Prescription of potentially inappropriate medications in geriatric patients: data from a single dental institution

Arwa Farag, BDS, DMSc,[a,b] Jessaca York, BA,[c] Matthew Finkelman, PhD,[d] and Bhavik Desai, DMD, PhD[e]

Objectives. The Beers criteria and the Screening Tool of Older Persons' Potentially Inappropriate Prescriptions (STOPP) are consensus-driven lists of potentially inappropriate medications (PIMs) in geriatric patients. The primary objective was to determine the frequency of PIMs prescribed to geriatric patients at Tufts University School of Dental Medicine. The secondary aim was to determine the American Society of Anesthesiologists (ASA) status of these patients and suggest that Beers/STOPP guidelines should be implied with consideration to the patient's ASA status.

Study Design. Beers/STOPP criteria were studied and PIMs thus identified. A retrospective electronic chart review of patients at TUSDM aged 65 and older was performed for calendar years 2013, 2014, and 2015. Search queries were generated for ASA status, along with PIMs prescribed.

Results. Out of 15,569 geriatric patients, more than half of patients between 65–74 years were classified as ASA I. Over a 3-year period, 895 (5.75%) and 840 (5.4%) received new prescriptions for opioids or nonsteroidal anti-inflammatory drugs, respectively. New prescriptions for muscle relaxants, benzodiazepines, and tricyclic antidepressants were given to 65 (0.42%), 44 (0.28%), and 38 (0.24%) patients, respectively.

Conclusions. PIMs are prescribed at low percentages to geriatric patients. However, prescription of opioids, benzodiazepines, and nonsteroidal anti-inflammatory drugs across undergraduate and postgraduate clinics is not uncommon. The majority of Tufts University School of Dental Medicine geriatric patients fall within the category of ASA I–II. ASA classification must be taken into consideration when PIMs are prescribed to geriatric patients rather than relying solely on chronologic age. (Oral Surg Oral Med Oral Pathol Oral Radiol 2019;128:e6–e12)

A geriatric person is typically defined as an adult older than age 65.[1] With a rapidly aging demographic, the geriatric population in the United States has been steadily rising and is expected to account for about 21% of the population by 2040.[2] This group of adults has unique medical and dental needs, compounded by the presence of chronic diseases and use of multiple prescription medications. Almost half of adults older than 65 reportedly suffer from at least 2 or more chronic medical conditions.[2] According to Avendano et al, the most prevalent disease conditions that affect this population in the United States and Europe are heart disease, hypertension, diabetes, and orthopedic impairments.[3]

Moreover, the elderly population has the highest prescription drug consumption and expenditures in the United States.[4] The Centers for Disease Control and Prevention reported that more than 76% of Americans, aged 60 and older, use 2 or more prescription drugs and nearly 40% use 5 or more.[5] Although health care professionals often prescribe multiple medications for optimum health outcomes for their geriatric patients, there lies an increased risk for adverse drug-related events. This can be attributed to inaccurate dosage, multiple drug interactions, prolonged periods of use, or age-related decline in physiologic functions. Polypharmacy-associated risks are corroborated by the statistic that geriatric patients account for more than 177,000 emergency department visits for adverse drug events annually (twice the amount of adults younger than 65) and are nearly 7 times more likely than younger adults to be hospitalized after a drug-related emergency visit.[5]

Lists of potentially inappropriate medications (PIMs) have been compiled by clinicians and researchers in geriatric medicine. These lists are intended to serve as a guideline for clinicians when prescribing medication to geriatric patients to improve safety and

Statement of Clinical Relevance

The incidence of dentists prescribing potentially inappropriate medications for geriatric patients, that may lead to adverse reactions, is rarely reported. To ensure patient safety, dentists must be knowledgeable and trained to prescribe appropriately for increasingly medically complex geriatric patients.

The submitted documents represent original research that has not been published previously except in an abstract form to the American Academy of Oral Medicine Meeting in Orlando, Florida, in April 2017.

