Brown & Brown | RISK strategies CONSULTING

WHITE PAPER

Closing the Sleep Care Gap in Chronic Disease Management

In the Fight Against Chronic Disease, Sleep is the Hidden Gap in Care (Part 3)

February 2026

Table of Contents

Executive Summary

Plan sponsors and population health managers are increasingly focused on improving outcomes and managing costs for members with chronic and high-cost conditions such as diabetes, obesity, behavioral health, musculoskeletal issues, and women's health concerns, including fertility and menopause. However, sleep disorders such as obstructive sleep apnea (OSA) and chronic insomnia, which are highly comorbid with these conditions, remain an overlooked gap in care. Because poor sleep contributes to the onset and worsening of chronic disease, integrating sleep care management helps close this gap, strengthens existing condition-specific programs, and ultimately drives better health outcomes and lower overall costs.

1. **High-Cost Members Disproportionately Suffer From Sleep Disorders:** Patients with one or more chronic conditions excessively drive underlying health risks and account for 75% of total healthcare costs.[1] A disproportionate share of these members suffer from unmanaged sleep disorders, primarily sleep apnea and insomnia, which are highly comorbid with the most common conditions that plan sponsors and population health managers focus upon: obesity, cardiovascular disease (CVD), diabetes, depression and anxiety, musculoskeletal conditions, as well as menopause. Among patients with these chronic conditions, the prevalence of sleep disorders is estimated to be between 30% and 70%, which, while a seemingly wide range, is broken out by condition in Figures 1 and 2.[2-12]

2. **The Connection Between Sleep and Chronic Conditions:** Sleep and chronic disease have a bi-directional relationship: poor sleep can cause or worsen chronic illness, while chronic illness can disrupt sleep.[13] Conditions such as sleep apnea and chronic insomnia interfere with the body's restorative functions, driving physiological stress and disease progression across multiple systems.[13-15]
   a. **Obesity:** Sleep disruption may alter appetite hormones (leptin and ghrelin), promoting weight gain.[16]
   b. **Diabetes:** Impaired sleep may elevate cortisol and weaken insulin response, which has been shown to increase diabetes risk.[17]
   c. **Cardiovascular Disease:** Sleep loss has been shown to trigger inflammation and overactivation of the sympathetic nervous system, which may lead to hypertension, arrhythmia, and cardiac strain.[3]
   d. **Musculoskeletal Conditions & Chronic Pain:** Fragmented sleep can heighten systemic inflammation, amplifies pain perception, and lowers pain tolerance.[18]
   e. **Mental Health:** Sleep disorders are often misdiagnosed as psychiatric symptoms.[19] Left untreated, they intensify depression, anxiety, suicidal ideation, and complicate treatment.[15,19]
   f. **Women's Health:** Poor sleep increases the risk of gestational diabetes, hypertension, and preeclampsia, while worsening menopausal symptoms such as hot flashes.[20-21]

3. **The Impact of Treating Sleep Disorders:** Guideline-based management of OSA and insomnia can reverse these effects, slowing disease progression and improving overall health outcomes.[13,22]
   a. **Metabolic Health:** Continuous positive airway pressure (CPAP) and cognitive behavioral therapy for insomnia (CBT-I) have been shown to improve insulin sensitivity and overnight glucose control.[17,23]
   b. **Cardiovascular Risk:** Treating OSA has been shown to reduce blood pressure and reduce the risk of heart failure.[24-25]
   c. **Pain:** Better sleep can lower inflammation and restore natural pain modulation with resulting improvement in function.[26]
   d. **Mental Health:** CPAP and CBT-I improve mood and emotional resilience.[27-28]
   e. **Women's Health:** Effective therapy has been shown to reduce pregnancy complications and improves menopausal quality of life.[6,20]

4. **Sleep Care Gaps Worsen Chronic Disease Burden:** As elucidated in our prior study: (i) approximately two-thirds of sleep apnea cases are undiagnosed and untreated, and (ii) among those diagnosed, only a small percentage adhere to therapy at 1 year [25%], and even fewer persist at two years [11%] with CPAP therapy.[29] **Our current study using a proprietary commercial claims dataset sought to quantify the size of these gaps in care specifically for patients suffering from sleep apnea and highly comorbid conditions.**
   a. We found that these two gaps in care are substantially magnified amongst the population suffering from these highly comorbid conditions, which lead to substantially increased healthcare resource utilization amongst those who are non-adherent to care, or remain undiagnosed. **Using prevalence estimates from published literature, our study finds greater than 50% of the cardiometabolic population lives with untreated sleep disorders that quietly drive higher medical costs, absenteeism, and worsening chronic disease.** Even among those with mental health disorders and MSK conditions, substantial care gaps of approximately 26-30 percentage points remain. These are the very populations in which plan sponsors and population health managers invest the most, and yet the majority are missing an essential element of care that directly fuels emergency room visits, hospitalizations, and long-term cost escalation.[30-31]

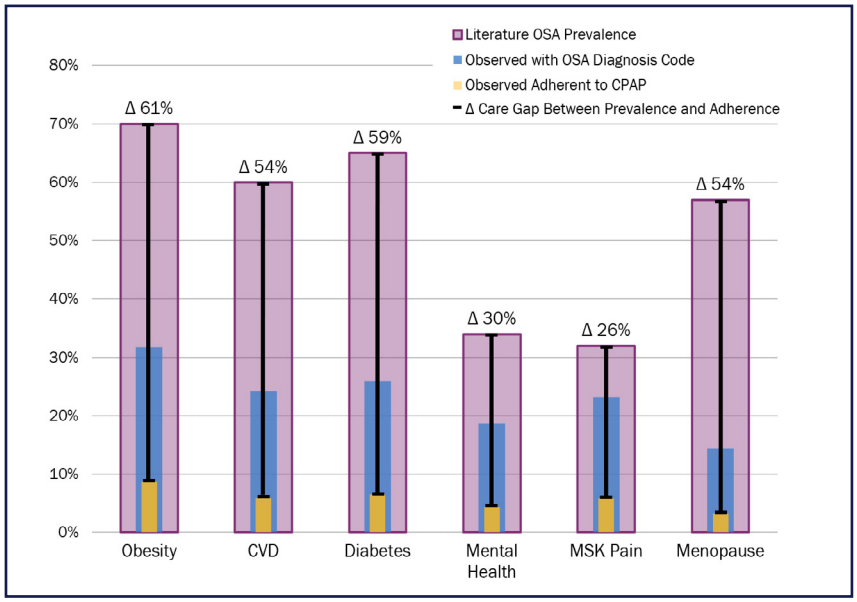


Figure 1. Gap in care due to the difference in the percentage of members adherent to CPAP versus percent diagnosed with OSA vs literature estimations of the prevalence for OSA among populations with each of the following chronic diseases: obesity,[2] cardiovascular (CVD),[3] diabetes,[4] depression or anxiety (mental health),[5] menopause,[6] and musculoskeletal (MSK) pain.[7]

5. **Integrating Sleep Care to Improve Outcomes and Reduce Costs:** Integrating comprehensive sleep care management into chronic condition programs closes critical gaps in care, enhances member health, and reduces total costs. Large-scale commercial claims analyses show that members who adhere to sleep therapy experience fewer inpatient admissions, emergency visits, and outpatient encounters, resulting in average annual savings of $2,743 per patient in each of the first two years of treatment.[29]

   By embedding sleep management into programs targeting obesity, cardiovascular disease, diabetes, behavioral health, musculoskeletal conditions, and women's health, plan sponsors and population health managers can strengthen overall program effectiveness and drive measurable health and financial improvements across their populations.

Introduction

The population of members with chronic conditions is the single greatest driver of healthcare costs.[1] Many plan sponsors and population health managers are focused on: (i) improving the health and reducing the cost of these members, and (ii) embracing programs focused on specific conditions, especially obesity, diabetes, and cardiovascular disease, as well as mental health, musculoskeletal health, and women's health conditions.

Yet, a critical factor that is consistently overlooked in managing these populations, and common to all of them, is the profound impact of untreated sleep disorders, which actively worsen health outcomes and increase healthcare utilization and spending.[13-15] Treating sleep disorders is one intervention, common to all these diseases, which can demonstrably improve patient health, leading to lower healthcare resource utilization and to a reduction in total healthcare costs. In the fight against chronic disease, sleep is the hidden gap in care.

