1.52–1.58).

Prescriptions for nifedipine matching the Beers criteria for being potentially inappropriate were the next most frequently prescribed drug type for older adult British Columbians in 2013. There were no sex differences in the

Table 2. Adjusted odds ratios for the likelihood of filling at least one potentially inappropriate prescription by community-dwelling British Columbians aged 65 and older, sex-stratified and pooled results

Variable	Women		Men		Women + men, no interactions		Women + men, with interactions	
	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI
Sex								
Men (ref.)	–		–		1.00		1.00	
Women	–		–		1.23	1.22–1.25	1.16	1.12–1.21
Age								
65–74 (ref.)	1.00		1.00		1.00		1.00	
75–84	0.94	0.92–0.95	0.99	0.97–1.01	0.96	0.94–0.97	0.99	0.97–1.01
85+	0.89	0.87–0.92	0.93	0.90–0.96	0.91	0.89–0.92	0.93	0.90–0.97
Sex and age interaction								
Women × 65–74 (ref.)	–		–		–		1.00	
Women × 75–84	–		–		–		0.95	0.92–0.97
Women × 85+	–		–		–		0.95	0.91–0.99
Health status								
0 Major ADGs (ref.)	1.00		1.00		1.00		1.00	
1 Major ADG	1.01	0.99–1.03	1.00	0.97–1.02	1.01	0.99–1.02	1.00	0.97–1.02
2–3 Major ADGs	1.07	1.04–1.09	1.03	1.00–1.06	1.05	1.03–1.07	1.03	1.01–1.06
4+ Major ADGs	1.32	1.27–1.38	1.26	1.21–1.31	1.29	1.26–1.33	1.27	1.22–1.32
Sex and health status interaction								
Women × 0 Major ADGs (ref.)	–		–		–		1.00	
Women × 1 Major ADG	–		–		–		1.01	0.98–1.05
Women × 2–3 Major ADGs	–		–		–		1.03	1.00–1.06
Women × 4+ Major ADGs	–		–		–		1.04	0.98–1.09
Polypharmacy								
5+ Drug classes	4.20	4.13–4.28	4.14	4.06–4.23	4.17	4.12–4.23	4.18	4.12–4.23
Number of providers								
5+ Providers	1.14	1.12–1.16	1.16	1.14–1.19	1.15	1.13–1.17	1.15	1.13–1.17

AOR, adjusted odds ratio, adjusted for all variables listed in Tables 2 and 3, combined. Values in bold are statistically significant at $P = 0.05$.

odds of receiving potentially inappropriate nifedipine prescriptions after adjusting for all other factors that influence such risks. The third most frequently prescribed Beers list drugs were tertiary (first generation) tricyclic antidepressants, prescriptions for which were filled by 4.0% of women and 1.9% of men. The adjusted odds that a woman would receive a potentially inappropriate prescription for tertiary tricyclic antidepressants were more than twice that of men (AOR = 2.18, 95% CI = 2.11–2.26).

Women were at greater crude and adjusted odds of using several other categories of potentially inappropriate medications than men. These included non-selective NSAIDs, muscle relaxants, first-generation antihistamines and nitrofurantoin. Similarly, women were less likely than men to fill prescriptions from several other categories of potentially inappropriate medications: these included long-duration sulfonyleureas, spironolactone, indomethacin, antiarrhythmic drugs and fast-acting insulin. Some Beers list drug categories were almost exclusively used by women (estrogens) and men (α -1 blockers and androgens) owing to sex-specific indications for their use.

Discussion

We found that 28% of older adult residents of British Columbia filled one or more potentially inappropriate

prescription in 2013. The crude prevalence of receiving potentially inappropriate prescriptions was higher among women than men (31 versus 26%). Women were at 16–23% greater odds of exposure to potentially inappropriate prescription drugs than men, even after adjusting for sex differences in clinical and socioeconomic factors associated with the use of potentially inappropriate medications. Much of this sex difference stemmed from women's increased odds of receiving potentially inappropriate prescriptions for benzodiazepines and other hypnotics, for tertiary tricyclic antidepressants and for non-selective NSAIDs.

The prevalence of potentially inappropriate prescription drug among older British Columbians is within the range of prevalence estimates for community-dwelling older adults in other countries, most of which fall between 20 and 30% [2, 6]. Our finding that women are at increased odds of receiving a potentially inappropriate prescription is consistent with some prior research [10, 12, 13, 28]. However, this finding is not unanimously supported in the literature [8]. For example, Bradley *et al.* [9] document that men are at increased odds of receiving a potentially inappropriate prescription in the UK. Other studies have found that women's increased odds of receiving a potentially inappropriate prescription is moderated when patient age, health status or income are taken into account [7, 10, 11].

