Anticholinergic and sedative medication burden in older adults: an observational analysis

Jehath Syed,[1,2] Prathibha Pereira,[3] Tejaswini C J,[3] Shilpa Avarebeel,[3] Kshama Ramesh,[3] Madhan Ramesh,[2] Krishna Undela,[4] Sri Harsha Chalasani[2]

[1]Department of Pharmaceutical Sciences, School of Health Sciences and Technology, Dr. Vishwanath Karad MIT World Peace University, Pune; [2]Department of Pharmacy Practice, JSS College of Pharmacy, JSS Academy of Higher Education and Research, Karnataka; [3]Department of Geriatrics, JSS Medical College and Hospital, JSS Academy of Higher Education and Research, Karnataka; [4]Department of Pharmacy Practice, National Institute of Pharmaceutical Education and Research Guwahati, India

Correspondence: Sri Harsha Chalasani, Department of Pharmacy Practice, JSS College of Pharmacy, JSS Academy of Higher Education and Research, Mysore-15, Karnataka, India.
E-mail: sriharshachalasani@jssuni.edu.in

Key words: anticholinergic agents, anticholinergic burden, drug burden index, older adults.

Contributions: CSH, JS, conceptualization; JS, CSH, investigation, data curation; CHS, PP, methodology, project administration; JS, writing-original draft; MR, TCJ, SA, KR, KU, Supervision, validation, writing - review and editing. All authors approved the final version of the manuscript.

Conflict of interest: the authors declare no potential conflict of interest.

Ethics approval and consent to participate: the study was approved by the Institutional Human Ethics Committee of JSS Medical College, Mysuru (Letter No.: JSSMC/ IEC/ 17112021/ 05NCT/ 2021-22).

Informed consent: participants gave written consent for anonymous clinical data collection.

Patient consent for publication: not applicable.

Availability of data and materials: all data generated or analyzed during this study are included in this article.

Funding: none.

Received: 25 July 2025.
Accepted: 22 October 2025.

Geriatric Care 2025; 11:14173
doi:10.4081/gc.2025.14173

Abstract

The cumulative effects of multiple medications with anticholinergic and sedative properties, referred to as anticholinergic and sedative burdens, can result in adverse effects in older adults. This study aimed to evaluate the exposure of older adult patients to anticholinergic and sedative medications. This cross-sectional study included older adult patients (aged ≥60 years) admitted to the geriatric inpatient wards. The anticholinergic burden was assessed using the CRIDECO scale, and the Drug Burden Index (DBI) quantified the cumulative anticholinergic and sedative burden. The data obtained were categorically assessed and are represented as [n (%)]. The associations between medication burden and health outcomes were analyzed using appropriate tests. The mean age of the participants in the study cohort was 72.80±7.41 years. Among the participants, 29.17% were administered at least one anticholinergic medication, with a mean cumulative Anticholinergic Cognitive Burden (ACB) score of 2.49±2.00. The majority (94.34%) had a cumulative DBI score of ≥1, with a mean DBI score of 3.14±1.55. Linear regression analysis demonstrated that both ACB and DBI were significant predictors of the length of hospitalization (ACB: p=0.002; DBI: p=0.001), whereas only DBI was associated with the Charlson Comorbidity Index (p=0.001). Logistic regression revealed that ACB scores significantly predicted cognitive decline (p=0.047). This study highlights the high prevalence of anticholinergic and sedative medication use among hospitalized older adult patients and its association with adverse health outcomes. Regular medication reviews and targeted deprescribing strategies are essential to reduce the medication burden in this vulnerable population.

Introduction

By 2030, it is estimated that 1 in 6 individuals worldwide will be aged ≥60 years.[1] Increasing age is associated with a greater prevalence of multimorbidity, resulting in a significant increase in polypharmacy among older adults, raising multiple concerns, such as drug interactions, increased treatment burden, adverse effects, and increased healthcare costs. Medications with anticholinergic or sedative properties are frequently prescribed to older adults for age-related conditions such as depression, bladder dysfunction, Parkinson's disease, and chronic obstructive pulmonary disease.[2,3] The prevalence estimates range from 13% to 42% for medications with sedative properties and 8% to 36% for medications with anticholinergic properties.[4]

Although these medications are necessary, they present considerable risks to older adults. Anticholinergic drugs can cause peripheral effects, such as dry mouth, blurred vision, constipation, and urinary retention,[5] as well as central effects, such as dizziness, confusion, reduced concentration, and delirium.[6] Sedative medications can negatively affect cognitive function, memory, psychomotor skills, and balance.[7] The intricate interplay between aging, multiple medications, and their potential adverse effects underscores the critical need for a comprehensive evaluation of the burden of anticholinergic and sedative drugs in older adults.

