MEDICINEINSIGHT SHORT REPORT

A snapshot of anticholinergic and sedative medicine burden MedicineInsight patients

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ABSTRACT

Background: Medicines with anticholinergic and sedative effects are associated with poorer clinical outcomes in older adults. The risk increases with increasing anticholinergic and sedative exposure. The Drug Burden Index (DBI) measures total exposure to anticholinergic and sedative medicines. In a large population of community dwelling individuals, this study 1) described exposure to anticholinergic and sedative medicines, and sociodemographic and clinical characteristics according to the degree of burden within general practice; and 2) explored the relationship between DBI score and provision of medicine reviews.

Methods: Retrospective, de-identified prescription data from 434 Australian general practice sites and 502,545 community-dwelling patients aged ≥ 65 years was collected in April 2022. Patients were categorised by DBI score as low risk (score of 0), moderate risk (score between 0 and 1) or high risk (score ≥ 1) of experiencing anticholinergic or sedative effects. The most commonly prescribed anticholinergic and sedative medicines were identified and the prevalence of health assessments and formal medicine reviews explored according to DBI score.

Results: Among 502,545 eligible patients, 7.5% had a DBI ≥ 1, indicating a high anticholinergic and/or sedative burden and 19.1% had a moderate burden (DBI score between 0 and 1). Female patients, patients aged ≥ 75 years and patients from socioeconomically disadvantaged areas were more likely to have a higher DBI score. The prevalence of relevant comorbidities, including depression, sleep problems, anxiety, Parkinson's disease, epilepsy and chronic pain generally increased as the DBI score increased. Patients with a higher DBI score were more likely to have a record of a recent fall. Almost 20% of patients with a high DBI had no record of a recent health assessment in the prior year and only 3.4% had a formal medicines review in the previous 12 months.

Conclusions: Over a quarter of general practice patients aged 65 years or older had a moderate or high anticholinergic and/or sedative burden. While most patients with a high DBI had a record of a health assessment, very few had a record of a formal medicines review in the past year, suggesting there could be benefit in interventions that prompt GPs to request these reviews to reduce patient risk.

INTRODUCTION

Older people are more likely to be prescribed multiple medicines, some of which may have anticholinergic and sedative effects (examples include antipsychotics, medicines for urinary incontinence, tricyclic antidepressants) that contribute to cumulative anticholinergic and sedative burden, potentially causing harm. Anticholinergic and sedative burden has been associated with increased risk of cognitive decline, delirium, dementia, falls, fractures and death.[1-5]

Use of anticholinergic and sedative medicines, which impair physical and cognitive function in older adults, is relatively common in Australia, especially in the older population. Approximately 21% of Australian men aged 70 years or older living in the community in 2007 were taking medicines with anticholinergic or sedative effects.[6] Similarly, a high proportion of older Australian women have a significant anticholinergic burden, largely driven by the cumulative anticholinergic effect from use of multiple medicines.[7] Newly registered Australian GPs prescribed an anticholinergic medicine in approximately 10% of their consultations with patients aged 65 years or older.[8]

The Drug Burden Index (DBI) is a measure of an individual's cumulative exposure to anticholinergic and sedative medicines.[9,10] It is calculated by summing the burdens from every medicine with clinically relevant anticholinergic or sedative effects, considering daily dose taken and the minimum recommended daily dose, according to the published equation.[9]

Recent studies using DBI as a measure of anticholinergic and sedative burden in older adults have shown a substantial level of exposure and associations with higher levels of hospitalisations, falls and mortality,[4,11] but there is limited information on how this correlates with the provision of medicines reviews. In 2014, only 7.4% of Australian patients using DBI-contributing medicines had received a medicines review.[12]

Using more recent data collected from the electronic health records (EHRs) of general practices, the aim of this study was to 1) describe exposure to anticholinergic and sedative medicines, and sociodemographic and clinical characteristics according to the degree of burden of community-dwelling older adults within the general practice setting; and 2) explore the relationship between DBI score and provision of medication reviews.

METHODS

Study design and data source

A cross-sectional study was conducted, using Australian general practice EHR data from MedicineInsight from February 2019 to March 2022. Data recorded outside this study period was used to collect information on patient demographics and patient medical history (i.e. previously diagnosed chronic conditions).

