

## Review

# The Economic and Social Burden of Insulin Resistance in Obesity

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### Abstract

Insulin resistance, a precursor to various metabolic disorders, represents a significant burden when associated with obesity. This detailed examination reveals the multifaceted economic and social impacts of insulin resistance intertwined with obesity. The financial strain is immense, primarily due to the increased prevalence of related conditions such as type 2 diabetes, cardiovascular diseases, and non-alcoholic fatty liver disease. Healthcare costs surge due to the need for continuous management, medications, and treatments, compounded by indirect expenses from reduced productivity and absenteeism. These financial pressures extend beyond individual and healthcare systems, affecting businesses and the broader economy through decreased efficiency and increased disability support costs. Socially, insulin resistance linked to obesity carries profound implications. The stigma associated with obesity often leads to discrimination, adversely impacting the psychological well-being and social status of affected individuals. This stigma can perpetuate workplace bias, hindering career advancement and widening socio-economic disparities. The relationship between obesity and mental health is bidirectional, with insulin resistance exacerbating stress, depression, and anxiety, which further deteriorates the individual's overall health and social relationships. Effective management of insulin resistance in obesity necessitates a holistic approach. Lifestyle modifications, including dietary adjustments and regular physical activity, are foundational. Medications like metformin and thiazolidinediones are crucial when lifestyle changes are insufficient. Emerging treatments such as SGLT2 inhibitors and gut microbiota modifications offer promising avenues. Addressing comorbid conditions like dyslipidemia and hypertension is vital to reducing overall risk. Patient education is paramount, empowering individuals to take control of their health journey and ensuring a comprehensive understanding of insulin resistance's physiological and psychosocial aspects. A multidisciplinary approach involving collaboration among healthcare providers is essential. This strategy ensures tailored interventions that address both the physical and emotional dimensions of insulin resistance. As research advances, refining treatment approaches and reducing the social impacts associated with insulin resistance within the obesity framework remains a priority. This comprehensive approach aims to mitigate the broader implications of insulin resistance, fostering a more inclusive and supportive environment for those affected.

**Keyword:** Behavioral Interventions, Clinical Management, Insulin Resistance, Lifestyle Modifications, Pharmacological Approaches

**Introduction**

Diminished cellular responsiveness to insulin, known as insulin resistance, plays a role in the web of metabolic dysregulation linked to obesity. Apart from its effects on health, insulin resistance also places an economic strain and influences different facets of societal welfare (1). Studies have shown that there is an impact associated with insulin resistance in relation to obesity, highlighting a complex connection involving both direct and indirect expenses (2, 3). Research consistently indicates an increase in healthcare costs linked to conditions like type-2 diabetes, heart diseases, and non-alcoholic fatty liver disease that are related to obesity (4). It is clear that insulin resistance often precedes and worsens these conditions leading to a pressure on healthcare systems. The costs of managing complications from insulin resistance in healthcare are quite high. The expenses rise due to the need for treatments, medications, and continuous monitoring, placing a financial burden on both individuals and healthcare systems (5). This financial strain is further compounded by costs resulting from decreased work productivity and frequent absences due to obesity-related health issues. These costs go beyond impacts affecting businesses and the overall economy (6, 7). Businesses face decreased productivity as a result of work efficiency and increased absences among individuals dealing with the effects of insulin resistance and obesity. This impact extends to disability support programs and social welfare initiatives needed to assist individuals who are unable to work due to health issues. The economic consequences, whether indirect, emphasize the pressing need for strategies aimed at addressing and alleviating the economic challenges posed by insulin resistance within the context of obesity (8, 9). The societal effects of insulin resistance, in cases of obesity, are just as significant. Having impacts on different facets of society. Studies suggest that the social stigma surrounding obesity frequently results in discrimination, which affects the well-being of those individuals. Workplace bias is an issue that affects career growth and widens the gap between socio-economic groups. This strain on society makes it challenging to create a fair environment.

Connecting insulin resistance with health problems further complicates this issue. Research indicates a two-way relationship between obesity and mental well-being, showing that people with insulin resistance often experience levels of stress, depression, and anxiety (10, 11). These mental health hurdles do not impact the affected individual's overall health. Also, it strains their relationships and increases the need for mental health services. To address the social impact of insulin resistance in obesity, a comprehensive strategy is needed. Research indicates that it is crucial to implement strategies that target the prevention and treatment of obesity through lifestyle modifications and the use of medications to lower healthcare expenses (12, 13). Similarly, encouraging workplace wellness initiatives and creating environments that promote activity can help decrease absenteeism and improve productivity. At a level, combatting the bias against obesity is crucial. Studies highlight the significance of public health initiatives in promoting awareness, fostering inclusivity, and addressing discrimination. It's equally important to incorporate health support into programs for managing obesity to ensure the well-being of individuals impacted by insulin resistance and obesity (14, 15). The complex issue of insulin resistance in obesity carries both social implications that require consideration. The intricate link between insulin resistance and obesity highlights the importance of nuanced solutions that go beyond healthcare methods. By tackling the impacts and societal outcomes, we can work towards fostering a more supportive environment for those dealing with insulin resistance and obesity. This review aims to provide an overview of the economic and social burden of insulin resistance in obesity.