Several tools have been developed to quantify anticholinergic and sedative burdens in older adults. The CRIDECO Anticholinergic Load Scale, created by the Clinical Risk Decision Evaluation Committee, assesses the total anticholinergic burden of medications. The Drug Burden Index (DBI) measures the overall exposure to anticholinergic and sedative medications.[8,9] These tools have shown an association between higher scores and negative outcomes in older adults, including falls, functional impairment, cognitive decline, and mortality.

Our understanding of the burden of anticholinergic drugs in India is predominantly based on limited data from a few studies. However, few studies have compared these assessment tools in the Indian context. This study aimed to evaluate the exposure of older adult patients to anticholinergic and sedative medications in a tertiary care facility in southern India. The assessment utilized the CRIDECO Anticholinergic Load Scale and the DBI. Furthermore, this study sought to compile a comprehensive list of medications with significant anticholinergic and/or sedative effects (DBI medications) for older adults, along with their corresponding minimum recommended daily dosages.

Materials and Methods

Study design and setting

This cross-sectional study was conducted in the Department of Geriatrics at a tertiary care hospital between November 2021 and December 2022. The study protocol was reviewed and approved by the Institutional Human Ethics Committee (Letter No.: JSSMC/ IEC/ 17112021/ 05NCT/ 2021-22). Written informed consent was obtained from all the participants or their legally authorized representatives.

Study population

Older adult patients admitted to the inpatient geriatric wards during the 14-month study period were enrolled. Eligible participants included patients aged ≥60 years of any sex who were admitted to the inpatient wards for a minimum of 48 hours, had at least 1 chronic disease, and provided informed consent to participate in the study. Patients who were discharged within 24 hours of hospital admission or those admitted under medicolegal case status were excluded.

Measures

Assessment of medication burden

Anticholinergic burden assessment

The CRIDECO Anticholinergic Load Scale was used as the primary instrument to evaluate medication-related anticholinergic burden. This standardized scale encompasses 217 anticholinergic medications, representing an expansion of 129 additional drugs compared with the traditional Anticholinergic Cognitive Burden (ACB) scale. Each medication was assigned a score on a 3-point scale based on anticholinergic potency: score 1, mild anticholinergic activity; score 2, moderate anticholinergic activity; and score 3, strong anticholinergic activity. Medications not included in the scale were assigned a score of 0.

Drug Burden Index assessment

The DBI was used to quantify the cumulative anticholinergic and sedative burdens and was calculated using the following equation: $DBI=\Sigma\ (D/(D+\delta))$; where D is the daily dose administered and δ is the minimum licensed daily dose, utilized as an estimate of DR50 (daily dose required to achieve 50% of the maximal effect at steady state).

Health-related quality of life

Health-related quality of life (HRQoL) was measured using the EuroQol 5-Dimension 5-Level (EQ-5D-5L) questionnaire. The EQ-5D-5L is a concise, self-administered questionnaire that assesses an individual's current health status in five key dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each dimension was evaluated on three levels of functioning: no problems, some problems, and extreme problems, or an inability to perform the activity. This health state classification system represents the health state as vectors, with 11111 indicating optimal health and 33333 indicating the least favorable health state. Index value sets have been developed through population-based valuation studies to assign values to these health states. When these value sets are applied to the health state vectors, they yield preference-based index values. These index values generally range from less than 0 (considered worse health) to 1 (optimal health).[10]

Geriatric syndrome

Frailty was assessed *via* the 5-Item Frail Questionnaire (FRAIL scale), which comprises five components: fatigue, resistance, ambulation, illness, and weight loss. A score of 0 indicated robustness, 1-2 indicated pre-frailty, and 3-5 indicated frailty.[11]

Sarcopenia was evaluated using the SARC-F questionnaire, a rapid screening tool for sarcopenia risk. A score ≥4 indicates a risk of sarcopenia.[12]

Cognitive impairment was assessed using the Mini-Cog test, a brief cognitive screening tool comprising a three-item recall task and clock-drawing test. A score of 0-2 indicates a positive screen for cognitive impairment.[13]

Comorbidity burden

The Charlson Comorbidity Index (CCI) was used to evaluate the comorbidity burden, with higher scores indicating a greater burden.

Development of the list of Drug Burden Index medications

Medications with potential anticholinergic and/or sedative properties were identified as follows: i) examination of multiple drug records; ii) analysis of previously published studies; iii) evaluation of pharmacological profiles.

Medication use was classified as clinically significant if:

- anticholinergic effects: this compound exhibited blocking activity at muscarinic receptors and demonstrated a side effect profile consistent with anticholinergic effects reported in the literature;

- sedative effects: somnolence was listed as a common (>1/100 and <1/10 users) or very common (>1/10 users) adverse effect.

