Allergy and Asthma Medication Use in Home-Dwelling U.S. Older Adults

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Abstract

Background: Little is known about the use of allergy and asthma medications in older adults. This study aimed to assess the prevalence of use of these medications in older adults and evaluate predictors of their use.

Methods: Cross-sectional study using data from the National Social Life, Health, and Aging Project, a nationally representative sample of community dwelling, U.S. adults 57–85 years (n=2976) collected in 2005–6. We determined prevalence of medication use and used logistic regression to evaluate socio-demographic and health factors associated with their use.

Results: Overall prevalence of allergy medication usage was 8.4% (most commonly antihistamines), and prevalence of asthma medication usage was 8.0% (most commonly bronchodilators). Allergy medication use was significantly associated with history of asthma (OR 2.37, 95% CI 1.52–3.69), chronic obstructive pulmonary disease (COPD) (OR 2.35, 95% CI 1.58–3.51), or nasal surgery (OR 1.97, 95% CI 1.00–3.86). Older age was associated with decreased allergy medication use (per decade, OR 0.80, 95% CI 0.66–0.98). Although increased education was associated with increased overall allergy medication use, it was associated with decreased use of allergy medications generally contraindicated in the elderly. In contrast, the only significant predictors of asthma medication use were history of asthma (OR 19.66, 95% CI 3.18–121.70) or COPD (OR 4.25, 95%CI 0.88–20.44).

Conclusion: Allergy and asthma medication use is prevalent among older adults and driven mostly by history of asthma or COPD. Additional socio-demographic factors predict allergy (but not asthma) medication use. Further studies are needed to evaluate efficacy of these drugs in the elderly.

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Introduction

Upper and lower airway disease pose a large burden for older adults and create clinical challenges for the physicians who must address them in this growing demographic group of patients. In both diseases, precise information about prevalence, incidence, and pathophysiology of disease is largely unknown. For example, classifying rhinitis in older adults is challenging. Although the prevalence of rhinitis remains relatively similar across adult age groups[1], the proportion of allergic rhinitis (AR) appears to decrease with age, while that of non-allergic rhinitis (NAR) seems to increase[2]. In contrast, the prevalence of asthma in adults, another atopic disease, may remain relatively similar across age groups, affecting approximately 8% of adults ≥ 65 years of age[3]. Here, too, solid data with detailed clinical phenotyping is not widely available. Given the rapid aging of our society, increased knowledge about the epidemiology of these diseases is warranted.

A related area in which we have sparse information is about allergy and asthma medication use in older people, an important question to clinicians who must treat these disorders. Several of these medications are not recommended for use in older adults. For example, the American Geriatrics Society (AGS) Beers Criteria strongly recommend against the use of sedating antihistamines in the elderly due to their anticholinergic and sedative effects[4–6], especially in light of effective alternatives. The AGS also strongly cautions against the use of decongestants in this age range due to their stimulatory effects[5]. Notably, despite limited efficacy, antihistamines are also commonly used in the treatment of NAR, which can be clinically difficult to distinguish from AR[7]. Thus, prevalence of antihistamine use in older people may be expected to exceed the prevalence of AR due to its use for this indication.

While most asthma medications are not inappropriate *per se* in older patients, the use of theophylline, a xanthine derivative, is not recommended by the AGS due to its stimulatory effects[5] and toxicity (e.g., arrhythmias, seizures, and death)[8]. Interestingly, elderly patients with asthma have been found to be more likely to use theophylline compared to younger patients, despite using similar numbers and classes of medications overall[9].

The aims of this study were 1) to evaluate the prevalence and characterize the use of allergy and asthma medications among older adults, 2) to evaluate predictors of allergy and asthma medication use, and 3) to evaluate predictors of use of allergy and asthma medications that are inappropriate in older adults. We hypothesized that allergy and asthma medication use is prevalent among older adults, and would roughly match the purported frequency of disease in this age group. Furthermore, we expected allergy, but not asthma, medication use to decrease with increasing age, given age-associated trends in disease prevalence. We also expected that those with more education/higher socioeconomic status (SES), women, and Whites would be more likely to use allergy medications, as these factors have been associated with self-reported "hay fever"[10]. In contrast, we hypothesized that those with less

education/lower SES, and current smokers would be more likely to use asthma medications, as these factors have been associated with asthma[3,11]. Finally, we hypothesized that those with less education/lower SES would be more likely to use inappropriate allergy and asthma medications.