MedicineInsight has been described in detail elsewhere.[13] It is a national general practice data program managed by NPS MedicineWise with funding support from the Australian Government Department of Health and Aged Care. MedicineInsight extracts and collates longitudinal, de-identified patient health records from clinical information systems (CIS; 'Best Practice' or 'MedicalDirector') of participating practices. The data includes patient demographics, encounters, diagnoses, prescriptions and pathology tests. Progress notes, recorded by providers in the unstructured area of the medical record, are not collected because they may contain identifiable information.[13] The sociodemographic characteristics of MedicineInsight patients are broadly comparable to the national patient population who visited a GP at least once during a year.[14]

Baseline study population and RA cohort

MedicineInsight is an open cohort meaning patients and practices can leave or join over time. In addition, Australian patients are not registered with a single practice and can visit multiple general practices. To improve data quality and completeness we restricted the study population to regularly attending patients as described below.

Only MedicineInsight practices meeting standard data quality criteria (described elsewhere) were included.[13] Patients with valid, non-missing data for age and sex, who were 65 years or older and who had visited the general practice site at least three times (Royal Australian College of General Practitioners [RACGP] definition of 'active' patients [15]) between February 2019 and March 2022 were eligible for inclusion. Patients also had to have at least 1 clinical encounter in 2019, to ensure that they were not patients newly entering the practice and there was sufficient patient history to identify patients with a new diagnosis of RA.

Patients identified as living within a residential aged care facility (RACF) were excluded because they may have their medicines recorded in two different places – at the RACF or at the general practice – and complete capture of medicines was not certain.

Patient age was calculated at 1 July 2020 based on the patient's year of birth. Patient postcode was used to assign socioeconomic status using the Australian Bureau of Statistics (ABS) Index of Relative Socioeconomic Advantage and Disadvantage [IRSAD].[16] Patients were stratified by IRSAD quintiles (1 to 5, most disadvantaged to most advantaged). Patient postcode was used to assign a remoteness category (based on the ABS Australian Statistical Geography Standard [ASGS]).[17] Categories include major city, inner regional, outer regional, remote and very remote. Because of low numbers of patients, the very remote category was combined with the remote category.

Medicine exposure

DBI was calculated using MedicineInsight prescription data for each eligible patient using the formula as applied to the Australian setting in Gnjidic et al.[6] Each medicine ingredient with anticholinergic and sedative properties has a DBI score between zero and one, depending on dose taken by the patient. The patient's cumulative DBI score is the sum of DBI scores for each

anticholinergic and sedative medicine that they take. For the purposes of this research a cumulative DBI score of 0 was considered to indicate a patient as being at low risk, a score between 0 and 1 to be moderate risk and a score of 1 or more was considered to be high risk of experiencing functional impairment from medicines with anticholinergic or sedative effects. Medicines were categorised using Anatomical Therapeutic Chemical (ATC) codes or, if an ATC code was missing, the name of the active ingredient of the medicine.

To be included in the DBI calculations, medicines had to be listed as current medicines in the EHR, not be recorded as having been ceased or deleted and have been prescribed in the 7-month period up to and including the day upon which the data was extracted and collated from participating MedicineInsight practices. Medicines delivered as an injection and which did not have a frequency of administration were excluded from the calculation, with the exception of depot injection formulations for chronic psychosis. When medicines had variable dosing instructions, the highest possible dose was used in the calculation. 'As needed' or 'pro ne rata' (PRN) medicines were only included if they had been prescribed in the 90-days prior to the date of download. For PRN medicines with variable dosing instructions, the maximum daily dose was used to calculate the DBI. If all of the information on strength, dose or frequency was not available, the population median daily dose for the active ingredient was used. Topical formulations, except nasal sprays or transdermal patches, were excluded.

Diagnosed conditions

Patients were defined as having RA if they had a relevant coded (Docle, Pyefinch) or free text entry in one of the three diagnosis fields – diagnosis, reason for encounter or reason for prescription – recorded at any time from the patient's earliest record up to the end of 2021 (Table 1). Patients newly diagnosed with RA were patients whose first recorded diagnosis of RA fell within the two-year study period and who had no record of RA prior to diagnosis (index date). Explorations of medicines use and medical testing around the time of diagnosis were undertaken by looking at the period 90 days before the index date and 90 days after the index date.

Patients were identified as having medical conditions using MedicineInsight 'condition flags'. These flags use an algorithm that looks at relevant coded (Docle, Pyefinch) or free text entries in at least one of the three diagnosis fields – diagnosis, reason for encounter or reason for prescription. These can be recorded at any time from the patient's earliest record up to the download date (ie, ever recorded in the medical history). The definitions for each of the study flags used in this study are included in Table 1. To assess the burden of comorbidities, the Charlson Comorbidity Index (CCI)[18] was calculated for each patient with a higher score indicating a greater comorbidity burden.