In our two previous white papers in this three-part series on sleep care, we provided both original research and a comprehensive analysis of the two most common sleep disorders, sleep apnea and chronic insomnia, and their impact on member health and total health care costs.[29,32]

Review the Prior White Papers in Series

Part 1
In the Fight Against Chronic Disease, Sleep is the Hidden Gap in Care

Part 2
Insomnia: The need for an integrated care approach

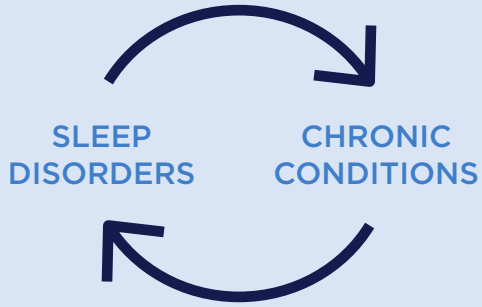
This paper draws upon both our original research and peer-reviewed literature to build upon that foundation and provide plan sponsors and population health managers with a deeper understanding of the bi-directional relationship between sleep and each of several conditions. **Specifically, we seek to illuminate the health and financial consequences of unmanaged sleep disorders in patients suffering from the conditions upon which they are most focused (i.e., obesity, diabetes, cardiovascular disease, mental health disorders, musculoskeletal disease, and critical aspects of women's health, especially during menopause).**

Ultimately, sleep is not a passive state but an active, essential process for physical and mental restoration. Disrupting these restorative processes has direct, negative consequences on the body, triggering systemic inflammation, hormonal disruption, and metabolic dysfunction. By understanding and addressing sleep, plan sponsors and population health managers have an opportunity to close a critical gap in care, improve the well-being of their members, and amplify the effectiveness of their entire chronic disease and condition specific management strategies.

Sleep and Chronic Conditions: The Bidirectional Relationship

While plan sponsors and population health managers have prioritized programs for chronic conditions and women's health, few have focused on sleep care management. The reason is simple: many recognize that sleep disturbance often accompanies chronic disease, but far fewer understand that poor sleep can also cause or worsen these same conditions. This misunderstanding has left a critical gap in care — one that perpetuates higher costs and poorer outcomes across every disease-specific program. Sleep disturbance and chronic conditions share a bidirectional relationship.

Untreated sleep apnea increases the risk of high blood pressure, diabetes, obesity, depression, and cardiovascular disease.[13] Insomnia can worsen anxiety, depression, and chronic pain.[14-15]



Having these chronic conditions makes it harder to sleep well. For instance, diabetes can cause nighttime urination and blood sugar swings that disrupt sleep; obesity increases airway obstruction and raises sleep apnea risk; and depression often triggers insomnia or hypersomnia.[13-15]

So instead of being a **one-way cause-and-effect relationship**, it's a **vicious cycle**: poor sleep makes chronic disease worse, and chronic disease further disrupts sleep. That's why treating sleep disorders is such a powerful lever for improving outcomes in all chronic condition programs — it helps break the cycle.

Simply put, **when you fix sleep, you reverse the cycle**. Instead of poor sleep driving worse disease, better sleep becomes an amplifier of health, making every chronic condition management program more effective.

It is important for plan sponsors and population health managers to understand the clinical mechanisms underlying the bidirectional relationship between sleep disorders — particularly sleep apnea and chronic insomnia — and each of the increasingly prevalent conditions: obesity, diabetes, cardiovascular disease, mental health disorders, musculoskeletal disease, as well as its impact on women's health, specifically during pregnancy and menopause.

The following sections provide a view into the bidirectional relationship between sleep and each of these conditions.

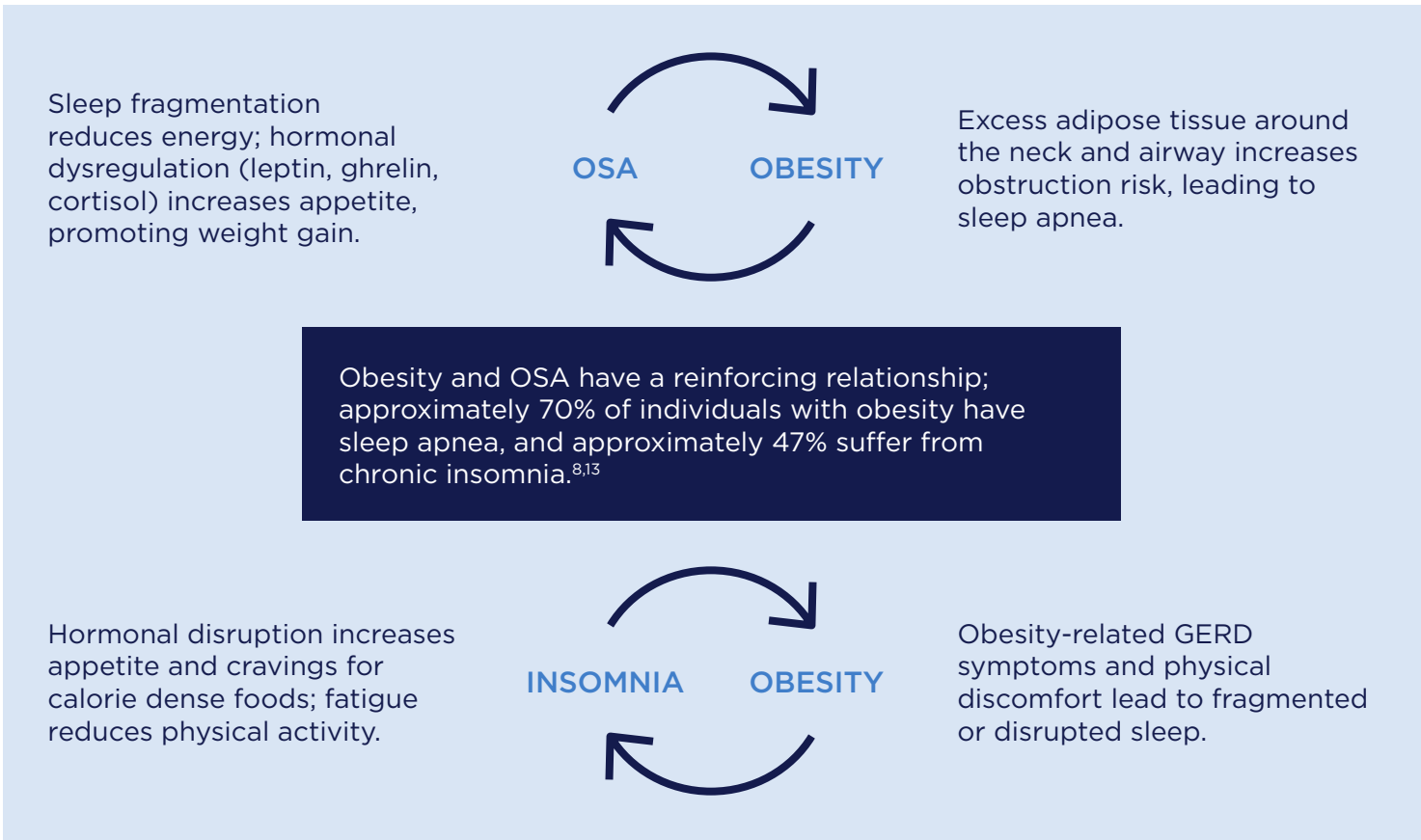
1. Obesity

Sleep disorders play a significant role in the development and progression of obesity. Poor sleep quality, particularly when driven by conditions such as sleep apnea and chronic insomnia, can lead to decreased physical activity, impaired metabolic regulation, and hormonal imbalances that increase appetite and cravings for calorie-dense foods.[16] Over time, these factors contribute to weight gain and elevate the risk of obesity.

Obesity and sleep disorders are highly comorbid. It is estimated that approximately 70% of individuals with obesity have sleep apnea, and approximately 47% suffer from chronic insomnia.[8,13]

Excess adipose tissue around the neck and upper airway increases the risk of sleep apnea by narrowing the airway and causing frequent breathing interruptions during sleep.[16] In turn, sleep apnea fragments sleep, disrupts hormonal regulation of appetite (leptin, ghrelin, cortisol), and reduces energy and physical activity, all of which promote weight gain.[16] Given this vicious cycle, addressing sleep apnea is essential not only to improve sleep but also to break the pathway that drives further weight gain and worsens obesity-related health risks.