The minimum effective daily dose was determined through an independent review by two pharmacists. Any discrepancies in medication classification or minimum effective dosing were resolved through consensus discussions with a third senior pharmacist, when needed. The minimum effective daily dose for older adults was used when stated; otherwise, the minimum effective daily adult dose was used.

Statistical analysis

Participants' characteristics were summarized using descriptive statistics. Continuous variables are presented as mean ± standard deviation (SD), and categorical variables are expressed as percentages. Multiple regression analyses were conducted to investigate the relationship between anticholinergic burden and various health outcomes.

Linear regression analyses were performed to assess the associations between ACB and DBI and continuous outcome variables, including length of stay, CCI, and HRQoL scores. The relationships between ACB and DBI and the binary outcome variables, sarcopenia and cognitive decline, were evaluated using logistic regression analysis. Multinomial logistic regression was used to examine the association between ACB, DBI, and frailty status. All analyses were conducted using SPSS version 25 (IBM, Armonk, NY, USA), with statistical significance set at $p<0.05$.

Results

A total of 836 patients were reviewed during the study period. Of these, 597 (71.4%) met the study criteria and were included (Figure 1). Among the 597 patients, 336 (56.28%) were male and 261 (43.71%) were female. The mean age of the participants in the study cohort was 72.80±7.41 years, with a range of 60-99 years. Most of the participants were in the young-old age group of 60-74 years [347 (58.12%)].

Regarding the CCI, 332 (55.61%) patients had a moderate 12-month mortality rate, whereas 219 (36.68%) had a severe 12-month mortality rate. The majority of the cohort had a 10-year survival rate of 41-60% [181 (30.32%)]. The sociodemographic characteristics of the study population are shown in Table 1.

The mean (SD) EQ-5D-5L index value for the study population was 0.75 (0.26), with a median of 0.82 and a range of -0.38 - -1.00. *Supplementary Table 1* presents the frequencies and proportions of EQ-5D-5L responses reported by dimension and level.

Anticholinergic Cognitive Burden score

Among the total study population (n=597), 147 patients (29.17%) were administered at least one anticholinergic medication. The mean (SD) number of anticholinergic drugs per patient was 2.03 (1.49), with a median of 2 and a range of 0-8 drugs. The number of patients with a cumulative ACB score of 3 or above was 259 (51.39%). The mean (SD) cumulative ACB score was 2.49 (2.00), with a median of 2 and a range of 0-10.

Drug Burden Index

Among the total study population (n=597), 23 (3.95%) were administered at least one anticholinergic or sedative drug. The mean (SD) number of anticholinergic and sedative drugs per patient was 5.02 (2.30), with a median of 5 and a range of 1-15 drugs. The number of patients with a cumulative DBI score of ≥1 was 549 (94.34%). The mean (SD) cumulative DBI score was 3.14 (1.55), with a median of 2.99 and a range of 0.50-8.81.

The number of anticholinergic medications, cumulative cognitive burden scores, DBI medication counts, and cumulative DBI scores of the study population are shown in Table 2.

Pattern of anticholinergic drug use

Most anticholinergics prescribed during hospitalization belong to the class of drugs that act on the respiratory system (30.69%). Other frequently observed drug classes were those that act on the cardiovascular (28.80%) and nervous (19.14%) systems. The most frequently prescribed respiratory agents were ipratropium (n=274), levocetirizine (n=74), and dimenhydrinate (n=14). *Supplementary Table 2* shows the anticholinergic drugs prescribed during hospitalization. The anticholinergic potency of the prescribed medications is presented in *Supplementary Table 3.*

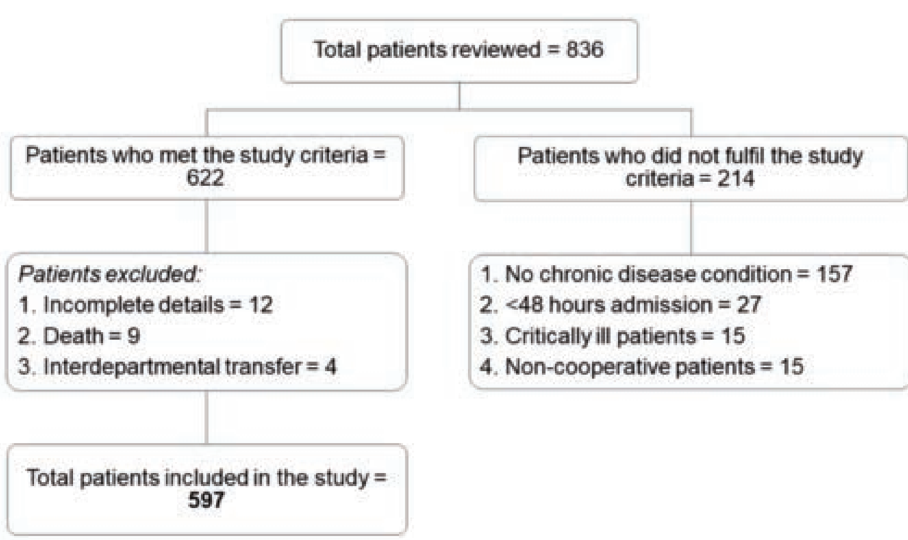

Figure 1. Inclusion-exclusion flow diagram.