Using data from the National Social Life, Health, and Aging Project (NSHAP), a nationally representative sample of U.S. community-dwelling adults 57–85 years of age, we assessed the prevalence of allergy and asthma medication use in older people and evaluated predictors of their use. The "Strengthening the Reporting of Observational Studies in Epidemiology" (STROBE) checklist was utilized for reporting of cross-sectional observational studies[12].

Methods

Study Population

NSHAP utilized a probability sample representative of home-dwelling older adults in the United States. In 2005–6 (Wave 1) professional interviewers from the National Opinion Research Center (NORC) conducted in-home interviews with 3005 community-dwelling older adults (1454 men and 1551 women) 57–85 years of age living throughout the US[13,14]. Interviews included assessment of demographic, social, psychological, and biological measures, including direct recording of medication use from review of actual prescription bottles and medications. Further details regarding design, data collection, and baseline characteristics of NSHAP respondents are provided elsewhere[13,15]. This study was approved by the Institutional Review Boards of The University of Chicago and NORC; all respondents provided written, informed consent. These data are publically available through the National Archive of Computerized Data on Aging within the Inter-university Consortium for Political and Social Research at University of Michigan (http://www.icpsr.umich.edu/icpsrweb/NACDA/studies/20541).

Medication Classification

Medications were classified using a modified version of the Multum Lexicon Plus drug hierarchy[16]. Allergy medications included antihistamines (oral and intranasal), decongestants, nasal irrigations, and nasal steroids. Combination medications including decongestants were categorized as decongestants. Antihistamines were further classified as sedating or non-sedating. We note that although loratadine is not recommended according to the AGS Beers Criteria[5], it is a non-sedating antihistamine and was therefore classified as such. Asthma medications included bronchodilators, inhaled corticosteroids (ICS), ICS-bronchodilator combinations, leukotriene modifiers, expectorants, mast cell stabilizers, and xanthine derivatives (e.g., theophylline). Bronchodilators were further classified as short acting ß-agonists (SABAs), long acting ß-agonists (LABAs), anticholinergics, or ß-agonist-anticholinergic combos. Leukotriene modifiers were classified as asthma medications because they were not yet approved for allergic rhinitis in 2005 at the time of data collection. Full listings of medications included in each category are presented in the supplemental material (see Table S1).

Additional Covariates

We considered social and demographic factors, including age (continuous variable, in decades), gender, race/ethnicity (standard NIH classifications), and education (as a measure of socioeconomic status, defined as the highest degree or certification completed: <high school; high school graduate or equivalent; some college, vocational certificate, or associates degree; or bachelors or higher). Health insurance was coded as follows: respondents with private insurance (irrespective of any other insurance) were coded as privately insured, and respondents with Medicare were coded as Medicare (including those who also reporting additional coverage by Medicaid or Veteran's Affairs (VA) insurance). Those with supplemental private insurance were coded as privately insured.

Relevant health characteristics examined included asking participants if they had a history of nasal surgery or had ever been told by a medical doctor they have asthma or chronic obstructive pulmonary disease (COPD). There were no additional details of these conditions in the survey. Health behaviors included current alcohol use and cigarette smoking (treated as current, former, or never smokers). We accounted for additional comorbidities using a modified version of the Charlson comorbidity index[17] that excluded asthma/COPD, as these conditions were considered separately. Conditions included in the modified comorbidity index include: history of myocardial infarction, heart failure, peripheral vascular disease, ulcers, arthritis, stroke, Alzheimer's disease/dementia, diabetes, cirrhosis, kidney disease, or any cancer (including leukemia/lymphoma). Further details are available elsewhere[17,18]. All covariates were chosen a priori based on clinical relevance for geriatric airway disease.

Statistical Analysis

Sampling weights, accounting for differential probabilities of selection and non-response, were employed to determine prevalence rates and predictors of medication use. Design-based standard errors were calculated using the linearization method together with the strata and primary sampling unit (cluster) indicators. Univariate and multivariate logistic regression were used to evaluate predictors of overall allergy and asthma medication usage, as well as predictors of medications not recommended for use in older adults (sedating antihistamines and decongestants for allergy and theophyllines for asthma). Due to a limited number of respondents using the not-recommended medications, these analyses only considered those covariates found to predict overall medication use in multivariate analyses ($P<0.1$).