Chronic insomnia contributes to a reinforcing cycle where poor sleep promotes weight gain, and excess weight further disrupts sleep. Insomnia contributes to obesity through disruption of hormonal regulation, increased appetite and cravings for high-calorie foods, reduced energy and physical activity, and impaired decision-making around healthy choices.[33] Conversely, obesity can worsen insomnia through sleep apnea–related fragmentation, gastroesophageal reflux disease (GERD) symptoms, and physical discomfort, all of which impair sleep quality.[34]



2. Cardiovascular Health

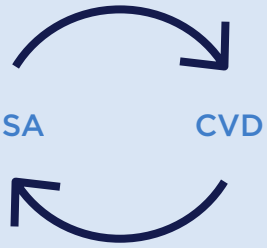
Conditions such as OSA and chronic insomnia increase sympathetic activation, inflammation, and metabolic dysfunction that worsen hypertension, arrhythmias, and heart failure — while cardiovascular diseases themselves cause fluid shifts while recumbent, neurohormonal changes further disrupt sleep.[35-37]

Untreated sleep disorders can negatively affect cardiovascular health through mechanisms including intermittent hypoxia, sympathetic nervous system activation, systemic inflammation, and elevated stress hormone levels.[35-36] As a result, sleep disorders are highly comorbid with CVD [65%], which is inclusive of coronary heart disease [65%], congestive heart failure [55%], and atrial fibrillation [50%].[3,35,37-38]

Cardiovascular health and sleep apnea are closely interconnected, with sleep apnea independently increasing the risk of cardiovascular problems and cardiovascular disease potentially worsening sleep apnea. Untreated sleep apnea causes repeated drops in oxygen levels and sleep fragmentation, which activate the sympathetic nervous system and raise blood pressure.[3,35] This chronic strain promotes vascular inflammation, increases oxidative stress, and accelerates atherosclerosis.[35] Over time, these changes heighten the risk of hypertension, atrial fibrillation, heart failure, and stroke. [3,35]

Chronic insomnia can increase the risk of developing or exacerbating cardiovascular disease, which can in turn worsen insomnia. Irregular sleep patterns can also increase the risk of cardiovascular events. Persistently insufficient sleep elevates blood pressure, increases heart rate, and promotes systemic inflammation — all of which strain the cardiovascular system.[37] Over time, these effects contribute to a higher incidence of hypertension, coronary artery disease, and heart failure among individuals with untreated insomnia.[38-39]

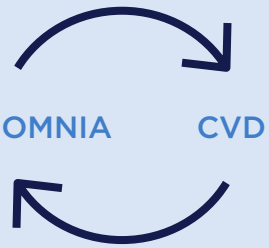
Repeated oxygen desaturation and arousal activate the sympathetic nervous system, raising blood pressure and promoting vascular inflammation, oxidative stress, and atherosclerosis.



Fluid shifts when recumbent and neurohormonal changes from heart disease can exacerbate airway obstruction.

Sleep disorders are highly comorbid with CVD; approximately 65% of those with CVD, 65% of those with CAD, 55% of those with CHF, and 50% of those with AFib experience sleep disorders.[3,35,37,38]

Persistently insufficient sleep increases blood pressure, heart rate, and systemic inflammation, stressing the cardiovascular system.



Symptoms of CVD, like sudden episodes of severe breathlessness, and side effects of medications may disrupt sleep continuity and quality.

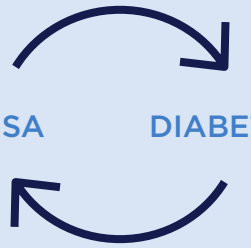
3. Diabetes

Sleep disorders play a significant role in the development and poor control of diabetes, while diabetes increases the risk of developing sleep apnea and chronic insomnia. As a result, sleep disorders are highly comorbid with diabetes, with up to 86% of people with type 2 diabetes also suffering from a sleep disorder —most commonly sleep apnea.[40]

Poor sleep quality from sleep apnea contributes to impaired glucose metabolism through intermittent hypoxia, sympathetic activation, and elevated cortisol levels, all of which promote insulin resistance.[17] Adults with sleep apnea are more than twice as likely to have or develop type 2 diabetes, and this association is stronger among adults under 50.[40]

Chronic insomnia disrupts the balance of hormones such as cortisol, leptin, and ghrelin, promoting cravings for high-carbohydrate foods and elevating blood sugar.[41] In turn, diabetes exacerbates insomnia through frequent nighttime urination, neuropathic pain, and blood glucose fluctuations.[42] This cycle of poor sleep and poor metabolic control leads to increased healthcare utilization and poorer quality of life.

Intermittent hypoxia, sympathetic activation, and elevated cortisol from poor sleep promote insulin resistance and impaired glucose metabolism.



Diabetes increases OSA risk through autonomic dysfunction affecting the upper airway.

Up to 86% of people with type 2 diabetes have a sleep disorder; adults with OSA are more than two times as likely to develop type 2 diabetes with a higher probability among those under age 50.[40]

Chronic insomnia disrupts cortisol, leptin, and ghrelin balance, increasing cravings for high-carb foods and elevating blood sugar.

Diabetes causes nocturia, neuropathic pain, and blood glucose fluctuations that fragment sleep.

4. Musculoskeletal Health

Sleep disorders increase pain sensitivity and inflammation, while chronic pain itself disrupts sleep continuity. As a result, sleep disturbances are highly comorbid (32%) with chronic pain related to musculoskeletal conditions.[7]

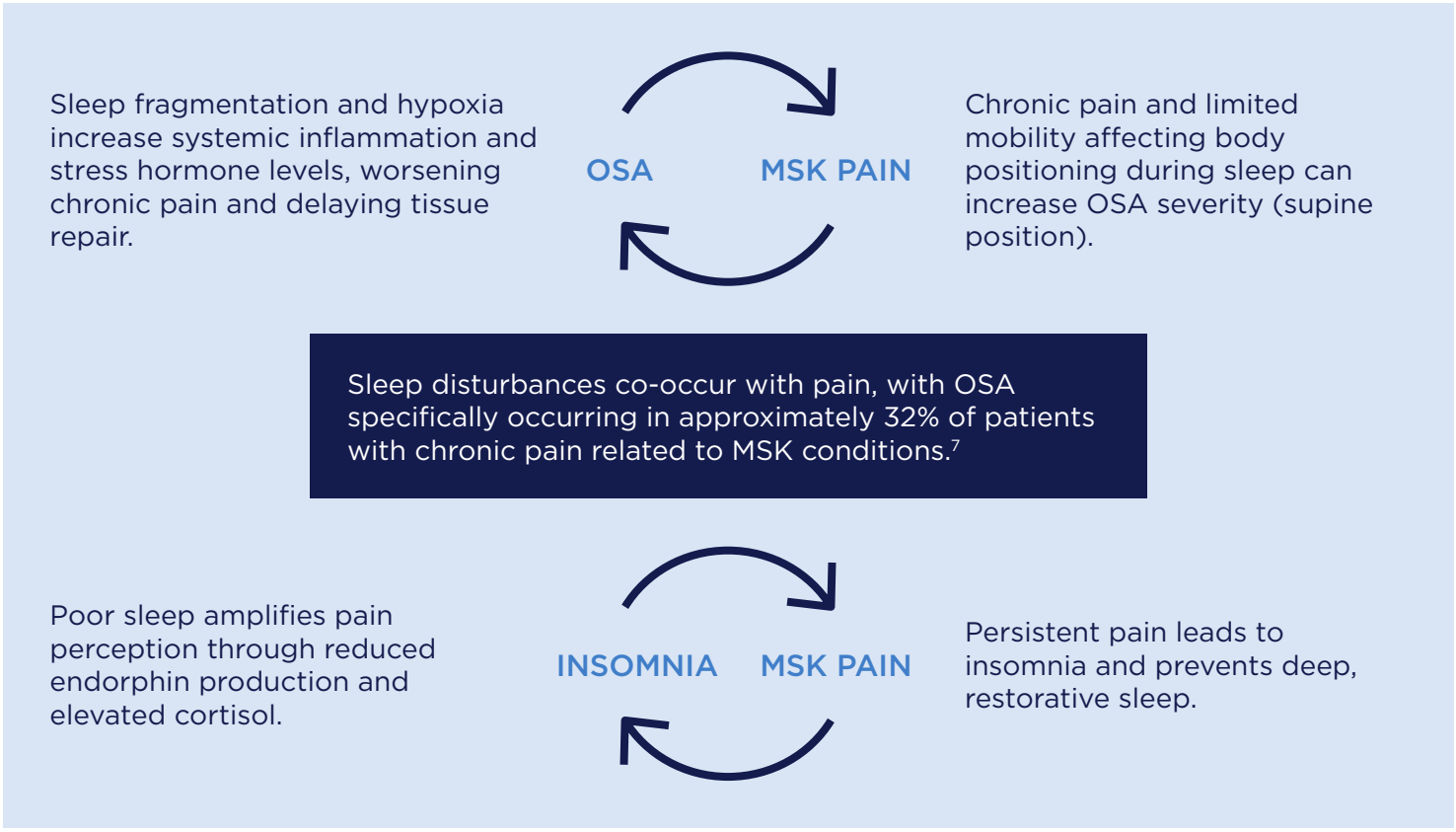
Physical discomfort can interfere with both the ability to fall asleep and stay asleep. Over time, disrupted sleep can intensify pain through mechanisms such as increased systemic inflammation, reduced endorphin production, and elevated levels of stress hormones, like cortisol.[26,43]

Sleep fragmentation and hypoxia from sleep apnea increase systemic inflammation and stress hormone levels, worsening chronic pain.[43] Over time, these physiological stresses heighten pain sensitivity, delay tissue repair, and reduce the body's ability to recover, making everyday discomfort more persistent and difficult to manage.