**Method**

The economic and social burden of insulin resistance in obesity was examined. Articles from PubMed and Scopus, published in English since 2008, were analyzed along with references cited within to provide a comprehensive understanding. Keywords such as insulin resistance, obesity,

economic burden, social impact, healthcare costs, and healthcare disparities guided the search criteria.

## **Discussion**

Insulin resistance in individuals with obesity highlights the balance between making lifestyle changes using medications and exploring treatment options. Research emphasizes the importance of adjustments and regular exercise in enhancing insulin sensitivity, showing that personalized exercise plans involving resistance training can improve metabolic health. Psychological factors linked to obesity and insulin resistance are also considered in interventions, which play a role in sustaining long-term lifestyle changes (16). When lifestyle changes are not enough, medications like metformin and thiazolidinediones become tools. Drugs targeting obesity, such as orlistat and GLP 1 receptor agonists, aid in weight loss and indirectly boost insulin sensitivity. Additionally, new treatments like SGLT2 inhibitors show promise in controlling blood sugar levels and improving heart health (17, 18). Innovative approaches, such as modifying gut microbiota, add complexity to the evolving landscape of care. Managing associated conditions like dyslipidemia and hypertension is crucial for care. These common issues seen with insulin resistance require interventions to reduce risk. Emphasizing the nature of patient care is also highlighted through educating patients, which is crucial for explaining the complex connection between insulin resistance. Adopting a multidisciplinary approach ensures that diverse aspects, both physiological and psychosocial, are considered, fostering a comprehensive understanding of insulin resistance and facilitating tailored interventions for individual patients.

## ***Clinical Manifestation***

Insulin resistance, which is commonly seen in cases of obesity, leads to health issues that have an impact on both individuals and healthcare systems. One major consequence is the development of Type 2 Diabetes Mellitus (T2DM), where inflammation due to obesity hinders the body's ability to process glucose properly, resulting in blood sugar levels and typical symptoms of diabetes such as urination and

unexplained weight loss. Additionally, individuals with insulin resistance often experience metabolic syndrome characterized by obesity, abnormal lipid levels, and high blood pressure, which further heightens the risks of heart-related problems and increases healthcare expenses (19, 20). The complex relationship between insulin resistance and metabolic syndrome intensifies the likelihood of events like heart attacks and strokes. This connection creates a scenario where addressing each risk factor individually becomes crucial in order to prevent negative health outcomes. Dyslipidemia, which is identified by levels and low high-density lipoprotein (HDL) cholesterol, represents the metabolic imbalance that comes with insulin resistance. Hypertension, a feature of metabolic syndrome, adds complexity by requiring management of blood pressure to reduce the risks to heart health. Non-Alcoholic Fatty Liver Disease (NAFLD), another aspect related to insulin resistance, presents a range of liver issues, from buildup to severe cirrhosis. The continuous accumulation of fat in the liver due to insulin resistance leads to liver inflammation and scarring. Signs like elevated liver enzymes and enlarged liver serve as warnings of worsening liver damage, leading healthcare toward hepatology and liver transplants. Obstructive Sleep Apnea (OSA), a sleep disorder closely tied to insulin resistance and obesity, reveals symptoms beyond nighttime disturbances. Daytime drowsiness, often mistaken for tiredness, indicates disruptions in sleep patterns with systemic effects. Loud snoring observed, pauses in breathing during sleep, and morning headaches highlight the impacts of OSA on both sleep quality and daily functioning, emphasizing the need for diagnosis and treatment to prevent heart-related issues. Reproductive disorders are known consequences of insulin resistance that contribute to the network of hormonal imbalances affecting both men and women. Polycystic Ovary Syndrome, a known condition affecting women in their reproductive years, illustrates the disrupted ovarian activity linked to insulin resistance. High levels of androgens, irregular ovulation, and the presence of cysts in the ovaries come together to show up as periods, excessive body hair growth, and difficulties

with fertility. These symptoms highlight how insulin resistance significantly influences women's health. On the other hand, men dealing with insulin resistance also face challenges related to their health. Low testosterone levels, known as hypogonadism, can lead to issues like reduced sex drive, erectile problems, and fertility issues for men. This connection between insulin resistance and reproductive issues goes beyond hormones impacting the emotional well-being of those affected. Furthermore, chronic inflammation and immune system dysfunction linked to insulin resistance have reached effects that go beyond just metabolic disruptions. The body fat tissue, which acts as an endocrine organ, releases substances that contribute to low-level inflammation. This persistent inflammation does not disrupt the metabolic balance. It also increases the risk of infections and autoimmune conditions, creating a continuous cycle of managing these health challenges. Studies indicate that these health issues highlight the need for approaches that go beyond disease management strategies. Lifestyle changes, medication options, and sometimes even surgery come together to address the social burdens caused by insulin resistance and its associated conditions. Embracing an approach that considers the complex relationship between insulin resistance and its symptoms is crucial for achieving outcomes and moving towards personalized medical care tailored to individual needs.

