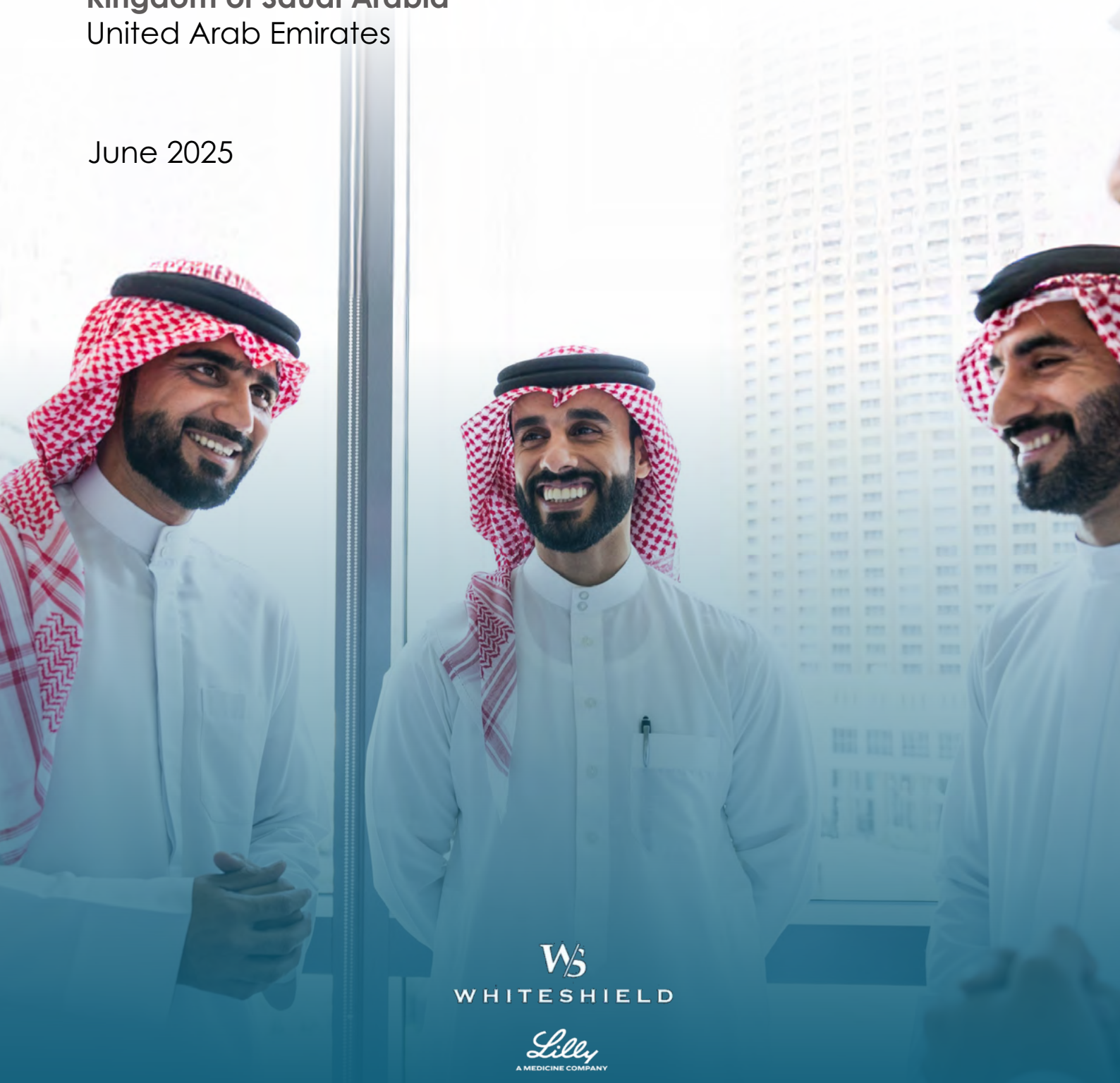
UNCOVERING THE FULL SCALE OF THE ECONOMIC AND SOCIETAL BENEFITS OF WEIGHT LOSS

Report for the:
Kingdom of Saudi Arabia
United Arab Emirates

June 2025



WHITESHIELD

Lilly
A MEDICINE COMPANY

This report was commissioned and funded by Eli Lilly Suisse SA. This report was authored independently by Whiteshield.

Contents

Executive Summary

SUMMARY: MEDICAL INNOVATION, WEIGHT LOSS, AND THE HIDDEN COUNTRY-WIDE SOCIOECONOMIC BENEFITS

In recent years, significant advancements in obesity pharmacotherapy have been enriched with new and more effective medications. These developments have the potential to revolutionize obesity management and achieve sustainable weight loss, ultimately reducing obesity rates[1].

This country-level perspective departs from the traditional narrow lens of measuring obesity's impact on healthcare outcomes and spending.

Obesity affects 1 in 8 people globally[2] — a rate that climbs to 3 in 8 adults in the Kingdom of Saudi Arabia[3].

Obesity is a serious, chronic, and progressive disease affecting more than 890 Mn adults in the world[4]. Prevalence rates have more than doubled, from 6.8% in 1990 to 15% in 2020, and continue to trend upwards, potentially reaching 57.4% for men and 60.3% for women by 2050[5]. Obesity rates for adults in the Kingdom of Saudi Arabia (KSA) are even higher than the latest world average, reaching 39%. Women are particularly impacted, with obesity prevalence touching 42%. Global and KSA rates are likely to increase, due to low levels of physical activity, poor dietary habits and an ageing population[6].

The consequences of obesity are well-documented. Adults with obesity may lose as much as eight years of life due to associated health conditions like Type 2 diabetes[7]. Their overall quality of life also suffers, with a potential loss of up to 18 quality-adjusted life years[8]. Obesity is further connected to higher incidences of depression and declining mental health, which negatively impacts social interaction, physical activity, and productivity[9].

Previous public health strategies aimed at reducing obesity have achieved limited results. The condition is influenced by a range of factors, including genetics and environmental elements, making it difficult to address through a single approach[10]. Recently developed treatments, such as GLP-1 receptor agonists, offer a promising solution, helping individuals with obesity lose as much as 20% of their body weight[11]. However, the successful adoption of these treatments largely depends on access—driven by physician endorsement, treatment availability, and insurance reimbursement.

The benefits of weight loss at a country scale deserve a first of its kind holistic examination

The impact of weight loss on people is well known: Obesity related conditions are prevented and people spend less on healthcare, thereby reducing financial burdens, are more productive at work, and change their lifestyle[12]. The straightforward estimated decrease in healthcare spending from losing weight and even the cost savings from a person being less sick are clear. But the benefits at the country level are not yet well understood, as the impact of a large share of society moving from living with obesity to losing weight has wide ranging effects. For example:

- A person who loses weight is more productive at work, which boosts economy-wide production and output, with knock-on effects across many economic sectors[13]
- Young adults with lower weight may be more inclined to attend university and get higher-skill jobs, increasing a country's pool of educated labour[14]

These dynamic interactions need to be modelled together as a system to understand the true country impact of weight loss, particularly if a large share of the population significantly loses weight.

KSA: Three scenarios for the future of weight loss

Comparing the current projected trajectory of obesity in KSA until 2030 with two weight loss scenarios, based on the reach of obesity interventions, shows the extent of the benefits that extreme weight loss can have on a country's economy and society:

Status quo: Obesity evolves at its historical pace, projected to reach 41% prevalence among all adults by 2030, which is likely due to a combination of sedentary lifestyles, unhealthy dietary habits, and limited access to effective weight management interventions

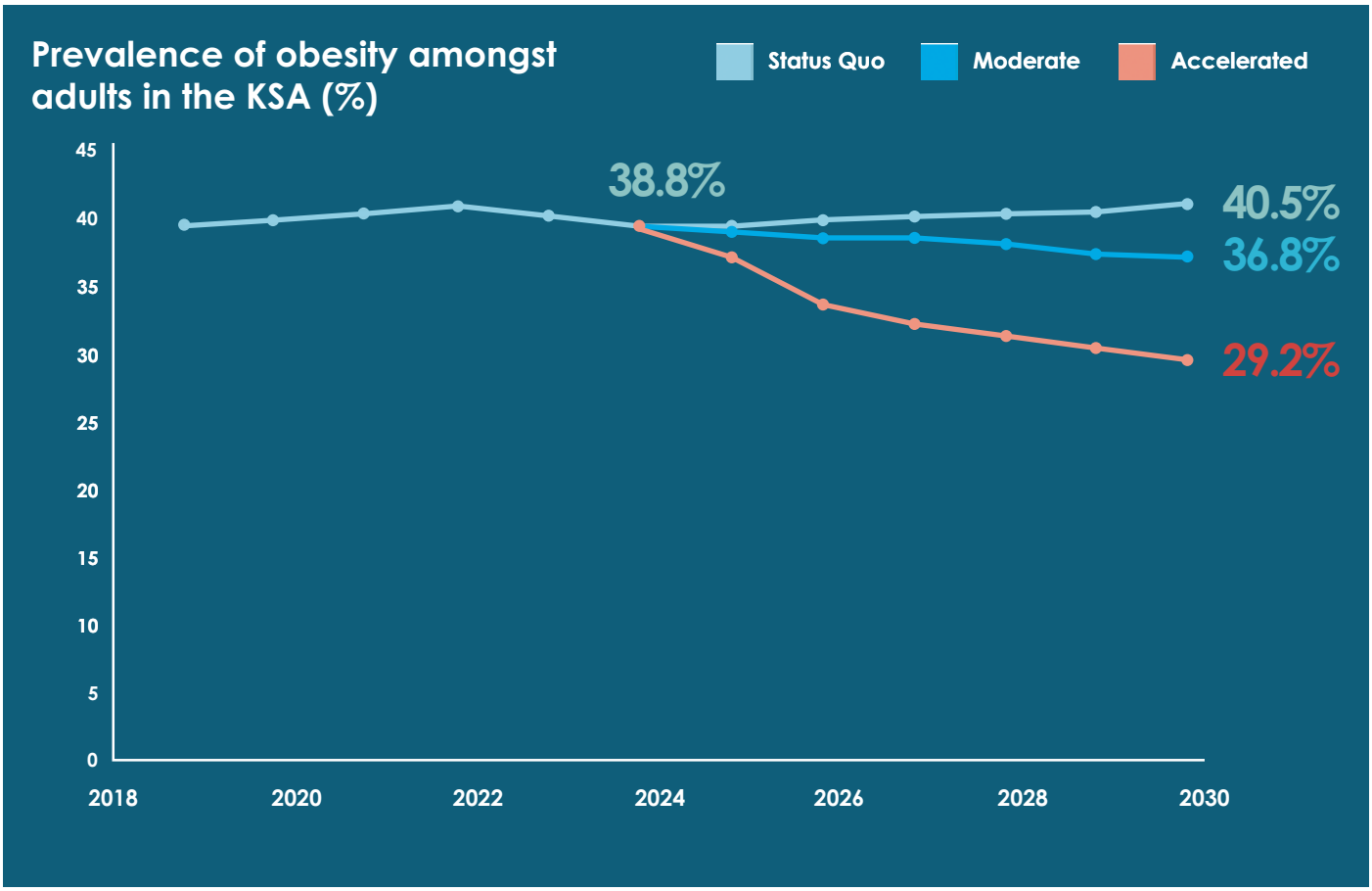
Moderate intervention: 1,172,000 Mn adults could transition out of obesity by 2030, as innovative weight loss solutions reach 15% of adults living with obesity.

Accelerated intervention: 3,300,000 adults could transition out of obesity by 2030, as innovative weight loss solutions reach 57% of adults living with obesity.

Reducing weight at a national scale, particularly in an accelerated intervention, could transform KSA across 5 areas

3,300,000 adults transitioning out of obesity, in an accelerated scenario, would transform the KSA across five areas:

- **Public Healthcare Expenditure:** Obesity-related illnesses, such as diabetes and 13 types of cancer, are estimated to decline due to lower demand for medical treatments, hospitalizations, and long-term care, reducing the burden on healthcare systems and promoting longer, healthier lives[15] In the KSA, up to $1.8 Bn in healthcare costs to the government and individuals could be averted by 2030, equivalent to nearly one full year of the public expenditure on healthcare. Life expectancy may increase by 1.1 years for nearly 10 Mn people previously living with obesity.



- **Economy:** People overcoming obesity are typically more productive and have fewer health-related absences, in part due to improved mental health[16]. GDP growth could rise on average by one percentage points above the projected growth rate until 2030, reaching $1,411 Bn by 2030.
- **Fertility:** Adults living with obesity may be hindered from conceiving or carrying pregnancy to term[17]. Freed from obesity-related conditions, up to 152,000 additional births may take place, cumulatively by 2030.
- **Education:** Students no longer affected by obesity have improved physical and mental well-being and are shown to better perform academically[18]. Bachelor's program enrollments could grow by over 10,000 additional students by 2030.
- **Security:** Improving physical fitness among young Saudi males can expand the pool of people eligible for military service[19].By 2030, up to 78,000 additional Saudi youth might meet the necessary criteria in an accelerated intervention scenario.

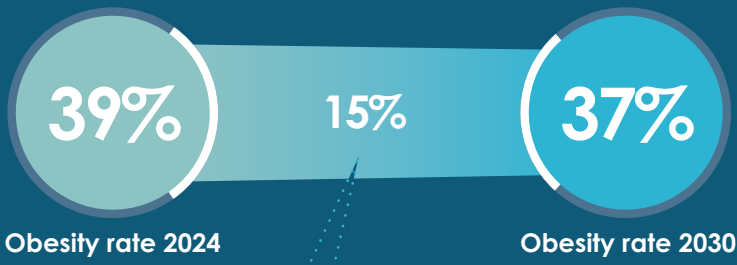
Even in the moderate weight loss scenario, benefits remain significant for the KSA, with positive impacts across all five areas. Due to novel weight loss solutions, these benefits, at whatever level they are realised, are in reach in only a few years. Policymakers now have a unique opportunity to deploy these tools in the fight against obesity.

Future Scenarios

The introduction of innovative weight loss solutions may reshape societies

STATUS QUO
Obesity continues to evolve at its historical pace, with prevalence largely stagnating. Other scenarios are compared to this baseline to determine the socioeconomic impacts of weight loss

