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ORIGINAL ARTICLE

Asthma medication use among late midlife US AdultsMaithili Deshpande, PhD¹, Betty Chewning, PhD², David Mott, PhD², Joshua M. Thorpe, PhD³, and Henry N. Young, PhD⁴¹Pharmacy Practice, Southern Illinois University-Edwardsville, Edwardsville, IL, USA, ²Social and Administrative Sciences, University of Wisconsin-Madison, Madison, WI, USA, ³Pharmacy and Therapeutics, University of Pittsburgh, Pittsburgh, PA, USA, and ⁴Clinical and Administrative Pharmacy, University of Georgia-Athens, Athens, GA, USA**Abstract**

Objective: Despite substantial prevalence of asthma, little is known about asthma in late midlife adults (50–64 years). The objective of this study was to examine the factors associated with the use of asthma medications among late midlife adults. **Methods:** Pooled data were obtained from the 2006 to 2010 Medical Expenditure Panel Survey. Medication use outcome variables include: (a) daily use of a preventive asthma medication and (b) use of more than three canisters of rescue inhalers in last 3 months. The Andersen Behavioral Model of Health Services Utilization was used to guide the selection of independent variables. Descriptive, unadjusted and adjusted logistic regression analyses were performed. Point estimates were weighted to the US civilian population and variance estimates were adjusted to obtain appropriate standard errors. All analyses were conducted using STATA (version 12). **Results:** A total of 1414 (weighted sample of 15 030 364) self-reported late midlife asthmatics were identified. About 31% of late midlife adults with asthma were using a preventive medication on a daily basis while 11% reported overusing acute medications. Adjusted analyses found that race, rurality and smoking were related to poor use of asthma medications among late midlife adults. **Conclusion:** Results suggest that asthma medication use is far from optimal among vulnerable groups of late midlife US adults.

Keywords

Acute medication, asthma, disparities, late midlife, overuse, preventive medication

History

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Introduction

An estimated 18 million American adults are currently diagnosed with asthma [1]. According to the Expert Panel Report 3, “Guidelines for the Diagnosis and Management of Asthma”, appropriate medication therapy including regular use of preventive asthma medications (i.e. long-term controllers) and controlled use of acute asthma medications (i.e. rescue medications) are key to successful asthma therapy [2]. Despite these guidelines, studies have documented disparities in asthma care. However, the majority of this research has focused on younger populations with asthma [3]. To the best of our knowledge, little is known about whether disparities persist into later adulthood.

According to a Center for Disease Control & Prevention (CDC) report, one in five Americans will be 50–64 years of age by 2015, i.e. late midlife [4]. Adults in this stage of midlife juggle family and work pressures and are fast approaching retirement [4]. By the time they reach 60 years of age, about 70% are diagnosed with one or more chronic health conditions [4]. Individuals with asthma in this age group can face competing chronic conditions which increase disease burden and complexity of disease management [4]. In addition, loss of employment and subsequent difficulty in

securing adequate health insurance coverage can render midlife adults with asthma less than healthy as they progress into Medicare eligibility [5].