TABLE 1: CLINICAL DEFINITIONS USED TO IDENTIFY MEDICINEINSIGHT PATIENTS

Condition	Terms used to identify condition
Anxiety	Terms include: adjustment disorder with anxiety, adjustment disorder with mixed anxiety and depressed mood, anxiety, anxiety (generalised or neurosis or phobia or PTSD or social), anxiety disorder, anxiety with panic attacks, anxiety/depression, depressive anxiety disorder, GAD, generalised anxiety disorder, mixed anxiety depression, nervous anxiety, neurotic anxiety, phobic anxiety disorder, social anxiety disorder, social phobia or substance induced anxiety disorder.

	Excludes (when recorded in isolation): anxiety feeling, adjustment disorder, (parental or performance or separation) anxiety, neurosis, OCD, PTSD, phobias or panic disorders
BPSD	Terms include: behavioural and psychological symptoms of dementia, BPSD
Chronic pain	Terms include: chronic pain, chronic pain syndrome, complex regional pain syndrome, CRPS, pain (chronic or intractable or referral or specialist or syndrome or team), pain clinic referral, pain syndrome - myofacial
Dementia	Terms include: alzh, alzheimer disease, binswanger (disease or encephalopathy), demen, dementia, (early onset or frontotemporal or korsakoff or Lewy-body or multi infarct or pick or semantic or subcortical or substance-induced or vascular or young onset) dementia, major neurocognitive disorder due to alzheimer disease, parkinson disease with lewy body dementia, psychosis (korsakoff or dementia related), senile dementia with psychosis, subcortical arteriosclerotic encephalopathy
Depression	Terms include: adjustment disorder with (depressed or anxious mood), anxiety/depression, depression, depression (endogenous or major or melancholic or minor or non melancholic or neurotic or organic or postnatal or psychotic or reactive or recurrent or subsyndromal), depression/anxiety, insomnia - depression-related, involutional melancholia, mixed anxiety depression
Epilepsy	Terms include: absence attacks, absences, acquired epileptic aphasia, complex partial seizures, Dravet syndrome, epilepsy, epilepsy (benign Rolandic or focal or generalised or grand mal or Jacksonian or juvenile myoclonic or petit mal or post-traumatic or polymorphic seizures or progressive myoclonic or psychomotor or temporal lobe or tonic clonic or treatment resistant), epileptic fit, fits, generalised (fits or seizures), generalized flexion epilepsy, (grand mal or Jacksonian or petit mal or psychomotor or tonic clonic) plus (fit or fits or seizures), infantile acquired aphasia, infantile (epileptic or myoclonic) encephalopathy, infantile spasms, jackknife convulsions, Janz syndrome, Lafora disease, Lafora progressive myoclonic epilepsy, Landau Kleffner syndrome, Merff syndrome, myoclonic epilepsy with ragged red fibers, opsoclonus myoclonus syndrome, partial complex seizures, petit mal, polymorphic epilepsy in infancy, polymyoclonia familial arrhythmic myoclonus, pyridoxine dependency syndrome, pyridoxine dependent (epilepsy or seizures), salaam spasms, spike and wave epilepsy, status (epilepsy or epilepticus), temporal lobe fits, vitamin b6 responsive epilepsy or west syndrome.
Falls	Terms include: fall, trip and fall, fall over, fall off chair, fall out of bed, fall from bed
GORD	Terms include: acid reflux, acid regurgitation, gastro-oesophageal reflux, gor, gord, heartburn, laryngopharyngeal reflux, non-erosive reflux disease, oesophageal reflux, reflux laringitis, reflux oesophagitis
Hypertension	Terms include: antihypertensive agent prescription, (blood pressure or bp) and (labile or review or unstable), hbp, high blood pressure, ht, hypertension, hypertension (controlled or diastolic or essential or isolated systolic or labile or life style management or malignant or pregnancy or primary or renal or renovascular or review or unstable), pih, pregnancy induced hypertension or severe refractory hypertension
Insomnia/sleep problems	Terms include: difficulty sleeping, insomnia, poor sleep, sleep (disturbance or difficulty).

Neuropathic pain	Terms include: brachial neuralgia, charcot's joint, frozen shoulder, neuralgia (glossopharyngeal or herpes zoster or occipital or trigeminal or post herpetic or pudendal or shingles), neuropathic or nerve (pain), sciatica
Parkinson disease	Terms include: Benign tremulous parkinsonism, Drug induced parkinsonism, Festinating gait, Neuroleptic induced parkinsonism, Paralysis agitans gait, Parkinsonian gait, Parkinsonism, Parkinsonism - drug-induced, Parkinsonism - post encephalitic, Parkinsonism – pseudo, Parkinsonism, benign tremulous, Parkinsonism, drug induced, Parkinsonism, neuroleptic induced, Parkinsonism, post encephalitic, Parkinsonism, pseudo, Parkinson's disease, Parkinson's disease - Lewy body dementia, Post encephalitic Parkinsonism, Post encephalitic Parkinson's disease, Pseudo parkinsonism
Urinary incontinence	Terms include: bedwetting, enuresis, (urine or urinary) incontinence, incontinent of urine.