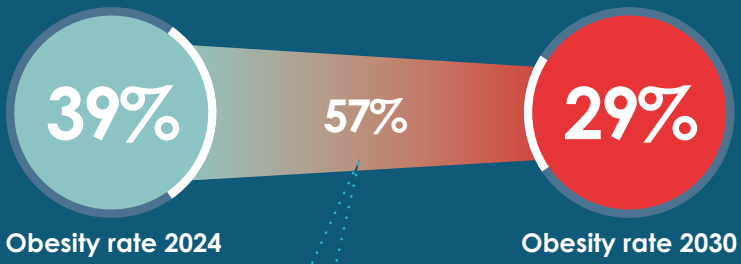
MODERATE INTERVENTION SCENARIO



15% adoption rate among adults living with obesity

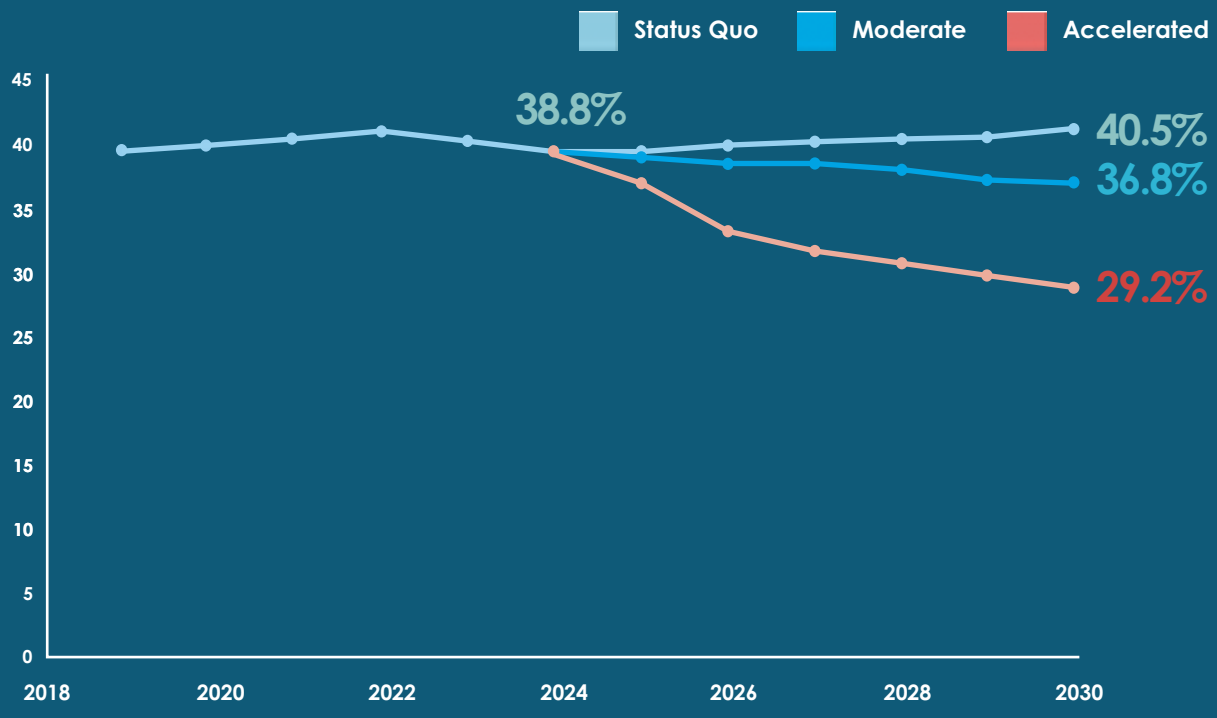
-1,100,000
adults living with obesity

ACCELERATED INTERVENTION SCENARIO

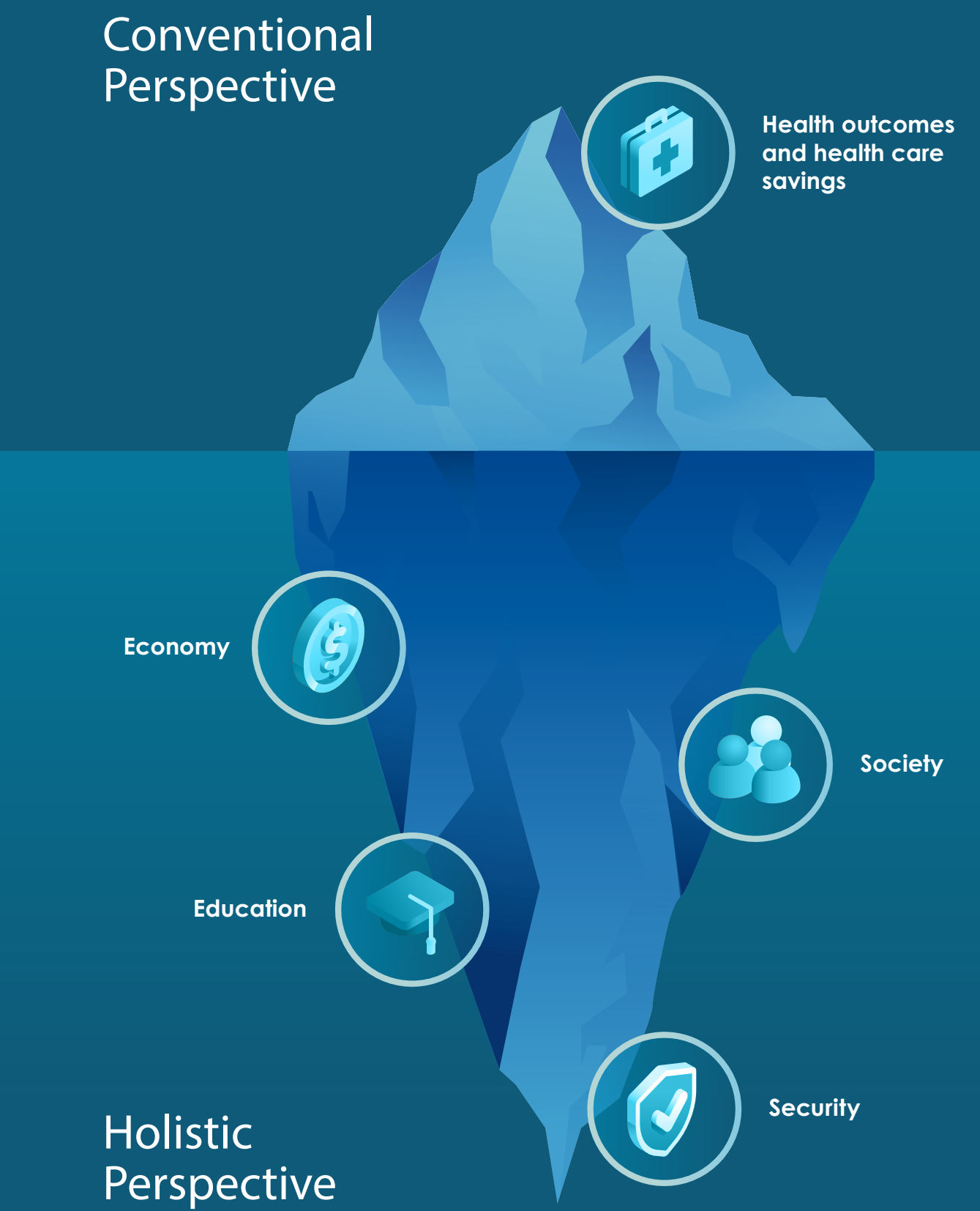


57% adoption rate among adults living with obesity

-3,300,000
adults living with obesity



Impacts of obesity and weight loss

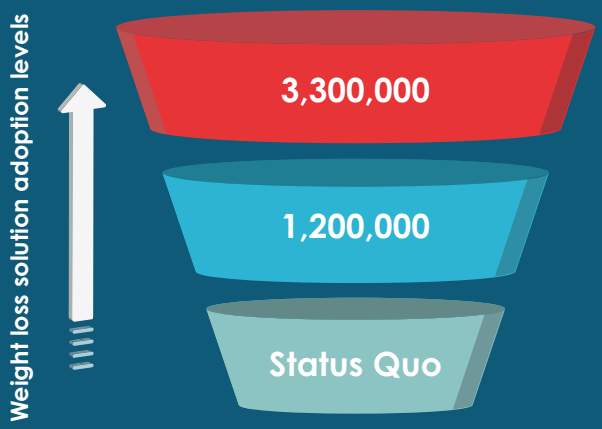


Health

Weight loss helps individuals lead longer, healthier lives

Obesity rate by weight loss scenario 2030

3.3 million people transition out of obesity in a high impact scenario...



Adults transitioning out of obesity thanks to weight loss interventions by 2030:

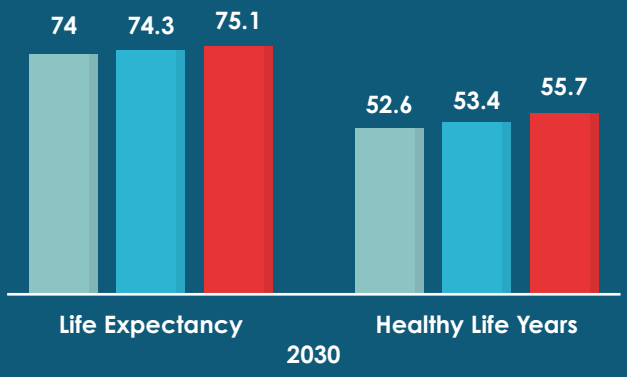
- **3,300,000**
  Accelerated scenario – prevalence reduces to 29% from 39%
- **1,200,000**
  Moderate scenario – prevalence reduces to 37% from 39%

...this substantially reduces comorbidities and lengthens healthy life by up to 3.1 years...

+3.1 years

of healthy life for each adult that previously lived with obesity

Life Expectancy and Healthy Life years[1] (2030)



...and frees up to $1.8 Bn of healthcare resources to be reallocated

Cumulative healthcare savings[2]

Up to $1.8 Bn

In the accelerated scenario - where prevalence reduces from **39%** to **29%**

1. Fontaine et al., "Years of Life Lost Due to Obesity", 2. World Obesity Federation; Whiteshield Analysis

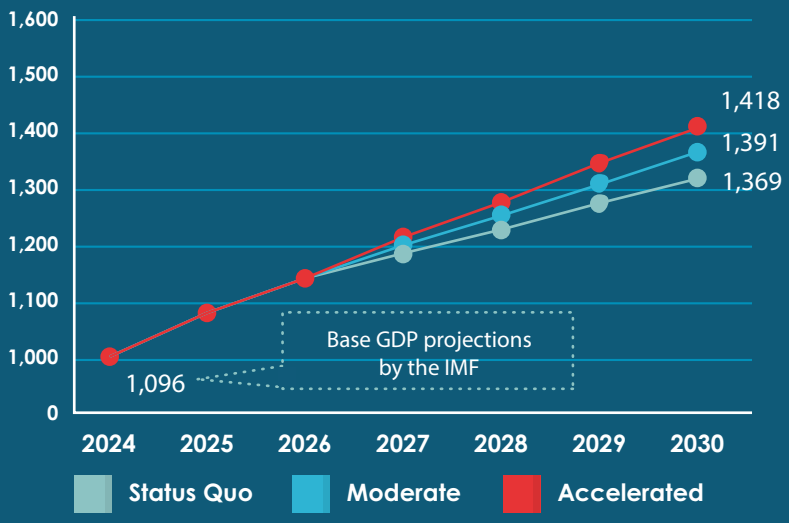
Economy

3.3 Mn people no longer suffer from obesity and realize their full economic potential

Obesity rate by weight loss scenario 2030

A healthier population could boost GDP growth by an additional 0.9% points...

KSA GDP[1] – 2024-2030 ($Bn)



Addition to GDP in 2030

+$49 Bn
Accelerated Intervention

+$22 Bn
Moderate Intervention

...due to healthier workers who gain up to 6 days of productive work[2] per year...

+3 to 7
Days of productive work per worker who was previously living with obesity

+$156 to **$366** /year
Average increase in annual income for the population by 2030

...an 8.3% increase in consumption drives the economy forward and lifts VAT collections

Increase in Consumption[3] ($ Bn)

+$49 Bn → **+$110 Bn**

cumulative gain driven by increased productivity and higher income

Up to
+$6.9 Bn
Yearly increase in VAT receipts by 2030, In the high impact scenario as **3.3 Mn** people experience weight loss

1. *International Monetary Fund, Whiteshield Analysis*
2. *Sheehan, Rasmussen, and Sweeny, "The Impact of Health on Worker Attendance and Productivity in the APEC Region"*
3. *Obesity Drugs' Ripple Effects, Morgan Stanley*

Society

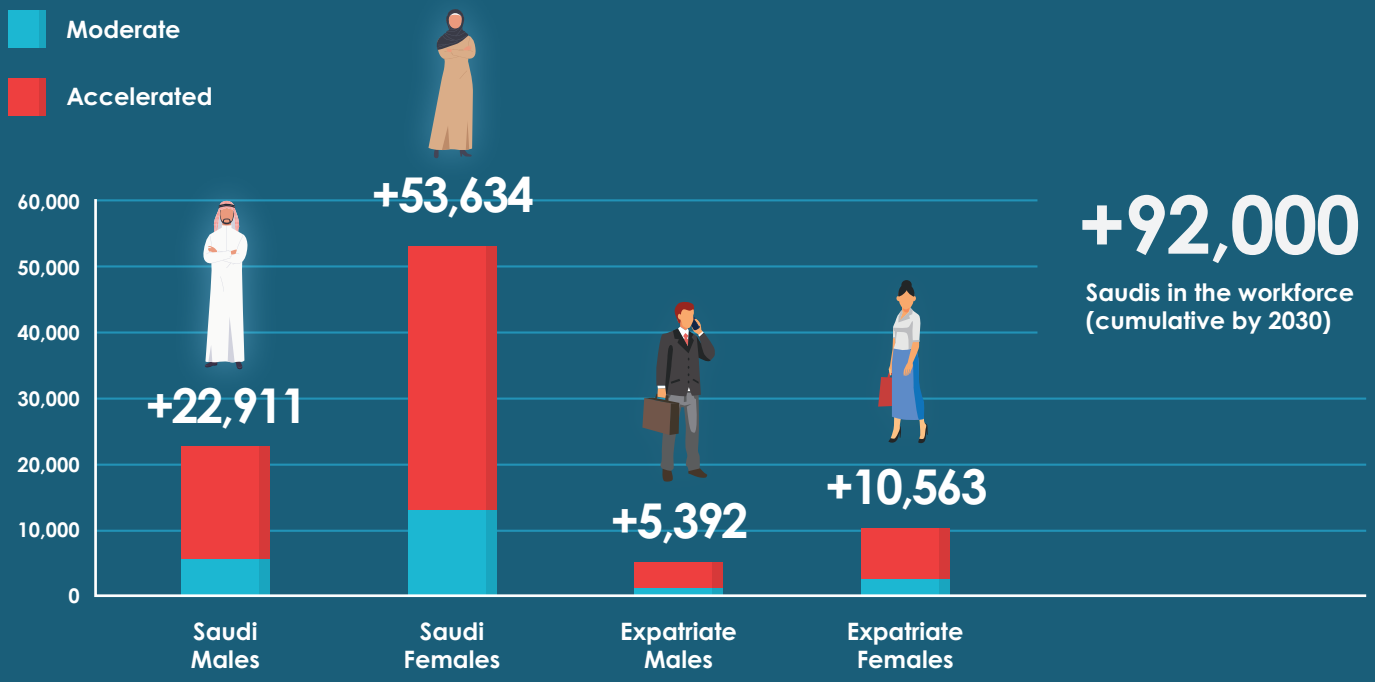
Healthy individuals contribute to a more cohesive and prosperous society

Obesity rate by weight loss scenario

2030

92,000

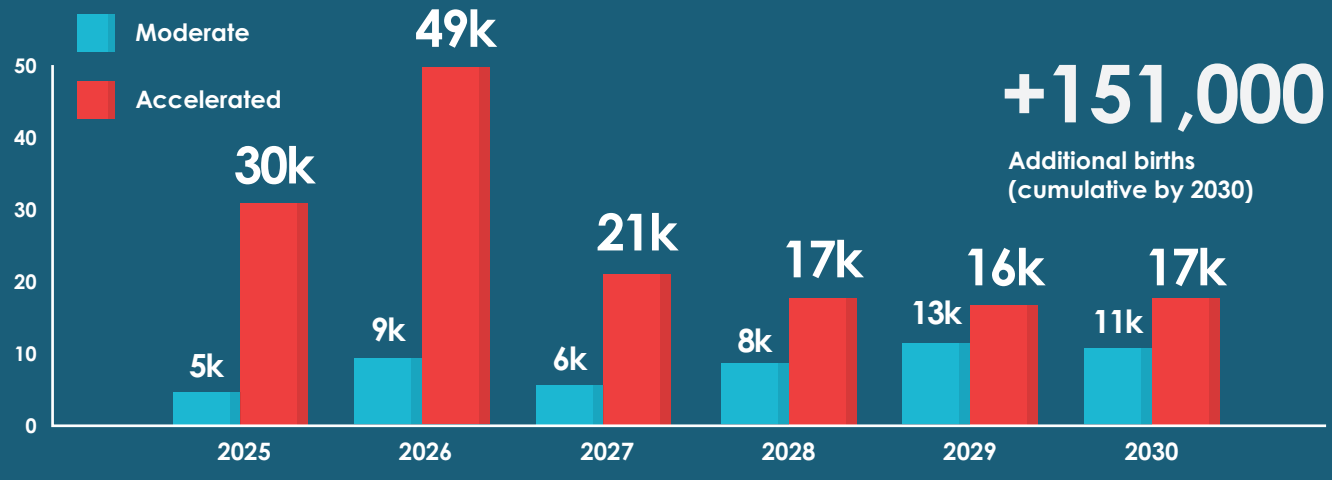
Over 92,000 residents are empowered to join the workforce
Addition to the workforce by 2030[1]



+92,000
Saudis in the workforce (cumulative by 2030)

151,000

Combined with infertility dropping, leading to 151,000+ additional births[2]
Additional births due to reduction in the infertile population owing to weight loss (000s)



+151,000
Additional births (cumulative by 2030)

1. Lee et al., "Impact of Obesity on Employment and Wages among Young Adults"
2. The Impact of Obesity on Reproductive Health and Pregnancy Outcomes - PMC

Education

A fitter youth is empowered to take on and complete higher education

Obesity rate by weight loss scenario 2030

Status Quo | Moderate | Accelerated

Healthy youth are more likely to undertake higher education...