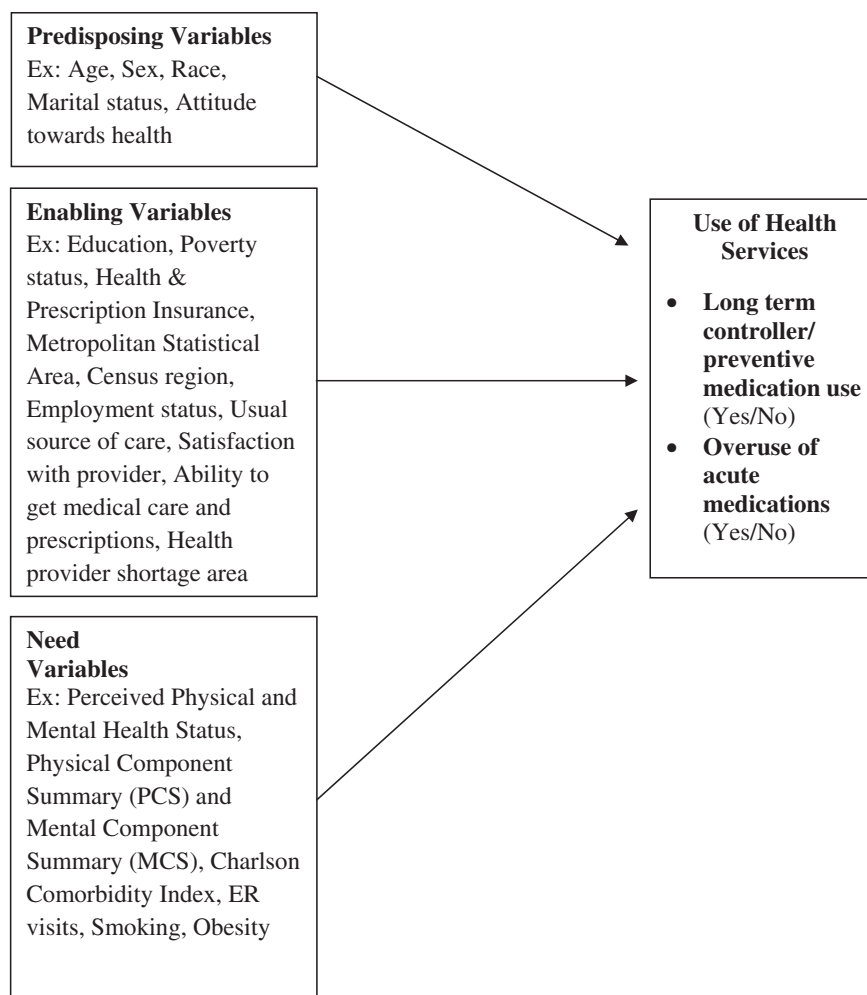
A 2010 National Health Interview Survey reported that 8.4% of adults between 45 and 64 years of age are currently suffering from asthma [6]. An Agency for Healthcare Research and Quality (AHRQ) report found that adults aged 65 and over were more likely to receive treatment for asthma than those 45–64 years [7]. In a study of adults (18–85 years old) with asthma, Deshpande et al. found that late midlife asthmatics were less likely to use a preventive asthma medication on a daily basis compared to 65 and older adults [8]. However, there are few studies that focus on the late midlife adults with asthma and their medication use. This study aims to fill this gap by assessing patterns and predictors of asthma medication use among late midlife adults with asthma.

Methods**Conceptual framework**

In order to identify the factors associated with asthma medication use among US adults, this study used the Andersen Behavioral Model of Health Services Utilization (Andersen Model) [9]. The Andersen Model has been widely used to identify factors associated with health services use including medication use [10–15]. The model suggests that

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Figure 1. A conceptual model of utilization of asthma medications based on Andersen's behavioral model of health services use.



patients' use of health services such as medications is based upon their predisposition to use services, factors which enable or facilitate use of services and the patient's need for care. Predisposing, enabling and need variables were hypothesized to influence medication use among late midlife adults (Figure 1).

Data source

This cross-sectional study used pooled 2006–2010 Medical Expenditure Panel Survey (MEPS) data for asthmatic patients 50–64 years of age [16]. MEPS is a nationally representative survey that collects data on health and healthcare utilization and is conducted by AHRQ. Detailed information about MEPS can be found at its website <http://meps.ahrq.gov/mepsweb> [16].

We used the MEPS-Household Component (MEPS-HC) to study the association of Andersen Model variables and asthma medication use by linking the Full Year Consolidated Data Files, and the Medical Condition Files [16]. The Full Year Consolidated Files provided sociodemographic characteristics, asthma classification, insurance coverage, health status and health attitudes for each subject while the Medical Condition File was used to identify co-morbid conditions for each subject.

This study was granted Institutional Review Board approval from the University of Wisconsin-Madison.