Chronic musculoskeletal pain stemming from conditions such as fibromyalgia, osteoarthritis (OA), rheumatoid arthritis (RA), gout, and chronic neck and back pain is frequently accompanied by sleep disturbances.[44] These conditions frequently coexist with sleep disorders, and there is a well-documented bidirectional relationship between chronic pain and impaired sleep.[13-14,44]

Chronic insomnia both stems from and intensifies chronic pain.[26]

Addressing coexisting sleep disorders is a critical component of comprehensive pain management and can significantly improve quality of life in individuals with chronic musculoskeletal conditions. Improving sleep quality can reduce inflammation, enhance physical recovery, and improve emotional resilience, all of which are essential for managing chronic musculoskeletal conditions.[26]



5. Mental Health

Since sleep disturbance is a common symptom of mental health conditions, underlying sleep disorders can be easily missed. This oversight can have serious consequences, as comorbid sleep disorders may increase the risk of developing or exacerbating episodes of depression, anxiety, bipolar disorder, and psychosis.[15,19] Symptoms of sleep disorders are frequently misattributed to the mental health condition itself, complicating diagnosis and delaying appropriate intervention.[45]

As a result, sleep disorders are highly comorbid with mental health conditions; approximately 50% of people with mental health disorders also experience chronic insomnia.[11]

Sleep fragmentation and intermittent hypoxia caused by untreated sleep apnea interfere with emotional regulation and cognitive function, doubling the odds of depression and tripling the odds of bipolar disorder.[46]

Chronic insomnia contributes to dysregulation of stress and mood-related neurotransmitters, increasing the likelihood of depressive and anxiety disorders.[11,45] At the same time, these conditions perpetuate insomnia through rumination, hyperarousal, and medication side effects.[11,45]

These findings highlight the importance of screening for and treating sleep disorders in patients with mental health conditions. Integrating sleep-focused interventions into behavioral health care can improve treatment outcomes, reduce relapse risk, and enhance overall well-being.[27-28]

How Sleep Apnea Impacts Mental Health

1. **Increased Risk of Mental Health Conditions:** Studies show a link between sleep apnea and an increased risk of developing or exacerbating mental health conditions including mood disorders, anxiety, and psychosis in predisposed individuals. Fragmented sleep secondary to sleep apnea results in nonrestorative sleep and can trigger or worsen mental health conditions, adding to symptoms such as lethargy, decreased motivation, mood instability and irritability.
2. **Cognitive Impairment:** Sleep fragmentation and decreases in blood oxygen levels during sleep secondary to sleep apnea can lead to cognitive decline with difficulty concentrating, memory problems, and reduced overall mental function, as well as an increased risk of developing dementia.
3. **Suicidal Ideation:** Individuals with sleep apnea have an increased risk for psychopathology, including suicidal ideation.

How Mental Health Impacts Sleep Apnea

1. **Increased Risk or Worsening of Sleep Apnea due to Medication Side Effects:** Individuals with certain mental health conditions, such as schizophrenia or other psychoses, may have a higher risk of developing sleep apnea due to weight gain as a medication side effect. Other medications used in the treatment of mental health disorders can have sedating, muscle-relaxant, and respiratory depressant effects that can worsen sleep apnea.
2. **Difficulty Adhering to Treatment:** Mental health conditions, including depression, anxiety, and psychotic disorders, can cause impairments that make sleep apnea harder to manage by interfering with the patient's ability to adhere to treatment, such as CPAP.

INSOMNIA → MENTAL HEALTH

How Insomnia Impacts Mental Health

1. **Increased Risk of Mental Health Conditions:** Chronic insomnia, defined as difficulty falling asleep or staying asleep for three or more nights a week for over three months, can increase the risk of developing or worsening mental health conditions like anxiety and depression.
2. **Worsening of Existing Conditions:** Insomnia can exacerbate symptoms of existing mental health problems, making them more difficult to manage.
3. **Mood Changes:** Sleep deprivation can lead to mood swings, irritability, and a negative outlook.
4. **Cognitive Impairment:** Lack of sleep can impair cognitive function, making it harder to concentrate, make decisions, and solve problems.
5. **Social Isolation:** Insomnia can lead to fatigue and reduced energy, potentially leading to social withdrawal and feelings of isolation.
6. **Increased Stress:** Persistently poor sleep can lead to increased stress and anxiety, further disrupting sleep.

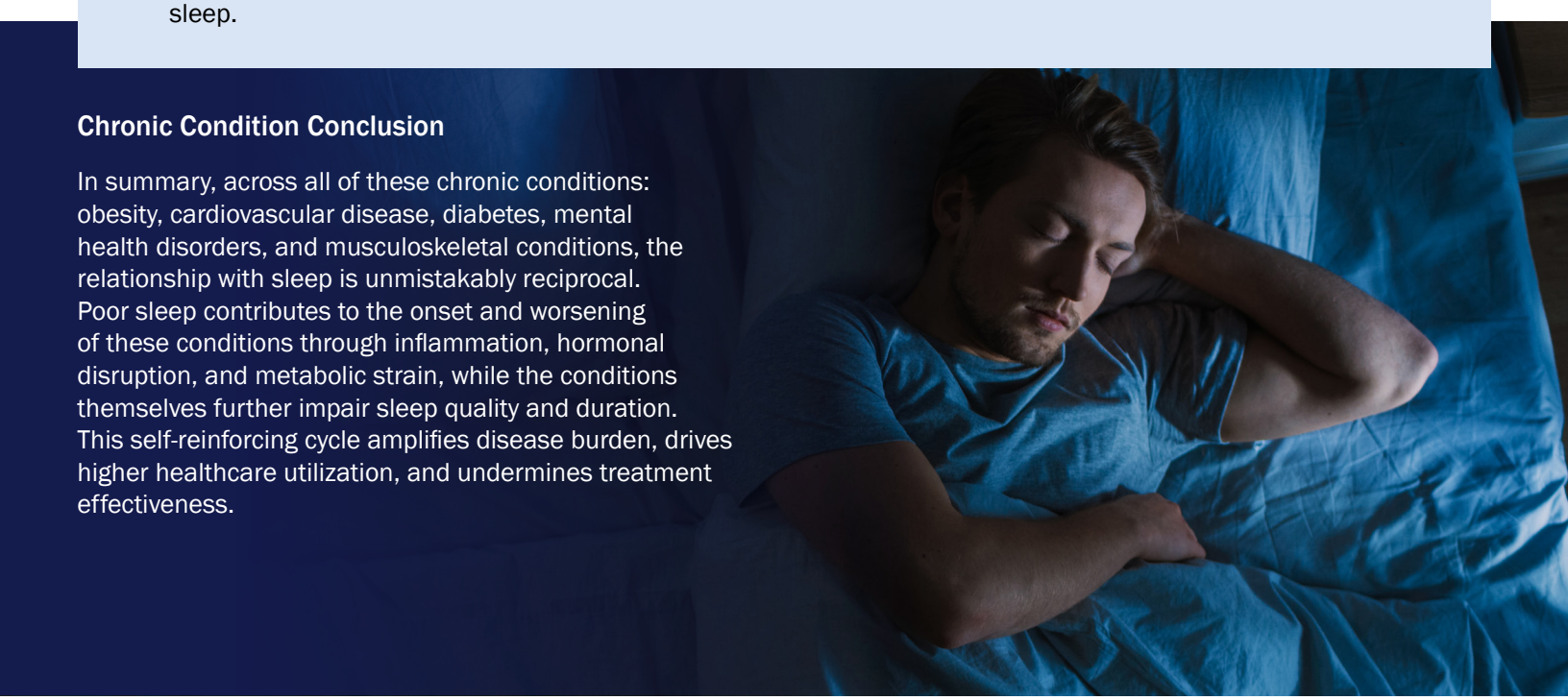
INSOMNIA ← MENTAL HEALTH

How Mental Health Impacts Insomnia

1. **Pre-existing Mental Health Conditions Can Cause Insomnia:** Conditions like anxiety and depression can disrupt sleep patterns and make it difficult to fall asleep or stay asleep.
2. **Mental Health Conditions Can Worsen Insomnia:** The stress and anxiety associated with mental health conditions can worsen insomnia, creating a vicious cycle.
3. **Mental Health Treatment Can Affect Sleep:** Certain medications used to treat mental health conditions can have side effects that affect sleep.
4. **Psychosis and Insomnia:** Insomnia can be a risk factor for psychosis and a sign of the prodromal (initial appearance of symptoms ahead of the full development of the disease) stage of psychosis.