[a]Assistant Professor, Department of Oral Diagnostic Sciences, Faculty of Dentistry, King AbdulAziz University, Jeddah, Saudi Arabia.
[b]Department of Diagnostic Sciences, Division of Oral Medicine, Tufts University School of Dental Medicine, Boston, MA, USA.
[c]DMD/MPH Candidate, Tufts University School of Dental Medicine, Boston, MA, USA.
[d]Associate Professor, Department of Public Health and Community Service, Tufts University School of Dental Medicine, Boston, MA, USA.
[e]Associate Professor, Oral Health and Diagnostic Sciences, Oral Medicine Section, Dental College of Georgia at Augusta University, Augusta, GA, USA.

Received for publication Oct 24, 2018; returned for revision Jan 14, 2019; accepted for publication Jan 21, 2019.

2212-4403/$-see front matter
http://doi.org/10.1016/j.oooo.2019.01.075

minimize the risk of drug-related negative health outcomes. However, the discretion in customizing these prescriptions still rests entirely with the clinician. Two widely used lists of PIMs for geriatric health care settings are Beers criteria for Potentially Inappropriate Medication Use in Older Adults and the Screening Tool of Older Persons' Potentially Inappropriate Prescriptions (STOPP) criteria.[6,7]

The Beers criteria, which were most recently updated in 2015 by the American Geriatrics Society, are a compilation of medications that have been deemed potentially inappropriate for elderly patients based on the results of evidence-based methodologic studies.[7] They include details on the circumstances under which professionals should avoid prescribing the drugs listed, rationale behind the drugs' potential inappropriateness for geriatric patients, and evidence-based reference information supporting these rationales. The STOPP criteria are similar to the Beers criteria in content but place special emphasis on potentially adverse drug-drug interactions and duplicate drug class prescriptions.[6,8,9] STOPP criteria also provide therapeutic alternatives for the listed PIMs. Unlike with Beers, PIMs outlined in the STOPP criteria are strongly linked to avoidable adverse drug events that directly cause or contribute to hospitalization among older adults.[6]

Dental school patients have previously been documented as being medically complex in significant numbers.[10] Analgesics and antibiotics account for the majority of prescriptions written by dental providers.[11] Within the dental health care setting, all patients, including geriatric patients, are often prescribed these medications for their therapeutic effects during dental procedures, for preexisting oral health issues, and for postoperative recovery.

The incidence of dental professionals prescribing PIMs in an academic setting has not been previously reported. The aim of this study was to examine the frequency with which this population has been prescribed medications at Tufts University School of Dental Medicine (TUSDM) that have been deemed potentially inappropriate by the Beers and STOPP criteria.

The study further aimed to evaluate the percentage, physical health status, and comorbidity profile of geriatric patients who sought care at TUSDM over a 3-year period (2013−2015) to determine how critical it is to adhere to the recommendations made by the Beers and STOPP criteria.

METHODS

The study received approval from Tufts University Health Sciences Institutional Review Board and was conducted according to the principles of the Declaration of Helsinki. Electronic patient records were reviewed from all TUSDM departments using the dental school's axiUm electronic health record database. To retrieve data of interest, an initial query was run in axiUm to determine how many adults older than age 65 were seen at TUSDM annually from January 1, 2013, to December 31, 2015. Within these yearly totals, each patient was counted only once for each year that they received treatment at TUSDM.

Patients were further categorized according to age as "young-old" (aged 65−74), "old" (aged 75−84), and "oldest-old" (85 years and older) groups. Using health record data, additional queries were run to collect information about patients' age at the time of visit, as well as the existing medical comorbidities. American Society of Anesthesiologists (ASA) status was determined by dental school faculty members with criteria established by the department of medicine at TUSDM. Consultation letters from patients' physicians were reviewed for every patient with an ASA III status and beyond. Search queries were generated on the electronic health record system, axiUm, to separate geriatric patients based on their ASA classification as reported by dental school students and faculty members.