Study sample

The study sample consisted of late midlife adults who had ever been told by a doctor or other health professional that they had asthma. We identified current asthmatics by limiting the sample to those who self-reported “still having asthma” or if they had “an episode or an asthma attack in the past 12 months”.

Dependent variables

National Heart Lung and Blood Institute (NHLBI) guidelines for asthma treatment recommend regular use of long-term controller medication (preventive medication) and controlled use of acute “rescue” medications (no more than 2 days/week) as an indicator of asthma control [2]. Therefore, two dependent variables including daily use of preventive asthma medications and no overuse of acute medications were included in the study. Daily use of preventive asthma medication was based on self-report response. For the preventive medication use variable, participants were first asked, “Have you ever taken the preventive kind of asthma medicine used every day to protect your lungs and keep you from having attacks? Include both oral medicine and inhalers. This is different from inhalers used for quick relief.” Those who responded “Yes” to this, were further asked, “Are you now taking this medication (that protects the lungs) daily or almost daily?” Participants who reported “Yes” on both

questions were classified as using daily preventive medication. Similarly, for overuse of acute medications participants were first asked, “During the past 3 months, have you used the kind of prescription inhaler that you breathe in through your mouth that gives quick relief from asthma symptoms?” Those who responded “Yes” to this were further asked, “During the past 3 months, did you use more than 3 canisters of this type of inhaler?” Participants who reported “Yes” on both questions were classified as overusing acute medications.

Independent variables

Independent variables were selected based on the Andersen Behavioral Model of Health Services Utilization [9]. *Predisposing factors* included age, race/ethnicity, sex and marital status. We also included one question related to patient attitude toward medical care and risk taking: “I am more likely to take risks”. The *enabling factors* included federal poverty status, region of country, education level, health and prescription insurance status, and rurality. We also included availability of usual source of care and two related follow-up questions. These follow-up questions asked if the usual source of care asked the person to help make decisions between a choice of treatments and if the usual source of care usually asked about prescription medications and treatments other doctors may have given them. Two other access to care questions asked if the participant was: (a) unable to get medical care and (b) unable to get prescription medication in the last 12 months. Lastly, Health Professional Shortage Areas (HPSA) usually have poorer access to services. HPSA codes were obtained from the AHRQ data center at Rockville, MD. HPSA was classified as none of the county designated as a shortage area, one or more parts of the county designated as a shortage area, or the whole county designated as a shortage area. The medical *need factors* include the SF-12 Physical Component Summary and Mental Component Summary, current smoker, overweight/obese and the Charlson Comorbidity Index (CCI) based on the comorbid conditions available in the MEPS-HC file. The MEPS medical condition file was used to assign a score to each medical condition to obtain an adapted CCI [17] described by D’Hoore et al. [18]. We also included perceived physical and perceived mental health status as need variables. In order to control for asthma severity, we included asthma specific ER visits (ICD-9 code: 493) using the Emergency Room Visits File. Detailed information about the survey questions may be found on the MEPS website at <http://meps.ahrq.gov/mepsweb/> [16].

Statistical analysis

Data were analyzed using STATA version 12 [19]. With less than 10% of the data missing, multiple imputation was used to obtain 10 complete data sets [20]. Demographic characteristics of the sample including means and frequencies were calculated and unadjusted logistic regression ($p < 0.2$) [21] along with Andersen Behavioral Model of Health Services Utilization was used to identify key independent variables predictive of use of preventive asthma medications and overuse of acute asthma medications [22]. In order to build a theoretically-based prediction model, we used the Andersen

Behavioral Model of Health Services Utilization to develop our multivariate adjusted logistic regression model. Point estimates were weighted to the US civilian population and variance estimates were adjusted to obtain appropriate standard errors in order to account for the complex survey design of MEPS [16]. Odds ratio (OR) and 95% Confidence intervals (CI) were used to report unadjusted and adjusted estimates.