Chronic Condition Conclusion

In summary, across all of these chronic conditions: obesity, cardiovascular disease, diabetes, mental health disorders, and musculoskeletal conditions, the relationship with sleep is unmistakably reciprocal. Poor sleep contributes to the onset and worsening of these conditions through inflammation, hormonal disruption, and metabolic strain, while the conditions themselves further impair sleep quality and duration. This self-reinforcing cycle amplifies disease burden, drives higher healthcare utilization, and undermines treatment effectiveness.



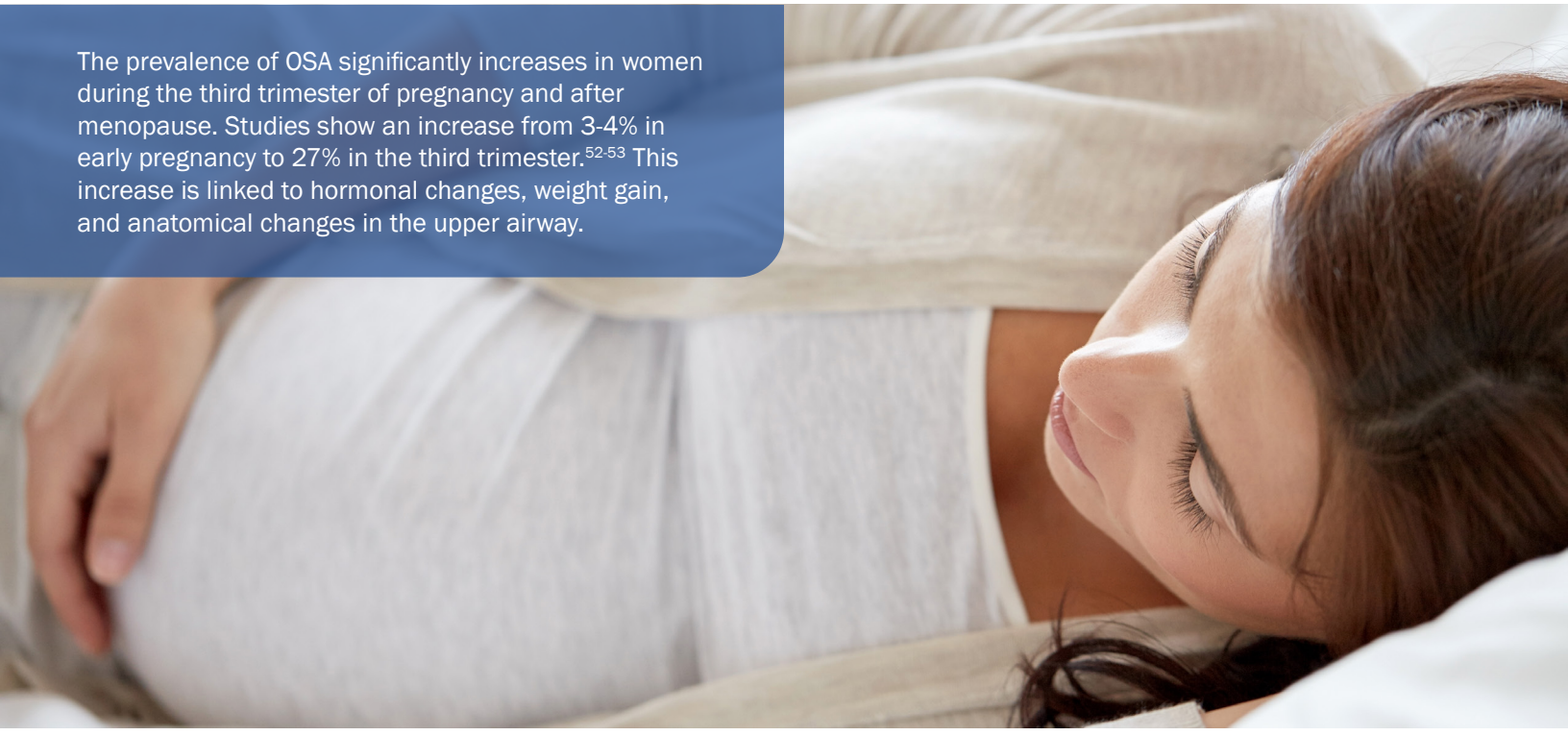
Sleep and Women's Health

Women experience unique hormonal and physical changes that make them especially vulnerable to sleep disorders. These changes can be caused by life stages such as pregnancy and menopause or conditions such as polycystic ovarian syndrome (PCOS). More than half of women in midlife report a sleep disorder, and the prevalence of OSA rises sharply during this stage, affecting an estimated 47-67% of postmenopausal women.[6,47] Fortunately, much like with chronic conditions, addressing sleep can prevent costly complications and improve health outcomes for women.

Unmanaged sleep disorders can have serious health and safety consequences for women, such as:

- **Worsening of perimenopausal and menopausal symptoms:** Poor sleep can be intensified by other menopausal symptoms like hot flashes and night sweats, creating a negative cycle.[48]
- **Increased complications during pregnancy:** The physiological changes resulting from OSA can directly contribute to pregnancy complications such as preeclampsia, preterm birth, and gestational diabetes.[6,20]
- **Cardiovascular disease:** Chronic insomnia and short sleep duration have been linked to an increased risk of cardiovascular disease (CVD) events later in life for women.[49] According to the American Heart Association (AHA), women who were peri- and postmenopausal and experienced sleep disturbances scored worse on cardiovascular health measures.[50]
- **Osteoporosis:** Studies have linked short sleep duration and fragmented sleep to lower bone mineral density and an increased risk of osteoporosis in women aged 50 and older.[51]
- **Mental health:** Pregnancy and menopause are periods of increased vulnerability for mood and anxiety disorders, and sleep disturbances, particularly insomnia, can exacerbate these conditions.[6,20,48]
- **Impact on quality of life:** Sleep disturbances can significantly affect a woman's well-being and quality of life, impacting relationships, work productivity, and overall daily functioning.

The prevalence of OSA significantly increases in women during the third trimester of pregnancy and after menopause. Studies show an increase from 3-4% in early pregnancy to 27% in the third trimester.[52-53] This increase is linked to hormonal changes, weight gain, and anatomical changes in the upper airway.

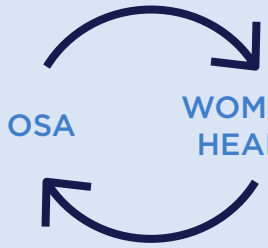


For women who are juggling family responsibilities (partner, pregnancy, children, aging parents, etc.) along with employment outside the home, it is crucial that sleep issues be addressed expeditiously and appropriately so that relief can be achieved, resulting in positive outcomes for women, their unborn fetuses, and the people in their lives who are profoundly invested in their well-being. When poor sleep moves to good sleep, everyone benefits — including loved ones, friends, employers, and society.

Effectively treating sleep disorders like OSA and insomnia provides transformative health benefits for women across key life stages, from fertility through menopause. During pregnancy, evidence-based treatments such as CPAP can significantly reduce the risk of major complications like preeclampsia and gestational diabetes, promoting healthier fetal development and improving maternal mental health.[54-55] For women in perimenopause and menopause, treatment is crucial for protecting long-term health by lowering cardiovascular risk.

Furthermore, therapies like CBT-I can break the debilitating cycle of hot flashes and poor sleep, leading to enhanced mood, sharper cognitive function, and a profound improvement in daily quality of life.[56-57]

OSA increases risk for hypertension, atrial fibrillation, heart failure, and stroke during and after menopause.



Declining estrogen and progesterone reduce airway stability and alter fat distribution, increasing OSA risk.

More than 50% of women in midlife report a sleep disorder with OSA specifically affecting approximately 47–67% of postmenopausal women.[6,47]

Hot flashes and night sweats fragment sleep, increasing fatigue, stress, and metabolic risk.