1,810,000
Current bachelors' enrolments

Weight loss in obesity drives higher education[1]

Additional students in bachelors' programs (in 2030)

+10,600 in accelerated intervention

+3,500 in moderate intervention

...and to complete their diploma, boosting KSA's Education Index ranking

+22,000
Up to 22,114 more students finish their bachelors program by 2030

DROPOUT RATE

30% → 28.6%

in the accelerated scenario

UNDP Human Development Index (Education rankings) – (2024-2030)

52nd	KSA (2030)
53rd	Moldova
54th	Belarus
55th	KSA (2024)

1. *Cohen et al., "Educational Attainment and Obesity"*

Security

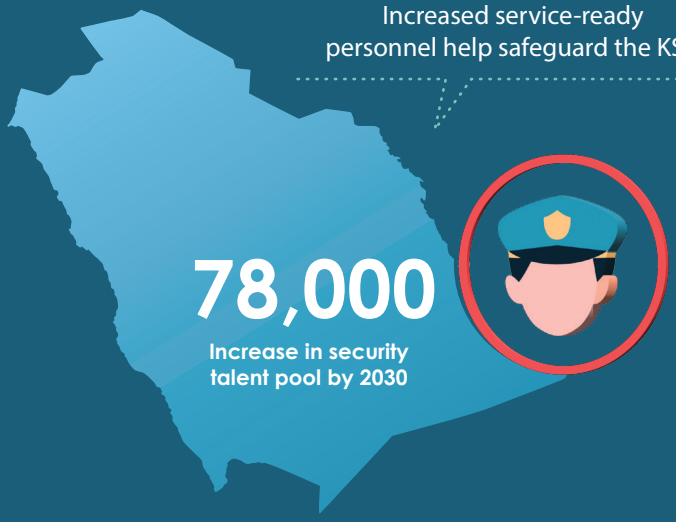
The police and military forces have an expanded pool of service-ready candidates

Obesity rate by weight loss scenario

2030

Status Quo | Moderate | Accelerated

78,000 Weight loss helps 78,000 Saudi males to become physically and mentally fit...



Increased service-ready personnel help safeguard the KSA

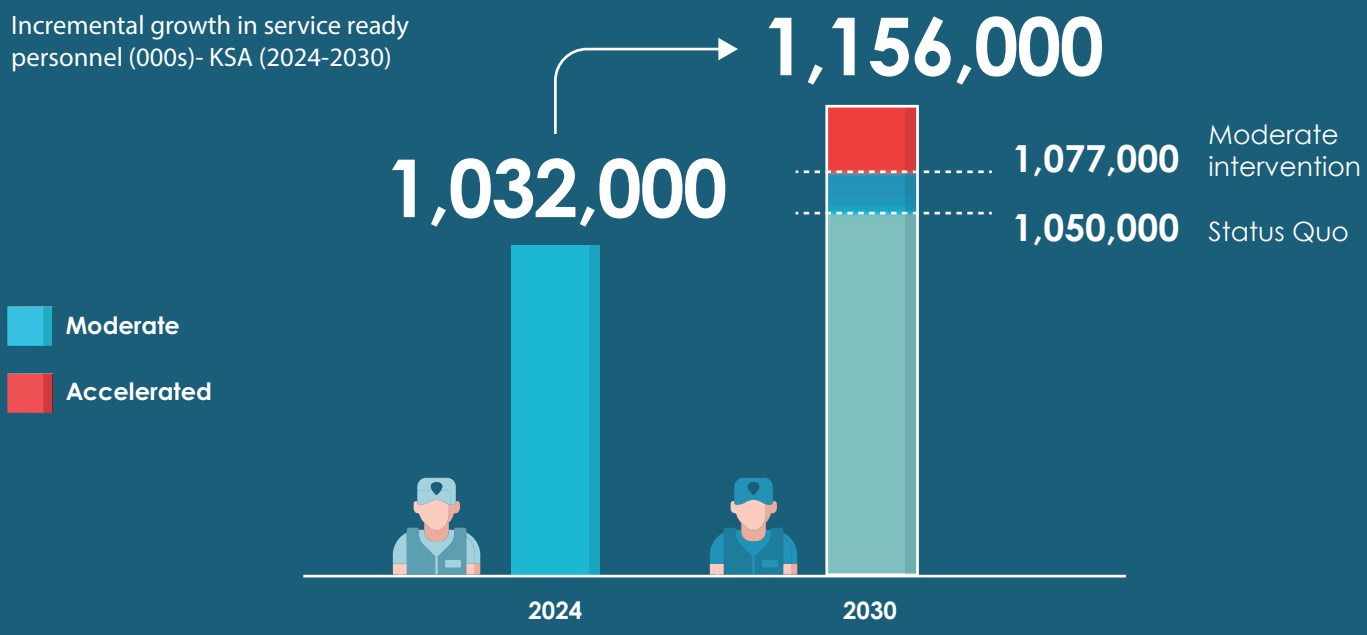
Increase in service-ready pool by 2030[1]

+7%
Accelerated Intervention

+2%
Moderate Intervention

...boosting the number of fit citizens by 7.2%

Incremental growth in service ready personnel (000s)- KSA (2024-2030)



1. Obesity in the Military ,The George Washington University; Whiteshield Analysis.

Table 1: Results overview

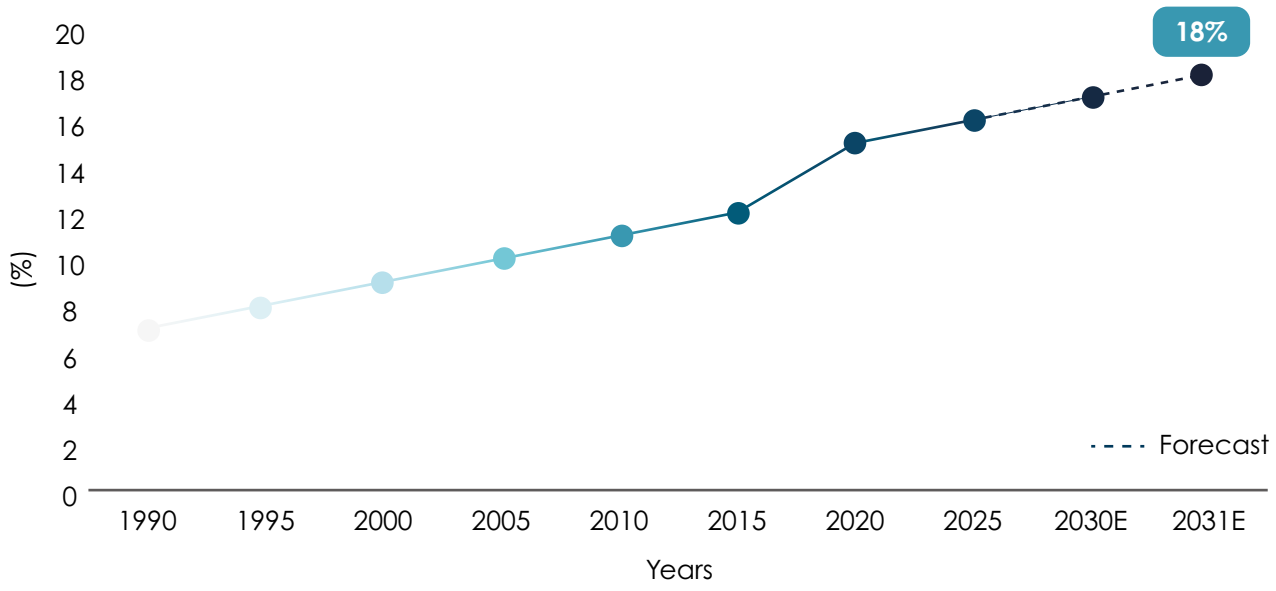
Category	Indicator (by 2030)	Measure	Status Quo (2024)	Base Scenario (2030)	Moderate Intervention (2030)	Accelerated Intervention (2030)
Scenarios	Adoption of weight loss interventions	Adoption among adults living with obesity	3%	0%	15%	57%
Health	Prevalence of obesity	%	39	41.8%	37% (-2% points)	29% (-10% points)
	Healthcare costs	$ Bn	8.5	9.8	9.7 ($0.15 Bn)	9.3 ($0.47 Bn)
	Life expectancy	Years (adults living with obesity)	75.5	75.5	75.8 (+0.3 years)	76.6 (+1.1 years)
	QALY savings	Healthy Life Years (adults living with obesity)	53.4	53.4	54.2 (+0.8 years)	57.3 (+3.1 years)
Economy	GDP	$ Bn	1,096	1,369	1,391 (+22 Bn)	1418 (+49 Bn)
	GDP growth rate	%	4.6	3.3	3.7 (+0.4% points)	4.2 (+0.9% points)
	Productivity savings	Days per year per adult previously living with obesity	260	260	262.94 (+2.94 days)	267 (+7 days)
	Government revenue (VAT only)	$ Bn	65.7	82	85.1 (+3.1 Bn)	88.9 (+6.9 Bn)
	Consumption	$ Bn	438	547	567.5 (+20.6 Bn)	585 (+48 Bn)
	Individual income	$	32,880	37,322	37,478 (+156)	38,745 (+366)
Society	Total births	#	572,172	502,083	512,599 (+10,516 births)	518,872 (+16,879 births)
	Additions to workforce	#	16.8 Mn	17.8 Mn	17.8 Mn (+29,581)	17.9 Mn (+92,500)
	Women in the workforce	#	6 Mn	6.4 Mn	6.4 Mn (+20,477)	6.4 Mn (+64,197)
	Youth in the workforce	#	2.7 Mn	2.9 Mn	2.9 Mn (+6,203)	2.9 Mn (+19,059)
Education	Bachelors' enrolment	#	1,795,937	1,795,937	1,799,381 (+3,444)	1,806,500 (+10,563)
	Students dropping out	#	538,871	538,618	534,255 (+4,363)	516,504 (+22,114)
Security	Security Talent Pool	# of healthy weight young Saudi males	282,000	291,761	313,994 (+22,233)	370,242 (+78,481)

Context: Implications of obesity

GLOBAL EPIDEMIC
MORE THAN 1 BN PEOPLE WILL LIVE WITH OBESITY BY 2030

Obesity is a global epidemic, with 15% of the global population or 890 Mn adults suffering from obesity[20]. **The prevalence of obesity has increased from 6.8% in 1990 to 15% in 2020 and is expected to affect 18% of the adult population by 2030[21].** According to the World Health Organization (WHO), a person with obesity has a body mass index (BMI) greater than 30 – or for someone 170 cm tall, weighing 87 kilograms or more. Such individuals are likely to earn less money, attend fewer years of school, are less likely to have children, are more likely to be unemployed as well as have a shorter life expectancy than someone without obesity[22].

Figure 1: Global Prevalence of Obesity – WHO (1990-2035)



The prevalence of obesity varies between countries, genders, and incomes, though across all these groups it is rising and expected to continue to rise. The global obesity prevalence among adult men was 14% in 2022, compared to 18.5% for women[23]. Geographically, obesity prevalence varies from as low as 7% in South Korea to as high as 40% in the United States[24]. However, obesity prevalence in certain countries, such as the United States has started showing a surprising trend. For the first time in a decade, the country's prevalence of obesity reduced from 41.9% to 40.3%. This decline is particularly interesting given the US's long-standing struggle with high obesity rates. It suggests that recent public health initiatives, increased awareness, and advancements in weight management strategies may be beginning to take effect. This changing trend in the US demonstrates that significant public health improvements are achievable with concentrated efforts and interventions.

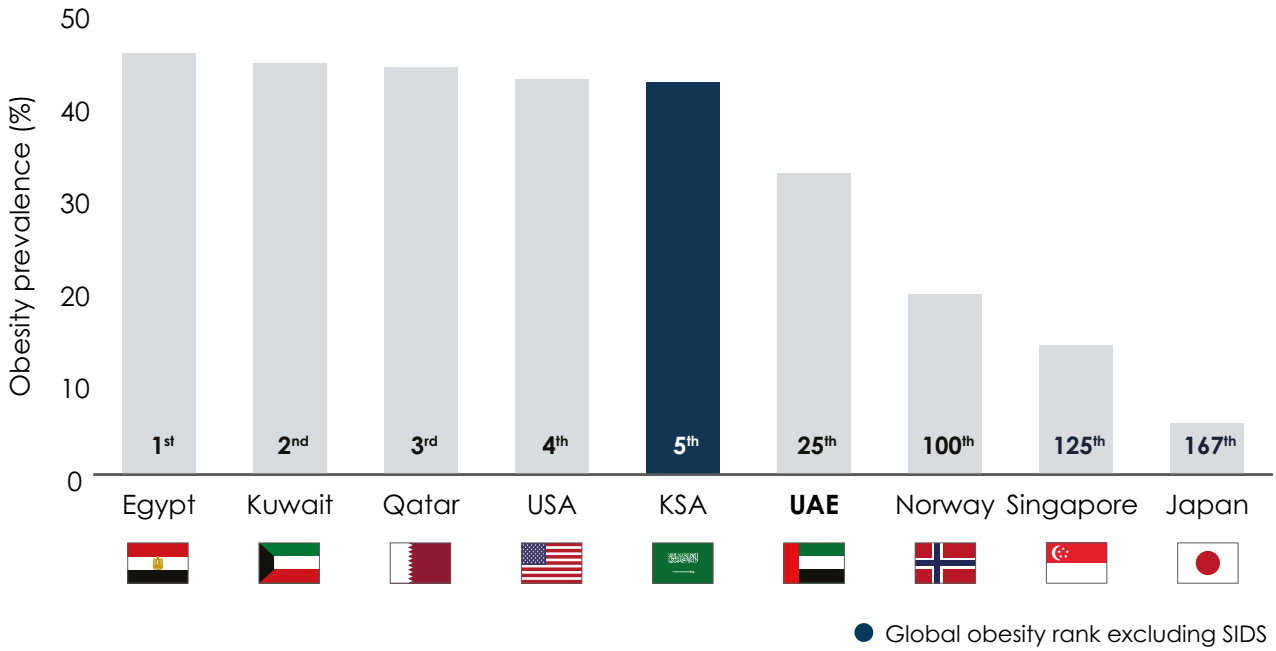
While obesity has multiple contributing factors (e.g., genetics, specific conditions, etc.), an imbalance between caloric intake and expenditure plays a key role[25], particularly in the KSA, where environmental factors further exacerbate the issue (see environmental drivers of obesity in the KSA on the following page).

KSA: 39% OF ADULTS CURRENTLY LIVE WITH OBESITY

KSA is ranked the 5th in the Global Obesity Rankings (excluding Small Island Developing States): 39% of adults live with obesity. Although obesity prevalence in KSA is estimated at 45% by the World Obesity Federation (WOF), for this report, we apply a 2024 model estimate of 39%, which offers a more recent and precise reflection of current conditions.

The WOF figure is referenced for broader alignment, but all modelling is based on the 39% estimate to ensure a comprehensive analysis. The consequences of obesity are strongly felt in the Kingdom, and prevalence is much higher than that of other, developed, nations.

Figure 2: Obesity prevalence and world ranking (excluding Small Developing Island Nations)



- **Increasing obesity trend:**

  Obesity rates in the Kingdom have been steadily increasing over time. Between 1990-1993, the prevalence of obesity among the adult population with 22% and it significantly increased to 39% of the adult population suffering from obesity in 2024.

- **Obesity rates vary between nationals and expatriates:**

  There is a difference in prevalence of obesity among Saudi nationals and expatriates. Saudi nationals suffer from obesity at a rate of 40%, while the corresponding rate among expatriates is 38%. The higher obesity prevalence among KSA nationals compared to expatriates probably can be attributed to a combination of genetic predispositions, lifestyle habits, socio-economic conditions, environmental influences, and urbanization[26]. These factors collectively create a more obesogenic environment for Saudi nationals, leading to higher obesity morbidity.

- **Gender also leads to varying obesity levels:**

  Women have an obesity prevalence of 42% compared to 36% among men, which is in line with global trends of higher obesity rates among women. This may be due to various physiological factors such as loss of muscle mass, pregnancy and hormonal changes that affect women. Additionally, societal expectations and roles may restrict women's access to fitness facilities and recreational activities, further contributing to the higher obesity prevalence among women[27].

- **Variation in obesity level among provinces:**

  The Central, Northern and Eastern regions of KSA exhibit higher rates of obesity among adults, between 40%-46% of the adult population. Other regions such as the Southern and Western have a much lower rate of obesity, at around 32.8%-35.8% of the adult population. Other studies have also highlighted the difference in obesity prevalence among rural areas (27%) and urban areas (39.7%) which could be explained by differences in dietary habits, levels of physical activity, socioeconomic factors, and cultural norms that vary across these regions[28].

In the Kingdom a primary factor leading to obesity is sub-optimal dietary intake. 72% of the daily caloric intake is derived from carbohydrates, and protein sources are mainly of animal origin[29]. Additionally, 81% of the population consumed less than three servings of fruits and vegetables per day and only 6% of the population consumed more than 5 servings of fruits and vegetables daily[30].

CHALLENGE: LIMITED UNDERSTANDING OF THE BENEFITS OF WEIGHT LOSS

Although the negative impacts of obesity on society are well studied, one common prism to analyze the consequences of obesity is through its healthcare-related costs. Obesity related comorbidities, including Type 2 diabetes, cardiovascular diseases, certain cancers and musculoskeletal disorders like osteoarthritis, require long-term medical management, leading to substantial healthcare costs.

- Globally, obesity related medical costs were estimated at **~$820 Bn in 2024**, which is 20% of all healthcare costs[31].
- In KSA, the healthcare costs attributable to obesity are expected to cost the healthcare system **$9.8 Bn annually by2030**[32]

Impact assessments of obesity reduction are typically concerned with comparing the cost of intervening to the costs of treatment for the condition. These assessments may expand to touch on the loss of productivity due to increased absenteeism and presenteeism. For example, the World Obesity Foundation has led impact studies that cover medical costs, premature mortality and productivity costs[33].