Results

Table 1 describes the characteristics of the study sample. A total of 1414 (weighted sample of 15 030 364) self-reported asthmatics age 50–64 years were identified and included in this analysis. About 66% of the sample was comprised of women. Seventy-six percent were non-Hispanic White, about 12% were African American and about 7% were Hispanic. About 19% of the adults lived in a non-MSA area. Only 31% of the asthmatic population was using a preventive medication on a daily basis for their asthma, while 11% reported overusing the acute care medication.

Table 2 describes the unadjusted bivariate relationships between the Andersen Model independent variables and each of the two dependent variables. We found that late midlife Hispanic and African American adults were significantly less likely to use a preventive asthma medication daily than 50–64-year-old Whites (OR: 0.62, CI: 0.40–0.96; OR: 0.56, CI: 0.40–0.79, respectively). Non-metropolitan late midlife adults were significantly more likely to overuse acute medication compared to those living in metropolitan area (OR: 2.87, CI: 1.85–4.44). Higher comorbidity score was associated with higher asthma medication use behavior for both preventive and acute medications compared to lower comorbidity score in late midlife adults (Preventive use OR: 1.12, CI: 1.06–1.19; Acute overuse OR: 1.30, CI: 1.15–1.47). Late midlife adults who smoked were less likely to use a preventive asthma medication daily (*not significant*) and significantly more likely to overuse acute asthma medication compared to non-smoking late midlife adults (OR: 0.67, CI: 0.41–1.12 and OR: 2.55, CI: 1.94–3.34, respectively).

Table 3 provides the adjusted logistic regression models that were used to identify factors associated with preventive asthma medication use and overuse of acute asthma medication among late midlife US adults. Hispanic and African American were significantly less likely to use a preventive asthma medication daily compared to non-Hispanic whites (OR: 0.49, CI: 0.31–0.80; OR: 0.46, CI: 0.32–0.66, respectively). We also found that late midlife adults from non-metropolitan areas were more likely to overuse acute asthma medication than those who were from a metropolitan area (OR 2.75, CI: 1.59–4.76). Late midlife adults with greater comorbidity scores were more likely to use a preventive asthma medication daily compared to those with lower comorbidity scores (OR: 1.11, CI: 1.00–1.23). Higher comorbidity scores were also associated with an increased risk of overusing acute asthma medications (OR: 1.17, CI: 1.02–1.32). Lastly, late midlife adults who smoked were less likely to use a preventive asthma medication daily and significantly more likely to overuse acute asthma medication compared to non-smoking late midlife adults (OR: 0.62, CI: 0.41–0.95 and OR: 1.62, CI: 1.17–2.85, respectively).

Table 1. Description of sample: late midlife US adults with asthma.

Study variables	Late midlife US adults Unweighted <i>n</i> = 1414 Weighted <i>n</i> = 15 030 364 Weighted mean or weighted percent (standard error)
Predisposing characteristics	
Age, years	56.5 (0.13)
Male, %	33.9
Race/ethnicity, %	
Hispanic	6.9
Black, non-Hispanic	11.6
Asian/Other, non-Hispanic	5.6
White, non-Hispanic	75.8
Marital status, %	
Married	59.0
Widow/divorced/separated	31.9
Single-unmarried	9.0
More likely to take risks than the average person, %	
Disagree strongly	51.3
Disagree somewhat	19.1
Uncertain	11.9
Agree somewhat	14.7
Agree strongly	3.1
Enabling characteristics	
Education, %	
No degree	15.4
HS/GED/other	56.5
BSc/MSc/PhD	28.1
Poverty status, %	
Poor/near poor	18.9
Low income	11.6
Middle income	26.7
High income	42.8
Health insurance status, %	
Any private	69.9
Public	20.3
Uninsured	9.7
Prescription insurance, %	79.8
Region, %	
Northeast	16.8
Midwest	20.9
South	35.7
West	26.7
Non-metropolitan statistical area, %	18.9
Unable to get medical care, %	7.3
Unable to get prescription medications, %	9.1
Has Usual Source of Care (USC), %	92.2
USC asks about prescription medications and treatments other doctors may give them, %	75.5
USC explores treatment options with the patient, %	84.8
Health provider shortage area (HPSA)	
No shortage	14.5
Whole county shortage	40.9
Partial county shortage	44.6
Need characteristics	
Smoking, %	22.1
Overweight/obese, %	78.1
Mean adapted Charlson Comorbidity	1.2 (0.02)
Score aggregate	
ER count 0	97.8
ER count 1	1.4
ER count ≥2	0.8
Mean physical component summary	39.9 (0.35)
Mean mental component summary	47.8 (0.27)