Further queries were run for medications prescribed by TUSDM providers, at any point during the studied 3 years, which have been deemed potentially inappropriate for geriatric patients per the most updated versions of Beers and/or STOPP criteria.[6,7] This includes opioids, the most commonly prescribed muscle relaxants (i.e., cyclobenzaprine, methocarbamol [Robaxin], metaxalone, and baclofen [Lioresal]), sedatives/anxiolytics (benzodiazepines; i.e., diazepam, clonazepam, alprazolam, lorazepam, and midazolam), tricyclic antidepressants (TCAs; i.e., amitriptyline, nortriptyline, imipramine, and doxepin), and long-term nonsteroidal anti-inflammatory drugs (NSAIDs). It should be noted here that differences in the medications included in Beers criteria and STOPP list, relevant to dentistry and oral medicine, were encountered. Search queries were run on the axiUm electronic health record system for medications included in both lists. For example, opioid analgesics were not part of the Beers list but were included in our study in keeping with STOPP criteria.

The TUSDM departments where these prescriptions came from were also recorded (i.e. predoctoral, periodontology, oral surgery, endodontics, prosthodontics, oral medicine/orofacial pain, implantology, and others).

Statistical analysis

Descriptive statistics (counts and percentages) were calculated using SPSS Version 22 (IBM Corp., Armonk, NY, USA). Comparison of the 3 age groups in terms of ASA status was conducted using the

Kruskal-Wallis test for each year separately; Dunn's test with the Bonferroni correction was used in post hoc tests. Prevalence of 8 common geriatric comorbidities was also determined, summing all reported cases from patient health records over the 3 years.

RESULTS

A total of 15 569 geriatric patients were obtained. In calendar years 2013, 2014, and 2015, 18.92%, 19.37%, and 19.85%, respectively, of all patients seen at TUSDM were adults older than 65. In each of these years, more than half of geriatric patients between 65−74.9 years were classified as ASA I, whereas approximately half of the patients aged 75−84.9 were classified as ASA II and the majority of those aged 85 and older were ASA II (Table I). For each year, the Kruskal-Wallis test comparing the ASA statuses of the different age groups was statistically significant ($P < .001$), as were all post hoc comparisons using Dunn's test with the Bonferroni correction. Across each year studied, the most commonly reported comorbidity among the studied geriatric patients was hypertension, followed by arthritis and cancer (any form including basal cell carcinoma) (Table II).

The most commonly prescribed PIMs were opioids and NSAIDs in all 3 calendar years (5.1%−6.3% and 4.5%−6.2%, respectively), with low rates of prescription of muscle relaxants, TCAs, and benzodiazepines (Table III). Across the 3 years studied, the average number of geriatric patients with an ASA status of II and greater to whom benzodiazepines, muscle relaxants, antidepressants, opioids, or NSAIDs were prescribed were 2.3 (0.07%), 3.7 (0.16%), 1.6 (0.06%), 79 (2.6%), and 73 (2.5%), respectively. Muscle relaxants and TCAs were prescribed almost exclusively by oral medicine and orofacial pain providers, whereas the prescription of opioids, NSAIDs, and benzodiazepines was distributed across various specialties as well as postgraduate and undergraduate providers at TUSDM (Figure 1).

DISCUSSION

Definition of geriatric patients in dental practice

The classification of *geriatric* as age 65 years or older defines the eligibility for retirement and social security benefits in the United States and several other developed Western countries.[12] It is well agreed on in the health care community that this number is completely arbitrary and is not tied to any biological basis or clinical evidence. In medical and dental practices, ASA status is used to classify physical status of the patient and determine the necessity for treatment modification.[13] This single-institution investigation found that more than half of the TUSDM patient population aged 65−74 fall within the category of ASA I, for whom no care plan modifications may be required. On the other hand, modifications and precautions in dental treatment as well as adherence to the Beers and STOPP criteria may be warranted for dental patients with an ASA status of II or higher,[13] which, in this investigation, were mostly older than age 75.