In this paradigm, interventions that may have a highly positive societal impact might still appear to be cost ineffective. Indeed, health-related challenges are the tip of the societal iceberg that is obesity. Understanding the links between weight and socioeconomic impact is key to informing decision-making, and correctly framing obesity and its consequences beyond healthcare.

This study encompasses a "whole-of-society" approach to bring a novel, and more complete, perspective on the societal benefits of weight loss. To achieve this, the study segments these benefits into five key themes, aiming to capture the primary societal dimensions influenced by weight loss, consistent with scientific literature on the subject.

Health:

Reduction in obesity lowers the prevalence and incidence of chronic diseases, can enhance mental well-being, improving quality of life and longevity[34].

Economy:

Improved health can support greater workforce participation, enhances productivity, and drives economic growth. As consumption patterns evolve, sectors such as retail and hospitality could benefit, while increased economic activity contributes to government revenues through higher tax collections[35].

Society:

Promoting overall health and well-being may support reproductive health, helps maintain demographic balance, and contributes to intergenerational equity and sustainable development[36].

Education:

Improved health outcomes among students may help achieve better academic outcomes, bolstering the KSA's human capital[37].

Security:

Supporting physical fitness initiatives may broaden the pool of individuals eligible for military service and helps reduce the risk of training-related injuries[38].

Impacts of obesity and weight loss

INNOVATION: A NEW OPTION TO TACKLE WEIGHT LOSS

Policymakers have long attempted to reduce the prevalence of obesity, oftentimes with communication campaigns, supporting healthy eating and lifestyles, or through medical interventions, **but these interventions do not seem to have significantly reduced obesity prevalence**[39].

Traditional approaches to tackling obesity have not significantly reduced obesity in the KSA. Changing established habits through communication efforts by the government is a timely exercise, and an uphill battle as genetic makeup is a strong factor for obesity, which is immutable.

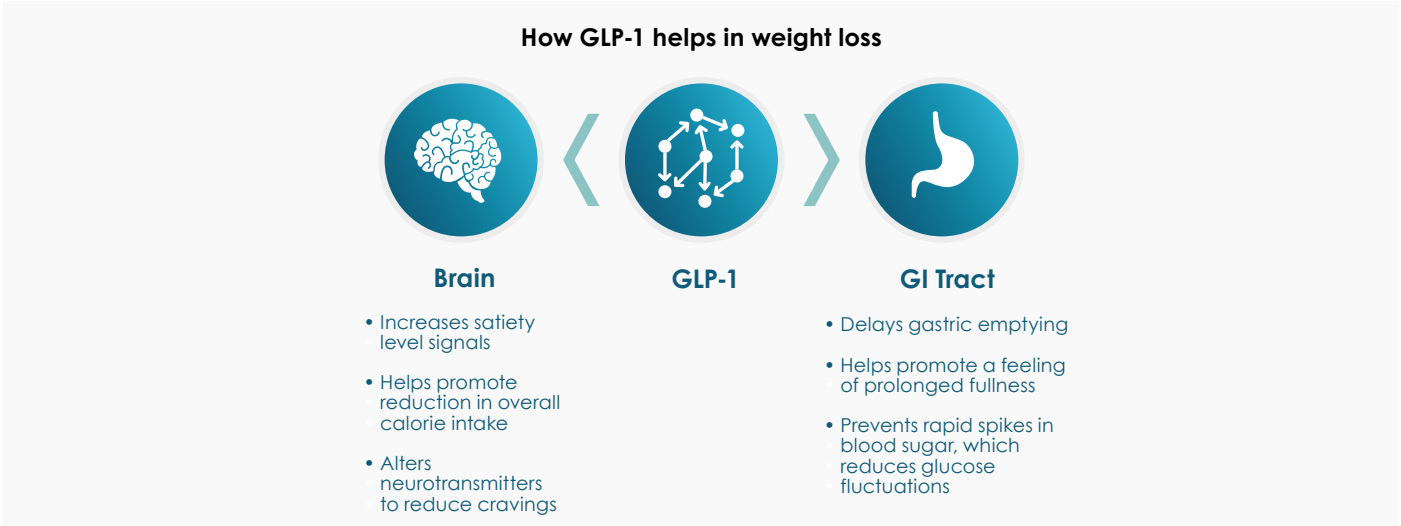
Even conventional weight loss interventions have limitations. For example, while bariatric surgery is highly effective it is also extremely costly, only applicable to the population living with the highest degree of obesity, and carries risks of complication[40] More than 15,000 bariatric surgeries are performed in KSA every year, costing more than $10,000 each[41]. Previously used weight loss medicines lacked effectiveness and were associated with strong side effects[42].

The KSA government, at the federal and local levels, has undertaken various initiatives such as the Saudi Food and Drug Authority's policies to reduce the content of sugar, salt, saturated and trans-fat and the mandatory display of caloric content of foods, overseen by the Ministry of Municipality and Rural Affairs. The Ministry of Health also introduced the Obesity Prevention and Control Strategy 2020-2030 aiming to reduce the prevalence of obesity by 3% by 2030[43].

To combat obesity, innovative weight loss solutions, such as GLP-1 agonists, have recently been made available to adults living with obesity. These novel solutions are transforming obesity management, offering more effective results beyond traditional lifestyle interventions[44]. These solutions include incretin-based GLP-1 medications, which provide a one approach to managing weight and improving overall health. GLP-1 RAs for weight loss offer effective appetite reduction, improved metabolic health, cardiovascular benefits, lower blood pressure, better lipid profiles, enhanced quality of life, reduced inflammation, and convenient dosing, making them a comprehensive solution not only for weight management, but also to overall health improvement.

Innovative weight loss solutions were recently adopted at scale in the United States, which may be responsible for the first observed drop in obesity prevalence since 2012 in the country[45] It is important to emphasize, however, that medication is only one tool in the broader obesity care toolkit. Effective obesity management should be grounded in a holistic, patient-centred approach—one that combines lifestyle modification, behavioural support, pharmacotherapy, and, where appropriate, surgical options. Ultimately, treatment decisions should be made collaboratively between healthcare providers and patients, ensuring alignment with each individual's needs, preferences, and clinical circumstances.

Figure 4: Weight loss mechanism of GLP-1s



Methodology
Using advanced economic analysis

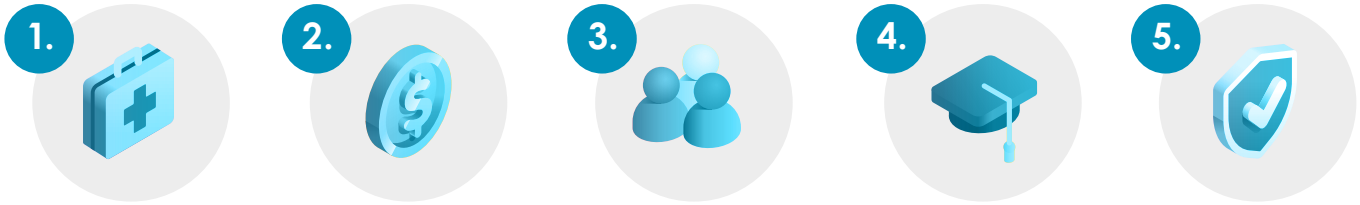
Considering the serious consequences of obesity, in particular among Saudi nationals, and existing research focusing on healthcare costs and outcomes mostly, this study argues about the socioeconomic benefits of weight loss among population. Such approach would help to understand the details about obesity complexity that influences to all demographic groups, especially with long-term implications for health, education, employment, and community engagement. This section addresses methodology of the study, and more technical details are given in the appendix.

CAPTURING SHIFTS IN SOCIETAL VARIABLES ACROSS COHORTS

To understand the full socio-economic impact of weight loss and inform policy makers, five categories capturing 17 variables were assessed. In addition, each of the variables was examined by:

- Nationality (Saudi national, Expatriate)
- Gender (Female, Male)
- Age (youth 18-29 years old, core working age 30-59)

Figure 4: 5 societal themes and 17 socioeconomic indicators



Health
1.1 Physical health status
1.2 Healthcare cost
1.3 Gain in life expectancy
1.4 QALY savings

Economy
2.1 GDP
2.2 GDP growth rate
2.3 Productivity savings
2.4 Government revenue
2.5 Consumption
2.6 Individual income

Society
3.1 Total fertility rate
3.2 Addition to workforce
3.3 Women in workforce
3.4 Youth in workforce

Education
4.1 Bachelor's enrolment
4.2 Dropout rate

Security
5.1 Military and police fit population pool

MODELLING THE IMPACT OF WEIGHT LOSS ON SOCIETY

Figure 5: 4-step approach

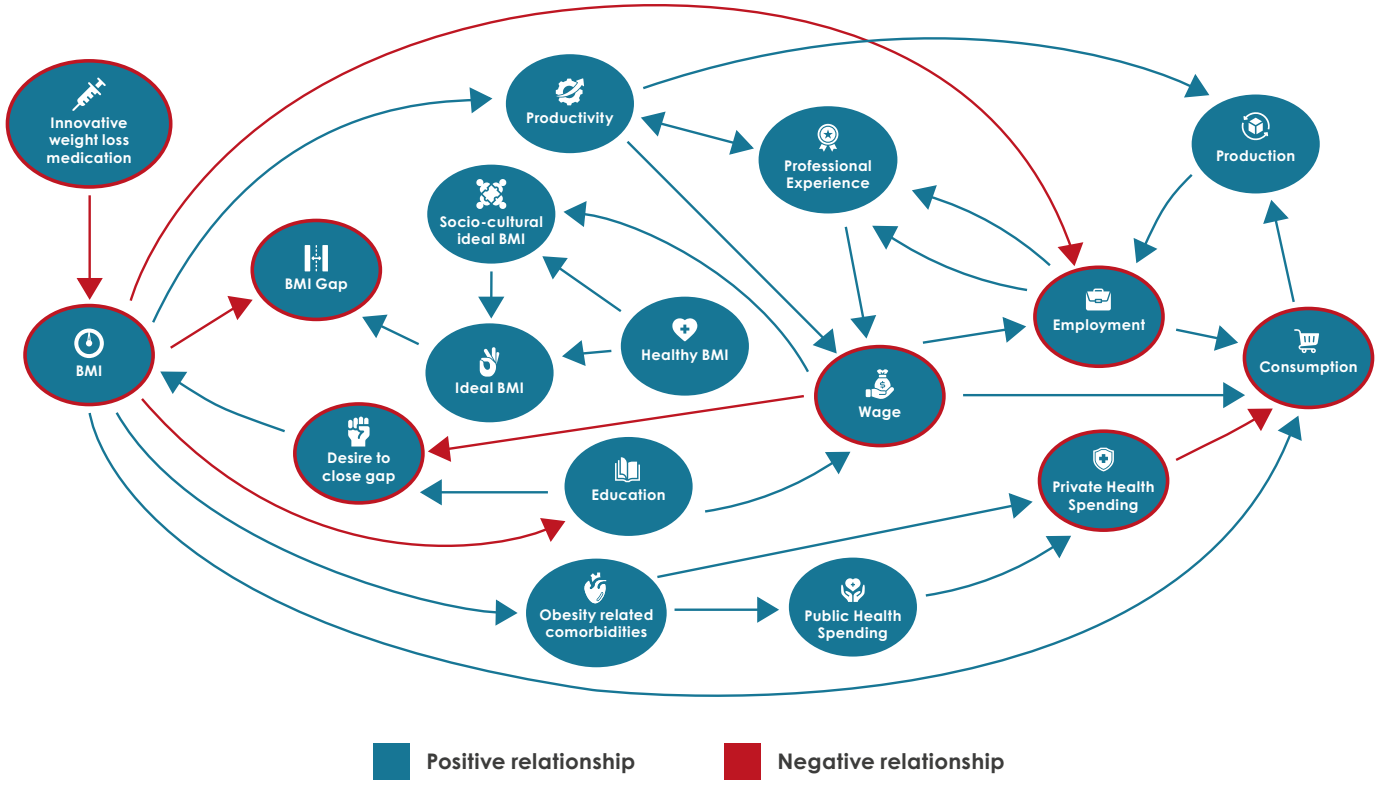
a. Mapping the links

Studies examining obesity's impact typically rely on a one-directional approach. For instance, productivity losses due to obesity are typically estimated by multiplying the number of individuals living with obesity by a fixed monetary cost per person. These methods fail to link the underlying drivers of weight loss that also improve productivity with broader socio-economic factors, such as educational attainment or fertility rates.

A system-thinking approach that maps the relationships between socio-economic variables can uncover knock-on effects and reinforcing loops of behavior driven by weight loss.

The adoption of new weight loss interventions by adults with obesity—and the resulting weight reduction—sets off a chain of socio-economic effects[46], as supported by existing scientific research. These effects are projected over time and lead to shifts in various socio-economic indicators. These changes are then evaluated against a baseline scenario in which no weight loss interventions are implemented. The outcomes of this comparative analysis are explored throughout the report.

Figure 6: Conceptual and simplified depiction of the societal impact channels



b. Defining weight loss scenarios

There are three main weight loss scenarios that have been defined for the KSA, a Status Quo, Moderate intervention Scenario and Accelerated intervention scenario.

Table 2: Description of weight loss scenarios

Indicator (2030)	Status Quo	Moderate intervention	Accelerated intervention
Description	No weight loss interventions are implemented Obesity prevalence progresses at current trajectory	Limited intervention towards weight loss Obesity declines but at a slow rate	Aggressive weight loss interventions are implemented Obesity declines at a rapid pace
Intervention rationale	N.A	Uptake trajectory is based on historical trends observed in the adoption of novel therapies for chronic conditions with a moderate rate of initial clinical adoption in the US	Uptake assumes a faster adoption pattern, drawing from precedents in the UK where preventative therapies for chronic conditions (e.g., cholesterol and diabetes) have been rapidly scaled through national health initiatives
Intervention curve	No intervention takes place	15% of the target population by 2030	57% of the target population by 2030
Obesity prevalence (Adult population)	41%	37%	29%
No. of adults losing weight by 2030	0	1,172,025	3,292,098
Population Coverage	N.A	All	All
Regional Coverage	NA	All regions are covered equally	All regions are covered equally

In these scenarios, the population receiving innovative weight loss solutions consists solely of the adult people living with obesity in the KSA and the period between 2025-2030 was chosen, considering 'Saudi Vision 2030', which has set specific aims for various socio-economic indicators in the country. Baseline data for scenarios was collected from national statistics agencies, the World Health Organization (WHO)[47], the United Nations (UN) and academic literature. Variables, particularly obesity prevalence, were broken down by nationality, gender, and age.

c. Applying an analytical approach

Figure 7: 3 step approach

1. **Define historical prevalence trend:**

   A Markov Model traced the evolution of obesity prevalence across demographic groups (using over 500,000 empirical observations). This was used to calibrate the System Dynamics model in observed historical data.

2. **Model societal benefits of weight loss:**

   The System Dynamics Model interlinks obesity drivers and socio-economic indicators and output shifts in these variables based on the three weight loss scenarios.

3. **Validate results:**

   Fixed-effects regressions were conducted to test the effect of BMI on socio-economic indicators, such as GDP. The dataset encompasses eleven countries—United States, United Kingdom, United Arab Emirates, Kingdom of Saudi Arabia, Singapore, Iceland, Switzerland, Morocco, Pakistan, Chile, and Slovenia — over the period 2000–2016, capturing a timespan during which obesity and its associated economic implications have become increasingly salient. These countries were selected to represent a broad spectrum in terms of population size, demographic makeup, income levels, and ethnic diversity. All key variables displayed statistically significant results, supporting the validity of the System Dynamics model results.

d. Contextualizing with citizen voice

1. **Sentiment analysis:**

Advanced natural language processing techniques were utilized to conduct a sentiment analysis on over 300,000 social media posts. This analysis identified public attitudes, opinions, and emotions related to obesity and weight loss initiatives, providing valuable insights into societal perceptions and acceptance of various interventions.

2. **Contextualize with citizen voice:**

A sentiment analysis assessed changes in patients' quality of life associated with weight loss. This step linked the SD results to real-world patient experiences.

Adopting a citizen-centric perspective helps to contextualize the findings of the analysis, recognizing that obesity has life-long impacts, which may affect individuals differently based on their demographic characteristics. To accomplish this, 5 main cohorts of interest were developed. These archetypes include both nationals (youth and core working age) as well as male expatriates (core working age) and were selected based on their significant contribution to the socio-economic fabric of the KSA. Together these 5 cohorts make up 70% of the adult population suffering from obesity in KSA. Reducing obesity among these cohorts is a key priority for many different ministries, including the Ministry of Human Resources and Social Development, Ministry of Health, Ministry of Economy and the Ministry of Defense, for the effective achievement of the Saudi Vision 2030 goals.