Drugs contributing to the drug burden index

List of Drug Burden Index medications

This compilation encompassed 121 medications, comprising 42 with both anticholinergic and sedative effects, 17 with only anticholinergic effects, and 62 with sedative effects. A comprehensive list of DBI medications and their corresponding minimum effective daily doses is provided in *Supplementary Table 4*.

The majority of DBI medications prescribed during hospitalization were drugs that acted on the alimentary tract and metabolism (27.69%). Other frequently observed drug classes were those acting on the respiratory (24.79%) and cardiovascular (24.38%) systems. Among the alimentary tract and metabolism agents, the most frequently prescribed drugs were pantoprazole (n=481), ondansetron (n=163), and metformin (n=51). *Supplementary Table 5* shows the DBI medications prescribed during hospitalization.

Statistical analysis

Linear regression

Linear regression analyses demonstrated that both the ACB and DBI were significant predictors of length of hospitalization (ACB: B=0.230, p=0.002; DBI: B=0.307, p=0.001). However,

Table 1. Sociodemographic characteristics of the study population.

Characteristics		Distribution (%) (n=597)
Gender	Male	336 (56.28)
	Female	261 (43.72)
Age (In years)	Young-old (60 – 74)	347 (58.12)
	Middle-old (75 – 84)	201 (33.67)
	Oldest-old (≥ 85)	49 (8.21)
	Mean ± SD	72.80±7.41
Geriatric syndrome		
Frailty	Frail	354 (59.30)
	Prefrail	124 (20.77)
	Non-frail	119 (19.93)
Sarcopenia	Present	307 (51.42)
	Absent	290 (48.58)
Cognitive decline	Present	95 (15.91)
	Absent	502 (84.09)
Length of hospitalization(In days)	2-5	266 (44.56)
	6-10	251 (42.04)
	≥11	80 (13.40)
	Mean ± SD	6.79±3.57
Number of comorbidities	1-4	574 (96.15)
	≥5	23 (3.85)
	Mean ± SD	2.46±1.14
No. of Medications	1-4	11 (1.84)
	5-9	189 (31.66)
	≥10	397 (66.50)
	Mean ± SD	11.66±4.23
Polypharmacy	5-9	189 (31.66)
Hyperpolypharmacy	≥10	397 (66.50)
Charlson Score		
12-month mortality rate	Mild (1-2)	46 (7.71)
	Moderate (3-4)	332 (55.61)
	Severe (≥5)	219 (36.68)
10-year survival rate (%)	0-20	97 (16.25)
	21-40	122 (20.44)
	41-60	181 (30.32)
	61-80	152 (25.46)
	81-100	45 (7.54)
Health-related quality of life		
Index value range	<0	16 (2.68)
	0-0.2	21 (3.52)
	0.2-0.4	16 (2.68)
	0.4-0.6	59 (9.88)
	0.6-0.8	146 (24.46)
	0.8-1	339 (56.78)

SD, standard deviation.

only DBI was significantly associated with the CCI (B=0.126, p=0.001), while ACB was not (B=0.027, p=0.359). Neither ACB nor DBI was a significant predictor of HRQoL index values (ACB: B=-0.005, p=0.326; DBI: B=-0.010, p=0.147). Table 3 presents the linear regression results.

Logistic regression

Logistic regression analyses indicated that ACB scores significantly predicted cognitive decline [odds ratio (OR)=1.111, 95% confidence interval (CI): 1.002-1.233, p=0.047] but not sarcopenia (OR=0.972, 95% CI: 0.897-1.054, p=0.495). The DBI score did not significantly predict either cognitive decline or sarcopenia. Compared with the non-frail category, multinomial logistic regression revealed no significant associations between ACB or DBI scores and pre-frail or frail status. Table 4 presents the results of the logistic regression.

Discussion

Anticholinergic Cognitive Burden score

Among the study population, 29.17% were taking at least one anticholinergic drug, with a mean of 2.03 (SD 1.49) anticholinergic drugs per patient. This high prevalence is consistent with previous studies on the use of anticholinergic medications in older adults. The reported prevalence rates vary across studies, ranging from 44.9% (11.3% with a high anticholinergic load) to 54.1% in older adult patients, and 81.3% in patients with Parkinson's cognitive decline (44.5% with a high anticholinergic load).[14-16] Lampela *et al*. reported that approximately 57% of individuals used at least one anticholinergic drug.[17] Raei *et al*. estimated the prevalence of anticholinergic exposure to be approximately 29% and 36.3% using the DBI and Anticholinergic Drug Scale, respectively.[18]

Table 2. Anticholinergic medication count, Cumulative Cognitive Burden Score, and Drug Burden Index metrics in the study population.