Identification of health checks

The Australian government subsidises health care services provided to citizens under the Medical Benefits Schedule (MBS). These include a number of formal health assessments for patient with chronic illnesses or complex care needs which are undertaken by the GP alone or as part of a larger team of health professionals. The MBS also subsidises GP participation in formal medication reviews, known as a Domiciliary Medication Management Review or Home Medicines Review, once a year for patients living in the community with a chronic medical condition or a complex medication regimen. Patients were identified as having been provided one of these services in the previous 12 months if a relevant MBS item code was recorded in billing section or in one of the three diagnosis fields of the EHR (Table 2).

TABLE 2: TERMS USED TO IDENTIFY HEALTH CHECKS

Class	Identifers
GP Management Plan (GPMP) or Team Care Arrangement (TCA)	MBS item codes: 229, 230, 233,721, 723, 729, 731, 732, 92024, 92025, 92026, 92027, 92028, 92055, 92056, 92057, 92059, 92068, 92069, 92070, 92071, 92072, 92099, 92103, and 92100 AND/OR a relevant condition term in diagnosis, reason for contact/visit or reason for prescription fields
Other health check	MBS item codes: 701, 703, 705, 707, 224, 225, 226, 227, 228, 231, 232, 233, 92011, 92023, 92058, 92101, 92102, UP01, UP02, UP03, UP04 or MBS Aboriginal and Torres Strait Islander MBS item code 715, 92004 or 92016 AND/OR a relevant condition term in diagnosis, reason for contact/visit or reason for prescription fields
Home medicines review	MBS item code: 900 AND/OR a relevant condition term in diagnosis, reason for contact/visit or reason for prescription fields

Statistical analysis

Analyses were conducted using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA). To indicate the reliability of the estimates of prevalence and proportion, 95% confidence intervals (CIs) were calculated using robust errors to adjust for clustering by practice site. Non-overlap of 95% CIs and p-value <0.05 were used to indicate statistical significance where appropriate.

Ethics approval

Approval to conduct this study was granted on 22 October 2021 by the MedicineInsight Independent Data Governance Committee (2021–018). The Royal Australian College of General Practitioners (RACGP) National Research and Evaluation Ethics Committee (NREEC) granted ethics approval for the study on 1 March 2022 (NREEC 21-123).

RESULTS

There were 502,545 patients from 434 Australian general practice sites who met eligibility criteria for this study (Table 3). Of these, 7.5% had a high degree of anticholinergic and sedative burden (DBI score of 1 or more) and 19.1% had moderate degree of anticholinergic and sedative burden (DBI score between 0 and 1). The DBI was not able to be calculated for 3.9% of patients. Subsequent data analyses were undertaken using the low, moderate and high DBI categories.

TABLE 3: DEGREE OF ANTICHOLINERGIC AND SEDATIVE BURDEN AMONG COMMUNITY DWELLING REGULAR PATIENTS AGED 65+ YEARS AS CALCULATED BY THE DRUG BURDEN INDEX (DBI)

Characteristic	n	% (95% CI)
DBI = 0	349,280	69.5 (68.7, 70.3)
0 < DBI < 1	95,880	19.1 (18.5, 19.6)
DBI ≥ 1	37,636	7.5 (7.2, 7.8)
Not available	19,749	3.9 (3.6, 4.3)
Total	**502,545**	**100**

Female patients had significantly higher prevalence of high DBI than males – 9.1% of all female patients had a DBI ≥ 1 compared to 6.3% of male patients (Table 4). A significantly greater proportion of patients aged 75 years or older had a DBI ≥ 1 than among patients aged 65–69 or 70–74 years. Anticholinergic and sedative burden did not appear to vary by remoteness but patients in the Northern Territory were significantly less likely to have a high DBI score than patients in other states or territories. There was a linear correlation between increasing degrees of disadvantage and increasing prevalence of a high DBI.

Patients with a moderate or high DBI had more comorbidities, indicated by higher mean CCI scores. The mean CCI score for patients with a low DBI was 1.93 (95% CI 1.92–1.94) compared with 2.19 (95% CI 2.17–2.20) for patients with moderate DBI and 2.39 (95% CI 2.37–2.41) for patients with high DBI.