Figure 8: Citizen Archetypes

*Mariam is an **18-year-old Saudi woman** who lives in **Jeddah** She is about to graduate high school. However, she's faced challenges with **obesity since childhood**, which has taken a toll on her mental health and academic results. She may not be able to attend university.*

*Saad is a **38-year-old National**, from **Riyadh** with a **BMI of 35**. He suffers from **Type 2 diabetes** as well. Although he has been married for 3 years, he has not yet been able to conceive a child.*

*Fatima is a **47-year-old National** from **Dammam**, with a **BMI of 37**. She was recently diagnosed with **hypertension** and now complains of **joint pain**. Due to her condition, she's had to quit her job as a government employee.*

*Ali is a **55-year-old expatriate who drives a taxi in Riyadh** and is battling with the **consequences of unhealthy eating**. His **BMI has climbed to 34**. Every day is a struggle, and doctors have warned that he is at risk of strokes.*

*Aditya, a **42-year-old Indian consultant** who has been working on a project in Khobar since the past 3 years. With a BMI of 33, he struggles with obesity due to his sedentary lifestyle and work stress. His weight has led to pre-diabetes and sleep apnea, **affecting his job performance** and causing him to miss out on a recent promotion. He doesn't have a comprehensive healthcare plan and is considering **moving back to India**, to manage his healthcare expenses*

Benefits of weight loss: Estimated impact across socio-economic indicators

Weight loss interventions lead to a positive impact across society

Obesity prevalence is estimated to reduce from 39% (current KSA prevalence) to 29% by 2030 (see Table 1 for details on each scenario), if the KSA were to introduce innovative weight loss solutions. Reducing obesity prevalence yields substantial socioeconomic benefits. Drawing from the scientific literature, five socioeconomic themes impacted by weight loss were identified. The relationships between obesity reduction and socioeconomic factors were modeled to assess the broader societal impact of weight loss (see Figure 4 and Figure 6 for details on the socioeconomic indicators and their links):

- **As people lose weight, they become more active and more productive, the economy may expand:**

  A growing, more productive, workforce could drive GDP growth, increasing by up to $42 Bn or 0.9 percentage points per year, with GDP reaching as high as $1,411 Bn by 2030, pushing towards $1,700 Bn target as part of the Saudi Vision 2030. Even with moderate weight loss interventions, GDP growth may increase by $16 Bn or 0.4 percentage points year-on-year, with GDP reaching $1,385 Bn by 2030. With changing investment and consumption patterns, industries related to health and wellness will expand[48].

- **With a lower burden of disease and chronic illnesses, healthcare costs may drop, and life expectancy may increase:**

  Decreasing health issues, and consequent reductions in medical treatments, hospitalizations, and long-term care associated with obesity-related illnesses, may reduce the healthcare expenditures by up to $1.8 Bn from 2025 to 2030, with $469 Mn saved in 2030 alone. With fewer health complications, the average person's life expectancy may increase by up to 1.1 years.

- **More people are potentially employed, and more children are born:**

  More people may enter and remain in the workforce, expanding the workforce by anywhere between 29,000 to 92,500 people. Men and women's reproductive health improves as obesity decreases, which may lead to up to an additional 151,000 births, of which 103,000 are Saudi nationals, by 2030.

- **A more educated country:**

  Dropout rates may decline from 30% to 28.6%, and enrolments in university bachelor's programmes may increase by more than 10,500 students.

- **Improved security capacity:**

  As the military and police have restrictions based on weight, losing weight could allow more than 78,000 additional Saudi youth to become eligible for military and police service.

The model suggests particularly high benefits among Saudi nationals, with women also experiencing significant health and economic gains

Societal gains for Saudi nationals:

Saudi nationals who suffer from a 40% obesity prevalence, are most likely to gain from weight loss interventions. In the accelerated intervention scenario, prevalence of obesity reduces to 28%, and 37% in the moderate intervention scenario. Saudi nationals could account for 68% of all additional births by 2030, and 95% of all additional bachelors' enrolments by 2030.

More women may join the workforce:

Saudi women have a high prevalence of obesity at 43%, and are also most likely not to work. Reducing their obesity rates significantly will lead to a large workforce gain. From the potential 92,500 new workforce members, 53,634 are Saudi women.

More productive Saudi workforce:

The Saudi labour force could become more productive, with between 8 and 18 days of additional work per worker per year gained depending on the number of Saudi nationals experiencing weight loss.

Table 1: Results overview

Category	Indicator (by 2030)	Measure	Status Quo (2024)	Base Scenario (2030)	Moderate Intervention (2030)	Accelerated Intervention (2030)
Scenarios	Adoption of weight loss interventions	Adoption among adults living with obesity	3%	0%	15%	57%
Health	Prevalence of obesity	%	39	41.8%	37% (-2% points)	29% (-10% points)
	Healthcare costs	$ Bn	8.5	9.8	9.7 ($0.15 Bn)	9.3 ($0.47 Bn)
	Life expectancy	Years (adults living with obesity)	75.5	75.5	75.8 (+0.3 years)	76.6 (+1.1 years)
	QALY savings	Healthy Life Years (adults living with obesity)	53.4	53.4	54.2 (+0.8 years)	57.3 (+3.1 years)
Economy	GDP	$ Bn	1,096	1,369	1,385 (+16 Bn)	1,411 (+42 Bn)
	GDP growth rate	%	4.6	3.3	3.7 (+0.4% points)	4.2 (+0.9% points)
	Productivity savings	Days per year per adult previously living with obesity	260	260	262.94 (+2.94 days)	267 (+7 days)
	Government revenue (VAT only)	$ Bn	65.7	82	85.1 (+3.1 Bn)	88.9 (+6.9 Bn)
	Consumption	$ Bn	438	547	567.5 (+20.6 Bn)	585 (+48 Bn)
	Individual income	$	32,880	37,322	37,478 (+156)	38,745 (+366)
Society	Total births	#	572,172	502,083	512,599 (+10,516 births)	518,872 (+16,879 births)
	Additions to workforce	#	16.8 Mn	17.8 Mn	17.8 Mn (+29,581)	17.9 Mn (+92,500)
	Women in the workforce	#	6 Mn	6.4 Mn	6.4 Mn (+20,477)	6.4 Mn (+64,197)
	Youth in the workforce	#	2.7 Mn	2.9 Mn	2.9 Mn (+6,203)	2.9 Mn (+19,059)
Education	Bachelors' enrolment	#	1,795,937	1,795,937	1,799,381 (+3,444)	1,806,500 (+10,563)
	Students dropping out	#	538,871	538,618	534,255 (+4,363)	516,504 (+22,114)
Security	Security Talent Pool	# of healthy weight young Saudi males	282,000	291,761	313,994 (+22,233)	370,242 (+78,481)

Regional Analysis:

Higher economic gains in Riyadh and Makkah, societal gains in Northern province

Obesity prevalence in Southern and Western regions:

Compared to the other regions, the Southern region, which comprises Asir and Najran and the Western region, which comprises, Makkah, Medina and Tabuk have the lowest prevalence of obesity at 32.8% and 35.8% respectively, which could lower to 24.3% and 26.6% in the accelerated intervention scenario. This is primarily due to the higher number of expatriate workers in this region, who are mainly employed in physical and manual labour jobs, bringing down the overall prevalence of obesity.

Obesity prevalence in Central, Eastern and Northern region:

On the other hand, the Central region, which comprises Riyadh, Qassim and Ha'il, the Eastern Province and the Northern region, consisting of the Al-Jawf province, have a much higher prevalence of obesity, between 40% - 46%. Weight loss could help bring down this prevalence, in the range of 30%-34%. The higher prevalence of obesity observed is mainly due to the higher number of Saudi nationals living in these regions, who drive up the obesity rate.

Significant societal gains in Northern and Southern regions:

The regions of Riyadh, Makkah and the Eastern province may see the highest increase in the total number of births. Around 61,990 of the total 151,197 additional births could occur in these three regions alone, owing to their larger population size. However, the percentage of Saudi births is much higher in the Northern regions of Al-Jawf and the Southern region of Jazan, due to higher concentration of Saudi nationals living in these regions. Around 71% of the additional births in these regions are Saudi nationals, while only 50% of the additional births in the regions of Makkah and Eastern Province are Saudi nationals.

Higher economic gains in Riyadh, Makkah and Eastern province:

Out of the potential $47 Bn increase in overall GDP in the accelerated intervention scenario, 70% or $33 Bn may be contributed by the administrative regions of Riyadh, Makkah and the Eastern province alone, while the rest of the 10 administrative regions contribute the remaining increase of 14 Bn. This disparity is due to Riyadh, Makkah and the Eastern Province's pivotal roles as the KSA's primary economic hubs, housing a larger concentration of businesses, industries, and a more extensive workforce.

HEALTH: PREVALENCE OF OBESITY PROJECTED TO DROP TO 29% BY 2030

Achieving and maintaining a healthy weight brings numerous positive benefits to individuals' health and overall well-being:

Lower risk of chronic illnesses:

Weight loss significantly reduces the likelihood of developing chronic conditions such as type 2 diabetes, heart disease, hypertension, and certain cancers[49].

Improved Mobility and Physical Function:

Shedding excess weight alleviates joint pain and decreases the risk of early-onset osteoarthritis. Enhanced mobility enables individuals to engage in physical activities more comfortably, promoting a more active and dynamic lifestyle[50].

Increased Life Expectancy:

Maintaining a healthy weight is associated with a longer life expectancy. By reducing the risk of life-threatening diseases like cardiovascular disease and stroke, weight loss contributes to a healthier, and longer life[51]. This extended lifespan may allow individuals to remain active in their communities, and spend more quality time with their families, including the possibility of meeting future generations.

Enhanced Mental Health:

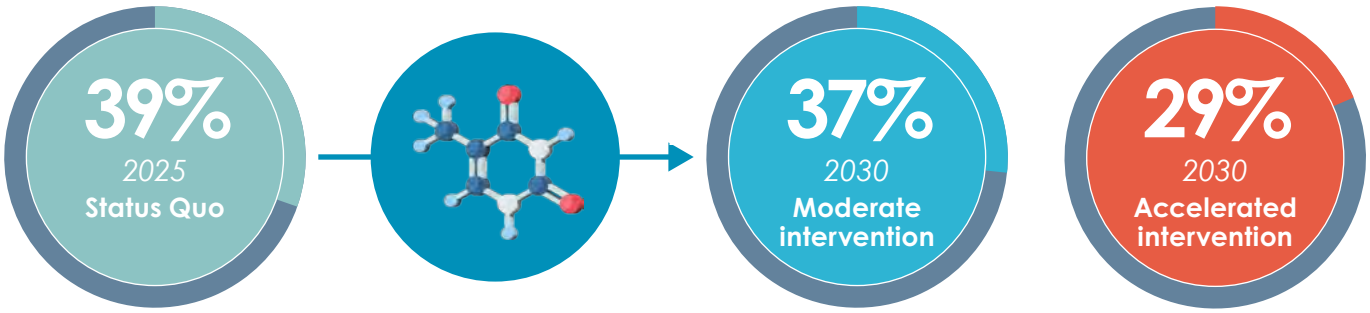
Weight loss positively impacts mental health by reducing the incidence of depression, anxiety, and low self-esteem[52].

Addressing obesity may lead to reduced healthcare expenditures for treating obesity and its related comorbidities. Consensus on the positive health implications of losing weight are observed through a sentiment analysis of social media channels.

"I've noticed a significant reduction in dislocations, and I have much greater mobility post weight loss"

"Losing weight been a game-changer for my diabetes management. My blood sugar levels are much more stable" - *Whiteshield Sentiment Analysis*

Figure 9: Reduction in obesity prevalence (2025-2030)

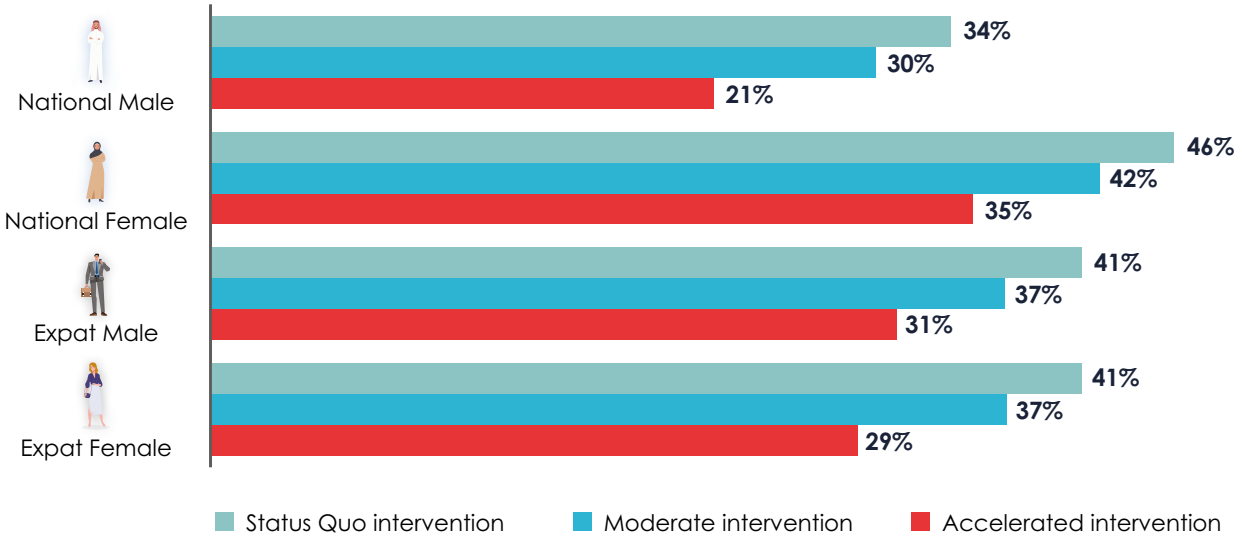


Obesity prevalence reduces to 29% by 2030

In recent years, the prevalence of obesity in KSA has remained high, at around 39% of the adult population. While expatriate workers exhibit lower rates of obesity, compared to Saudi nationals, the overall impact on national obesity trends is less pronounced due to the smaller proportion of foreign workers in the population.

Innovative weight loss solutions could shift the trend, as they have demonstrated high efficacy, allowing patients to achieve weight loss goals. This efficacy is reflected by the significant projected reduction in prevalence of obesity in the System Dynamics model employed for this report, with over one million adults estimated to transition out of obesity by 2030 in the most aggressive intervention scenario (see Table 1 for details on each scenario).

Figure10: KSA Prevalence of obesity- % (2030)

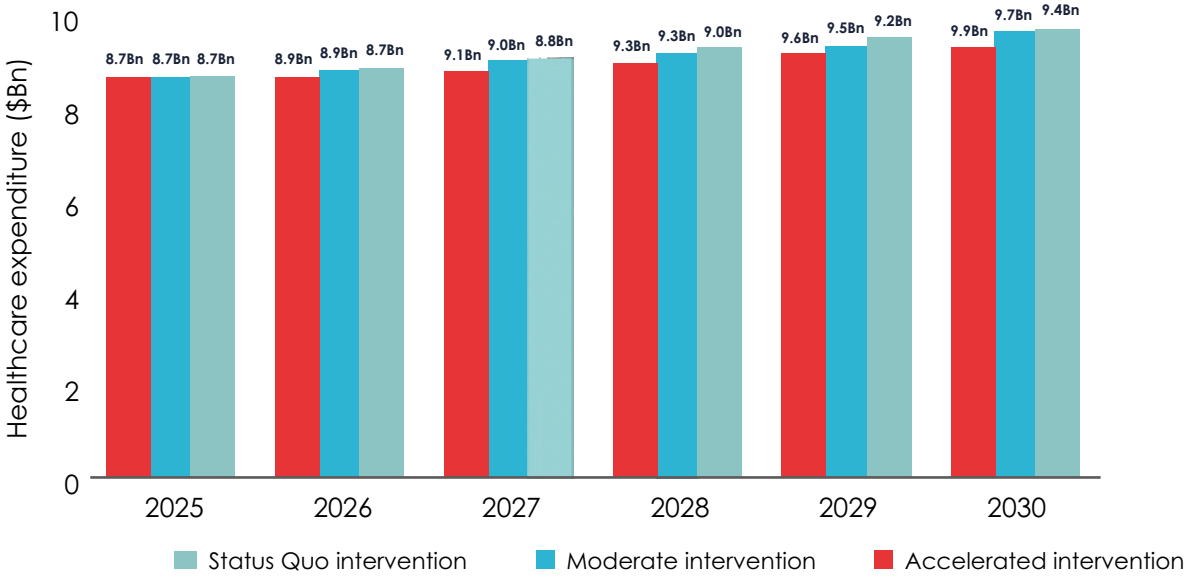


With accelerated intervention scenario, the prevalence of obesity in the adult population, which currently stands at 38%, could drop to 29% by 2030, and 37% in the moderate scenario.