No. of anticholinergic medications	Distribution (%) (n=504)	No. of DBI medications	Distribution (%) (n=583)
1	147 (29.17)	1	23 (3.95)
2	152 (30.16)	2	46 (7.89)
3	114 (22.62)	3	90 (15.44)
4	54 (10.71)	4	106 (18.18)
5	23 (4.56)	5	90 (15.44)
6	10 (1.98)	6	93 (15.95)
7	3 (0.60)	7	62 (10.63)
8	1 (0.20)	8	30 (5.15)
-	-	9	22 (3.77)
-	-	10	8 (1.37)
-	-	11	6 (1.03)
-	-	12	4 (0.69)
-	-	13	1 (0.17)
-	-	14	1 (0.17)
-	-	15	1 (0.17)
Total number of ACB medications	1229	Total number of DBI Medications	2925
Mean number of ACB medications ± SD	2.03±1.49	Mean number of DBI Medications ± SD	5.02±2.30
Cumulative ACB score		**Cumulative DBI score**	
1 – 2	245 (48.61)	<1	33 (5.66)
≥ 3	259 (51.39)	≥1	549 (94.34)
Total score	1485	Total score	1829.67
Mean score ± SD	2.49±2.00	Mean score ± SD	3.14±1.55

DBI, Drug Burden Index; ACB, Anticholinergic Cognitive Burden score; SD, standard deviation

Table 3. Linear regression coefficients for predictors of length of hospitalization, the Charlson Comorbidity Index, and the Health-Related Quality Of Life Index value.

Outcome	Predictor	B	Std. Error	β	t	p	95% CI lower limit	95% CI upper limit
Length of hospitalization	ACB	0.230	0.073	0.129	3.161	0.002*	0.087	0.373
	DBI	0.307	0.090	0.138	3.405	0.001*	0.130	0.485
Charlson Comorbidity Index	ACB	0.027	0.029	0.038	0.917	0.359	-0.031	0.084
	DBI	0.126	0.036	0.142	3.500	0.001*	0.055	0.196
HRQoL Index value	ACB	-0.005	0.005	-0.040	-0.983	0.326	-0.016	0.005
	DBI	-0.010	0.007	-0.059	-1.451	0.147	-0.023	0.003

ACB, Anticholinergic Cognitive Burden score; DBI, Drug Burden Index; Std., standard; CI, confidence interval; CI: confidence interval. *Statistically significant.

Table 4. Odds ratios for predictors of sarcopenia, cognitive decline, and frailty.

Outcome	Predictor	Odds ratio	95% confidence interval lower limit – upper limit	p
Sarcopenia^	ACB	0.972	0.897-1.054	0.495
	DBI	1.005	0.910-1.111	0.919
Cognitive decline^	ACB	1.111	1.002-1.233	0.047*
	DBI	1.058	0.925-1.210	0.413
Frailty#				
Non frail	Reference			
Prefrail	ACB	0.900	0.789-1.026	0.114
	DBI	0.949	0.808-1.114	0.522
Frail	ACB	0.999	0.902-1.107	0.987
	DBI	1.065	0.935-1.214	0.342

ACB, Anticholinergic Cognitive Burden score; DBI, Drug Burden Index. ^Binary logistic regression; #multinomial logistic regression; *statistically significant.

While 29.17% of patients were taking one anticholinergic drug, a significant proportion were taking multiple anticholinergic drugs, with 30.16% taking 2, 22.62% taking 3, and up to 8 anticholinergic drugs simultaneously. Polypharmacy of anticholinergics is a concern, as it can lead to cumulative anticholinergic exposure and potentially increase the risk of adverse effects.

The mean cumulative ACB score was 2.49 (SD 2.00); however, more than half of the patients (51.39%) had a cumulative ACB score of three or more. Higher ACB scores are associated with an increased risk of cognitive decline, falls, and other adverse outcomes in older adults. A 20-year Cognitive Function and Aging (CFAS I and II) study reported an increase in the mean total anticholinergic burden from 0.99 (95% CI 0.96–1.03) in 1991 to 1.11 (95% CI 1.08-1.15) in 2011, which highlights the growing problem of anticholinergic medication use in older adults.[19]

Drug Burden Index

The prevalence of anticholinergic and sedative medication use was alarmingly high, with 94.34% of patients having a cumulative DBI score of ≥1 and a mean DBI score of 3.14 (SD 1.55). This prevalence was significantly higher than that reported in previous studies. Hilmer *et al*. reported a mean DBI score of 0.18 (SD 0.35),[9] and Shmuel *et al*. reported a mean daily DBI score of 0.38 (SD 0.69).[20] This difference can be partly explained by the differences in the study population and duration.