(continued)

Table 1. Continued

Study variables	Late midlife US adults Unweighted <i>n</i> = 1414 Weighted <i>n</i> = 15 030 364 Weighted mean or weighted percent (standard error)
Perceived physical health status, %	
Excellent	39.9
Very good	28.7
Good	21.8
Poor/fair	9.6
Perceived mental health status, %	
Excellent	36.6
Very good	25.3
Good	30.5
Poor/fair	17.6
Dependent variables, %	
Use of preventive medication	31.4
Overuse of rescue medication	10.9

GED, Graduate Education Development test; HS, High School; BSc, Bachelor of Science; MSc, Master of Science; PhD: Doctor of Philosophy.

Discussion

Individuals approaching 50–60 years of age show an increased likelihood of serious health problems, including chronic diseases and complex medication regimens [4,5,23]. The total number of individuals aging into Medicare is projected to be nearly 80 million by 2030 [24]. A simulation study by Rula et al. found that on average, the present value of the Fee-for-Service Medicare benefit, from age 65 to death was \$174 018 per beneficiary (2008 dollars) [24]. The study also found that each simulation scenario that increased the proportion of low-risk individuals entering Medicare was associated with both annual and lifetime cost savings [24]. Given the benefits of healthy aging and its impact on Medicare, CDC issued a call to action to focus on 50–64-year-old population and their preventive health services use [4]. Since asthma is prevalent in this population (8.4%) [6], appropriate treatment and control of asthma should be a priority for the late midlife population.

Our study found predisposing, enabling and need variables associated with asthma medication use in the late midlife population. For example, similar to previous research, our study found racial disparities in the use of asthma medications [25,26]. Late midlife African Americans and Hispanics were less likely to use preventive asthma medication compared to Whites. Although not significant, a trend indicated that Hispanics had a higher likelihood of overusing acute asthma medication. Increasing age is usually associated with a decrease in lung capacity, making it imperative to have appropriate asthma management [27]. Since late midlife minorities may face other competing obstacles, it is important to understand the basis of racial disparities in late midlife adult's asthma management. The Institute of Medicine report, *Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care*, suggests that various patient level (e.g. patients' attitudes, preferences and expectation regarding healthcare), care process level (e.g. physician bias, stereotyping and language barriers) and system level factors

Table 2. Late midlife US adults asthma medication use: unadjusted bivariate analysis.