This investigation did not aim to evaluate the outcomes of PIMs in geriatric patients because this has been already documented in the investigations cited by the Beers criteria and STOPP list.[6,7] Rather, the study highlights the existence of the well-validated criteria

Table I. ASA status of geriatric dental patients at Tufts University School of Dental Medicine, 2013−2015

Year	*Patient age (y)*	*ASA I*	*ASA II*	*ASA III*	*ASA IV*	*P**
2013	*Young-old*	N = 1004	N = 730	N = 115	N = 0	<.001
(N = 2935)	*(65−74.9)*	(54.3%)	(39.5%)	(6.2%)	(0%)	
	Old	N = 327	N = 496	N = 78	N = 1	
	(75−84.9)	(36.3%)	(55%)	(8.6%)	(0.1%)	
	Oldest Old	N = 45	N = 113	N = 26	N = 0	
	(85+)	(24.5%)	(61.4%)	(14.1%)	(0%)	
2014	*Young-old*	N = 1116	N = 686	N = 90	N = 0	<.001
(N = 2962)	*(65−74.9)*	(59%)	(36.3%)	(4.8%)	(0%)	
	Old	N = 355	N = 449	N = 72	N = 1	
	(75−84.9)	(40.5%)	(51.2%)	(8.2%)	(0.1%)	
	Oldest old	N = 52	N = 112	N = 29	N = 0	
	(85+)	(26.9%)	(58%)	(15%)	(0%)	
2015	*Young-old*	N = 1199	N = 634	N = 84	N = 1	<.001
(N = 3000)	*(65−74.9)*	(62.5%)	(33.1%)	(4.4%)	(0.1%)	
	Old	N = 389	N = 423	N = 63	N = 2	
	(75−84.9)	(44.4%)	(48.2%)	(7.2%)	(0.2%)	
	Oldest old	N = 64	N = 116	N = 25	N = 0	
	(85+)	(31.2%)	(56.6%)	(12.2%)	(0%)	

ASA, American Society of Anesthesiologists.
*Statistical significance was determined by the Kruskal-Wallis test.

Table II. Reported comorbidities among TUSDM geriatric patient population, 2013−2015

Comorbidity	*Annual prevalence of reported comorbidity by year*		
	2013	*2014*	*2015*
Hypertension	2093 (41.16%)	2111 (40.49%)	2132 (40.42%)
Arthritis	1054 (20.73%)	973 (18.66%)	901 (17.08%)
Cancer	899 (17.68%)	850 (16.3%)	787 (14.92%)
Diabetes	624 (12.27%)	626 (12.01%)	642 (12.17%)
Heart disease	364 (7.16%)	455 (8.73%)	438 (8.3%)
Asthma	310 (6.1%)	319 (6.12%)	331 (6.27%)
Bronchitis/emphysema	205 (4.03%)	210 (4.03%)	216 (4.09%)
Stroke	154 (3.03%)	118 (2.26%)	100 (1.89%)
Total no. of geriatric patients in calendar year	5085	5213	5275

TUSDM, Tufts University School of Dental Medicine.

and yet recommends that adherence to such criteria should not be extrapolated to all geriatric patients. Dental practitioners need to understand the correlation of higher ASA class with increased peri- and postoperative morbidities.[14] A study by Hackett et al.,[14] found that patients' ASA status was associated with increased morbidity and mortality even after the standardization of interventions. It was also reported that ASA status was an independent predictive factor when controlling for all other comorbidities. For that, adherence to the Beers/STOPP criteria is suggested for dental patients with an ASA status of II or higher based on the existing comorbidities.

Improvement and facilitation of access to health care services has positively affected the health of the general population and increased life expectancy. The aforementioned results are in agreement with the recent statistics indicating that baby boomers are expected to live far longer after retirement than earlier generations. A recent estimate by the Office for National Statistics in the United Kingdom projected that the average retiree could now draw their pension for up to 24 years, which is 50% longer than the generation of their parents.[15] This finding opens the door for discussion that geriatric patients in dentistry be defined not merely as a function of age older than 65 years. Instead, clinicians should determine health status based on the overall systemic condition and existence of comorbidities.[16] It is worth mentioning here that a potential effect modifier does exist in this investigation because our research was conducted in a state with a higher rate of medical insurance coverage and health care access compared with the U.S. average.[17] Greater access to health care has been found to contribute to a healthier geriatric population.[18]