Vasomotor symptoms and hormonal fluctuations perpetuate insomnia and fatigue.

The Gap in Care

Sleep disorders remain one of the most persistent and costly gaps in chronic disease management. Despite clear clinical guidelines, effective diagnosis and treatment are rare, leaving millions of adults with unmanaged conditions that silently worsen health outcomes and inflate costs.

The following section summarizes findings from our independent analysis of a large, commercial claims database comprised of longitudinal data for a population in excess of ten million lives. Our current study specifically observed over three million members between the ages of 18 and 63 years old with 36 consecutive months of continuous medical and pharmacy health coverage over a three-year study period, from January 2022 to December 2024, to quantify the prevalence of comorbid sleep disorders and chronic conditions, as well as the care gap. The population and methodology for our prior studies are described in our publications.[29,32]

Our prior research demonstrated substantial gaps in care for both insomnia and OSA. For OSA, approximately two-thirds of cases remain undiagnosed and untreated, and among those diagnosed, adherence to CPAP therapy, the recognized standard of care, is strikingly low. Among commercial populations, 13% to 15% suffer from sleep apnea, but only 6% have ever been diagnosed, and just 1% to 2% adhere to therapy.[29] **That means roughly 12% to 13% of the workforce lives with an untreated condition that drives higher healthcare costs, absenteeism, and chronic disease progression.** In our current study, focusing on members with chronic conditions and women in menopause, gaps are even more pronounced: among those with obesity, diabetes, cardiovascular disease, and menopause, **we found gaps of 54% to 61% between estimated prevalence and those both diagnosed and adherent to therapy** (Figure 1). Even in populations with mental health disorders and musculoskeletal conditions, gaps remain substantial at 26% to 30%.

The story is similar for insomnia. Evidence-based first-line therapy, cognitive behavioral therapy for insomnia (CBT-I), is not widely used. Instead, prescription medications dominate treatment even though guidelines recommend CBT-I as the initial and most effective long-term approach. In our previous study, only 8% of members prescribed insomnia treatment received CBT-I, **while 97% were treated with medications**, 70% of which were controlled substances.[32] This pattern persists in our new claims analysis: among members with chronic conditions such as obesity, cardiovascular disease, diabetes, mental health disorders, musculoskeletal disease, and menopause, **14% to 23% had a documented insomnia diagnosis, yet fewer than 1% were adherent to CBT-I** (Figure 2). The overwhelming reliance on medications not only contradicts clinical standards but also introduces health and safety risks.

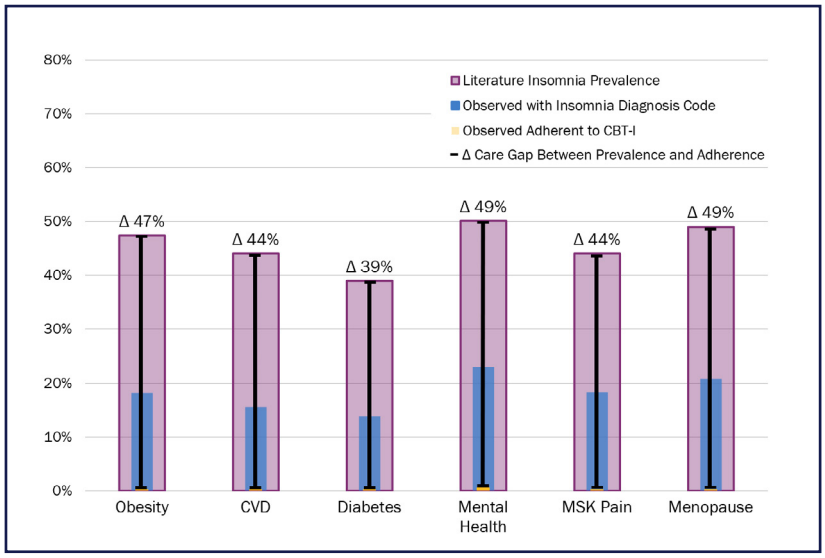


Figure 2. *Gap in care due to the difference in the percent of population using CBT-I versus percent diagnosed with Insomnia versus literature estimations of prevalence for insomnia among each of the following diseases: obesity,[8] cardiovascular (CVD),[9] diabetes,[10] depression or anxiety (mental health),[11] menopause,[12] and musculoskeletal disorders (MSK).[7]*

These care gaps carry a significant financial burden. Chronic conditions alone increase member costs above the average. Sleep disorders amplify the severity and cost of nearly every chronic condition, inflating total healthcare costs approximately 40% to 90% more than the cost of members with comparable chronic conditions without sleep conditions (Figure 3). It is reasonable to conclude that this increased cost burden is the result of untreated sleep disorders, which worsen disease progression and increase utilization.

Number of Sleep Related Chronic Conditions	Control Cohort (No SCs)	Sleep Condition (Insomnia or OSA)	Ratio
0 Chronic Conditions	$6,625	$12,759	1.93
1 Chronic Condition	$9,539	$13,051	1.37
2 Chronic Conditions	$11,527	$16,547	1.44
3 Chronic Conditions	$14,075	$20,413	1.45
4 Chronic Conditions	$18,840	$26,817	1.42
5+ Chronic Conditions	$27,002	$38,697	1.43
Overall	$9,597	$17,999	1.88

Figure 3. *Total Cost of Care for those with and without sleep conditions stratified by number of sleep related chronic conditions, specifically Insomnia and OSA.*

Conversely, when patients adopt and adhere to CPAP or CBT-I therapy, outcomes improve, and costs decline. For example, our prior research (Figure 4) shows that members with sleep apnea who adhere to CPAP therapy experience annual savings of $2,743 per patient for each of the first two years, driven primarily by reductions in inpatient admissions and emergency visits.[29] These savings compound in high-cost chronic conditions, reflecting the broad impact of effective sleep care.

Item	Non-Adherent	Adherent	Savings
Year 1 clinical and sleep costs	$17,082	$14,547	**$2,535**
Year 2 clinical and sleep costs	$18,973	$15,853	**$2,950**
Total two-year clinical and sleep costs	$35,875	$30,390	**$5,485**
Per treated patient per year	*$17,938*	*$15,195*	***$2,743***

Figure 4. *Comparison of adherent versus non-adherent health plan members over a two-year period from our first White Paper (In the Fight Against Chronic Disease, Sleep is the Hidden Gap in Care).*

Integrating comprehensive sleep-care management into chronic-condition programs is not optional; it is essential. Treating sleep apnea and insomnia appropriately helps normalize sleep physiology, reduce metabolic and inflammatory stress, improve cardiovascular outcomes, stabilize mood, and enhance overall well-being. For plan sponsors and population health managers, closing this gap represents a clinically achievable and financially compelling opportunity to improve health outcomes and reduce costs across the population.

What Can Plan Sponsors Do?

What Can Plan Sponsors and Population Health Managers Do to Improve the Health and Reduce the Costs of Members Suffering from Chronic Conditions?

Plan sponsors and population health managers, including those who have purchased or are contemplating the addition of condition-specific programs for obesity, CVD, diabetes, mental health, women's health, and/or musculoskeletal disorders, can amplify the effectiveness of these programs through the addition of a comprehensive sleep care management program. As we have demonstrated, there are substantial gaps in care within each of these populations with regard to both sleep apnea and insomnia.

Considering sleep apnea, there are significant gaps in care across each of these conditions between the small percentage of their populations adherent to CPAP therapy, and the large percentage of their populations both diagnosed and undiagnosed who are not on therapy.

Concerning chronic insomnia, the overwhelming use of prescription medications, instead of first-line CBT-I therapy, and the excessive use of controlled substances, create untenable health and safety risk for employee and employer alike.

Plan sponsors and population health managers can improve the overall health of members with chronic conditions and conditions specific to women's health by utilizing programs designed to provide effective identification and management of highly prevalent comorbid sleep disorders, which otherwise can remain undetected/untreated and limit the treatment response to disease-specific solutions alone.

Because sleep apnea and chronic insomnia are frequently comorbid with costly chronic conditions and complicate pregnancy and menopause, the effective identification, treatment, and ongoing management of these sleep disorders are central to a successful program.

Conclusion

The evidence presented in this paper reveals a critical opportunity for plan sponsors and population health managers at the intersection of sleep and chronic disease. Untreated sleep disorders are not merely a secondary symptom but a primary driver of poor health and a significant contributor to the progression, severity, and cost of the most common chronic conditions. By continuing to overlook this fundamental component of health, current condition-specific care strategies are missing a key opportunity to improve outcomes and reduce spending.