Some models of overall allergy or asthma medication use and inappropriate allergy medication use had sample sizes <2976 due to missing data for certain variables. As this was largely driven by missing information for two covariates (history of nasal surgery and insurance status, Supplemental Material Table S2), a category option of 'missing data' was added to these variables and the data re-analyzed. Data completeness for other variables was >99% (Table S2). Results from these models (data not shown) did not substantially impact our conclusions. Adjusted Wald tests were used to determine P values and 95% confidence intervals (CI). All statistical analyses were conducted using Stata Version 12.1[19].

Results

NSHAP's overall response rate was 75.5%, with respondents and non-respondents sharing similar demographic characteristics (age, gender, race, and urban/rural dwelling; details provided elsewhere) [13]. Respondents with missing medication information (n = 29) were excluded. Thus, of the 3005 respondents interviewed, 2976 (99%) were included in analysis.

Social, demographic, and health characteristics for the population are presented in the supplementary material (Table S2). Overall, 8.4% of older adults reported allergy medication use, most commonly antihistamines (6.8%) (Table 1). While the majority of antihistamines used were non-sedating, 1.1% of older adults reported using a sedating antihistamine, accounting for 16% of antihistamine users. The total number of allergy medications used ranged from 1–2 with approximately 1% using 2 medications. Overall, 8.0% of older adults reported use of asthma medications, most commonly bronchodilators (5.0%), particularly SABAs (3.6%). In contrast to allergy medications, the number of asthma medications used varied widely, from 1 to 7, with approximately 1.4% using 3 medications.

Univariate and multivariate models for predictors of allergy medication use are presented in Table 2. Increased age was, as expected, associated with decreased odds of allergy medication use with a significant association in multivariate (OR 0.80, 95% CI 0.66–0.98), but not univariate, analysis. Hispanics were significantly less likely to use these drugs compared to Whites, but the overall association between race/ethnicity and medication use was non-significant (P = .16). Older adults with some education beyond high school were significantly more likely than those with less than high school level education to use these medications in univariate analysis (OR 1.93, 95% CI 1.24–3.00; OR 1.54, 95% CI 1.04–2.27). Although these associations were somewhat attenuated in multivariate analysis, education overall remained a significant predictor of allergy medication use (P = .04). Those with a history of asthma, COPD, or nasal surgery were approximately twice as likely to use them compared to those without such history, in both univariate and multivariate models. In both models, increased comorbidity was also associated with increased odds of allergy medication use. Gender, alcohol use, smoking, and insurance status were not associated with allergy medication use in any model.

We then performed an analysis of risk factors for use of inappropriate allergy medications (sedating antihistamines or decongestants), including age, education, nasal surgery, and history of COPD and asthma (Table 2). Older adults with history of nasal surgery were approximately three times as likely to be using an inappropriate allergy medication compared to those without history. Those with increased comorbidity and with a history of asthma were also more likely to be using these medications in univariate and multivariate models, whereas any association with COPD was nearly entirely attenuated in multivariate analysis. Interestingly, adults with a bachelors or higher education trended toward decreased use of these medications, despite being more likely to use allergy medications overall.

Not surprisingly, those with a history of asthma and COPD were significantly more likely than those without these diseases to use asthma medications (Table 3). In fact, they were the

only factors significantly associated with asthma medication use in multivariate analysis. In univariate analysis, a history of nasal surgery, no alcohol use, ever smoking, and increased comorbidity were all significant predictors of asthma medication use. However, these effects were all attenuated in multivariate analysis, likely because they were factors associated with asthma and/or COPD and so their effects were explained with the inclusion of asthma and COPD in the multivariate model. We therefore only tested asthma and COPD in a model to determine risk factors for xanthine derivative (theophyllines) use (the only inappropriate asthma medications). Those with a history of asthma (OR 19.66, 95% CI 3.18–121.70) and, to a lesser extent, COPD (OR 4.25, 95% CI 0.88–20.44) were more likely to use these relatively contraindicated drugs (Table 3).