Common health comorbidities in geriatric patients

We evaluated the presence of chronic comorbid conditions in our sample of adults older than 65 at TUSDM and found hypertension, osteoarthritis, cancer (including basal cell carcinoma), and diabetes to be the most prevalent conditions in our geriatric dental patients. These findings corroborate observations about common geriatric comorbidities in the United States.[19] The

Table III. Total number of PIMs prescribed to geriatric patients by calendar year

Calendar year	*Opioids*	*NSAIDs*	*Muscle relaxants*	*TCAs*	*Benzodiazepines*	*Total no. of geriatric patients in calendar year*
2013	318 (6.25%)	314 (6.18%)	18 (0.35%)	16 (3.14%)	17 (0.33%)	5085
2014	265 (5.08%)	287 (5.44%)	27 (5.17%)	13 (0.25%)	12 (0.23%)	5213
2015	312 (5.91%)	239 (4.53%)	20 (0.38%)	9 (0.17%)	15 (0.28%)	5275

PIM, potentially inappropriate medication; *NSAID,* nonsteroidal anti-inflammatory drug; *TCA,* tricyclic antidepressant.

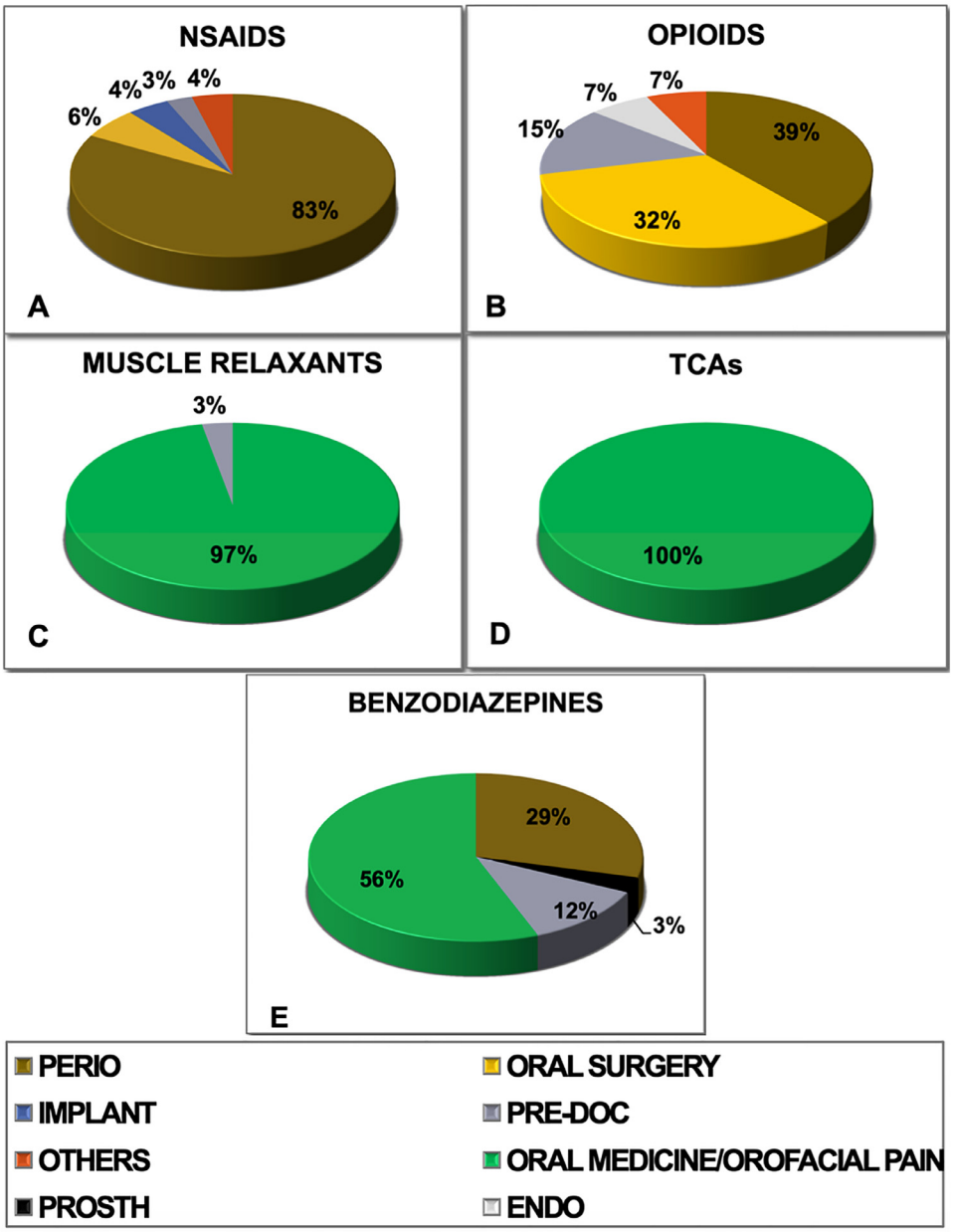

Fig. 1. PIMs prescribed by dental specialties. *PIMs,* potentially inappropriate medications; *NSAIDS,* nonsteroidal anti-inflammatory drugs; *TCAs,* tricyclic antidepressants; *PERIO,* periodontist; *PROSTH,* prosthodontist; *PRE-DOC,* predoctoral; *ENDO,* endodontist.

presence of multiple comorbid conditions in the geriatric population highlights the need for infrastructural and procedural modifications when providing dental care, precautions when prescribing medication, and incorporation of educational material in dental curricula pertinent to these conditions.

Prescription of PIMs in geriatric patients

The increased prevalence of illnesses and comorbidities that comes with aging is often to blame for the elderly's particular vulnerability to adverse drug reactions. It is important that clinicians base their judgment on the present comorbidities, physical status, and physiologic functioning when prescribing medication to older adults, rather than relying solely on the chronologic age. As a general principle, decreased hepatic and renal function may warrant corresponding dose adjustment of any medication prescribed.[11] In addition, dentists may request laboratory tests (e.g., liver function test and estimated glomerular filtration rate values) before prescribing PIMs for geriatric patients if comorbidities exist.[20,21]