TABLE 4: SOCIODEMOGRAPHIC CHARACTEISTICS OF COMMUNITY DWELLING REGULAR PATIENTS AGED 65+ YEARS (N=482,796) BY DRUG BURDEN INDEX (DBI) SUBGROUP

Characteristic	Low (DBI=0)		Moderate (0<DBI<1)		High (DBI≥1)	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Gender						
Male	170,990	76.5 (75.7, 77.2)	38,551	17.2 (16.7, 17.8)	14,083	6.3 (6.0, 6.6)
Female	178,290	68.8 (67.9, 69.7)	57,329	22.1 (21.5, 22.7)	23,553	9.1 (8.7, 9.5)
Age (years)						
65–69	105,371	76.2 (75.5, 77.0)	23,491	17.0 (16.5, 17.5)	9376	6.8 (6.5, 7.1)
70–74	94,951	74.1 (73.3, 74.9)	23,747	18.5 (18.0, 19.0)	9506	7.4 (7.1, 7.8)
75–79	67,999	70.7 (69.7, 71.6)	20,091	20.9 (20.2, 21.5)	8157	8.5 (8.1, 8.9)
80–84	48,593	67.6 (66.6, 68.6)	16,837	23.4 (22.7, 24.1)	6466	9.0 (8.6, 9.4)
85+	32,366	67.1 (66.0, 68.3)	11,714	24.3 (23.5, 25.1)	4131	8.6 (8.1, 9.0)
Remoteness						
Major city	198,873	73.2 (72.1, 74.2)	52,564	19.3 (18.7, 20.0)	20,433	7.5 (7.1, 7.9)
Inner regional	101,361	70.9 (69.4, 72.5)	29,689	20.8 (19.7, 21.8)	11,883	8.3 (7.7, 8.9)
Outer regional	44,424	71.8 (70.0, 73.5)	12,545	20.3 (19.1, 21.4)	4942	8.0 (7.3, 8.7)
Remote/very remote	3193	75.2 (71.7, 78.6)	775	18.2 (15.8, 20.6)	280	6.6 (5.1, 8.1)
Missing	1429	-	307	-	98	-
State						
Australian Capital Territory	7883	75.7 (73.6, 77.9)	1815	17.4 (16.3, 18.6)	712	6.8 (5.7, 8.0)
New South Wales	127,142	72.4 (71.1, 73.8)	35,328	20.1 (19.2, 21.0)	13,104	7.5 (6.9, 8.0)
Northern Territory	3453	83.1 (78.6, 87.5)	554	13.3 (9.4, 17.2)	147	3.6 (3.0, 4.2)
Queensland	69,181	72.7 (71.1, 74.3)	18,392	19.3 (18.3, 20.3)	7570	8.0 (7.3, 8.6)
South Australia	10,713	69.5 (65.9, 73.2)	3378	21.9 (20.0, 23.9)	1317	8.5 (6.7, 10.4)
Tasmania	27,103	69.9 (67.3, 72.5)	8331	21.5 (19.5, 23.4)	3355	8.6 (7.8, 9.5)
Victoria	39,810	72.0 (69.9, 74.0)	19,276	19.9 (18.6, 21.1)	7932	8.2 (7.3, 9.0)
Western Australia	33,995	73.4 (71.4, 75.4)	8806	19.0 (17.8, 20.2)	3497	7.6 (6.7, 8.4)
Socioeconomic status						
Most disadvantage (1)	64,599	69.8 (68.0, 71.6)	19,551	21.1 (20.0, 22.2)	8409	9.1 (8.3, 9.9)
2	67,783	70.7 (69.5, 72.0)	19,987	20.9 (20.0, 21.8)	8045	8.4 (7.9, 8.9)
3	72,299	71.6 (70.3, 72.9)	20,514	20.3 (19.5, 21.2)	8152	8.1 (7.5, 8.6)
4	61,166	73.3 (72.2, 74.4)	16,097	19.3 (18.6, 20.0)	6195	7.4 (6.9, 7.9)
Least disadvantage (5)	82,013	75.8 (74.6, 77.0)	19,426	18.0 (17.2, 18.8)	6737	6.2 (5.8, 6.7)
Missing	1420	-	305	-	98	-

The prevalence of a history of a condition generally increased as anticholinergic and sedative burden increased (Table 5). Just over 10% of patients with a DBI = 0 had a history of depression compared with 53.5% in patients with a DBI ≥ 1. The prevalence of a history of anxiety disorder and sleep problems was approximately 4 times higher in patients with a DBI ≥ 1 compared to those with a DBI = 0.

