Asthma Self-Management in Women
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ABSTRACT

- **Objective:** Asthma prevalence, morbidity, and mortality are all greater among adult women compared to men. Appropriate asthma self-management can improve asthma control. We reviewed published literature about sex- and gender-related factors that influence asthma self-management among women, as well as evidence-based interventions to promote effective asthma self-management in this population.

- **Design:** Based on evidence from the published literature, factors influencing women's asthma self-management were categorized as follows: social roles and socioeconomic status, comorbidities, obesity, hormonal factors, and aging-related changes.

- **Results:** A number of factors were identified that affect women's asthma self-management. These include: exposure to asthma triggers associated with gender roles, such as cleaning products; financial barriers to asthma management; comorbidities that divert attention or otherwise interfere with asthma management; a link between obesity and poor asthma outcomes; the effects of hormonal shifts associated with menstrual cycles and menopause on asthma control; and aging-associated barriers to effective self-management such as functional limitations and caregiving. Certain groups, such as African-American women, are at higher risk for poor asthma outcomes linked to many of the above factors. At least 1 health coaching intervention designed for women with asthma has been shown in a randomized trial to reduce symptoms and healthcare use.

- **Conclusion:** Future research on women and asthma self-management should include a focus on the relationship between hormonal changes and asthma symptoms. Interventions are also needed that address the separate and interacting effects of risk factors for poor asthma control that tend to cluster in women, such as obesity, depression, and gastroesophageal reflux disease.

In childhood, asthma is more prevalent in boys than in girls. In adolescence and adulthood, however, asthma becomes a predominantly female disease, with hormonal factors likely playing a role in this shift [1,2]. Fu et al [3] reviewed daily asthma symptom diaries of 418 children. From age 5 to 7, boys had more severe symptoms, but by age 10 girls’ symptoms were becoming more severe. By age 14, the girls’ symptoms continued increasing while the boys’ symptoms began to decline. A meta-analysis by Lieberoth et al [4] found a 37% increased risk of post-menarchal asthma in girls with onset of menarche < 12 years. Together, these studies implicate female sex hormones in both the increased incidence and severity of asthma after puberty. In 2012, nearly 10% of adult women reported current asthma, compared to only 6% of men [5]. Among adults with asthma, women have a 30% higher mortality rate than men [6]. Disparities that disadvantage women are also evident across a range of other asthma-related outcomes, including disease severity, rescue inhaler use, activity limitations, asthma-related quality of life, and healthcare utilization [7–12].

Chronic disease self-management refers to the tasks that individuals must carry out in order to minimize the impact of the disease on their daily lives [13]. In the case of asthma, these behaviors—such as medication adherence, identification and management of environmental triggers, and use of an asthma action plan—play a key role in successful asthma control. Limited evidence suggests that women have a tendency to be more adherent to certain aspects of recommended asthma self-care regimens [7,8,14], yet they are also subject to a number of specific challenges in doing so that are linked to both biological sex and socially defined gender roles [15,16]. In this article, we will first review evidence that social roles and status, comorbidities, obesity, hormonal factors, and aging-related changes all shape the context in which women manage their asthma (Table). Next, we will highlight evidence-based asthma self-management support interventions for women that are designed to

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address some of these factors. Finally, we will offer some tentative conclusions about what is needed to effectively support asthma self-management in women and suggest several potentially fruitful areas for future research in this area.

Factors Influencing Asthma Self-Management in Women

Social Roles and Socioeconomic Status
Traditional gender roles involve various responsibilities, such as household cleaning, cooking, and care of young children, that are associated with exposures to precipitants of asthma symptoms [17]. Gender norms also promote the use of personal care products, like fragrances and hair sprays, which are potential asthma triggers [17]. Recent observational studies in Europe have examined the link between women’s use of cleaning products and asthma. Bédard and colleagues [18] found an association between weekly use of cleaning sprays at home and asthma among women, and Dumas and colleagues [19] found that workplace exposure to cleaning products among women with asthma was related to increased symptoms and severity of asthma. The presence of comorbidities can reduce women’s capacity and motivation for effective asthma self-management.