That some results concerning sex differences have been sensitive to adjustments for age, health status and income

Table 3. Adjusted odds ratios for the likelihood of filling at least one potentially inappropriate prescription by community-dwelling British Columbians aged 65 and older, sex-stratified and pooled results

Variable	Women		Men		Women + men, no interactions		Women + men, with interactions	
	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI
Income quintile								
Lowest (ref.)	1.00		1.00		1.00		1.00	
Second	1.02	0.99–1.04	0.99	0.96–1.02	1.02	1.00–1.04	0.98	0.95–1.01
Third	1.00	0.97–1.03	0.94	0.91–0.97	0.98	0.96–1.00	0.92	0.90–0.95
Fourth	0.99	0.96–1.01	0.93	0.90–0.96	0.97	0.95–0.99	0.91	0.88–0.93
Fifth	1.02	0.99–1.05	0.88	0.85–0.91	0.95	0.93–0.97	0.86	0.83–0.88
Sex and income interaction								
Women × lowest (ref.)	–		–		–		1.00	
Women × second	–		–		–		1.05	1.01–1.09
Women × third	–		–		–		1.10	1.06–1.14
Women × fourth	–		–		–		1.11	1.07–1.15
Women × fifth	–		–		–		1.22	1.17–1.27
Relationship status								
Single (ref.)	1.00		1.00		1.00		1.00	
Marriage-like relationship	1.00	0.98–1.02	0.92	0.89–0.94	0.97	0.96–0.98	0.96	0.95–0.98
Ethnicity								
Other (ref.)	1.00		1.00		1.00		1.00	
Chinese	0.75	0.73–0.78	1.00	0.96–1.03	0.85	0.83–0.87	0.99	0.95–1.03
South Asian	0.83	0.79–0.87	0.95	0.91–1.00	0.89	0.86–0.92	0.95	0.90–0.99
Sex and ethnicity interaction								
Women × European and other (ref.)	–		–		–		1.00	
Women × Chinese	–		–		–		0.76	0.73–0.80
Women × South Asian	–		–		–		0.88	0.82–0.94
Neighbourhood urbanisation								
Metropolitan (ref.)	1.00		1.00		1.00		1.00	
Mixed urban/rural	1.12	1.10–1.14	1.08	1.05–1.10	1.10	1.08–1.11	1.10	1.08–1.11
Rural	1.13	1.09–1.17	1.13	1.09–1.17	1.13	1.10–1.16	1.13	1.11–1.16

AOR, adjusted odds ratio, adjusted for all variables listed in Tables 2 and 3, combined. Values in bold are statistically significant at $P = 0.05$.

suggest that the risk of potentially inappropriate medication use is shaped by both biological and social forces. Biological influences include direct effects of sex differences in the prevalence of conditions for which medications may be inappropriately prescribed. There may also be indirect biological influences, such as if sex differences in health status result in different patterns of health services use, including the number of care providers, that, in turn, increase the risk of potentially inappropriate care—as has been demonstrated with risks of polypharmacy [27, 29, 30]. Sex differences in the risks of potentially inappropriate medication use may also result from social forces, including social dimensions of gender, such as how health professionals differentially diagnose and treat women and men who present with similar conditions [31–36]. Finally, sex differences in risk may result from the intersection between sex, gender and other socioeconomic influences on health and health care, including income and ethnicity, both of which can shape patient expectations and relationships between patients and providers [26].

For older residents of British Columbia, we found evidence of direct biological influences on sex differences in risk of potentially inappropriate medication use: age and health status both contributed to risks in ways that explain, in part, crude sex differences in the prevalence of exposure. Similarly, we found evidence of indirect biological influences

on sex differences: polypharmacy and having multiple prescribers contributed to risks in ways that help explain crude sex differences in the prevalence of potentially inappropriate medication use. All of these associations are consistent with findings of several other studies [1–7].

We also found socioeconomic factors associated with the risk of receiving potentially inappropriate prescriptions. Higher income was associated with lower odds of receiving a potentially inappropriate prescription among men but not women. This may be a result of an intersection between wealth, sex and power in relationships between patients and healthcare providers and/or between patients and social supports [26, 27]. Ethnicity also influenced women's likelihood of being exposed to a potentially inappropriate prescription, but did not do so for men. This finding is also consistent with other findings, particularly those concerning ethnic variations in psychotropic drugs, the use of which may carry greater stigma for women of Asian ethnicity found to be at lower risk of exposure in our study [37, 38].