TABLE 5: PREVALENCE OF CLINICAL CONDITIONS EVER RECORDED IN REGULAR PATIENTS AGED 65+ (N=482,796) BY DRUG BURDEN INDEX (DBI) SUBGROUP

	Low (DBI=0)		Moderate (0<DBI<1)		High (DBI≥1)	
Condition	**Number**	**(%; 95% CI)**	**Number**	**(%; 95% CI)**	**Number**	**(%; 95% CI)**
All patients	349,280	-	95,880	-	37,636	-
Hypertension	177,120	50.7 (49.5, 51.9)	63,263	66.0 (65.2, 66.8)	25,428	67.6 (66.6, 68.5)
Gastro-oesophageal reflux disease	98,130	28.1 (27.2, 28.9)	44,006	45.9 (44.9, 46.9)	20,412	54.2 (53.0, 55.5)
Depression	37,494	10.7 (10.3, 11.2)	34,686	36.2 (35.4, 37.0)	20,151	53.5 (52.4, 54.7)
Insomnia/sleep problems	33,176	9.5 (9.0, 10.0)	24,228	25.3 (24.3, 26.3)	14,315	38.0 (36.5, 39.6)
Anxiety disorder	33,383	9.6 (9.1, 10.0)	26,077	27.2 (26.3, 28.0)	14,166	37.6 (36.5, 38.8)
Neuropathic pain	45,126	12.9 (12.3, 13.5)	25,582	26.7 (25.9, 27.5)	13,942	37.0 (35.9, 38.2)
Chronic pain	13,469	3.9 (3.6, 4.1)	9910	10.3 (9.7, 11.0)	8951	23.8 (22.6, 25.0)
Urinary incontinence	11,547	3.3 (3.1, 3.5)	7308	7.6 (7.3, 8.0)	4184	11.1 (10.6, 11.7)
Parkinson disease	1885	0.5 (0.5, 0.6)	1528	1.6 (1.5, 1.7)	2087	5.5 (5.3, 5.8)
Epilepsy	1633	0.5 (0.4, 0.5)	1830	1.9 (1.8, 2.0)	1497	4.0 (3.8, 4.2)
Dementia	4722	1.4 (1.3, 1.4)	2316	2.4 (2.3, 2.6)	1117	3.0 (2.8, 3.2)
BPSD	281	0.1 (0.1, 0.1)	178	0.2 (0.1, 0.2)	122	0.3 (0.2, 0.4)

BPSD: behavioural & psychological symptoms of dementia

The conditions that were most likely to have been recorded as having been managed by GPs within the previous 3 months, among patients with a high anticholinergic and sedative burden, were depression, chronic pain and anxiety disorder (Table 6). There were 2520 patients with a record of a fall in the previous 3 months and the likelihood of a fall having been recorded increased with DBI.

TABLE 6: PREVALENCE OF RECENT CLINICAL CONDITIONS (RECORDED WITHIN THE PREVIOUS 3 MONTHS) IN REGULAR PATIENTS AGED 65+ (N=482,796) BY DRUG BURDEN INDEX (DBI) SUBGROUP

	Low (DBI=0)		Moderate (0<DBI<1)		High (DBI≥1)	
Condition	**Number**	**(%; 95% CI)**	**Number**	**(%; 95% CI)**	**Number**	**(%; 95% CI)**
Depression	621	0.2 (0.2, 0.2)	2651	2.8 (2.5, 3.0)	1975	5.2 (4.8, 5.7)
Chronic pain	427	0.1 (0.1, 0.1)	1032	1.1 (1.0, 1.2)	1671	4.4 (4.0, 4.9)
Anxiety disorder	836	0.2 (0.2, 0.3)	2215	2.3 (2.1, 2.5)	1624	4.3 (3.9, 4.7)
Neuropathic pain	961	0.3 (0.3, 0.3)	2170	2.3 (2.1, 2.4)	1378	3.7 (3.4, 3.9)
Insomnia/sleep problems	508	0.1 (0.1, 0.2)	1992	2.1 (1.9, 2.3)	1382	3.7 (3.3, 4.0)
Falls	1110	0.3 (0.3, 0.4)	841	0.9 (0.8, 1.0)	569	1.5 (1.3, 1.7)
Urinary incontinence	312	0.1 (0.1, 0.1)	364	0.4 (0.3, 0.4)	208	0.6 (0.5, 0.6)
BPSD	15	0.0 (0.0, 0.0)	41	0.0 (0.0, 0.1)	21	0.1 (0.0, 0.1)

BPSD: behavioural & psychological symptoms of dementia

The conditions with the highest prevalence of high anticholinergic and sedative exposure (DBI≥1) were Parkinson's disease, epilepsy, chronic pain, depression and behavioural and psychological symptoms of dementia (BPSD). Among the 5500 patients diagnosed with Parkinson disease, approximately one third were in each of the low, moderate and high DBI exposure groups (Table 7). Approximately 20% of patients with depression, anxiety disorder, sleep problems and urinary incontinence fell into the high DBI category.