Table. Key Factors Influencing Women’s Self-Management of Asthma

<table>
<thead>
<tr>
<th>Factor</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Social roles</td>
<td>Due to socially prescribed gender roles, women are more likely to be exposed to certain asthma triggers, such as cleaning products and fragrances. Sexual activity also may be a common but understudied asthma trigger in women.</td>
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<tr>
<td>Socioeconomic status</td>
<td>Women are more likely than men to be living in poverty. Low socioeconomic status is a risk factor for poor asthma outcomes, and asthma-related financial burden can impact medication adherence.</td>
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<tr>
<td>Comorbidities</td>
<td>Physical and psychological comorbidities with asthma (including gastroesophageal reflux disease, arthritis, hypertension, depression, and anxiety) are common in women and are associated with worse asthma outcomes. The presence of comorbidities can reduce women’s capacity and motivation for effective asthma self-management.</td>
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<tr>
<td>Obesity</td>
<td>Obesity is a possible risk factor for development of asthma in women, and for resting dyspnea. Obesity is associated with poor asthma-related quality of life. Obesity in women with asthma is likely to cluster with other risk factors complicating asthma self-management, such as comorbidities, low socioeconomic status, and psychosocial challenges.</td>
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<tr>
<td>Hormonal factors</td>
<td>Hormones exert a significant effect on asthma in women. More than a third of women report perimenstrual asthma symptoms. Hormone replacement therapy during the menopausal period may be associated with new-onset asthma.</td>
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<tr>
<td>Aging-related changes</td>
<td>Asthma-related mortality is disproportionately high in the elderly. Older women with asthma may have reduced ability to perceive asthma symptoms and may have functional limitations that make inhaler use more difficult. Medications such as aspirin and beta-blockers used to treat common comorbidities in this age group may exacerbate asthma symptoms.</td>
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insurance, they felt greatly burdened by out-of-pocket expenses such as high co-pays for medications or ambulance use, lost wages due to sick time, and gaps in insurance coverage. These financial concerns—and related issues such as time spent navigating health care insurance and cycling through private and public insurance programs—were described as a significant source of ongoing stress by this group of vulnerable asthma patients [23]. Focus group participants reported several strategies for dealing with asthma-related financial challenges, including stockpiling medications when feasible (eg, when covered by current insurance plan) for future use by the patient or a family member, seeking out and using community assistance programs, and foregoing medications altogether during periods when they could not afford them [23].

Comorbidities
The 2010 publication of Multiple chronic conditions: a strategic framework by the US Department of Health and Human Services [24] brought the attention of the medical and research communities to the scope and significance of multimorbidity in the US population, including the challenges that individuals face in managing multiple chronic health conditions. Although the prevalence of specific comorbidities with asthma differs by age, some that are most commonly associated with asthma and that may complicate asthma control are obstructive sleep apnea, gastroesophageal reflux disease (GERD), rhinitis, and sinusitis [25,26]. Among women with asthma, multimorbidity appears to be the rule, not the exception. Using nationally-representative data from the US National Health and Nutrition Examination Survey (NHANES), Patel et al [27] found that more than half of adults with asthma reported also being diagnosed with at least 1 additional major chronic condition. A recent study found that asthma/arthritis and asthma/hypertension were the second and third most prevalent disease dyads among all US women aged 18–44 years [28]. Studies have found that comorbidities among asthma patients are associated with worse asthma outcomes, including increased symptoms, activity limitations and sleep disturbance due to asthma [27], and ED use for asthma [15,27].

Qualitative research yields insight into the patient perspective of multimorbidity, that is, how women with asthma and coexisting chronic diseases perceive the effect of their health conditions on their ability to engage in self-management. Janevic and colleagues [29] conducted face-to-face interviews with African-American women participating in a randomized controlled trial of a culturally and gender-tailored asthma-management intervention to learn about their experiences managing asthma and concurrent health conditions. Interviewees had an average of 5.7 chronic conditions in addition to asthma. Women reported that managing their asthma often “took a backseat” to other chronic conditions. Participants also discussed reduced motivation or capacity for asthma self-management due to depression, chronic pain, mobility limitations or combinations of these, and reduced adherence to asthma medications due to the psychological and logistical burdens of polypharmacy.