Discussion

This is the first epidemiologic study of allergy and asthma medication use in a nationally representative sample of home-dwelling older US adults. We found that use of these medications remains prevalent in this age group, with asthma medication use prevalence roughly paralleling previously reported rates of asthma in older adults (8.1% in adults 65 years age)[3]. We acknowledge that many of these medications are also used in the treatment of COPD, something this secondary data analysis could not distinguish. Additionally, among those using at least one asthma medication, 14% did not self-report a history of asthma or COPD (data not shown), perhaps driven by underreporting of asthma/COPD, medication reporting errors, or use of these medications for other indications, such as albuterol for exercise-induced bronchospasm in the absence of an asthma diagnosis.

We observed that age was not associated with asthma medication use, consistent with the fact that the estimated prevalence of asthma remains generally stable across age groups in adults. Our finding that the association of asthma drug use with current/former smoking was attenuated in a multivariate model that included a history of asthma or COPD was not unexpected, as smoking is significantly associated with development of these conditions, which in turn are obviously strong predictors of asthma medication use. In contrast, although we had expected that medication use would be higher among those with decreased education and Blacks, two subgroups with higher rates of asthma, these factors were not significant even in univariate analyses. These results are consistent with epidemiologic data suggesting that, compared to adults 35–64 years of age, among adults 65 rates of asthma do not increase as much with lower education/SES[3]. This trend may be driven by selective survival that manifests by these older ages, differing risk factors for asthma in older adults, or increased healthcare access (via Medicare) for those of lower socioeconomic status after 65 years of age.

Although no epidemiologic studies of AR have been conducted in the elderly, self-reported prevalence of "hay fever" in older adults has been reported at 7.5–9.1%[10], similar to the prevalence of allergy medication use in this study. Of course, it is unclear to what extent this is driven by NAR, which likely constitutes a majority of rhinitis in this age group and for which some AR medications such as antihistamines are commonly used (though they may be ineffective). As with AR, there are no good epidemiology studies of NAR in older adults. However, prevalence of rhinitis symptoms in older adults has been reported at around 30%

in the United States and Portugal[1,20]; only ~40% of such subjects reported being diagnosed with rhinitis by a physician in the Portuguese study[20] Clinicians caring for this population should therefore consider that even patients who do not present with obvious allergic disease or clinically diagnosed rhinitis may still be using these medications, many of which are available over-the-counter. Notably, use of nasal saline irrigation, a safe treatment for rhinitis[21], was exceedingly low (0.02%), suggesting that clinicians can be more aggressive in recommending this effective therapy.

As we expected, younger older adults and those who had more education were more likely to use allergy medications, reflecting known risk factors for self-reported "hay fever"[10]. In contrast, although women and Whites have been reported to be more likely to have rhinitis, these groups tended towards increased allergy medication use, but these trends were not statistically significant. Our finding that those with more education were more likely to use any allergy medication but less likely to use an inappropriate allergy medication highlights the need for proper education of older patients, particularly those with limited health literacy. Additionally, clinicians caring for those with a history of nasal surgery should be aware that these patients are approximately 3 times as likely as those without such history to use an inappropriate allergy medication. This may be due to by such patients have more severe nasal symptoms, which may be more refractory to more appropriate first-line medications, however this is difficult to evaluate without more information on symptom severity. Use of xanthine derivatives, which are not recommended for use for asthma in older adults, was somewhat prevalent (0.7%), however we were unable to evaluate whether any additional socioeconomic or demographic factors beyond a history of asthma or COPD predicted their use.

This study was limited by a lack of details on allergy and lung disease, such as skin testing or pulmonary function. This was, of course, because of our study design as a secondary data analysis. All information was self-reported, without details on symptom severity, indications for medication use (including over-the-counter vs. prescription), dose, and frequency of usage. We do note that interviewers recorded medications by history and confirmed doses and names by direct inspection of the medication bottles in the homes. However, as medication use was limited to those taken on a "regular schedule" it may not have captured a majority of PRN use. The study did not determine whether respondents using medications classified as not recommended according to published guidelines suffered from any adverse events. Further studies using datasets with more detailed information on clinical parameters are clearly needed, especially in different subpopulations not investigated here, such as those residing in skilled nursing facilities, retirement homes, and other venues. We note that there are limited data about airway diseases in older adults in general, and thus stress the need for more investigation in this important area.