Our research highlights a clear, bidirectional relationship where disorders like sleep apnea and insomnia physiologically damage the body through systemic inflammation, hormonal imbalance, and metabolic dysfunction. This directly worsens outcomes in obesity, cardiovascular disease, diabetes, mental health disorders, and musculoskeletal conditions, while also complicating critical phases of women's health like menopause and pregnancy. The financial consequences are substantial, with our findings showing that members with co-occurring sleep disorders cost approximately 40% to 90% more than members with comparable chronic conditions without sleep conditions.

The current care paradigm for sleep is broken, defined by low treatment adoption and a failure to use evidence-based therapies. However, proven solutions exist. Integrated care models that support patients dramatically improve adherence to CPAP therapy, while new digital therapeutics have made CBT-I, the first-line treatment for insomnia, more accessible.

Prioritizing accessible, well-managed sleep care is essential to transforming the current care paradigm. For plan sponsors and population health managers, addressing sleep is not just about adding another program; it is about amplifying the effectiveness and return on investment (ROI) of existing investments in chronic care and women's health. By integrating comprehensive sleep management, plan sponsors and population health managers can close a critical gap in care, mitigate the adverse effects of chronic disease, and foster a proactive approach that leads to better health, enhanced quality of life, and a significant reduction in total healthcare costs.

References

1. Norbeck, T. B. (2013). Drivers of health care costs: a physicians foundation white paper-second of a three-part series. *Missouri medicine*, 110(2), 113.
2. Leong, W. B., Arora, T., Jenkinson, D., Thomas, A., Punamiya, V., Banerjee, D., & Taheri, S. (2013). The prevalence and severity of obstructive sleep apnea in severe obesity: the impact of ethnicity. *Journal of Clinical Sleep Medicine*, 9(9), 853-858.
3. Yeghiazarians, Y., Jneid, H., Tietjens, J. R., Redline, S., Brown, D. L., El-Sherif, N., ... & Somers, V. K. (2021). Obstructive sleep apnea and cardiovascular disease: a scientific statement from the American Heart Association. *Circulation*, 144(3), e56-e67.
4. Reutrakul, S., & Mokhlesi, B. (2017). Obstructive sleep apnea and diabetes: a state of the art review. *Chest*, 152(5), 1070-1086.
5. Garbarino, S., Bardwell, W. A., Guglielmi, O., Chiorri, C., Bonanni, E., & Magnavita, N. (2020). Association of anxiety and depression in obstructive sleep apnea patients: a systematic review and meta-analysis. *Behavioral sleep medicine*, 18(1), 35-57.
6. Jehan, S., Auguste, E., Zizi, F., Pandi-Perumal, S. R., Gupta, R., Attarian, H., ... & McFarlane, S. I. (2016). Obstructive sleep apnea: women's perspective. *Journal of sleep medicine and disorders*, 3(6), 1064.
7. Mathias, J. L., Cant, M. L., & Burke, A. L. J. (2018). Sleep disturbances and sleep disorders in adults living with chronic pain: a meta-analysis. *Sleep medicine*, 52, 198-210.
8. Vgontzas, A. N., Pejovic, S., Calhoun, S., & Bixler, E. O. (2009). Obesity and self-reported short sleep duration: a marker of sleep complaints and chronic psychosocial stress. *Sleep Medicine Clinics*, 4(1), 65-75.
9. Taylor, D. J., Mallory, L. J., Lichstein, K. L., Durrence, H. H., Riedel, B. W., & Bush, A. J. (2007). Comorbidity of chronic insomnia with medical problems. *Sleep*, 30(2), 213-218.
10. Koopman, A. D., Beulens, J. W., Dijkstra, T., Pouwer, F., Bremmer, M. A., Van Straten, A., & Rutters, F. (2020). Prevalence of insomnia (symptoms) in T2D and association with metabolic parameters and glycemic control: meta-analysis. *The Journal of Clinical Endocrinology & Metabolism*, 105(3), 614-643.
11. Soehner, A. M., & Harvey, A. G. (2012). Prevalence and functional consequences of severe insomnia symptoms in mood and anxiety disorders: results from a nationally representative sample. *Sleep*, 35(10), 1367-1375.
12. Nowakowski, S., Meers, J., & Heimbach, E. (2013). Sleep and women's health. *Sleep medicine research*, 4(1), 1.
13. Gleeson, M., & McNicholas, W. T. (2022). Bidirectional relationships of comorbidity with obstructive sleep apnoea. *European respiratory review*, 31(164).
14. Grandner, M., Olivieri, A., Ahuja, A., Büsser, A., Freidank, M., & McCall, W. V. (2023). The burden of untreated insomnia disorder in a sample of 1 million adults: a cohort study. *BMC Public Health*, 23(1), 1481.
15. Wu, T. T., Zou, Y. L., Xu, K. D., Jiang, X. R., Zhou, M. M., Zhang, S. B., & Song, C. H. (2023). Insomnia and multiple health outcomes: umbrella review of meta-analyses of prospective cohort studies. *Public Health*, 215, 66-74.
16. Messineo, L., Bakker, J. P., Cronin, J., Yee, J., & White, D. P. (2024). Obstructive sleep apnea and obesity: A review of epidemiology, pathophysiology and the effect of weight-loss treatments. *Sleep Medicine Reviews*, 78, 101996.
17. Doumit, J., & Prasad, B. (2016). Sleep apnea in type 2 diabetes. *Diabetes Spectrum: A Publication of the American Diabetes Association*, 29(1), 14.
18. Papaconstantinou, E., Cancelliere, C., Verville, L., Wong, J. J., Connell, G., Yu, H., ... & Taylor-Vaisey, A. (2021). Effectiveness of non-pharmacological interventions on sleep characteristics among adults with musculoskeletal pain and a comorbid sleep problem: a systematic review. *Chiropractic & Manual Therapies*, 29(1), 23.
19. Doghramji, K., Krystal, A., Benca, R. M., & Chepke, C. (2023). Recognition and management of obstructive sleep apnea in psychiatric practice. *J Clin Psychiatry*, 84(2), 22r14521.
20. Maniaci, A., La Via, L., Pecorino, B., Chiofalo, B., Scibilia, G., Lavalle, S., & Scollo, P. (2024). Obstructive sleep apnea in pregnancy: a comprehensive review of maternal and fetal implications. *Neurology International*, 16(3), 522-532.
21. Ohayon, M. M. (2006). Severe hot flashes are associated with chronic insomnia. *Archives of internal medicine*, 166(12), 1262-1268.
22. Wu, J. Q., Appleman, E. R., Salazar, R. D., & Ong, J. C. (2015). Cognitive behavioral therapy for insomnia comorbid with psychiatric and medical conditions: a meta-analysis. *JAMA internal medicine*, 175(9), 1461-1472.
23. Mostafa, S. A., Hanif, W., Crowe, F., Balanos, G., Nirantharakumar, K., Ellis, J. G., & Tahrani, A. A. (2025). The effect of non-pharmacological sleep interventions on glycaemic measures in adults with sleep disturbances and behaviours: A systematic review and meta-analysis. *Diabetes & Vascular Disease Research*, 22(1), 14791641241307367.
24. Blythe, K. Patients with *Type 2 Diabetes or Hypertension Must be Evaluated for Sleep Apnea*. (2013, June). https://aasm.org/patients-with-type-2-diabetes-or-hypertension-must-be-evaluated-for-sleep-apnea/.
25. Benjafield, A. V., Pepin, J. L., Cistulli, P. A., Wimms, A., Lavergne, F., Kuniyoshi, F. H. S., ... & Malhotra, A. (2025). Positive airway pressure therapy and all cause and cardiovascular mortality in people with obstructive sleep apnea: a systematic review and meta-analysis of randomised controlled trials and confounder-adjusted, non-randomised controlled studies. *The Lancet Respiratory Medicine*, 13(5), 403-413.
26. Koffel, E., McCurry, S. M., Smith, M. T., & Vitiello, M. V. (2019). Improving pain and sleep in middle-aged and older adults: the promise of behavioral sleep interventions. *Pain*, 160(3), 529-534.
27. Gupta, M. A., Simpson, F. C., & Lyons, D. C. (2016). The effect of treating obstructive sleep apnea with positive airway pressure on depression and other subjective symptoms: a systematic review and meta-analysis. *Sleep medicine reviews*, 28, 55-68.
28. Furukawa, Y., Nagaoka, D., Sato, S., Toyomoto, R., Takashina, H. N., Kobayashi, K., ... & Kasai, K. (2024). Cognitive behavioral therapy for insomnia to treat major depressive disorder with comorbid insomnia: A systematic review and meta-analysis. *Journal of Affective Disorders*, 367, 359-366.
29. *In the fight against chronic disease, sleep is the hidden gap in care*. Risk Strategies Consulting. (2025, February). https://www.risk-strategies.com/hubfs/Risk%20Strategies%20Consulting%20White%20Paper%20Hidden%20Gap%20Sleep%20Care%20Feb%202025.pdf
30. Adavadkar, P. A., Brooks, L., Pappalardo, A. A., Schwartz, A., Rasinski, K., & Martin, M. A. (2024). Association between sleep disorders and health care utilization in children with chronic medical conditions: a Medicaid claims data analysis. *Journal of Clinical Sleep Medicine*, 20(4), 595-601.
31. Huyett, P., & Bhattacharyya, N. (2021). Incremental health care utilization and expenditures for sleep disorders in the United States. *Journal of Clinical Sleep Medicine*, 17(10), 1981-1986.
32. *Insomnia: the need for an integrated care approach*. Risk Strategies Consulting. (2025, March). https://www.risk-strategies.com/hubfs/Consulting/Risk-Strategies-Consulting-WhitePaper-Insomnia.pdf?hsLang=en
33. Beccuti, G., & Pannain, S. (2011). Sleep and obesity. *Current Opinion in Clinical Nutrition & Metabolic Care*, 14(4), 402-412.
34. Ogilvie, R. P., & Patel, S. R. (2017). The epidemiology of sleep and obesity. *Sleep health*, 3(5), 383-388.
35. Javaheri, S., Barbe, F., Campos-Rodriguez, F. D. J., Khayat, R., Sogol, J., & Malhotra, A. (2016). Types, Mechanisms, and Clinical Cardiovascular Consequences. *J Am Coll Cardiol*, 23, 1079-84.
36. Javaheri, S., Barbe, F., Campos-Rodriguez, F., Dempsey, J. A., Khayat, R., Javaheri, S., ... & Somers, V. K. (2017). Sleep apnea: types, mechanisms, and clinical cardiovascular consequences. *Journal of the American College of Cardiology*, 69(7), 841-858.
37. Javaheri, S., & Redline, S. (2017). Insomnia and risk of cardiovascular disease. *Chest*, 152(2), 435-444.