Depression and anxiety are common comorbidities that are associated with worse asthma outcomes [26,30–32] and reduced asthma medication adherence [33,34]. In general population studies as well as among asthma patients, women are more likely than men to report depression and anxiety [30,35–37]. Screening for and treating depression and anxiety are indicated in women with asthma and may lead to improved adherence and outcomes [30].

Obesity
Adults with asthma are at increased risk of obesity [38]. Obesity is a possible risk factor for development of asthma in women [2] and for resting dyspnea in women with asthma [39]. It is associated with poor asthma-related QOL and use of emergency/urgent services [40]. Evidence is mixed regarding the link between BMI and asthma control [41–43], but the following studies suggest that women who are overweight/obese face unique asthma management challenges. Valerio and colleagues found that in a sample of 808 women enrolled in a randomized trial of an asthma-education intervention, nearly 7 out of 10 were overweight (BMI \( \geq 25 \)) or obese (BMI \( \geq 30 \)), and nearly a quarter were “extremely obese” (BMI > 35) [44]. This subgroup of women was more likely to have persistent asthma, comorbid GERD and urinary incontinence, to be non-white, and to have lower levels of education and income. Being overweight was also associated with greater use of health care services and having greater psychosocial challenges (ie, a higher need for asthma-related social support and lower asthma-related quality of life). These authors suggest the need to design communications for overweight women with asthma that recognize “the specific cultural and social influences on their asthma management behaviors” [44].
with a focus on psychosocial needs, while incorporating existing social support networks. In the previously discussed study by Janevic and colleagues [29] the average BMI of the interview participants was 36.0, and a number of respondents identified weight loss as the self-care behavior that they thought would benefit them the most across multimorbid conditions. Therefore, health care providers should provide appropriate counseling and/or referrals to help women with asthma achieve weight loss goals. Given trends over time showing increasing prevalence of asthma and obesity [45,46], interest is growing in the asthma research community about the interaction of the 2 conditions.

**Hormonal Factors**

Hormones exert a significant effect on asthma in women, and must be considered in clinical and self-management of the disease. Hormone levels fluctuate during the menstrual cycle, with a surge of estradiol (a type of estrogen) at the time of ovulation around day 14, accompanied by low levels of progesterone. During the luteal phase (day 14–28 of the menstrual cycle), estrogens decrease while progesterone levels increase then decrease again before onset of menstruation [47]. During pregnancy, levels of estrogens and progesterone increase and are the highest during the third trimester, when women usually experience good asthma control. Then, during menopause both estradiol and progesterone levels drop to lower levels than those during any phase of menstruation. In addition to the role in the menstrual cycle, there are estrogen receptors (ER-α and ER-β) which are expressed in the human lung and have a role in both airway responsiveness (relaxation) and inflammation [48]. Estrogen also acts directly on cells of the immune system to stimulate airway inflammation, particularly when allergens are present [48]. Further discussion about these contrasting actions of estrogen can be found in a recent review [48].

During the reproductive years, 30% to 40% of women with asthma report perimenstrual symptoms. Forced expiratory volume in 1 second and forced vital capacity are lowest in the periovulatory period, when estrogen levels are high. In contrast, during the luteal phase, studies have shown increased airway hyperreactivity, especially in the premenstrual period when estrogen levels are low [49]. However, when asthma patients with and without perimenstrual symptoms are evaluated, there is no significant difference in their perimenstrual estrogen and progesterone levels [50]. Clark et al [15] found women participating in a self-management intervention, which included checking daily peak flow rates, reported significantly more menstrual and perimenstrual asthma symptomatology than the control group. This suggests that some women with asthma may have, but do not recognize, perimenstrual symptoms. Further elucidation of the incidence of symptomatology related to the menstrual cycle as well as the role of hormonal variation is an area for future research efforts.