### ***Management***

Treating insulin resistance in individuals requires a flexible approach that plays a vital role in reducing the financial and societal impacts linked to this widespread health issue. From lifestyle changes to medication options and new treatment advancements, the interventions cover a range of strategies. In today's changing healthcare environment, grasping these treatment methods is essential for enhancing results and tackling the wider effects of insulin resistance. Lifestyle changes are crucial in healthcare management, highlighting the impact of adjusting diets and staying active. Studies consistently show the importance of embracing a dense diet while avoiding processed

sugars and saturated fats (21). This dietary shift not only helps with weight control but also plays a key role in improving insulin sensitivity. At the time, regular physical activity is essential in managing insulin resistance. Both aerobic workouts and strength training are effective in enhancing insulin sensitivity, emphasizing the need for tailored exercise plans that suit preferences and abilities. In addition to lifestyle adjustments, behavioral interventions acknowledge how psychological factors and adherence to recommended changes are interconnected (22). Evidence-based strategies focus on addressing stressors and promoting behavior change through counseling and support. By recognizing the aspects associated with obesity and insulin resistance, behavioral interventions strive to boost the long-term success of lifestyle modifications by emphasizing patient involvement. Pharmacological methods also play a role, especially when lifestyle changes alone may not produce results. Studies highlight the importance of metformin, a prescribed oral diabetes medication that enhances insulin sensitivity and controls blood sugar levels effectively. Another group of medications called thiazolidinediones target peroxisome proliferator-activated receptors, improving insulin function in tissue and muscles. Medications aimed at treating obesity, like orlistat and GLP 1 receptor agonists, help enhance insulin sensitivity indirectly by encouraging weight loss. The field of treatment is expanding to include therapeutic options that show promise for the future. Recent studies suggest progress, with drugs like sodium-glucose co-transporter-2 (SGLT2) inhibitors demonstrating potential not only in controlling blood sugar levels but also in positively affecting body weight and heart health outcomes. Exploring treatment methods, such as adjusting gut bacteria and understanding how the gut-brain connection impacts metabolic functions, offers insight into the changing landscape of care. In addition to managing insulin resistance, comprehensive clinical treatment involves addressing health issues. Conditions like cholesterol and high blood pressure often accompany insulin resistance, requiring strategies to reduce heart disease risk (23). Making lifestyle changes along

with using medications is crucial in managing these conditions, highlighting the importance of a holistic approach to patient well-being. Patient education plays a role in how clinical care is approached. Clear communication from healthcare providers is essential in explaining the links between insulin resistance, obesity, and associated health dangers. Prioritizing patient-centered care through shared decision-making and setting goals not only improves patient compliance with treatments but also significantly contributes to long-term success in handling insulin resistance. Educating patients on maintaining lifestyle habits, adhering to medication regimens, and staying vigilant about their health promotes a well-informed patient community. In dealing with the intricacies of care, it's essential to take a team-based approach. Working together, healthcare experts such as endocrinologists, dietitians, exercise physiologists, and mental health professionals can provide personalized treatment for patients. This interdisciplinary approach is essential for improving outcomes by recognizing the aspects of insulin resistance encompassing both physical and psychological factors. The collaboration enhances a comprehension of the condition. Enables personalized interventions tailored to meet each patient's specific needs. In essence, managing insulin resistance in the context of obesity is an ever-evolving field in healthcare. Lifestyle changes, medication options, and new treatment methods together create a plan to reduce the social challenges linked to insulin resistance. Managing health conditions, educating patients, and embracing a strategy are key elements of an effective clinical approach. As research progresses and deepens our knowledge, healthcare professionals have a role in refining treatment plans. Contributing to the ongoing battle against insulin resistance, within the broader scope of obesity.

## **Conclusion**

In summary, effectively managing insulin resistance in individuals with obesity requires a varied approach. The key lies in making lifestyle changes, including adjusting diet, engaging in exercise, and using interventions to enhance insulin sensitivity over time. Medications also play a role. Exploring

new treatment options shows promise for the future. Understanding the connection between insulin resistance and related health issues emphasizes the need for an approach to patient care. Educating patients becomes essential, empowering them to take a role in managing their health. Collaborating across healthcare disciplines ensures that all aspects of insulin resistance are addressed thoroughly, leading to personalized interventions that consider both physical and emotional well-being. As healthcare professionals refine treatment approaches and deepen our knowledge of insulin resistance, efforts to reduce the social impact of this condition must remain a priority. The evolving landscape of management underscores a commitment to improving outcomes and addressing the broader implications of insulin resistance within the context of obesity.

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There is no conflict of interest.

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Non applicable

### *Data availability*

Data that support the findings of this study are embedded within the manuscript.

### *Author contribution*

All authors contributed to conceptualizing, data drafting, collection, and final writing of the manuscript.

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