TABLE 7: PREVALENCE OF LOW, MODERATE AND HIGH DBI IN REGULAR PATIENTS AGED 65+ WITH A HISTORY OF CONDITIONS LIKELY TO BE INDICATIONS FOR ANTICHOLINERGIC AND SEDATIVE MEDICINES AND OTHER COMMON CONDITIONS

		Low (DBI=0)	Moderate	High (DBI≥1)
	N	**% (95% CI)**	**% (95% CI)**	**% (95% CI)**
Parkinson disease	5500	34.3 (32.4, 36.1)	27.8 (26.5, 29.0)	37.9 (36.3, 39.6)
Epilepsy	4960	32.9 (31.3, 34.6)	36.9 (35.6, 38.2)	30.2 (28.7, 31.7)
Chronic pain	32,330	41.7 (40.0, 43.3)	30.7 (29.8, 31.5)	27.7 (26.5, 28.9)
Depression	92,331	40.6 (39.4, 41.8)	37.6 (36.8, 38.3)	21.8 (21.1, 22.5)
BPSD	581	48.4 (43.2, 53.5)	30.6 (26.2, 35.0)	21.0 (17.2, 24.8)
Insomnia/sleep problems	71,719	46.3 (45.0, 47.5)	33.8 (33.0, 34.6)	20.0 (19.2, 20.7)
Anxiety disorder	73,626	45.3 (44.2, 46.5)	35.4 (34.7, 36.1)	19.2 (18.6, 19.9)
Urinary incontinence	23,039	50.1 (49.0, 51.2)	31.7 (31.0, 32.5)	18.2 (17.5, 18.9)
Neuropathic pain	84,650	53.3 (52.4, 54.2)	30.2 (29.7, 30.7)	16.5 (15.9, 17.1)
Dementia	8155	57.9 (56.0, 59.8)	28.4 (27.1, 29.7)	13.7 (12.6, 14.7)
Gastro-oesophageal reflux disease	162,548	60.4 (59.5, 61.3)	27.1 (26.5, 27.6)	12.6 (12.1, 13.0)
Hypertension	265,811	66.6 (65.8, 67.5)	23.8 (23.3, 24.3)	9.6 (9.2, 9.9)

BPSD: behavioural & psychological symptoms of dementia

The medicines contributing to high anticholinergic and sedative burden were most commonly antidepressants, benzodiazepines or medicines used in the management of pain (pregabalin or opioids; Table 8).

TABLE 8: 20 MOST COMMONLY PRESCRIBED CURRENT MEDICINES BY ACTIVE INGREDIENT AMONG PATIENTS STRATIFIED BY MODERATE AND HIGH DBI SUBGROUPS

	Patients with moderate DBI (n=95,880)		Patients with high DBI (n=37,636)	
1	amitriptyline	7122	paracetamol + codeine	2451
2	pregabalin	5713	temazepam	2025
3	sertraline	6021	pregabalin	1980
4	escitalopram	5933	mirtazapine	1797
5	temazepam	4696	buprenorphine	1771
6	paracetamol + codeine	4198	sertraline	1422
7	mirtazapine	4213	oxycodone + naloxone	1409
8	venlafaxine	3107	amitriptyline	1383
9	moxonidine	2993	escitalopram	1303
10	citalopram	3114	tramadol	1232
11	prazosin	2830	tapentadol	1034
12	oxycodone + naloxone	1777	melatonin	996
13	melatonin	2128	diazepam	965
14	buprenorphine	1321	oxycodone	959
15	tramadol	1701	venlafaxine	950
16	prochlorperazine	2028	moxonidine	779
17	duloxetine	1802	oxazepam	716
18	tapentadol	1285	prochlorperazine	701
19	desvenlafaxine	1692	duloxetine	671
20	diazepam	1230	pramipexole	568

The likelihood of a patient having received a formal health assessment in the 12 months prior to the download date increased with increasing anticholinergic and sedative burden (Table 9). While 33.8% of patients with a DBI = 0 had received a health assessment in the previous year, this increased to 59.5% among patients with a DBI ≥ 1. However, the proportion of patients with a record of a formal medicine review remained low regardless of DBI score – amongst the patients with a high DBI only 3.4% had a record of a formal medicine review in the previous 12 months.