At the time of menopause and continuing to postmenopause, levels of both estrogen and progesterone drop to below those during the reproductive years, leading to uncomfortable symptoms in many women. Hormone replacement therapy (HRT) with either estrogen alone or estrogen-progesterone combination effectively improves these, but there is concern for potential effects on asthma prevalence and severity. Two recent large studies support this concern. Postmenopausal women followed for 10 years in the Nurses’ Health Study with a history of HRT had an increased risk of new onset asthma when compared to postmenopausal women with no history of estrogen use (RR = 2.30, 95% CI 1.69–3.14) [51]. This persisted in estrogen-progesterone users. A large French cohort confirmed the increased onset of new asthma in users of estrogen-alone replacement therapy (HR = 1.54, 95% CI 1.13–2.09). However, this effect decreased with time if estrogen had been discontinued, and they did not find a similar increase in users of estrogen-progesterone combination therapy [52]. In contrast, Bonelykke et al [53] found an association between ever using HRT and first-ever hospital admission for asthma, in postmenopausal women (HR 1.46, CI 1.21–1.76), and this risk increased with duration of HRT use. It is clear that physicians need to be aware of these potential respiratory complications, inform their patients, and consider new-onset asthma when women on HRT bring complaints of dyspnea, cough, or wheeze. Future randomized trials are needed to clarify the relationship between HRT and asthma, and to test ways to optimize asthma self-management in women experiencing these transitions.

**Older Women and Asthma**

Although the bulk of research on asthma focuses on children and young adults, asthma in the elderly is receiving increased attention [54], in part because this demographic group has the highest asthma mortality rate and the most frequent hospitalizations [6,55]. In a sample...
of midlife and older women from the Nurses’ Health Study who had been diagnosed with persistent asthma, Barr et al found that adherence to asthma medication guidelines decreased with age [54]. In this study, women with more severe asthma and those with multimorbidity were less adherent than those without comorbidities, as were women who spent more hours caregiving for an ill spouse. The authors concluded that asthma is under-treated among older women.

Baptist et al (2014) describe several challenges to asthma management of older women by clinicians and by the women themselves [55]. For example, elderly women may be at increased risk for adverse effects of inhaled corticosteroids. Certain medications used to treat comorbidities, such as beta-blockers and aspirin, may also exacerbate asthma symptoms. In terms of self-management, older women may have a decreased ability to perceive breathlessness, requiring monitoring with a peak flow meter to detect reductions in airflow. Comorbidities are particularly prevalent in this age group, and asthma symptoms may be confused with symptoms of other conditions, such as heart disease [56]. Baptist and colleagues note factors common among elderly women that pose potential barriers to successful self-management of asthma, including limited income, poverty, depression, and caregiving [55]. They also mention that functional limitations such as those due to arthritis, visual difficulties, or weakened inspiratory strength can make inhaler use more difficult. It should also be noted that some behaviors may promote asthma self-management in this group; for example, Valerio and colleagues [57] found that women over age 50 were more likely than younger women to keep a daily asthma diary when asked to do so as part of a self-management intervention [57].

**Evidence-Based Asthma Self-Management Interventions for Women**

For women to achieve optimal asthma control, the unique factors as described above that influence their symptoms and management need to be addressed [58]. Several examples can be found in the literature of behavioral interventions that focus on the particular self-management challenges faced by women. Clark and colleagues reported the results of an RCT of the Women Breathe Free (WBF) program [15,16]. This intervention consisted of asthma self-management education delivered over 5 telephone sessions by a health educator. WBF content was based on self-regulation theory, which involves observing one’s behavior and making judgments on the observations, testing strategies to improve asthma management, and reacting to positive results of these strategies with enhanced self-efficacy and outcome expectations, ie, the belief that a given strategy will produce the desired results [59]. In WBF, participants used a problem-solving process based on this framework to carry out recommendations in their physician’s therapeutic plan. WBF also incorporated special attention to sex- and gender-based factors in asthma management.

Over a 12-month period, women who participated in the intervention relative to controls experienced significant reductions in nighttime symptoms, days of missed work/school, emergency department visits, and both scheduled and urgent office visits. Intervention group women also reported decreased asthma symptoms during sexual activity, improved asthma-related quality of life, and increased confidence to manage asthma. At long-term follow-up (2 years from baseline), persistent positive effects of the intervention were found on outpatient visits for asthma symptom level during sexual activity, days of missed work/school, asthma-related quality of life, and confidence to manage asthma [60].