In the case of no intervention, the prevalence of obesity is expected to reach 41% by 2030. For Saudi nationals, prevalence is expected to shift from 40% in 2025 to 27% by 2030 in the accelerated intervention scenario, a drop of 13 percentage points or a 33% decrease. This translates to nearly 2 Mn nationals being prevented from suffering from obesity by 2030. In the moderate intervention scenario, the prevalence could reduce to 41%. For adult expatriates, the prevalence could drop from 38% to 30%, in the accelerated scenario, which translates, to around 1.2 Mn expatriate adults freed from obesity.

Figure 11: Reduction in public healthcare expenditure

Weight loss helps save the KSA $1.8 Bn of healthcare expenditure in the accelerated intervention scenario, $0.45 Bn in the moderate intervention scenario



Healthcare expenditure savings estimated to amount to $1.8 Bn cumulatively by 2030.

Obesity imposes a substantial financial burden on government and private healthcare systems, diverting critical resources from other health services. Based on model results, the KSA healthcare system spends $8.5 Bn in 2025 on healthcare costs related to obesity. This expenditure is projected to increase to $9.8 Bn by 2030. However, with weight loss, these costs are expected to drop to $9.4 Bn in 2030, saving the healthcare system more than $1.8 Bn cumulatively from 2025 to 2030 in the accelerated intervention scenario, of which $469 Mn is saved in 2030 alone. The moderate intervention scenario could lead to cumulative savings of $459 Mn, $158 Mn of which is in 2030. **This significant cost reduction not only alleviates the healthcare budget but also enables the reallocation of funds towards preventive care and other important health initiatives, ultimately enhancing the efficiency and effectiveness of the national healthcare system.**

Life expectancy may increase by 1.1 years

Weight loss significantly contributes to the preservation and extension of individuals' life expectancy. Individuals suffering from obesity may lose up to 8 years of life expectancy as compared to individuals with a healthy weight[53]. According to estimates of this study, based on scientific literature on the topic, losing weight could add 1.1 years of life expectancy to each individual's life who was previously living with obesity, by 2030 in the accelerated intervention scenario and 0.3 years of life in the moderate intervention scenario. The key driver behind this increase in life expectancy is the reduction in life years lost, due to obesity related to comorbidities. By losing weight, a previously affected individual can live a longer and healthier life.

"I'm pre-diabetic with a BMI of 32+ (it was 37+ 3 months ago) […] I need to take action now to be healthy so I can live longer and not get diabetes." *- Whiteshield Sentiment Analysis*

Consider the case of Ali, the 55-year-old expatriate from Pakistan who drives a taxi in Riyadh. With effective weight loss, he has regained control over his health, significantly reducing his risk of developing chronic conditions such as type 2 diabetes, hypertension, and cardiovascular diseases. He finds himself more energetic, engaging in activities with his friends on the weekends and is not worried about his health anymore.

Weight loss is estimated to save up to 3.1 years of healthy life

Weight loss not only adds years to life but also improves the quality of those years, as measured by Quality-Adjusted Life Years (QALYs). By reducing obesity-related comorbidities, weight loss interventions substantially increase QALYs[54], ensuring individuals spend more of their extended lifespan in good health.

According to the study's estimates, in the accelerated intervention scenario, 3.1 years of healthy life are gained. In the moderate intervention scenario, the gain is 0.8 years of healthy life by 2030. This highlights how weight loss not only prolongs life expectancy but also enhances everyday functioning, mental well-being, and overall quality of life.

Table 3: Health indicators

Category	Indicator (by 2030)	Measure	Status Quo (2024)	Base Scenario (2030)	Moderate Intervention (2030)	Accelerated Intervention (2030)
Health	Prevalence of obesity	%	39	41.8%	37% (-2% points)	29% (-10% points)
	Healthcare costs	$ Bn	8.5	9.8	9.7 ($0.15 Bn)	9.3 ($0.47 Bn)
	Life expectancy	Years (adults living with obesity)	75.5	75.5	75.8 (+0.3 years)	76.6 (+1.1 years)
	QALY savings	Healthy Life Years (adults living with obesity)	53.4	53.4	54.2 (+0.8 years)	57.3 (+3.1 years)

From a health perspective, Saudis of all ages, and expatriates in the working age group benefit the most from weight loss

Analysis be Key Demographic

Nationality

- Obesity prevalence decrease occurs more strongly for Saudi nationals than expatriates. For nationals, the prevalence of obesity could drop from 40% to 28% and for expatriates, the prevalence may drop from 38% to 30%.
- The higher drop in obesity prevalence in Saudi nationals can be explained by the fact that they begin with a much higher obesity rate to begin with. They also usually have access to the most comprehensive healthcare plans provided by the government.

Age

- The most significant weight reduction in terms of people overcoming obesity is seen in the working age group of people aged 30-59. The obesity prevalence may reduce from 45% to 33%. This leads around 754,727 working age professionals to overcome obesity and become more productive in their employment, adding a significant boost to the GDP. The drop in the prevalence of obesity in the people aged 18-29 moves from 18% to 11%, causing around 167,228 youth to potentially overcome obesity.
- This implies a healthier and more active workforce, leading to an increase in individual and business income, more government revenue and lower public healthcare costs.

This implies a healthier and more active workforce, leading to an increase in individual and business income, more government revenues and lower public healthcare spending.

ECONOMY: GDP COULD GROW BY 0.9% POINTS BY 2030

Weight loss reshapes individuals, and the economy by boosting productivity and GDP growth

- **Boosted productivity:**

  Weight loss minimizes obesity-related health issues, such as type 2 diabetes, resulting in fewer medical appointments and absenteeism. Healthier individuals can maintain consistent work performance, thereby increasing overall productivity within the workforce[55].

- **Increased energy and efficiency levels:**

  Improved health from weight loss elevates employees' energy levels, reducing instances of presenteeism—where individuals are present at work but operate at lower efficiency. This leads to higher quality output and greater overall workplace effectiveness[56].

- **More employment opportunities:**

  Weight loss alleviates physical limitations and enhances self-confidence, empowering individuals to pursue and secure employment more actively. This not only broadens their personal career prospects but also contributes to a more dynamic and diverse labour market[57].

At the national level, increased business revenues enable higher wages, greater workforce expansion, and enhanced consumer spending, creating a cycle of economic growth. Governments also benefit from higher tax receipts, such as VAT and corporate taxes, which can be reinvested in public services and infrastructure. (see Figure 6 for a detailed view on the relationship between socioeconomic indicators).

The deep link between economic factors and weight loss is demonstrated by a large body of studies, specifically on productivity losses[58], but is also recognized by policymakers. For example, in the United Kingdom a new scheme was put in place to offer weight loss medications to unemployed people living with obesity[59]. The intended effect of the medication is to enable these people to re-enter the workforce by improving their physical and mental condition.

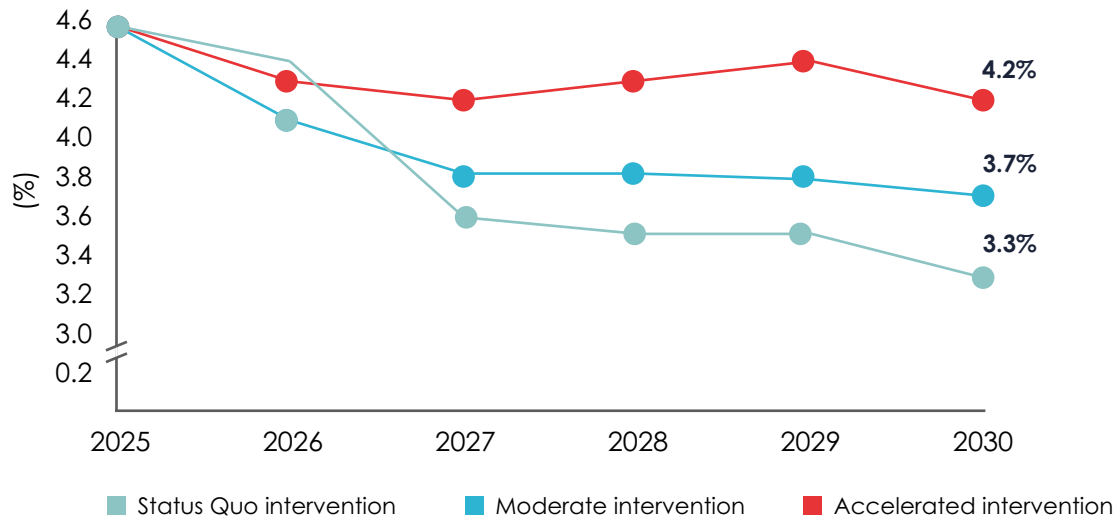
The positive effects of weight loss on workplace productivity are supported by a sentiment analysis, which found over 7,000 comments across platforms like YouTube and TikTok commenting on this aspect:

> **"Post weight loss, I feel more energized and focused at work now!"**
>
> **"I can focus better at work now that my blood sugar is under control with after I lost weight."**
>
> - Whiteshield Sentiment Analysis

The study's model estimates GDP to grow by up to an additional $42 Bn in 2030, with up to an additional 0.9 percentage point growth from KSA baseline GDP growth

As novel modern obesity care medications gain adoption, obesity prevalence decreases, unlocking greater productivity across the population. This increase in weight loss could drive an additional 0.4% to 0.9% points GDP growth in 2030 from the IMF baseline GDP projections. These results from the System Dynamics model are also consistent with the results from the Fixed Effects model, which predicts that 1% decrease in BMI will lead to GDP increasing by 0.5%. (see the Methodology and Appendix sections for more details).

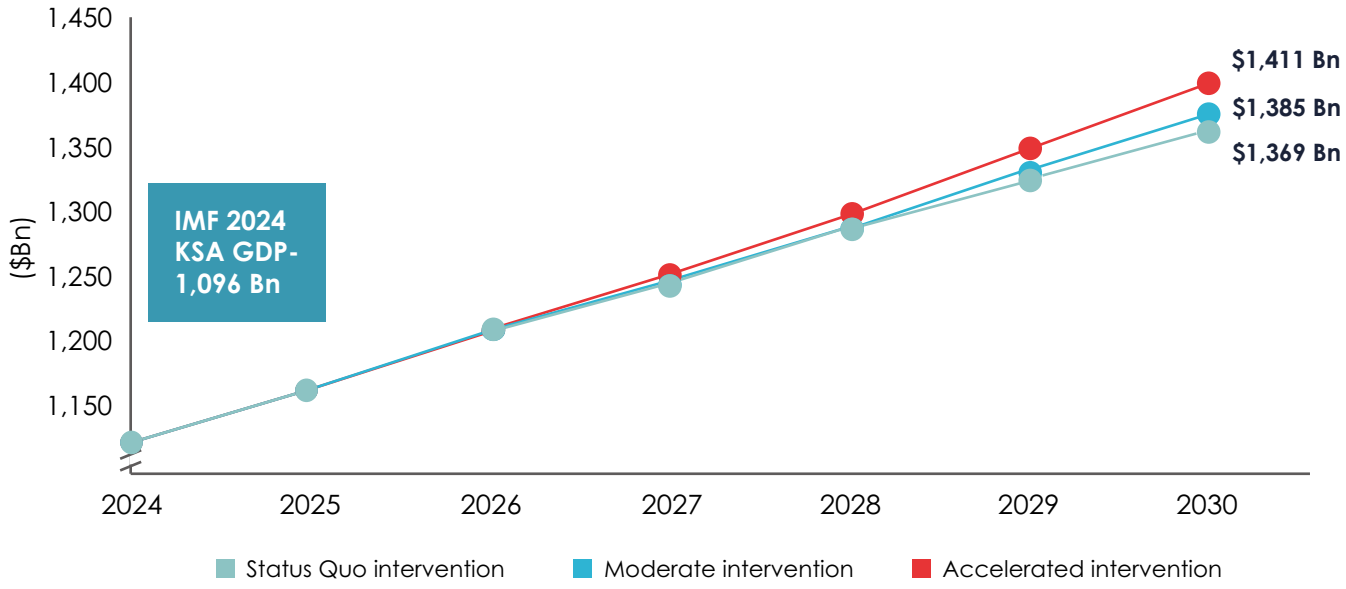
Figure 12: GDP growth rate - % (2025-2030)



The increase in GDP growth could boost the KSA GDP up to $1,411 Bn by 2030. This equates to a potential cumulative GDP gain of between $16 Bn and $42 Bn between 2025 and 2030. This also helps push the KSA closer to its GDP target of $1,700 Bn by 2030. Current growth estimates by the International Monetary Fund place GDP in 2030 closer to $1,400 Bn[60].

To contextualize these numbers' magnitude, the World Obesity Federation estimates the annual impact of obesity on the KSA's economy at $20 Bn per year, which adds up to $100 Bn between 2025 and 2030, due to healthcare and productivity losses alone[61].

Figure 13: KSA GDP (2025-2030)



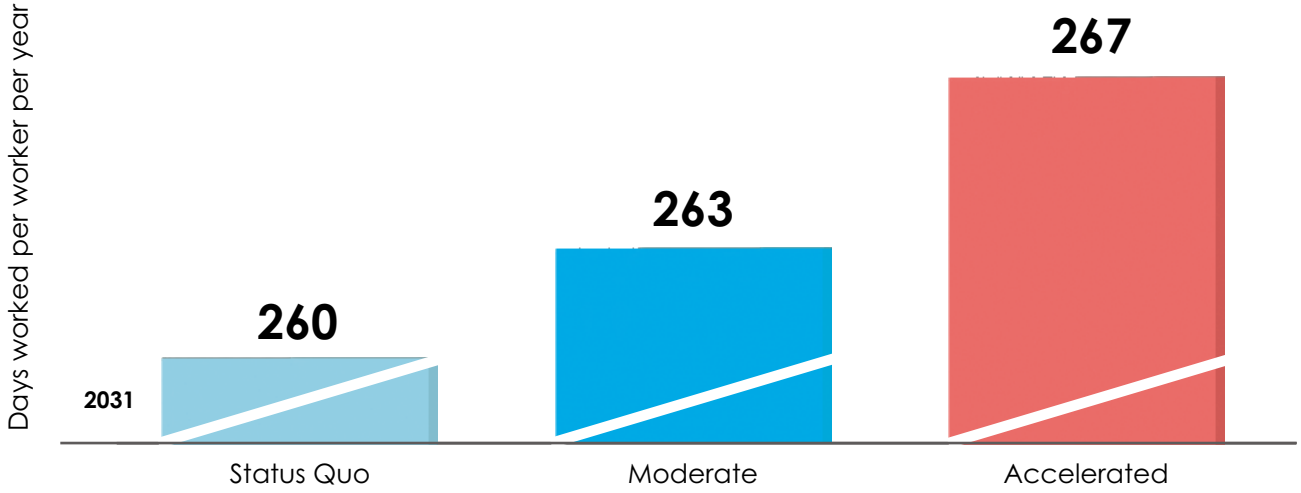
Worker productivity may increase, equivalent to adding 7 additional days of work per worker per year by 2030

Additional GDP growth is in part driven by productivity improvements, due to lower absenteeism rates among employees, who, after having overcome obesity, are able to perform more efficiently and take fewer days off from work.

This increased productivity is equivalent to adding over 7 days of additional work per worker per year in the accelerated intervention scenario and 3 more days per worker per year in the moderate intervention scenario.

Figure 14: Productivity - Additional days per year

Weight loss could add 7 work days per year per individual who previously suffered from obesity



Consider the example of Aditya, a 42-year-old consultant, whose BMI had reached 33 due to his sedentary lifestyle and stress. By reducing his BMI to 27, his health has improved significantly—specifically, the early signs of kidney issues, often exacerbated by obesity, have subsided. Previously, Aditya required frequent doctor visits and sometimes missed work due to pain and discomfort caused by these health challenges. Now, he is healthier, more focused, and able to fully engage with his team, taking fewer sick days.

VAT receipts estimated to increase by $ 6.9 Bn by 2030

Economic growth, fueled by increasing productivity, more employment, and increasing consumption and business revenues, will increase VAT collection. In the accelerated scenario, the government could collect an additional $6.9 Bn in revenue by 2030. In the moderate scenario, the government may collect $3.1 Bn in additional revenue.

Shift in consumption towards sectors focusing on fitness and healthy foods

As citizens experience positive health benefits and gain purchasing power, overall consumption is projected to grow 5.1% year on year by 2030in the accelerated scenario, as compared to the 4.4% increase year on year in the moderate scenario. In the base scenario, consumption may only grow by 3.7% year on year by 2030, from the baseline consumption.

This translates an increase of $45.8 Bn in consumption in the accelerated intervention scenario in 2030, and $20.6 Bn increase in the moderate intervention scenario.

This growth in consumption is likely to benefit specific sectors, such as fitness, healthy food, and household goods[62]. Preliminary analyses suggest that within categories like food, the shift is likely to focus on healthier alternatives rather than a complete departure from the segment[63].