Study variables	Odds ratio (95% CI)	
	Use of preventive medications	Overuse of acute medications
Predisposing characteristics		
Age	1.01 (0.97–1.05)	1.01 (0.99–1.05)
Male	0.81 (0.64–1.02)	1.16 (0.86–1.57)
Race/ethnicity		
Hispanic	0.62** (0.40–0.96)	1.86** (1.22–2.84)
African American	0.56*** (0.40–0.79)	1.51 (0.99–2.29)
Asian/other	0.40** (0.17–0.92)	0.97 (0.50–1.85)
White	Reference	Reference
More likely to take risks than the average person	0.97 (0.85–1.06)	1.11 (0.85–1.25)
Marital status		
Married	1.14 (0.78–1.65)	1.25 (0.71–3.25)
Widow/divorced/separated	1.25 (0.89–1.75)	1.05 (0.22–2.01)
Single-unmarried	Reference	Reference
Enabling characteristics		
Education status		
HS/GED/other	0.66 (0.48–1.22)	1.25 (0.75–1.63)
BSc/MSc/PhD	0.95 (0.60–1.53)	0.82 (0.35–2.15)
No degree	Reference	Reference
Poverty status		
Low income	0.91 (0.54–1.54)	0.84 (0.61–1.46)
Middle income	0.68 (0.39–1.17)	1.03 (0.54–2.04)
High income	0.72 (0.42–1.25)	0.37** (0.22–0.62)
Poor/near poor	Reference	Reference
Health insurance status		
Public	1.65 (0.85–2.99)	0.95 (0.38–2.25)
Any private	0.60 (0.87–3.15)	0.55 (0.22–1.19)
Uninsured	Reference	Reference
Prescription insurance	1.75*** (1.31–2.34)	1.06 (0.75–1.49)
Region		
Northeast	0.97 (0.65–1.46)	0.86 (0.50–1.46)
Midwest	1.14 (0.76–1.71)	0.72 (0.40–1.29)
West	0.71 (0.52–1.00)	0.55* (0.31–0.97)
South	Reference	Reference
Unable to get medical care	0.56 (0.29–1.09)	0.93 (0.55–1.58)
Unable to get prescription medications	1.78** (1.23–2.55)	1.44 (0.98–2.12)
Has Usual Source of Care (USC)	1.69** (1.22–2.35)	0.85 (0.55–1.31)
USC asks about prescription medications and treatments other doctors may give them	1.50** (1.11–2.04)	0.93 (0.52–1.67)
USC does not ask about prescription medications and treatments other doctors may give them	1.34 (0.89–1.98)	1.24 (0.59–2.57)
No care/USC	Reference	Reference
USC asks the person to help make decisions between a choice of treatments	1.34 (0.72–2.46)	1.11 (0.57–2.17)
USC doesn't ask the person to help make decisions between a choice of treatments	1.59* (1.12–2.26)	0.82 (0.57–2.17)
No care/USC	Reference	Reference
Rurality – MSA Classification		
Non-metropolitan statistical area	1.13 (0.86–1.47)	2.87*** (1.85–4.44)
Metropolitan statistical area	Reference	Reference
Health provider shortage area (HPSA)		
No SHORTAGE	1.28 (0.82–1.99)	1.80 (0.98–2.95)
Whole county shortage	0.93 (0.72–1.21)	1.17 (0.95–1.99)
Partial county shortage	Reference	Reference
Need characteristics		
Current smoker	0.67 (0.41–1.12)	2.55*** (1.94–3.34)
Overweight/obese	1.04 (0.69–1.56)	1.23 (0.77–1.93)
Charlson comorbidity score	1.12*** (1.06–1.19)	1.30*** (1.15–1.47)
ER visits	1.03 (0.59–1.80)	1.86** (1.25–2.78)
Perceived physical health	1.07 (0.96–1.18)	2.13*** (1.66–2.72)
Perceived mental health	0.89** (0.81–0.97)	1.39*** (1.18–1.65)
Physical component summary	0.99 (0.98–1.01)	0.96*** (0.95–0.97)
Mental component summary	1.00 (0.99–1.01)	0.97*** (0.96–0.98)

OR, adjusted odds ratio; CI: 95% confidence interval; GED, general education development test; HS, High School; BSc, Bachelor of Science; MSc, Master of Science; PhD, Doctor of Philosophy.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 3. Late midlife US adults asthma medication use: multivariate logistic regression.