This study recorded the incidence of prescribing PIMs as defined by the Beers and STOPP criteria in our sample geriatric dental population. Although the incidence of PIM use among geriatric dental patients has been documented in the literature,[22,23] this study is the first of its kind to document the incidence of PIMs prescribed by dental professionals in an academic setting. As expected, we found a relatively low incidence of dental professionals prescribing muscle relaxants, TCAs and benzodiazepines to their patients. These medications were almost exclusively prescribed by providers in orofacial pain and oral medicine, as consistent with the indications of these medications and the nature of an orofacial pain or oral medicine practice. Providers in these disciplines typically receive advanced training in pharmacologic management of chronic pain conditions and can be expected to periodically monitor their patients receiving PIMs. Benzodiazepines were prescribed across dental specialties other than maxillofacial surgery, oral medicine, or orofacial pain, but at a low rate. However, prescribing in the predoctoral clinic may necessitate further attention and enforcement of appropriate training of the prescribers as well as strict monitoring of any adverse drug events. Recent guidelines for oral medicine and orofacial pain specialists have been published on the prescription of PIMs for geriatric patients according the Beers and STOPP criteria.[24]

Data from this study indicate that opioids were prescribed to about 5%−6.25% of geriatric dental patients, from different dental disciplines, over the years 2013−2015. These findings support similar data published in 2012 indicating that 6.4% of opioid prescriptions came from dental practitioners.[25] NSAIDs were also prescribed by providers in various dental specialties. Prolonged use of NSAIDs in geriatric patients amounts to these medications being designated as PIMs according to the STOPP criteria. More robust documentation from dental providers about prescription of NSAIDs (including dosage, frequency, and duration of use) may be warranted given the ease of their availability without a prescription. NSAID overuse and misconceptions about their side effects are widespread problems in the United States,[26] and overuse of nonprescription NSAIDs has been previously reported in the dental literature.[27]

Study limitations

The results of this single-institution study may not be extrapolated to other dental institutions across the United States. Geographic location, social and cultural compositions, access to medical care through insurance coverage,[28] and patterns of training and drug prescription may vary among dental institutions.[29] These factors play an effect-modifying role and produce findings that may differ from what might be obtained in other institutions in the United States.