Some industries may face challenges, particularly smaller pharmaceutical or medical device companies that provide specialized solutions for obesity-related comorbidities, such as chronic kidney conditions[64]. As the prevalence of these health issues decreases, demand for such treatments may decline, impacting these niche providers. Additionally, demand for new clothing is likely to increase as people lose weight.

"I've lost 30 kgs […] over the last 9 months. 110 kgs to 80kg. I feel like a new person. I've had to buy new clothes to fit me twice"

- Whiteshield Sentiment Analysis

Consider Fatima, a working-age Saudi national woman from Dammam whose BMI had climbed to 37, due to which she had to quit her job as a government employee. With weight loss, she now feels more confident in her appearance and suffers less from knee pain, enabling her to become more physically active. Motivated to join a new fitness class, she purchases new sportswear, as her old outfit is now too large. At the same time, her improved health inspires a shift in her lifestyle: she buys fewer fast-food meals, instead opting for organic products at the supermarket. Her newfound interest in home cooking also leads her to invest in new cookware to fuel her passion.

Increase in individual income by $377 per year for each individual previously living with obesity

With improved productivity and boosted GDP growth, individual earnings could go up. By 2030, individual income may increase by $377 per year in the accelerated intervention scenario and $173 per year in the moderate intervention scenario. This translates to an additional $1,850 in additional income over the period of 2025-2030 for each individual who was previously living with obesity in the accelerated intervention scenario. In the moderate intervention scenario, this increase is around $850 over the same period.

Take the example of Mariam, the 18-year-old Saudi female from Jeddah, who had been struggling with obesity since childhood. Previously unemployed, like 13.6% of Saudi women currently are, Mariam struggled with self-confidence and preferred to stay at home, risking further health and economic decline. By losing weight, she has regained her self-confidence, recently completed her higher education, and even got a job.

All economic indicators are positively impacted by weight loss, noticeably GDP growth rate and employment numbers

Table 4: Economy indiactors

Category	Indicator (by 2030)	Measure	Status Quo (2024)	Base Scenario (2030)	Moderate Intervention (2030)	Accelerated Intervention (2030)
Economy	GDP	$ Bn	1,096	1,369	1,385 (+16 Bn)	1,411 (+42 Bn)
	GDP growth rate	%	4.6	3.3	3.7 (+0.4% points)	4.2 (+0.9% points)
	Productivity savings	Days per year per adult previously living with obesity	260	260	262.94 (+2.94 days)	267 (+7 days)
	Government revenue (VAT only)	$ Bn	65.7	82	85.1 (+3.1 Bn)	88.9 (+6.9 Bn)
	Consumption	$ Bn	438	547	567.5 (+20.6 Bn)	585 (+48 Bn)
	Individual income	$	32,880	37,322	37,478 (+156)	38,745 (+366)

Analysis by Key Demographics

Weight loss levels the playing field for the most impacted demographics:

Nationality:

Of the additional hours gained due to boosted productivity, Saudi national workers could gain the most, with 9 days per worker per year gained in the accelerated scenario and 4 days per worker per year gained in the moderate scenario. This is due to higher baseline obesity prevalence among the Saudi nationals and the corresponding greater improvement in their physical health status when weight loss interventions are implemented. On the other hand, the corresponding increase in productive hours for expatriate workers are only 3 days in the accelerated intervention scenario and 1 days in the moderate intervention scenario.

Gender:

In terms of an increase in individual income, women's income may increase more than men's income. While women could gain an addition $385 in the accelerated intervention scenario in 2030 and $ 227 in the moderate intervention scenario in 2030, men gain a lower $371 in the accelerated intervention scenario and $135 in the moderate intervention scenario. This difference is primarily driven by higher baseline obesity rates among women and the resulting greater gains in workforce participation, productivity, and reduced absenteeism once weight loss initiatives are adopted. As women see bigger relative health improvements, they experience correspondingly larger increases in individual income over time

SOCIETY: SURGE IN SAUDI BIRTHS WITH AN ESTIMATED 151,197 ADDITIONAL NEWBORNS BY 2030

Addressing obesity enhances societal well-being and helps KSA reach ita goals for Vision 2030

Enhanced fertility and family growth:

By reducing obesity rates, more individuals can overcome obesity-related infertility causes, allowing them to conceive and carry pregnancies to term successfully[65]. This leads to an increase in birth rates, contributing to the growth of Saudi population.

Increased workforce participation and advancement:

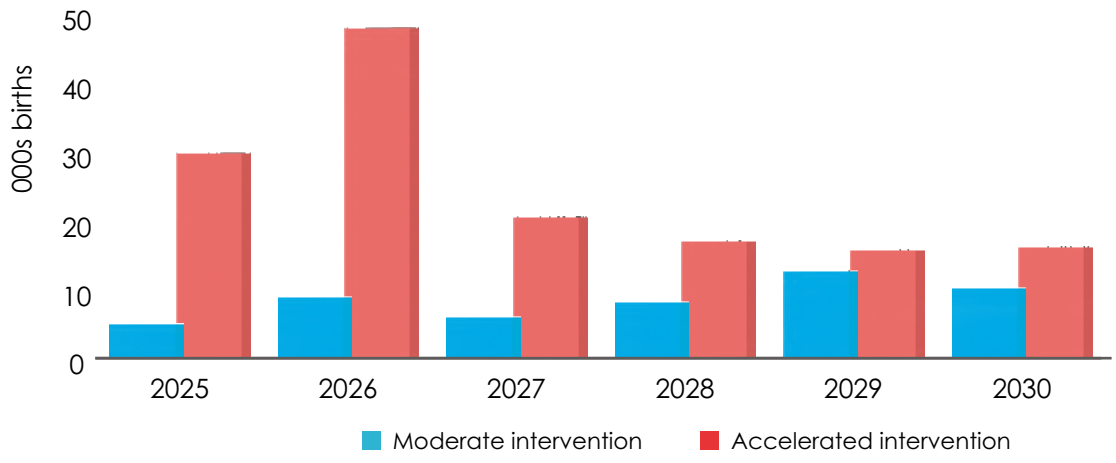
Weight loss positively impacts the participation and advancement of women and youth in the workforce[66]. Healthier employees experience fewer chronic illnesses and maintain better mobility, enabling them to perform job duties more effectively and sustain consistent employment.

The KSA government has prioritized increasing the number of Saudi families and enhancing workforce participation. The 2030 Vision highlights this commitment, citing families as the "key building block" of a prosperous society[67].

Weight loss could increase the total number of births in the KSA and empower women and youth to become a part of the workforce

Figure 15: Additional births (2025-2030)

With weight loss, 151,197 additional births occur in the KSA in the high impact scenario, 51,074 in the low impact



An estimated 151,197 additional births could take place in the accelerated scenario

At the present pace, an increasing number of people are estimated to experience infertility every year, which is contributing to a loss of live birth rate.

Obesity is linked to several conditions which may contribute to infertility, for both men and women, such as hormonal imbalance or a loss of periods[68]. Additionally, obesity can have significant impact on mental health[69], potentially reducing social interactions, and by extent, willingness to start a family.

However, weight loss at the population level could lead to a reversal of this trend, with people averting infertility and increasing birth rates. With weight loss, young adults transitioning out of obesity may see their perspective on the future brighten. They may have more ease finding employment, feel more self-confident, more willing to meet a partner and marry, and ultimately more willing and able to start a family.

> ***"I was diagnosed with ovarian failure and no more periods, now I am getting my periods back"*** *- Whiteshield Sentiment Analysis*

In the Kingdom specifically, this is reflected in a study with data from as early as 1988, already showing that individuals living with obesity are overrepresented in fertility treatments.

Consider the case of Hamdan, the 33-year-old Saudi from Riyadh. He was suffering from obesity with a BMI of 35, and was unable to have children. With weight loss, his BMI has now reached a healthy 24. He no longer finds himself in joint pain and muscle aches, his overall health drastically improved. He was later able to conceive for the first time.

Cumulatively, in the period between 2025-2030, **an additional 151,197 births could take place in the accelerated intervention scenario.** Out of these additional births, 68% or 102,636 are projected to be Saudi nationals. This is equivalent to around 25,000 new Saudi families being created. In the moderate intervention scenario, 51,074 additional births take place, out of which around 35,167 are Saudi births. This is a boost to the local population and supports Vision 2030's broader objectives of strengthening social cohesion and enhancing human capital in the region.

Figure 16: Additional births – Saudi nationals and expatriates

+151,197 In the high impact scenario, more than 151,197 additional births are born by 2030

Additional births - Saudis and expatriates

+102,636
Saudi births

+48,561
non-Saudi births

92,500 new workers could become a part of the workforce

The link between employment gains and weight loss are supported by academic studies, specifically observing that adults living with obesity are more likely to be unemployed[70]. This link is further attested by first-hand accounts emerging from the sentiment analysis.

> ***"I have [gained] 30 kilos as I no longer can do many sports activities I used to do, causing me also to be depressed […] [Weight loss] will improve my life considerably [...]. I can't even find a job full-time as I cannot handle it"***
>
> *- Whiteshield Sentiment Analysis*

With improved health and reduced bias towards adults living with obesity among employers, citizens will have a greater capacity to seek and secure employment. This could result in an estimated 92,500 additional workers in the accelerated intervention scenario. In the moderate intervention scenario, 29,581 additional Saudi workers are estimated to join the workforce by 2030.

64,197 Saudi women are estimated to join the workforce by 2030

Unemployment rates as well as obesity rates are higher for women in the KSA than their male counterparts, yielding a stronger benefit of weight loss for women.

Reducing obesity will empower women to take up employment opportunities in the public and private sector. There is an estimated addition of more than 64,197 women in the workforce in the accelerated intervention scenario and 20,477 additional women in the moderate intervention scenario by 2030. Out of these additional women, 88% or 53,634 are Saudi nationals in the accelerated intervention scenario and 17,232 in the moderate intervention scenario. This is primarily because of the higher baseline obesity prevalence among Saudi females (43.3%), which when reduces, allows more Saudi women to become active and join the workforce, contributing positively the nation's Vision 2030.

19,059 youth are estimated to join the workforce, 16,816 of them are Saudi

Youth suffering from obesity face a double challenge, in completing higher education and securing employment. Obesity is linked with reduced educational outcomes and employment opportunities[71]. Helping these individuals overcome obesity would be an especially important contribution to KSA society.

A well-employed youth population contributes to higher productivity, drives innovation, and supports the expansion of key economic sectors. Additionally, engaging young individuals in the workforce reduces dependency ratios and fosters a dynamic economy capable of adapting to global market changes. Weight loss is estimated to add close to 19,059 youth to the workforce, 16,186 of which are Saudi youth. In the moderate intervention scenario, this increase in the workforce is around 6,203 youth, 5,265 of which are Saudi.

Remember Fatima who had to quit her job as a customs agent? Losing weight loss will enable her and 64,197 women to become a part of the workforce.

Table 5: Society indicators

Category	Indicator (by 2030)	Measure	Status Quo (2024)	Base Scenario (2030)	Moderate Intervention (2030)	Accelerated Intervention (2030)
Society	Total births	#	572,172	502,083	512,599 (+10,516 births)	518,872 (+16,879 births)
	Additions to workforce	#	16.8 Mn	17.8 Mn	17.8 Mn (+29,581)	17.9 Mn (+92,500)
	Women in the workforce	#	6 Mn	6.4 Mn	6.4 Mn (+20,477)	6.4 Mn (+64,197)
	Youth in the workforce	#	2.7 Mn	2.9 Mn	2.9 Mn (+6,203)	2.9 Mn (+19,059)

Analysis by Key Demographics

Significant estimated societal gains for Saudis, 25,000+ new families could be created, 76,544 could enter the workforce:

Nationality:

- 68% or 102,636 Saudi births are estimated to take place due to reducing obesity in the population, along with 48,561 expatriate births.
- Out of the 19,059 youth added to the workforce by 2030, around 85%, or 16,186 are Saudi youth, in the accelerated intervention scenario. Even though Saudi nationals form only 23% oconsider example off the workforce, they suffer from a much higher prevalence of obesity (19.6%), compared to expatriate youth (16.2%). Weight loss benefits are therefore especially visible in Saudi.
- The impact of additional jobs created is also disproportionate across different demographic cohorts. For Saudi nationals, who suffer from a high prevalence of obesity, reducing weight enables 76,544 individuals to join the workforce in the accelerated intervention scenario, especially for women, for Saudi women, making up the majority of those joining the workforce (53,634). The impact of weight loss on expatriates is much smaller, as most of them are already absorbed in the workforce. Still, losing weight allows an additional 15,956 expatriates to enter the workforce by 2030.

EDUCATION: 10,563 ESTIMATED ADDITIONAL HIGHER EDUCATION GRADUATES

Addressing obesity can significantly improve educational attainment, as studies highlight a positive relationship between healthy weight and academic performance:

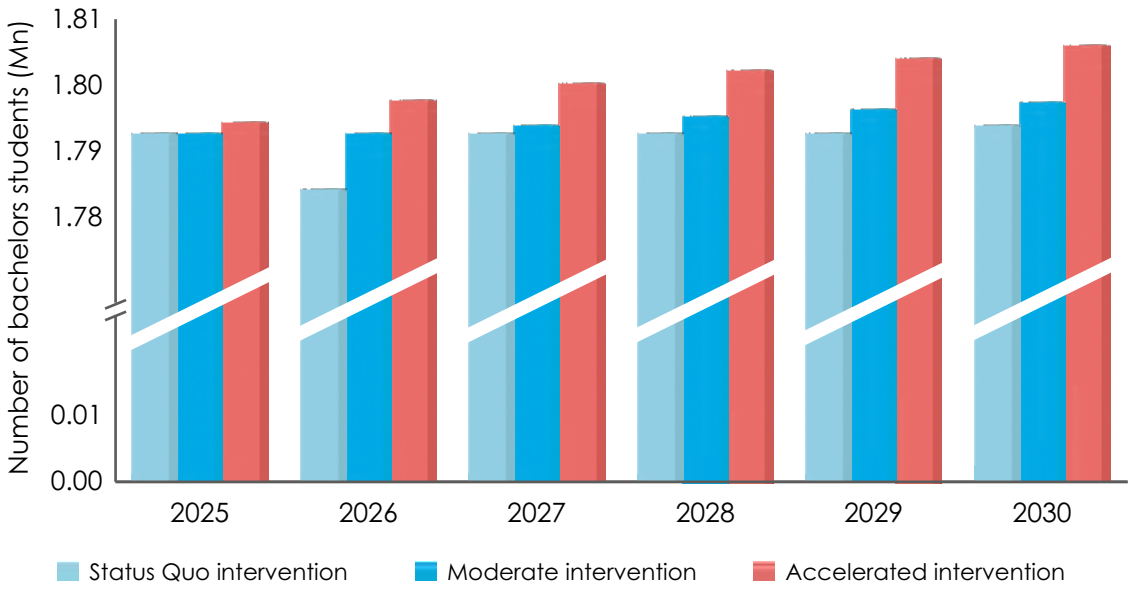
- Obesity is linked to chronic systemic inflammation[72]. Inflammation in brain tissue can worsen memorization skills. Although confounding variables may be at play, students living with obesity have been found to have higher dropout rates[73]
- By mitigating obesity-related health issues and boosting self-confidence, weight loss interventions help students remain committed to their studies. This can decrease the dropout rate in the KSA (currently rates are at 30-35%), ensuring that more individuals complete their education and are prepared to contribute to the workforce[74].

Increasing educational outcomes in the KSA is a key priority for the government's Vision 2030, and it is actively working to increase the number of skilled graduates in the country. Reducing obesity could increase the number of students pursuing higher education, helping achieve the objectives of this strategy as well as helping the KSA become future-ready.

Weight loss could lead to an increase in the number of bachelor's degrees graduates, as well as average years of schooling, and a reduction in dropout rate.

Figure 17: Additional bachelors program enrolments (2025-2030)

~10,563 more students obtain a bachelors education by 2030, equal to the current student size of the University of Ha'il in the high impact scenario



??

10,563 additional students could enroll in bachelor's programs in the KSA by 2030

Without weight loss interventions, growth of students obtaining a bachelor's degree in the KSA is constrained and is only projected to reach 1,795,394 students by 2030. As young adults start to lose weight, however, their self-esteem is positively impacted, and they are more likely to complete their studies, or enroll in higher education. This is partially due to that obesity is a severe health issue associated with many diseases, including neuroinflammation and cognitive decline. Due to these mechanisms, in the accelerated intervention scenario, 10,563 additional students are estimated to enroll in a bachelor's program, and in the moderate intervention scenario, 3,444 students enroll in a bachelor's program cumulatively, by 2030.

These additional students in higher education will be equipped with the necessary technical and practical skills to drive the economy in both public and private sectors. Around 95% of these additional students would be Saudi nationals. Weight loss would contribute to enabling additional students to enroll in higher education. By 2030, in the accelerated intervention scenario, 10,034 additional Saudi students could enroll, and 3,272 in the moderate intervention scenario.