TABLE 9: NUMBER AND PROPORTION OF PATIENTS WITH LOW, MODERATE AND HIGH DBI WHO HAVE RECEIVED A FORMAL HEALTH ASSESSMENT OR MEDICINES REVIEW IN THE PREVIOUS 12 MONTHS*

	Low (DBI=0)		Moderate		High (DBI≥1)	
	n	%	n	%	n	%
Formal health assessment	118,160	33.8	52,546	54.8	22,376	59.5
Formal medicines review	2134	0.6	1900	2.0	1273	3.4
Neither of the above	228,986	65.6	41,434	43.2	13,987	37.2

*Note that patients may have received both a formal health assessment and a formal medicines review within the year

DISCUSSION

Consistent with other studies[6,8,19], anticholinergic and sedative burden among Australian general practice patients was relatively high with 7.5% of all community-dwelling patients aged 65 or older having a high DBI and almost a fifth having a moderate DBI. The prevalence of a high anticholinergic and sedative burden was higher in women, patients aged 75 years or older and patients from more disadvantaged areas. While it appeared that patients from the Northern Territory were less likely to have a high DBI score, this may be due to differences in the age profile of the Northern Territory compared with other states or may be a chance finding related to the smaller number of Northern Territory patients in the dataset.

While regular review of prescribed medicines in older patients could reduce risk of adverse effects due to reducing anticholinergic and/or sedative burden[20-22] in Australian primary care, this study found that despite many patients having received a health assessment in the year prior, anticholinergic and sedative burden remained high. Formal medicines reviews, which are likely more focused on identifying patients with a high anticholinergic and sedative burden, were rarely recorded in the clinical record. It is possible that all formal medicines reviews may not have been picked up given identification relied partly on being able to identify MBS billing codes and approximately 5% of practices have billing software that is not compatible with the rest of the EHR from which data is extracted. However, the low figure suggests interventions to prompt GPs to request these reviews may offer an opportunity to reduce DBI exposure in older and at-risk patients, particularly among patients from more disadvantaged areas where burden was high. The low prevalence of formal medicines reviews in the previous year is comparable to the 4.7% prevalence over 5 years (2009–14) observed in the 45 and up Australian cohort study, which was slightly higher (7.4%) amongst participants with DBI>0.[12]

We did not investigate whether changes were made to medicines after health assessments or medicine reviews. This means we cannot determine whether anticholinergic and/or sedative burden did actually decrease after these assessments / reviews or whether the type of health assessments being undertaken reviewed high anticholinergic and sedative burden. Previous Australian studies have found that formal medicine reviews in primary care reduce DBI and potentially inappropriate prescribing.[20,22] However, the low levels of use seen in this study, and in other Australian studies,[23] suggests there is further work to be done to improve their uptake.

The medicines contributing to high anticholinergic and sedative burden were generally antidepressants, benzodiazepines or medicines used in the management of pain (pregabalin or opioids). Use of these medicines is not necessarily inappropriate, particularly given the high prevalence of anxiety, depression and pain recorded in patients with a high anticholinergic and sedative burden and seen in this study.

The study comprised a large sample of data from general practices across Australia, providing for the first time a national view of anticholinergic and sedative burden among community dwelling primary care patients. To our knowledge it is also the first time that DBI has been calculated automatically using data extracted from general practice EHRs. However, a limitation to the study, which is inherent in all studies using EHRs is that it is dependent upon the completeness and accuracy of recording in fields from which data can be extracted.[13] In particular, information about over-the-counter medicines and medicines prescribed by other prescribers (specialists, hospitals or GPs from practices not participating in MedicineInsight) may be missing. Many medicines that contribute to DBI are available over-the-counter and so this study may be underestimating the true anticholinergic and sedative burden among older patients.

Conclusions

More than a quarter of general practice patients aged 65 years or older were exposed to anticholinergic and/or sedative burden medicines. Burden was particularly high in patients with Parkinson disease, epilepsy and chronic pain. Patients with a higher DBI were more likely to have a record of a recent fall. While many patients had a record of a health assessment, few had a record of a formal medicines review. Only 3.4% of patients with a high DBI had a record of a formal medicines review in the previous 12 months. Further work to identify opportunities to increase the uptake of formal medicine reviews, particularly in older age groups and those likely to have a high DBI, is required to increase the likelihood that GPs to request these reviews for patients likely to benefit from them.

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