In a follow-up study, Clark and colleagues [61] developed the “Women of Color and Asthma Control” (WCAC) program. WCAC incorporates the theoretical orientation and many of the program elements of Women Breathe Free, but has been adapted to be responsive to the needs and preferences of African-American women. Poverty and race are associated with greater asthma morbidity and mortality [5,62,63]. African-American women and women of low socioeconomic status are particularly vulnerable to asthma and associated morbidity and mortality, making this an important group for intervention. Culturally responsive components in the WCAC intervention include use of culturally relevant activities and beliefs when discussing triggers and barriers to asthma management, as well as culturally appropriate visuals. This ongoing trial will test WCAC’s effect on ED visits, hospitalizations, and urgent care; asthma symptoms; and asthma-related quality of life at 1 year and 18 months from baseline.

In a small RCT among women with asthma, Bidwell and colleagues tested a program consisting of 10 weeks of yoga instruction (including breathing practices, poses, and meditation/relaxation skills) in a group setting followed by 10 weeks of home practice [64]. Women in the intervention group reported improved quality of life, as measured by the St. George’s Respiratory Quality of Life questionnaire [65],
and participants also had decreased parasympathetic modulation in response to an isometric forearm exercise. They conclude that yoga is a promising modality for improving quality of life among asthma patients and that these changes may be linked to better autonomic modulation. Although this program was not designed specifically for women, yoga is practiced significantly more frequently among women compared to men [66,67], and thus has the potential to be widely used in this group.

Based on our experience conducting self-management research among women with asthma, and unpublished process data from these studies, we observe that the following elements appear to contribute to high participant engagement in these programs and successful outcomes. First, in participant feedback questionnaires from the Women Breathe Free and Women of Color and Asthma Control studies, women have singled out the importance of their relationship with their assigned telephone asthma educator as motivating them to make positive changes in their asthma self-management behaviors. The popularity of health and wellness coaching, including for chronic disease management, is rapidly growing [68]. This is a patient-centered approach that guides patients in setting their own goals for disease management and devising their own strategies for achieving them [68]. Strong interpersonal relationships are thought to enhance the coaching process and this may be especially important for women [68]. Participants have also indicated that they are able to apply the goal-setting and problem-solving skills they have learned as part of the intervention to management of other health or psychosocial issues in their lives; therefore this component seems especially critical for women with asthma who are typically managing multiple health issues as well as those of others. Finally, maximizing the flexibility of interventions is important for working-age women who typically are engaged in part- or full-time employment and also have significant responsibilities caring for others. This flexibility can come in the form of telephone-based or “mHealth” interventions that use mobile technologies such as text messaging [69], as well as internet-based or smartphone/tablet “apps” that can be completed at a pace and schedule that is convenient for the participant [70]. Such interventions could be easily tailored to address sex- and gender-specific issues in asthma management.

**Future Research and Practice Directions**

This review points to several promising directions for research and practice in the area of supporting women’s asthma self-management. The first is a systematic exploration of the added value of gender-tailoring asthma self-management support interventions to determine which subgroups of women benefit from which type of sex- and gender-specific information, and in which form. More research is needed on the relationship between hormone levels and changes and asthma symptoms, and how this affects women’s self-management. This includes recognition of new or worsening asthma with the use of hormone replacement therapy in menopausal and post-menopausal women, a group that is rapidly increasing in number in the US population. Another direction for research is a family-systems approach to asthma education and supporting asthma management. Asthma in one or more first-degree relatives has been shown across diverse populations to be a risk factor for asthma [71]. Women with asthma are therefore more likely to have children with asthma, and vice-versa; however, no prior research was identified that addresses asthma self-management in mother/child dyads. For example, it is possible that teaching women to better manage their own asthma could have “trickle down” effects to how they help a child manage asthma. Last, as the above discussion of factors affecting women’s asthma makes clear, many risk factors for poor asthma management and control in women cluster together, such as obesity, depression, and GERD. Interventions that attempt to address the separate and interacting effects of these factors and comorbidities, may yield better outcomes among the most vulnerable asthma patients.

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Financial disclosures: None.

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