The mean number of DBI medications per patient (5.02, SD 2.30) in our study was also greater than that reported in previous studies. Hilmer *et al*. reported a mean of 1.7 DBI medications per person in community-dwelling older adults, which was significantly lower than our findings.[9] This discrepancy may be due to differences in the study settings, with our study focusing on hospitalized older adult patients with more complex medication regimens.

The associations between DBI, ACB, and length of hospitalization found in our study were consistent with those of previous studies. Lowry *et al.* demonstrated that a greater anticholinergic burden was associated with longer hospital stay in older adults.[21] Our findings extend this association to include a broader measure of DBI, suggesting that both anticholinergic and sedative medication burdens contribute to prolonged hospitalization.

In addition, DBI, but not ACB, was significantly associated with the CCI. This finding partially aligns with a study by Salahudeen *et al*.,[22] who reported associations between anticholinergic and overall medication burdens and between anticholinergic burden and comorbidity indices. The discrepancy in ACB associations warrants further investigation into the specific relationships between different types of medication burdens and comorbidity measures.

The lack of a significant association between DBI or ACB and HRQoL in our study contrasts with the findings of previous studies. Bosboom *et al.* reported that a higher DBI is associated with a lower quality of life in older adults with cognitive decline.[23] This may be because of the lower number of patients with cognitive decline in this study. Furthermore, evaluating HRQoL at a single point during acute hospital admission may not adequately capture the long-term effects of the medication burden. This is because EQ-5D-5L scores in hospitalized patients are likely to be more influenced by the severity of the acute illness than by the persistent effects of chronic medication use.

The significant association between ACB and cognitive decline is consistent with that of previous studies. Gray *et al.* reported strong evidence linking the use of anticholinergic medications to an increased risk of cognitive decline.[24] However, the lack of an association between DBI and cognitive decline in our study is surprising and contrasts with previous findings. Byrne *et al*. revealed that higher DBI scores are associated with an increased risk of cognitive decline.[25]

The absence of an association between the DBI and cognitive impairment in our study may be attributed to several factors that are unique to our study population. The hospitalized cohort exhibited elevated levels of comorbidities and acute illnesses, which may have masked the chronic cognitive effects typically associated with the DBI. Additionally, while the Mini-Cog screening tool is validated, it may lack the sensitivity required to detect subtle medication-related cognitive changes compared to comprehensive neuropsychological assessments. Evaluating cognitive function at a single time point during acute hospitalization may not adequately capture the long-term cumulative cognitive effects of sedative and anticholinergic medications, which are generally observed in stable community-dwelling populations over extended periods.

Current evidence does not support the routine use of anticholinergic drugs with antipsychotic medications to prevent extrapyramidal side effects (EPS). Although anticholinergics can help alleviate certain EPS when they occur, their preventive use is not effective in reliably stopping tardive syndromes, and there is limited scientific evidence supporting this approach. Not all patients exhibit extrapyramidal signs, especially when antipsychotic treatment is brief, which further challenges the rationale for automatic co-prescription. Clinical guidelines advise that anticholinergics should be used selectively in patients with significant EPS, and long-term use should be avoided unless necessary.[26,27]

Gallucci *et al*. provided compelling neuroimaging evidence of cognitive dysfunction induced by anticholinergic drugs in a patient administered biperiden as a prophylactic measure alongside antipsychotic treatment despite the absence of extrapyramidal symptoms. A series of Positron emission tomography with 18F-fluorodeoxyglucose tracer scans demonstrated a significant improvement in cortical metabolism 7 months after discontinuation of biperiden, which was accompanied by clinical improvements in speech and ambulation and a reduction in hallucinations and delusions. This finding underscores the potentially reversible nature of cognitive impairment attributable to anticholinergic effects.[28]

The ACB and DBI results have several important clinical implications. The high prevalence rates are significant in older adults, emphasizing the need for greater awareness among healthcare providers regarding the cumulative effects of anticholinergic and sedative medications. Implementing evidence-based deprescribing strategies that target high-risk or unnecessary anticholinergic and sedative medications may be beneficial in reducing the overall anticholinergic burden in this population.

Limitations

The single-center, cross-sectional study design limited the assessment of causal relationships between medication burden and health outcomes, with findings representing associations rather than causality. To establish temporal relationships and enhance causal inference, longitudinal studies that repeatedly assess both medication burden and clinical outcomes are essential. The medication assessment process has notable limitations, relying exclusively on hospital prescription records and excluding over-the-counter medications, herbal remedies, and supplements that could contribute to anticholinergic or sedative burden, which is particularly relevant in India, where traditional medications are commonly used. A single time-point measurement of quality of life may not adequately reflect the long-term impact of the medication burden.