38. Ferreira, M., Oliveira, M., Laranjo, S., & Rocha, I. (2024). Linking Sleep Disorders to Atrial Fibrillation: Pathways, Risks, and Treatment Implications. *Biology*, 13(10), 761.

39. Mahmood, A., Ray, M., Dobalian, A., Ward, K. D., & Ahn, S. (2021). Insomnia symptoms and incident heart failure: a population-based cohort study. *European heart journal*, 42(40), 4169-4176..

40. Huang, H., & Chen, Z. (2025). Association between obstructive sleep apnea syndrome and type1/type2 diabetes mellitus: A systematic review and meta analysis. *Journal of diabetes investigation*, 16(3), 521-534..

41. Henson, J., Covenant, A., Hall, A. P., Herring, L., Rowlands, A. V., Yates, T., & Davies, M. J. (2024). Waking up to the importance of sleep in type 2 diabetes management: a narrative review. *Diabetes Care*, 47(3), 331-343.

42. Khandelwal, D., Dutta, D., Chittawar, S., & Kalra, S. (2017). Sleep disorders in type 2 diabetes. *Indian journal of endocrinology and metabolism*, 21(5), 758-761.

43. Haack, M., Simpson, N., Sethna, N., Kaur, S., & Mullington, J. (2020). Sleep deficiency and chronic pain: potential underlying mechanisms and clinical implications. *Neuropsychopharmacology*, 45(1), 205-216.

44. Whale, K., & Gooberman Hill, R. (2022). The importance of sleep for people with chronic pain: current insights and evidence. *Journal of Bone and Mineral Research Plus*, 6(7), e10658.

45. Stores, G. (2007). Clinical diagnosis and misdiagnosis of sleep disorders. *Journal of Neurology, Neurosurgery & Psychiatry*, 78(12), 1293-1297.

46. Kim, J. Y., Ko, I., & Kim, D. K. (2019). Association of obstructive sleep apnea with the risk of affective disorders. *JAMA Otolaryngology–Head & Neck Surgery*, 145(11), 1020-1026.

47. Salari, N., Hasheminezhad, R., Hosseinian-Far, A., Rasoulpoor, S., Assefi, M., Nankali, S., ... & Mohammadi, M. (2023). Global prevalence of sleep disorders during menopause: a meta-analysis. *Sleep and Breathing*, 27(5), 1883-1897.

48. Baker, F. C., De Zambotti, M., Colrain, I. M., & Bei, B. (2018). Sleep problems during the menopausal transition: prevalence, impact, and management challenges. *Nature and science of sleep*, 73-95.

49. Sands-Lincoln, M., Loucks, E. B., Lu, B., Carskadon, M. A., Sharkey, K., Stefanick, M. L., ... & Eaton, C. B. (2013). Sleep duration, insomnia, and coronary heart disease among postmenopausal women in the Women's Health Initiative. *Journal of women's health*, 22(6), 477-486.

50. Aggarwal, B. A., Scaccia, S., Charliyan, G., Wang, P., Allison, M. A., Catov, J. M., ... & Vaidya, D. (2023). Associations Between Multiple Dimensions of Poor Sleep and Life's Essential 8 Cardiovascular Health Score During the Menopausal Transition: Findings From the AHA Research Goes Red Weight Study. *Circulation*, 148(Suppl_1), A19123-A19123.

51. Lee, C. L., Tzeng, H. E., Liu, W. J., & Tsai, C. H. (2021). A cross-sectional analysis of the association between sleep duration and osteoporosis risk in adults using 2005–2010 NHANES. *Scientific reports*, 11(1), 9090.

52. Johns, E. C., Hill, E. A., Williams, S., Sabil, A., Riha, R. L., Denison, F. C., & Reynolds, R. M. (2022). High prevalence of obstructive sleep apnea in pregnant women with class III obesity: a prospective cohort study. *Journal of Clinical Sleep Medicine*, 18(2), 423-432.

53. Street, L. M., Aschenbrenner, C. A., Houle, T. T., Pinyan, C. W., & Eisenach, J. C. (2018). Gestational obstructive sleep apnea: biomarker screening models and lack of postpartum resolution. *Journal of Clinical Sleep Medicine*, 14(4), 549-555.

54. Lee, Y. C., Chang, Y. C., Tseng, L. W., Lin, W. N., Lu, C. T., Lee, L. A., ... & Li, H. Y. (2024). Continuous positive airway pressure treatment and hypertensive adverse outcomes in pregnancy: a systematic review and meta-analysis. *JAMA Network Open*, 7(8), e2427557-e2427557..

55. Tantrakul, V., Ingsathit, A., Liamsombut, S., Rattanasiri, S., Kittivoravitkul, P., Imsom-Somboon, N., ... & Thakkinstian, A. (2023). Treatment of obstructive sleep apnea in high risk pregnancy: a multicenter randomized controlled trial. *Respiratory Research*, 24(1), 171..

56. McCurry, S. M., Guthrie, K. A., Morin, C. M., Woods, N. F., Landis, C. A., Ensrud, K. E., ... & LaCroix, A. Z. (2016). Telephone-based cognitive behavioral therapy for insomnia in perimenopausal and postmenopausal women with vasomotor symptoms: a MsFLASH randomized clinical trial. *JAMA internal medicine*, 176(7), 913-920.

57. Hunter, M. S. (2021). Cognitive behavioral therapy for menopausal symptoms. *Climacteric*, 24(1), 51-56.

Get to know us.

Risk Strategies Consulting, Inc., part of the Brown & Brown team, is focused on assessing, managing, and abating clinical and financial risks for our customers. We continuously mine our large claims database to expose unseen key issues and extract actionable insights.

Risk Strategies Consulting is comprised of experienced consultants, actuaries, data scientists, auditors, pharmacists, accountants, and other specialists able to help payers, providers, and plan sponsors clearly understand the risks of their business and ways to minimize and manage them. As a national consulting and actuarial services business, Risk Strategies Consulting provides high-touch consulting and state-of-the-art analytics services including strategy and consulting (encompassing health and welfare with deep pharmacy knowledge, as well as mergers and acquisitions); actuarial services for plan sponsors, providers, and insurers; and benefit and claim audit services. Services are provided for a wide variety of industry segments including government entities, manufacturing and distribution, and self-funded organizations including corporations and trusts, healthcare organizations, national and regional insurance companies, and private equity firms, among others.

Learn more.

Visit us at risk-strategies.com/consulting