Conclusions

In conclusion, the use of allergy and asthma medications in older US adults is prevalent, including medications not recommended for use in this age group. Though these data have limitations, they are the only nationally representative information available to date. Future work is needed to understand the epidemiology of airway diseases in older adults and the

efficacy of medications for these conditions. Clinicians should recognize that these medications are commonly used by their older patients, particularly those at risk for low health literacy, and maintain vigilance for potentially serious side effects associated with their use.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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Table 1.

Prevalence of allergy and asthma medication usage, weighted to reflect community dwelling U.S. adults 57–85 years of age (n = 2976).

Medication	Prevalence (%)	
Allergy medications	**8.4[a]**	
Antihistamines	6.8[b]	
Sedating		1.1
Non-sedating		5.8
Decongestants	0.9	
Nasal lubricants & irrigations	0.02	
Nasal steroids	1.4	
Asthma medications	**8.0[a]**	
Bronchodilators	5.0[b]	
Short-acting ß-agonists (SABAs)		3.6
Long-acting ß-agonists (LABAs)		0.4
Anticholinergics		1.5
ß-agonist-Anticholinergic combo		1.1
Inhaled corticosteroids (ICS)	2.3	
ICS-Bronchodilator combo	2.2	
Leukotriene modifiers	1.6	
Mast cell stabilizers	0.1	
Xanthine derivatives	0.7	

[a] Sum of allergy and asthma medication categories may be greater than overall allergy and asthma medication prevalence because of participants who report using more than one category of allergy or asthma medication.

[b] Sum of antihistamines sub-categories and bronchodilator sub-categories may be greater than overall antihistamine and bronchodilator prevalence because of participants who report using more than one sub-category of antihistamine or bronchodilator.

Table 2.

Univariate and multivariate logistic regression for predictors of allergy medication and inappropriate allergy medication (sedating antihistamines and decongestants) use, weighted to reflect the population of community dwelling U.S. adults 57–85 years of age. Univariate results reported as unadjusted odds ratios (ORs) and multivariate results reported as adjusted ORs (aORs) Analysis of inappropriate medications restricted to predictors of overall medication use in multivariate analysis (*P*<0.1). Some models had sample sizes <2976 due to missing data for certain variables. Bolded *P*-values significant (*P*<0.05).

Predictors	Allergy Medication (Univariate) (n = 2357–2976)		Allergy Medication (Multivariate) (n = 2298, 8.3% med. usage)		Inappropriate Allergy Medication (Univariate) (n = 2436–2976)		Inappropriate Allergy Medication (Multivariate) (n = 2436, 1.9% med. usage)	
	OR (95% CI)	P value	aOR (95% CI)	P value	OR (95% CI)	P value	aOR (95% CI)	P value
Age (decades)	0.88 (0.73–1.06)	.18	0.80 (0.66–0.98)	**.04**	0.81 (0.50–1.32)	.39	0.66 (0.36–1.21)	.18
Male (vs. Female)	0.80 (0.59–1.10)	.17	0.83 (0.59–1.16)	.27				
Race/Ethnicity (vs. White)		.08		.16				
Black	0.61 (0.36–1.02)		0.80 (0.45–1.44)					
Hispanic	0.54 (0.29–1.04)		0.45 (0.22–0.90)					
Other	1.26 (0.54–2.98)		1.19 (0.42–3.35)					
Education (vs. <High school)		**.006**		**.04**				.15
High school graduate or equivalent	1.01 (0.62–1.62)		0.75 (0.39–1.46)		1.16 (0.38–3.58)		1.04 (0.31–3.49)	
Some college, vocational certificate, or associates	1.93 (1.24–3.00)		1.55 (0.90–2.67)		1.31 (0.47–3.62)		1.18 (0.44–3.20)	
Bachelors or higher	1.54 (1.04–2.27)		1.22 (0.70–2.12)		0.53 (0.17–1.67)		0.40 (0.11–1.40)	
Nasal surgery	2.03 (1.07–3.83)	**.03**	1.97 (1.00–3.86)	**.048**	2.94 (0.88–9.86)	.08	3.04 (0.98–9.43)	.054
Asthma	3.56 (2.53–5.03)	**<.001**	2.37 (1.52–3.69)	**<.001**	1.97 (1.03–3.77)	**.04**	1.40 (0.57–3.43)	.21
COPD	3.37 (2.43–4.66)	**<.001**	2.35 (1.58–3.51)	**<.001**	1.62 (0.68–3.82)	.27	1.06 (0.37–3.02)	.92
Current alcohol use	1.11 (0.82–1.49)	.49	1.34 (0.89–2.02)	.15				
Smoking (vs. Never)		.57		.97				
Former	1.23 (0.83–1.82)		1.06 (0.66–1.72)					
Current	1.24 (0.72–2.13)		1.06 (0.58–1.93)					
Insurance (vs. Private)		.79		.40				
Medicare	1.03 (0.74–1.43)		1.22 (0.80–1.87)					
Medicaid/VA/other	0.79 (0.39–1.63)		0.76 (0.33–1.74)					
Comorbidity index	1.13 (1.03–1.23)	**.01**	1.11 (1.00–1.22)	**.046**	1.25 (1.08–1.43)	**.003**	1.21 (1.00–1.45)	**.045**