In addition, although the Mini-Cog screening tool for cognitive screening has been validated, it may lack sensitivity in detecting subtle cognitive changes and can be influenced by transient factors commonly observed in hospitalized older adults, such as acute illness, fatigue, delirium, or medication effects. The study did not employ a formal delirium assessment tool, such as the 4AT, which could have facilitated the differentiation between acute delirium and underlying cognitive impairment in the patients. This omission may have resulted in the misclassification of cognitive status, as delirium and cognitive impairment can present with similar characteristics in hospitalized patients.

The study relied on hospital records, which primarily classified patients as male or female. Future studies should explicitly capture non-binary and culturally specific gender identities to ensure inclusivity and accurate representation in geriatric research.

Future directions

The formation of multidisciplinary teams for medication review, comprising geriatricians, clinical pharmacists, and nursing staff, can facilitate the systematic identification of patients with significant anticholinergic and sedative loads for targeted interventions, such as deprescribing. To effectively implement targeted deprescribing strategies in Indian hospitals, it is imperative to adopt culturally sensitive and resource-appropriate methodologies. Given the prevalent involvement of family members in healthcare decisions within Indian culture, educational initiatives should engage family members and caregivers to ensure their understanding and compliance with medication adjustments.

Practical measures may include the development of institution-specific protocols for assessing anticholinergic burden using validated tools such as the CRIDECO scale, the establishment of medication reconciliation processes during admission and discharge, and the formulation of deprescribing guidelines that prioritize discontinuation of medications with the most unfavorable risk-benefit ratios. In settings where electronic health record systems are available, these systems can be programmed to generate automated alerts for high-risk anticholinergic combinations. Regular pharmacy-led medication reviews, particularly for patients experiencing polypharmacy, and the introduction of geriatric consultation services could significantly reduce inappropriate prescriptions. Training healthcare providers on anticholinergic burden awareness and evidence-based deprescribing practices is essential for the sustainable implementation of these strategies in resource-limited Indian healthcare environments.

Conclusions

This study provides significant insights into the burden of anticholinergic and sedative medications in hospitalized older adult patients. The findings revealed a notably high prevalence of medication burden, with 94.34% of patients prescribed anticholinergic and/or sedative medications. Both anticholinergic burden and DBI were significantly associated with prolonged hospitalization, and anticholinergic burden specifically predicted the risk of cognitive decline, highlighting important clinical concerns for this vulnerable population.

These findings underscore the critical need for regular medication reviews and the implementation of standardized anticholinergic burden assessment tools in routine geriatric care. Healthcare providers should prioritize targeted deprescribing strategies to reduce the medication burden, while longitudinal studies are needed to establish causal relationships and develop evidence-based intervention protocols for inappropriate medication use in older adults.

References

1. World Health Organization. Ageing and health. Available from: https://www.who.int/news-room/fact-sheets/detail/ageing-and-health.
2. Kouladjian L, Gnjidic D, Chen TF, et al. Drug burden index in older adults: theoretical and practical issues. Clin Interv Aging 2014;9:1503-15.
3. Arthur A, Savva GM, Barnes LE, et al. Changing prevalence and treatment of depression among older people over two decades. Br J Psychiatry 2020;216:49-54.
4. Lim R, Kalisch Ellett LM, Widagdo IS, et al. Analysis of anticholinergic and sedative medicine effects on physical function, cognitive function, appetite and frailty: a cross-sectional study in Australia. BMJ Open 2019;9:e029221.
5. Bishara D. Anticholinergic action is rarely a good thing. Ther Adv Psychopharmacol 2023;13:20451253231195264.
6. Ghossein N, Kang M, Lakhkar AD. Anticholinergic medications. Treasure Island, FL, USA: StatPearls Publishing; 2025.
7. Reallon E, Gervais F, Moutet C, et al. Impact of cumulative exposure to anticholinergic and sedative drugs on cognition in older adults: a memory clinic cohort study Alzheimers Res Ther 2024;16:163. Erratum in: Alzheimers Res Ther 2024; 16:195.
8. Ramos H, Moreno L, Pérez-Tur J, et al. CRIDECO anticholinergic load scale: an updated anticholinergic burden scale. Comparison with the ACB scale in Spanish individuals with subjective memory complaints. J Pers Med 2022;12:207.
9. Hilmer SN, Mager DE, Simonsick EM, et al. A drug burden index to define the functional burden of medications in older