Study variables	Odds ratio (95% CI)	
	Use of preventive medications	Overuse of acute medications
Predisposing characteristics		
Age	0.99 (0.97–1.21)	1.02 (0.98–1.06)
Male	0.82 (0.62–1.08)	1.27 (0.87–1.84)
Race/ethnicity		
Hispanic	0.49** (0.31–0.80)	1.61 (0.89–2.91)
African American	0.46*** (0.32–0.66)	1.09 (0.71–1.68)
Asian/Other	0.35* (0.14–0.85)	0.96 (0.45–2.07)
White	Reference	Reference
More likely to take risks than the average person	0.94 (0.82–1.07)	1.04 (0.92–1.19)
Marital status		
Married	0.99 (0.60–1.63)	0.67 (0.26–1.74)
Widow/divorced/separated	1.28 (0.83–1.99)	0.79 (0.43–1.43)
Single-unmarried	Reference	Reference
Enabling characteristics		
Education status		
HS/GED/other	0.86 (0.58–1.25)	1.18 (0.77–1.79)
BSc/MSc/PhD	0.98 (0.61–1.56)	0.89 (0.29–2.74)
No degree	Reference	Reference
Poverty status		
Low income	0.91 (0.54–1.54)	0.67 (0.39–1.15)
Middle income	0.68 (0.39–1.17)	1.05 (0.54–2.04)
High income	0.72 (0.42–1.25)	0.66 (0.19–2.24)
Poor/near poor	Reference	Reference
Health insurance status		
Public	1.72** (0.93–3.19)	0.93 (0.38–2.28)
Any private	0.67 (0.85–3.28)	0.57 (0.26–1.21)
Uninsured	Reference	Reference
Prescription insurance	1.38 (0.75–2.52)	2.01* (1.11–3.67)
Region		
Northeast	0.96 (0.57–1.59)	0.97 (0.51–1.86)
Midwest	1.05 (0.75–1.46)	0.67 (0.36–1.23)
West	0.72 (0.48–1.04)	0.66 (0.33–1.30)
South	Reference	Reference
Unable to get medical care	0.48* (0.23–0.96)	0.47 (0.20–1.12)
Unable to get prescription medications	1.75** (1.12–2.72)	1.28* (1.01–2.43)
Has Usual Source of Care (USC)	1.36 (0.55–3.36)	0.47 (0.08–2.54)
USC asks about prescription medications and treatments other doctors may give them	1.80 (0.38–1.69)	1.81 (0.35–9.28)
USC does not ask about prescription medications and treatments other doctors may give them	0.75 (0.34–1.67)	1.78 (0.59–5.31)
No care/USC	Reference	Reference
USC asks the person to help make decisions between a choice of treatments	1.11 (0.47–2.57)	0.45 (0.16–1.26)
USC doesn't ask the person to help make decisions between a choice of treatments	1.20 (0.49–2.91)	0.65 (0.33–1.28)
No care/USC	Reference	Reference
Rurality – MSA Classification		
Non-metropolitan statistical area	1.21 (0.87–1.67)	2.75*** (1.59–4.76)
Metropolitan statistical area	Reference	Reference
Health provider shortage area (HPSA)		
No Shortage	1.19 (0.71–2.00)	1.80* (1.08–2.97)
Whole county shortage	1.05 (0.73–1.51)	1.37 (0.92–2.06)
Partial county shortage	Reference	Reference
Need characteristics		
Current smoker	0.62* (0.41–0.95)	1.62** (1.17–2.85)
Overweight/obese	0.89 (0.57–1.38)	0.96 (0.53–1.72)
Charlson comorbidity score	1.1*** (1.00–1.23)	1.17** (1.02–1.32)
ER visits	1.12 (0.66–1.90)	1.77* (0.60–9.46)
Perceived physical health	1.27** (1.04–1.55)	1.38 (0.98–1.93)
Perceived mental health	0.76*** (0.67–0.86)	0.82 (0.66–1.00)
Physical component summary	1.00 (0.99–1.02)	0.97*** (0.96–0.98)
Mental component summary	0.99 (0.98–1.01)	1.00 (0.98–1.01)

OR, adjusted odds ratio; CI, 95% confidence interval; GED, general education development test, HS, high school, BSc, Bachelor of Science; MSc, Master of Science; PhD, Doctor of Philosophy.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(e.g. those related to financing, accessibility and geographic location) are responsible for racial disparities [28]. Future research should aim to identify which of these factors specifically affect the late midlife minority population.