For prescription of NSAIDs in geriatric patients, this study only recorded prescriptions documented in the electronic health records. Duration of use was not also precisely documented. NSAIDs are often available over the counter without prescription and are commonly recommended outpatient analgesics in dentistry. Patients' underreporting of NSAID usage and duration of use by virtue of inadequate documentation is an additional limitation of this study, and geriatric patients advised by their providers to take over-the-counter NSAIDs may have been missed in the study.

CONCLUSIONS

At TUSDM, PIMs are prescribed infrequently. Benzodiazepines, TCAs, and skeletal muscle relaxants were most commonly prescribed by specialists in oral medicine and orofacial pain with high levels of training in pharmacology. Opioid analgesic and NSAID prescriptions were most often written by providers in oral surgery and periodontics, who are highly capable of managing drug-related adverse effects. Proper training in pharmacology and geriatric dentistry in pre- and postdoctoral programs should be emphasized. Additionally, the results of this investigation highlight the importance of considering existing comorbidities, such as cardiovascular disease and diabetes mellitus, when prescribing PIMs in the geriatric population.

Case-control studies reporting the effect of PIMs on geriatric patients based on their ASA status vs their age would be of great value. Similar comparisons at other institutions that see a large volume of dental patients will strengthen our existing knowledge of this topic. The information might increase awareness of potentially harmful drug-related adverse events, their clinical consequences, and prescribing frequency for older adults using the Beers criteria and STOPP list. Doing so might help dentists in assessing patient health status and in making better prescribing decisions.

REFERENCES

1. Transgenerational Design Matters. The demographics of aging. Available at: http://transgenerational.org/aging/demographics.htm. Accessed March 10, 2016.
2. Lee KJ, Ettinger RL, Cowen HJ, Caplan DJ. Health trends in a geriatric and special needs clinic patient population. *Spec Care Dentist*. 2015;35:303-311.
3. Avendano M, Glymour MM, Banks J, Mackenbach JP. Health disadvantage in US adults aged 50 to 74 years: a comparison of the health of rich and poor Americans with that of Europeans. *Am J Public Health*. 2009;99:540-548. https://doi.org/10.2105/AJPH.2008.139469. Epub 2009 Jan 15.
4. Georgetown University. Health Policy Institute Prescription drugs. Data Profile no. 5 September 2002. Available at: https://hpi.georgetown.edu/agingsociety/pubhtml/rxdrugs/rxdrugs.html. Accessed December 14, 2015.