Table 3.

Univariate and multivariate logistic regression for predictors of asthma medication and inappropriate asthma medication (xanthine derivatives) use, weighted to reflect the population of community dwelling U.S. adults 57–85 years of age. Univariate results reported as unadjusted odds ratios (ORs) and multivariate results reported as adjusted ORs (aORs) Analysis of inappropriate medications restricted to predictors of overall medication use (P<0.1). Some models had sample sizes <2976 due to missing data for certain variables. Bolded P-values significant (P<0.05).

Predictors	Asthma Medication (Univariate) (n = 2357–2976)		Asthma Medication (Multivariate) (n = 2298, 8.4% med. usage)		Inappropriate Asthma Medication (Univariate) (n = 2976)		Inappropriate Asthma Medication (Multivariate) (n = 2976, 0.7% med. usage)	
	OR (95% CI)	P value	aOR (95% CI)	P value	OR (95% CI)	P value	aOR (95% CI)	P value
Age (decades)	1.06 (0.90–1.24)	.47	1.03 (0.80–1.31)	.84				
Male (vs. Female)	0.84 (0.62–1.14)	.26	1.29 (0.89–1.88)	.18				
Race/Ethnicity (vs. White)		.35		.56				
Black	0.64 (0.36–1.16)		0.92 (0.42–2.03)					
Hispanic	1.15 (0.69–1.90)		1.53 (0.74–3.19)					
Other	0.78 (0.30–1.99)		1.11 (0.44–2.82)					
Education (vs. <High school)		.22		.79				
High school graduate or equivalent	.84 (0.61–1.16)		1.17 (0.67–2.04)					
Some college, vocational certificate, or associates	1.06 (0.71–1.57)		1.35 (0.62–2.96)					
Bachelors or higher	0.70 (0.47–1.04)		0.99 (0.46–2.13)					
Nasal surgery	1.67 (1.00–2.79)	**.049**	1.16 (0.59–2.27)	.66				
Asthma	13.16 (9.72–17.82)	**<.001**	9.54 (5.48–16.62)	**<.001**	33.02 (8.70–125.23)	**<.001**	19.66 (3.18–121.70)	**.002**
COPD	28.36 (20.25–39.73)	**<.001**	24.21 (15.21–38.54)	**<.001**	13.11 (4.14–41.49)	**<.001**	4.25 (0.88–20.44)	.07
Current alcohol use	0.69 (0.52–0.92)	**.01**	0.77 (0.49–1.21)	.26				
Smoking (vs. Never)		**<.001**		.51				
Former	1.75 (1.29–2.36)		1.30 (0.83–2.06)					
Current	1.84 (1.22–2.77)		1.06 (0.45–2.47)					
Insurance (vs. Private)		.14		.45				
Medicare	1.37 (0.97–1.94)		1.29 (0.76–2.17)					
Medicaid/VA/other	1.01 (0.48–2.15)		0.75 (0.23–2.46)					
Comorbidity index	1.13 (1.02–1.25)	**.02**	0.93 (0.83–1.05)	.24				