Study findings indicated that late midlife adults from rural (non-MSA) areas were more likely to overuse acute asthma medications than those from MSA areas. A retrospective study by Deshpande et al. found that non-MSA populations have poor asthma medication use compared to MSA populations among US adults (≥ 18 years) [8]. Pesek et al. found that at risk rural children were more likely to report rescue medication use 2 or more days per week (not significant) compared to urban children [29]. Although this study controlled for several of the previously reported factors [30], rural disparities in overuse of acute medications still persisted. Additional research should examine interventions to improve asthma care in rural populations such as rural asthma management clinics involving multidisciplinary care teams, tele-management programs, and asthma education and self-management programs geared towards rural late mid-life adults.

Contrary to previous research, study results indicated that increased comorbidities were associated with higher prescription medication use for both preventive and acute asthma medications. Managing multiple comorbidities and medication regimens can be burdensome for an aging population. A study by Balkrishnan et al. found that increasing comorbidities were associated with lower preventive asthma medication possession in an HMO population [31]. An overall increase in the use of medication, regardless of their purpose (preventive vs quick relief) may indicate a lack of understanding about the purpose of the medications. These contrasting results indicate that multiple comorbidities and their implications on disease management may vary based on different populations (young adults vs late midlife vs older adults) and should be given consideration.

Lastly, late midlife adults who smoked were significantly more likely to overuse acute medications than non-smokers and underuse preventive medications. Adults with asthma who smoke have more severe asthmatic symptoms and face increased morbidity and mortality than non-smokers [32–34]. These patients may also have a concomitant diagnosis of Chronic Obstructive Pulmonary Disease (COPD) and have different treatment than those with only asthma. However, we controlled for COPD using the CCI in the multivariate logistic regression model. Although there is an association between smoking and corticosteroid insensitivity, preventive therapy with inhaled corticosteroids is still a recommended first option for smokers [35]. In addition, there is some evidence that current smokers with acute asthma lack asthma knowledge and self-management skills [36]. Large, dedicated studies are needed to comprehensively study asthma management practices and factors influencing them among smoking adults to identify best practices for managing smokers with asthma.

Limitations

As with any non-experimental study, it is difficult to make any causal conclusions from this study. Our sample

consisted of unique responses of study participants (i.e. non-overlapping panels). It is possible that some independent variables may have changed over time and could have impacted the medication use behavior. MEPS diagnosis codes and medication use are based on patient self-reports and may be inaccurate. However, Edwards et al. found fairly good agreement between medical records and MEPS household interviews [37]. Our selection criteria identified patients who had an asthma attack in the past 12 months or those who still had asthma. This may have limited the sample to a rather severe asthmatic population. However, this selection criterion was used to ensure that our sample consisted of persistent asthmatics, since NHLBI treatment guidelines recommend the daily use of preventive and controlled use of rescue inhalers for persistent asthmatics [2]. Although genetic influence on asthma is an important factor for minority populations [38], we did not have access to such data due to the nature of the study design (i.e. analysis of secondary database). Finally, this study does not describe the reasons that lead to the report of under or overuse of medications (e.g. lack of a prescription by the physician or the prescription was not filled by the patient).

Conclusions

Daily use of preventive asthma medications and controlled use of acute asthma medications is a major component of asthma care. However, findings from this study suggest that preventive asthma medications are largely underused and that there is considerable overuse of acute asthma medications among the understudied age group of late midlife US adults. This study also identified various factors that were associated with asthma medication use among late midlife US adults, such as race and rurality. The population specific and unique factors identified in this study may be important in developing interventions. Healthcare providers including physicians, nurse practitioners and pharmacists should pay particular attention to this age group and their health needs related to asthma.

Declaration of interest

The authors report no conflicts of interest. The research in this paper was conducted at the CFACT Data Center and the support of AHRQ is acknowledged. The results and conclusions in this paper are those of the author and do not indicate concurrence by AHRQ or the Department of Health and Human Services.

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