5. Gu Q, Dillon CF, Burt VL. Prescription drug use continues to increase: U.S. prescription drug data for 2007-2008. NCHS Data Brief, no. 42. Hyattsville, MD: National Center for Health Statistics; 2010. Available at: http://www.cdc.gov/nchs/data/databriefs/db42.htm. Accessed December 14, 2015.
6. O'Mahony D, O'Sullivan D, Byrne S, O'Connor MN, Ryan C, Gallagher P. STOPP/START criteria for potentially inappropriate prescribing in older people: version 2. *Age Ageing*. 2015;44:213-218.
7. American Geriatrics Society 2015 Beers Criteria Update Expert Panel. American Geriatrics Society 2015 Updated Beers Criteria for Potentially Inappropriate Medication Use in Older Adults. *J Am Geriatr Soc*. 2015;63:2227-2246.
8. Gallagher PF, O'Connor MN, O'Mahony D. Prevention of potentially inappropriate prescribing for elderly patients: a randomized controlled trial using STOPP/START criteria. *Clin Pharmacol Ther*. 2011;89:845-854. https://doi.org/10.1038/clpt.2011.44. Epub 2011 Apr 20.
9. Hamilton H, Gallagher P, Ryan C, Byrne S, O'Mahony D. Potentially inappropriate medications defined by STOPP criteria and the risk of adverse drug events in older hospitalized patients. *Arch Intern Med*. 2011;171:1013-1019.
10. Radfar L, Suresh L. Medical profile of a dental school patient population. *J Dent Educ*. 2007;71:682-686.
11. Araghi S, Sharifi R, Ahmadi G, Esfehani M, Rezaei F. The study of prescribing errors among general dentists. *Global J Health Sci*. 2016;8:32-43.
12. U.S. Social Security Administration. Retirement planner: Full retirement age. Available at: https://www.ssa.gov/planners/retire/retirechart.html. Accessed September 24, 2017.
13. Jackson DL, Johnson BS. Conscious sedation for dentistry: risk management and patient selection. *Dent Clin North Am*. 2002;46:767-780.
14. Hackett NJ, De Oliveira GS, Jain UK, Kim JY. ASA class is a reliable independent predictor of medical complications and mortality following surgery. *Int J Surg*. 2015;18:184-190.
15. U.K. Office for National Statistics. 2015. Occupational pension schemes survey: 2014 Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/personalandhouseholdfinances/pensionssavingsandinvestments/bulletins/occupationalpensionschemessurvey/2015-09-24. Accessed September 24, 2018.
16. Ouanounou A, Haas DA. Pharmacotherapy for the elderly dental patient. *J Can Dent Assoc*. 2015;80:f18.
17. Burns J. Massachusetts: what universal coverage could look like. *Manag Care*. 2017;26:33-34.
18. Jakovljevic MB, Getzen TE, Torbica A, Anegawa T. 10th World IHEA and ECHE Joint Congress: health economics in the age of longevity. *Expert Rev Pharmacoecon Outcomes Res*. 2014;14:781-783.
19. Salive ME. Multimorbidity in older adults. *Epidemiol Rev*. 2013;35:75-83.
20. Stevens LA, Coresh J, Greene T, Levey AS. Assessing kidney function—measured and estimated glomerular filtration rate. *N Engl J Med*. 2006;354:2473-2483.
21. National Kidney Foundation. NKF KDOQI Guidelines Available at: 2002. http://www2.kidney.org/professionals/kdoqi/guidelines_ckd/p4_class_g1.htm. Accessed April 16, 2017.
22. Vieira de Lima TJ, Garbin CAS, Garbin AJÍ, Sumida DH, Saliba O. Potentially inappropriate medications used by the elderly: prevalence and risk factors in Brazilian care homes. *BMC Geriatrics*. 2013;13:52.
23. Skaar DD, O'Connor HL. Use of the Beers criteria to identify potentially inappropriate drug use by community-dwelling older dental patients. *Oral Surg Oral Med Oral Pathol Oral Radiol*. 2012;113:714-721.
24. Farag AM, Desai B. Potentially inappropriate medications in geriatric population: a clinical update for oral medicine and orofacial pain practitioners. *Oral Surg Oral Med Oral Pathol Oral Radiol*. 2017;124:600-608.
25. Levy B, Paulozzi L, Mack KA, Jones CM. Trends in opioid analgesic-prescribing rates by specialty, U.S., 2007-2012. *Am J Prev Med*. 2015;49:409-413.
26. Cryer B, Barnett MA, Wagner J, Wilcox CM. Overuse and misperceptions of nonsteroidal anti-inflammatory drugs in the United States. *Am J Med Sci*. 2016;352:472-480.
27. Heard KJ, Ries NL, Dart RC, Bogdan GM, Zallen RD, Daly F. Overuse of non-prescription analgesics by dental clinic patients. *BMC Oral Health*. 2008;8:33.
28. McWilliams JM. Health consequences of uninsurance among adults in the United States: recent evidence and implications. *Milbank Q*. 2009;87:443-494.
29. McDonald DC, Carlson K, Izrael D. Geographic variation in opioid prescribing in the U.S. *J Pain*. 2012;13:988-996.

Reprint requests:

Arwa Farag,
BDS, DMSc,
Tufts University School of Dental Medicine,
1 Kneeland Street, 6th floor, DHS #638,
Boston,
MA 02111 USA.
Arwa.farag@tufts.edu