people. Arch Intern Med 2007;167:781-7.
10. Jyani G, Sharma A, Prinja S, et al. Development of an EQ-5D value set for India using an extended design (DEVINE) study: the Indian 5-level version EQ-5D value set. Value Health 2022;25:1218-26.
11. Abellan van Kan G, Rolland YM, Morley JE, Vellas B. Frailty: toward a clinical definition. J Am Med Dir Assoc 2008;9:71-2.
12. Malmstrom TK, Morley JE. SARC-F: a simple questionnaire to rapidly diagnose sarcopenia. J Am Med Dir Assoc 2013; 14:531-2.
13. Borson S, Scanlan JM, Chen P, Ganguli M. The Mini-Cog as a screen for dementia: validation in a population-based sample. J Am Geriatr Soc 2003;51:1451-4.
14. Cross AJ, George J, Woodward MC, et al. Potentially inappropriate medications and anticholinergic burden in older people attending memory clinics in Australia. Drugs Aging 2016;33: 37-44.
15. Weichert I, Romero-Ortuno R, Tolonen J, et al. Anticholinergic medications in patients admitted with cognitive impairment or falls (AMiCI). The impact of hospital admission on anticholinergic cognitive medication burden. Results of a multicentre observational study. J Clin Pharm Ther 2018;43:682-94.
16. Mantri S, Fullard M, Gray SL, et al. Patterns of dementia treatment and frank prescribing errors in older adults with parkinson disease. JAMA Neurol 2019;76:41-9.
17. Lampela P, Taipale H, Lavikainen P, Hartikainen S. The effect of comprehensive geriatric assessment on anticholinergic exposure assessed by four ranked anticholinergic lists. Arch Gerontol Geriatr 2017;68:195-201.
18. Raei K, Rahimi A, Hosseini SR, et al. Anticholinergic drug use in elderly people: a population- based study in Iran. Caspian J Intern Med 2021;12:593-9.
19. Grossi CM, Richardson K, Savva GM, et al. Increasing prevalence of anticholinergic medication use in older people in England over 20 years: cognitive function and ageing study I and II. BMC Geriatr 2020;20:267.
20. Shmuel S, Pate V, Pepin MJ, et al. Quantifying cumulative anticholinergic and sedative drug load among US medicare beneficiaries. Pharmacoepidemiol Drug Saf 2021;30:144-56.
21. Lowry E, Woodman RJ, Soiza RL, et al. Drug burden index, physical function, and adverse outcomes in older hospitalized patients. J Clin Pharmacol 2012;52:1584-91.
22. Salahudeen MS, Duffull SB, Nishtala PS. Anticholinergic burden quantified by anticholinergic risk scales and adverse outcomes in older people: a systematic review. BMC Geriatr 2015;15:31.
23. Bosboom PR, Alfonso H, Eaton J, Almeida OP. Quality of life in Alzheimer's disease: different factors associated with complementary ratings by patients and family carers. Int Psychogeriatr 2012;24:708-21.
24. Gray SL, Anderson ML, Dublin S, et al. Cumulative use of strong anticholinergics and incident dementia: a prospective cohort study. JAMA Intern Med 2015;175:401-7.
25. Byrne CJ, Walsh C, Cahir C, Bennett K. Impact of drug burden index on adverse health outcomes in Irish community-dwelling older people: a cohort study. BMC Geriatr 2019;19:121.
26. Chatterjee K, Dangi A, Sharma R, et al. Adding pre-emptive anticholinergics to antipsychotics: Is it justified? Ind Psychiatry J 2022;31:370-3.
27. World Health Organization. Role of anticholinergic medications in patients requiring long-term antipsychotic treatment for psychotic disorders. Available from: https://www.who.int/teams/mental-health-and-substance-use/treatment-care/mental-health-gap-action-programme/evidence-centre/psychosis-and-bipolar-disorders/role-of-anticholinergic-medications-in-patients-requiring-long-term-antipsychotic-treatment-for-psychotic-disorders.
28. Gallucci M, Pallucca C, Di Battista ME, et al. Anti-Cholinergic Derangement of Cortical Metabolism on 18F-FDG PET in a Patient with Frontotemporal Lobar Degeneration Dementia: A Case of the TREDEM Registry. J Alzheimers Dis. 2020;74(4):1107-17.

Online supplementary material:

Supplementary Table 1. EuroQol 5-Dimension 5-Level questionnaire frequencies and proportions reported by dimensions and level.

Supplementary Table 2. Anticholinergic drug use pattern during hospitalization according to the World Health Organization Anatomical Therapeutic Chemical classification system.

Supplementary Table 3. Anticholinergic potency of prescribed medications.

Supplementary Table 4. Anticholinergic and sedative profiles of selected drugs.

Supplementary Table 5. Drug Burden Index medication use pattern during hospitalization according to the World Health Organization Anatomical Therapeutic Chemical classification system.