Study limitations

This study is not without limitations. There are several different criteria with which to assess appropriateness of prescribing; we selected the Beers criteria, because it is the most widely applied measure in the literature and has been used in

Table 4. Prevalence and adjusted sex differences in odds of filling at least one potentially inappropriate prescription, by drug types with >1% prevalence of use, community-dwelling British Columbians aged 65 and older, 2013

Drug class	Women		Men		Women + men		Adjusted odds ratio (women)	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	AOR	95% CI
Benzodiazepines and other hypnotics (>90 days)	38,829	12.9	21,657	8.4	60,486	10.8	1.55	1.52–1.58
Nifedipine	11,967	4.0	9,339	3.6	21,306	3.8	1.01	0.98–1.04
Tertiary tricyclic antidepressants	12,021	4.0	4,835	1.9	16,856	3.0	2.18	2.11–2.26
Long-duration sulfonylureas	6,664	2.2	9,015	3.5	15,679	2.8	0.56	0.54–0.58
Estrogens with or without progestins	14,744	4.9	33	0.0	14,777	2.6	–	–
Non-COX selective NSAIDs (>90 days)	7,590	2.5	5,386	2.1	12,976	2.3	1.20	1.15–1.24
Skeletal muscle relaxants	7,457	2.5	5,380	2.1	12,837	2.3	1.19	1.14–1.23
Indomethacin	2,580	0.9	8,231	3.2	10,811	1.9	0.25	0.24–0.27
Spirolactone	5,333	1.8	5,151	2.0	10,484	1.9	0.86	0.83–0.90
Antiarrhythmic drugs	3,815	1.3	4,281	1.7	8,096	1.4	0.87	0.83–0.91
Fast-acting insulin	3,228	1.1	4,434	1.7	7,662	1.4	0.64	0.61–0.67
First-generation antihistamines	4,261	1.4	3,173	1.2	7,434	1.3	1.10	1.04–1.15
Anti-infective	5,649	1.9	1,323	0.5	6,972	1.2	3.87	3.63–4.12
Alpha 1 blockers	898	0.3	4,965	1.9	5,863	1.0	–	–
Androgens	164	0.1	4,252	1.6	4,416	0.8	–	–

AOR, adjusted odds ratio, adjusted for age, health status, polypharmacy, receipt of prescriptions from multiple doctors, income, marital status, ethnicity and neighbourhood urbanisation.

multiple jurisdictions [2, 5]. A recent review of methods for measuring the prevalence of potentially inappropriate medication use found women at higher risk of exposure across methods even though prevalence rates differed [28]. Furthermore, the drugs accounting for much of the sex difference observed in our study are found in most (NSAIDs) or all (benzodiazepines, tertiary tricyclic antidepressants) of the major lists of potentially inappropriateness prescriptions for older populations [17, 39–42]. As such, it is unlikely that the nature of sex differences identified in this study would differ using alternative criteria.

The linked administrative data that we use contained information needed to adjust for the explicit dose, duration and medical diagnoses that designate inappropriate use of Beers drugs; the lack of such details has been a criticism of prior studies using the Beers criteria [5]. Nevertheless, we were unable to review the full clinical data (including lab values) that would be attainable through a chart audit or analysis of electronic medical records. As such, we may have over-adjusted for some of the Beers criteria.

Our measure of potentially inappropriate prescribing is based on prescription dispensations. While dispensation of prescribed drugs is not equivalent to consumption of the medicines, it is likely that most patients who invest the time and out-of-pocket costs necessary to have prescriptions filled do so with intent to consume them. Moreover, as some prescriptions will be written but not filled by patients, this measure is arguably an understatement of the extent of potentially inappropriate prescribing in British Columbia.

Conclusion

There are significant sex differences in older adults' risk of receiving a potentially inappropriate prescription in British Columbia, even after adjusting for clinical and socioeconomic

factors that might influence sex difference. Sociodemographic disparities in access to potentially beneficial care might, in some cases, be justifiable on the grounds of differences in patient preferences for specific treatment options, including patient beliefs about the role of medications in their treatment. However, it would be difficult to justify such differences in risk of exposure to potentially inappropriate prescriptions based on patient beliefs or preferences, because no group should be exposed to a higher level of risk when lower risk alternatives exist.

Findings of this study—including sex differences in the effects of income, ethnicity and marriage—suggest that the elevated risks that women face are a result of complex intersections between biological and social constructs. Appropriate responses will therefore need to be both nuanced and fundamental. There is the obvious, fundamental need to invest in the dissemination of information and tools to assist with de-prescribing of potentially inappropriate medications. Such tools need to be targeted to and appropriate for both prescribers and patients. There is also a more nuanced need to study and invest in processes to address how gender—on its own and interacting with age, wealth and ethnicity—affect the norms of and relationships between prescribers and patients.

Key points

- The odds of receiving potentially inappropriate prescriptions is higher among women, even after adjusting for confounding.
- Women receive inappropriate prescriptions for benzodiazepines, tricyclic antidepressants and NSAIDs more frequently than men.
- Approaches to address inappropriate prescribing must include changes in norms and expectations of both prescribers and patients.

Authors' contributions

S.G.M. is responsible for study concept and design, acquisition of data, interpretation of results and preparation of manuscript. D.W. and B.P. assisted with study design, analysis of data, interpretation of results and editing of manuscript for important intellectual content. K.S., E.J.G., C.R. and B.M. assisted with study design, interpretation of results and editing of manuscript for important intellectual content.

Supplementary data

Supplementary data mentioned in the text are available to subscribers in *Age and Ageing* online.

Conflicts of interest

None declared.

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