Losing weight allows promising students like Mariam, who was previously at risk of not being able to enroll in university, to improve their academic performance and muster the self-confidence needed to join university and pursue a degree.

Dropout rate could reduce to 28.6%, preventing 22,114 students from dropping out of college by 2030

There is also an estimated reduction in the average dropout rate among those living with obesity. At present, the dropout rate for higher education students stands at 30%, due to factors such as disengagement, self-esteem issues, and greater absenteeism[76]. With weight loss interventions, the average dropout rate is estimated to reduce to 28.6% in the accelerated intervention scenario and 29.7% in the moderate intervention scenario by 2030. Taken cumulatively, this is equivalent to 22,114 students in the accelerated intervention scenario and 4,363 students in the moderate intervention scenario being prevented from dropping out of college by 2030.

Table 6: Education indicators

Category	Indicator (by 2030)	Measure	Status Quo (2024)	Base Scenario (2030)	Moderate Intervention (2030)	Accelerated Intervention (2030)
Education	Bachelors' enrolment	#	1,795,937	1,795,937	1,799,381 (+3,444)	1,806,500 (+10,563)
	Students dropping out	#	538,871	538,618	534,255 (+4,363)	516,504 (+22,114)

Analysis by Key Demographics

Weight loss contributes to a significant boost for Saudi and women graduates

Nationality:

- There is an increase of 10,034 Saudi nationals who graduate from bachelors' programs compared to 529 expatriate students in the accelerated intervention scenario by 2030. In the moderate intervention scenario, there is still an increase of 3,272Saudi graduates compared to 172 expatriate graduates by 2030.
- This is an important result as highly skilled Saudi graduates are more likely to be able to gain employment in the private sector, which is one of the key goals of the Vision 2030.

Gender:

- Out of the 10,034 additional graduates, in the accelerated intervention scenario, 5,770 are women, implying a significant increase in female participating in higher education in the KSA. Even in the more moderate scenario, there is an addition of 1,880 women in bachelors enrolment across KSA.
- This rise can be attributed to improved health outcomes and greater academic engagement among women following weight loss interventions, as well as evolving societal and policy support that encourages women's educational attainment in the KSA.

SECURITY: ESTIMATED INCREASE OF 78,481 IN THE SECURITY TALENT POOL BY 2030

Addressing obesity among young Saudi males presents significant opportunities to enhance national security

Enhanced recruitment and retention:

By reducing the current obesity prevalence of 35% among Saudi youth, more young Saudi males will meet the physical fitness standards required for mandatory national military service. This increase in eligible candidates strengthens the military and police recruitment efforts and ensures a more robust and capable workforce.

Improved military readiness and reduced injuries:

Weight loss initiatives contribute to higher overall fitness levels among military personnel, ensuring that a greater number are medically ready to deploy when needed. Additionally, reducing obesity decreases the likelihood of musculoskeletal injuries by approximately 33%, resulting in a more resilient and injury-resistant force

Reducing obesity enables Saudi males to become military ready. The KSA not only strengthens its armed forces but also enhances its overall national security.

78,481 Saudi males may overcome obesity by 2030

Weight loss among young Saudi males has a direct impact on their eligibility for defense and law enforcement roles. Cumulatively, between 2025 and 2030, weight loss could enable an additional 22,233 to 78,481 additional Saudi males to become eligible for military service and eventually increase their capacity to join the police force, depending on the level of the weight loss intervention scenario.

Figure 18: Military fit personnel (2025-2030)

There is an increase of 78,481 military fit personnel in the high impact scenario, 22,233 in low impact

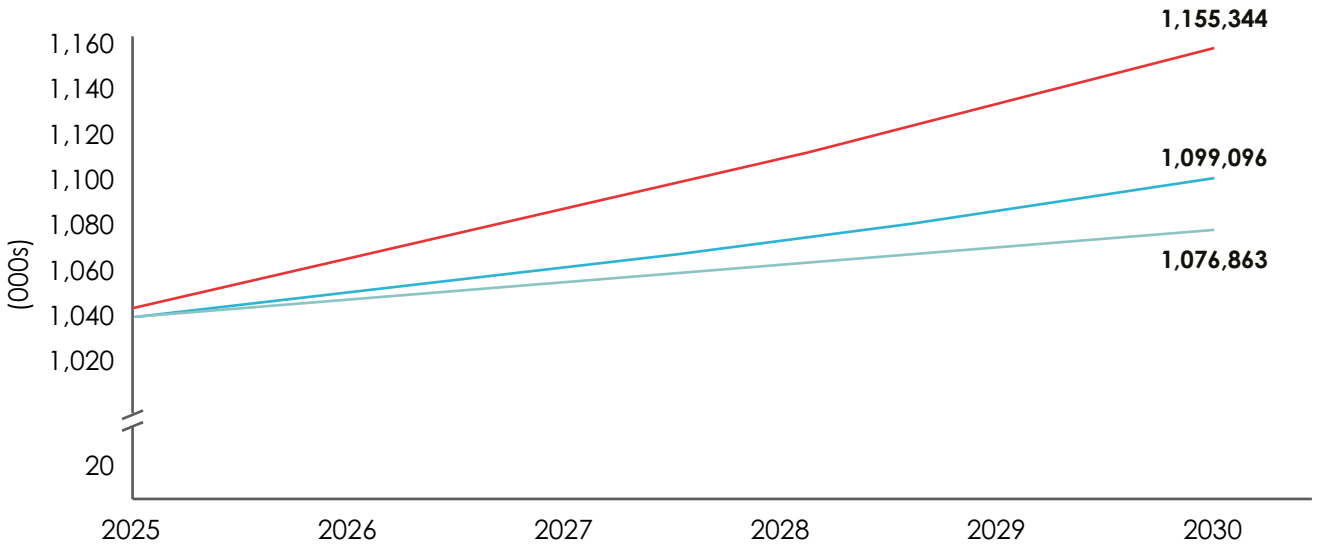


Table 7: Security indicator

Category	Indicator (by 2030)	Measure	Status Quo (2024)	Base Scenario (2030)	Moderate Intervention (2030)	Accelerated Intervention (2030)
Security	Security Talent Pool	# of healthy weight young Saudi males	282,000	291,761	313,994 (+22,233)	370,242 (+78,481)

Conclusion

Lowering the obesity rate from 39% to 29% by 2030 under the accelerated intervention scenario could have a significant impact in KSA. Addressing obesity creates widespread advantages that reach well beyond individual well-being. It strengthens the economy, reduces pressure on healthcare infrastructure, and improves the general standard of living across communities.

The weight loss could positively influence to GDP growth by estimated additional 0.4% to 0.9% by 2030. This increase in GDP growth will add up to $1,411 Bn to the KSA GDP by 2030.

Educational outcomes could also improve, as students losing weight may be better able to focus, perform academically, and stay in school. This, in turn, strengthens the KSA's future talent pool, ensuring a more skilled and capable workforce for future.

Adults losing weight would also require fewer hospital visits, reduced healthcare costs for more than $1.8 Bn cumulatively in 2025-2030, and could live longer, healthier lives.

Additionally, national security stands to benefit, as a greater share of the population could meet fitness standards required to be a part of the mandatory military services, and regular armed and security forces.

Obesity-related infertility causes could decrease and potentially lead to additional births of estimated 151,197 newborns by 2030.

The obesity crisis in Saudi Arabia is a challenge that touches every aspect of society—from healthcare and education to economic productivity and national security.

Tackling obesity requires bold, people-first solutions — and the time to act is now.

Medical breakthroughs like GLP-1 therapies offer real hope for sustained weight loss, while urban planning, digital health tools, and school-based interventions can support long-term prevention. But success requires coordination across sectors, and healthcare, education, industry, and government must work together with a unified vision and commitment.

Nevertheless, tackling obesity is not just a matter of public health, also it is an investment in the nation's future. A healthier population means a stronger workforce, lower healthcare costs, improved academic outcomes, and greater national resilience. The Kingdom has the tools, talent, and leadership to turn the tide. What's needed now is the resolve to act boldly and decisively to transform today's crisis into tomorrow's opportunity.

Appendix

GLOSSARY

Table: Glossary

S.No.	Term	Definition
1	Obesity	A person who has a body mass index (BMI) greater than 30
2	Markov model	A mathematical model that describes a system which transitions between a finite set of states or probabilities over time
3	System dynamics	A computational model used to understand, analyze, and simulate the behavior of complex systems over time. The primary goal is to capture the dynamic relationships and feedback effects that influence the system's behavior
4	Sentiment analysis	A computational technique used to determine and extract the emotional tone or sentiment expressed in a piece of text, such as a sentence, paragraph, or document
5	Baseline	The prevalence of obesity among a specific cohort without any interventions
6	Moderate intervention	Weight loss interventions cover 15% of the target population by the end of the period of study
7	Accelerated intervention	Weight loss interventions cover 57% of the target population by the end of the period of study
8	QALY	Quality Adjusted Life Years; the average life years where an individual lives a healthy life, free from any diseases
9	GLP-1 RA	A class of medications that mimic the action of the endogenous incretin hormone glucagon-like peptide-1 (GLP-1) to regulate glucose metabolism and have multiple benefits beyond glycemic control, including weight loss, cardiovascular protection, improved lipid profiles, reduced inflammation etc., often used in the treatment of Type 2 diabetes and obesity
10	GDP	The total final value of all goods and services produced within a country during a specific time period

METHODOLOGY

Data

Data collection focused on gathering socio-economic and health statistics to establish the historical baseline of the KSA's population. Key data points such as obesity prevalence, demographic population breakdown, shifts in the population, were collected based on best available data from national statistics agencies and supranational entities such as the World Health Organization (WHO). These factors, particularly obesity prevalence, were broken down by age, gender, and citizenship (expatriate or local citizen).

Population data, including male and female counts by age group, were obtained from the United Nations' demographic studies. Citizenship data were sourced from national statistical agencies. Other factors, such as employment rates, student numbers, and income, were derived from either national statistical agencies or relevant government entities (e.g., the Ministry of Education).

Historical obesity and overweight prevalence data were drawn from United Nations studies, selected for their large sample sizes and robust methodologies. National studies often suffer from sampling biases (e.g., participants refusing to be weighed). However, to obtain obesity prevalence rates specific to demographic cohorts, national health surveys were consulted and normalized against overall population prevalence values. To the authors' knowledge, no currently published study or data provides an accurate and detailed breakdown of the nation's obesity prevalence across demographic groups, making the data set used in this report uniquely close to real-world obesity prevalence in the KSA.

To ensure the study's validity and relevance, the authors conducted a comprehensive literature review covering obesity and related socio-economic indicators. Priority was given to local studies with large samples and strong methodologies. When national data were unavailable, suitable proxies were employed, including data from neighbouring countries such as the KSA and other Arab nations like Egypt.

Table: Data sources

Category	Indicator (By 2031)	Measure	Current Status (2024)	Source
Health	Prevalence of obesity	%	39%	World Health Organization and United Nations
	Healthcare Cost	$ Bn	8.5	Sum of public and private healthcare spending – World Obesity Federation, Public & Private healthcare spending – Whiteshield Analysis
	Life expectancy	Years (Population previously living with obesity)	74	World Bank, Lancet study, Whiteshield Analysis
	QALY savings	Healthy life years (Population previously living with obesity)	52.6	Ministry of Health, Lancet Study, Whiteshield Analysis
Economy	GDP	$ Bn	1,096	International Monetary Fund
	GDP growth rate	%	4.6%	International Monetary Fund
	Productivity Savings (Labor Force)	Days per employee who was previously living with obesity per year	260	5 days a week × 52 weeks a year
	Government revenue	$ Bn	65.7	Based on 15% VAT rate by Zakat, Tax and Customs Authority
	Consumption	$ Bn	438	General Authority for Statistics, KSA
	Individual income	$	32,880	World Bank
Society	Total Births	#	572,152	United Nations
	Addition to workforce	#	16,800,000	World Bank, Federal Statistics
	Women in the workforce	#	6,048,000	World Bank, Federal Statistics
	Youth in the workforce	#	2,730,000	World Bank, Federal Statistics
Education	Bachelors' enrolment	#	1,795,937	Ministry of Education
	Students dropping out	#	538,781	Based on 30% drop out rate reported by Ministry of Education
Security	Security Pool	# of Saudi males not living with obesity	282,000	World Health Organization and United Nations

System Dynamics Model

The System Dynamics (SD) model was initially developed through a conceptual phase, mapping causal relationships among variables informed by an extensive literature review of obesity and its socio-economic dimensions. The model was developed in Stella, a specialized modeling software, drawing on benchmarks from established SD models of obesity. Obesity and its progression can be approached through two primary frameworks: a physiological perspective, where weight changes reflect variations in caloric intake and expenditure, and a social-dynamic perspective, where shifts in self-perception influenced by social factors alter body mass index (BMI). The latter approach was employed here, and drug uptake was subsequently introduced as a dependent variable. This modeling strategy represents a deliberate departure from a solely physiological view of obesity, allowing for a more comprehensive understanding of the condition's socio-economic underpinnings.

To the author's knowledge no other study comprehensively studies the societal benefits of weight loss using a System Dynamics model. This novel approach for the topic provides new and unique insights on the topic.

The following sections describe different parts of the SD model.

1 – Population Dynamics

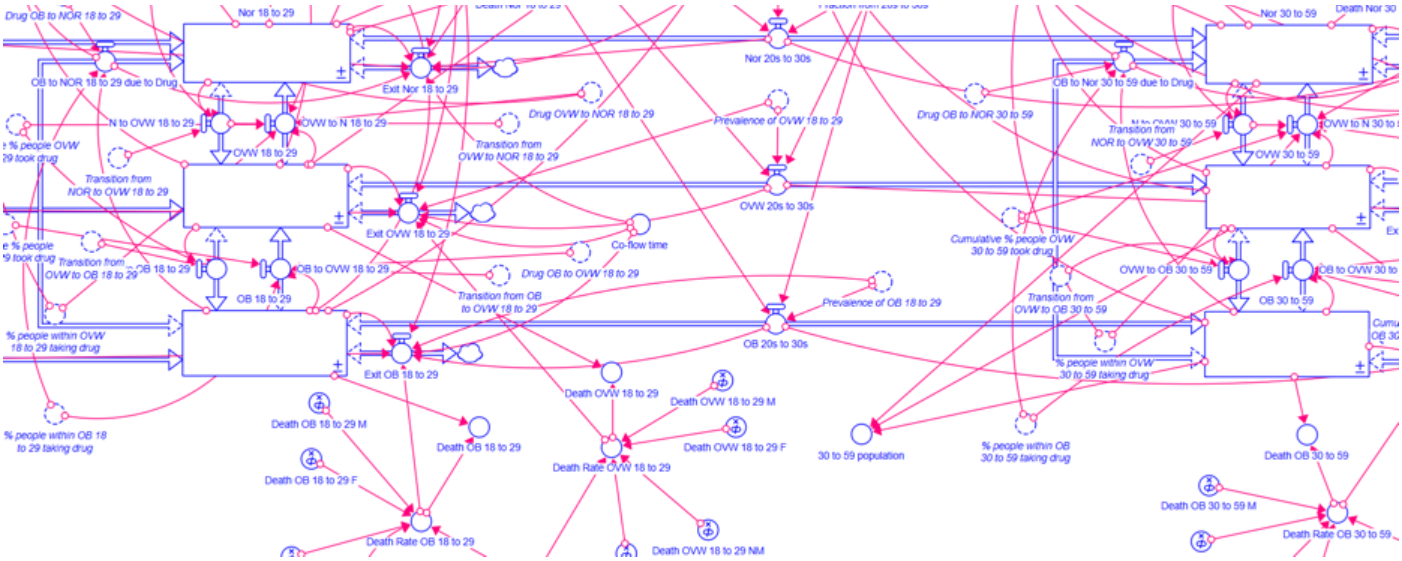
To best capture the impact of weight loss across society, the KSA's population was divided long 4 main cohorts based on gender (Male, Female) and Nationality (National, Expatriate). Within each cohort the population is further segmented across four age groups: Children (under 18 years old), Youth (18 to 29 years old), Core working age (30-59 years old), retired (60 years and above). This segmentation allowed the authors to separately examine the impact of weight loss and the challenges specific to each demographic cohort.

Each year, individuals transition from the under-18 group into the 18–29 group, from which a portion subsequently moves into the 30–59 group, and then into the above-60 group, before eventually exiting the system after a delay. Over time, the relative proportions of these age groups evolve, and these changes are incorporated into the model as exogenous inputs.

Each age category features an exogenous mortality rate further stratified by BMI category. Thanks to the use of empirical data on mortality rates per demographic cohorts as inputs for the System Dynamics model, the model accurately depicts changes in death rates over time, and more importantly enables a comparison between different uptake scenarios.

The model and its outputs focus on the adult population, and therefore the under 18 category is not discussed in this report.

Sample view of the population dynamics from the System Dynamics model in the Stella software



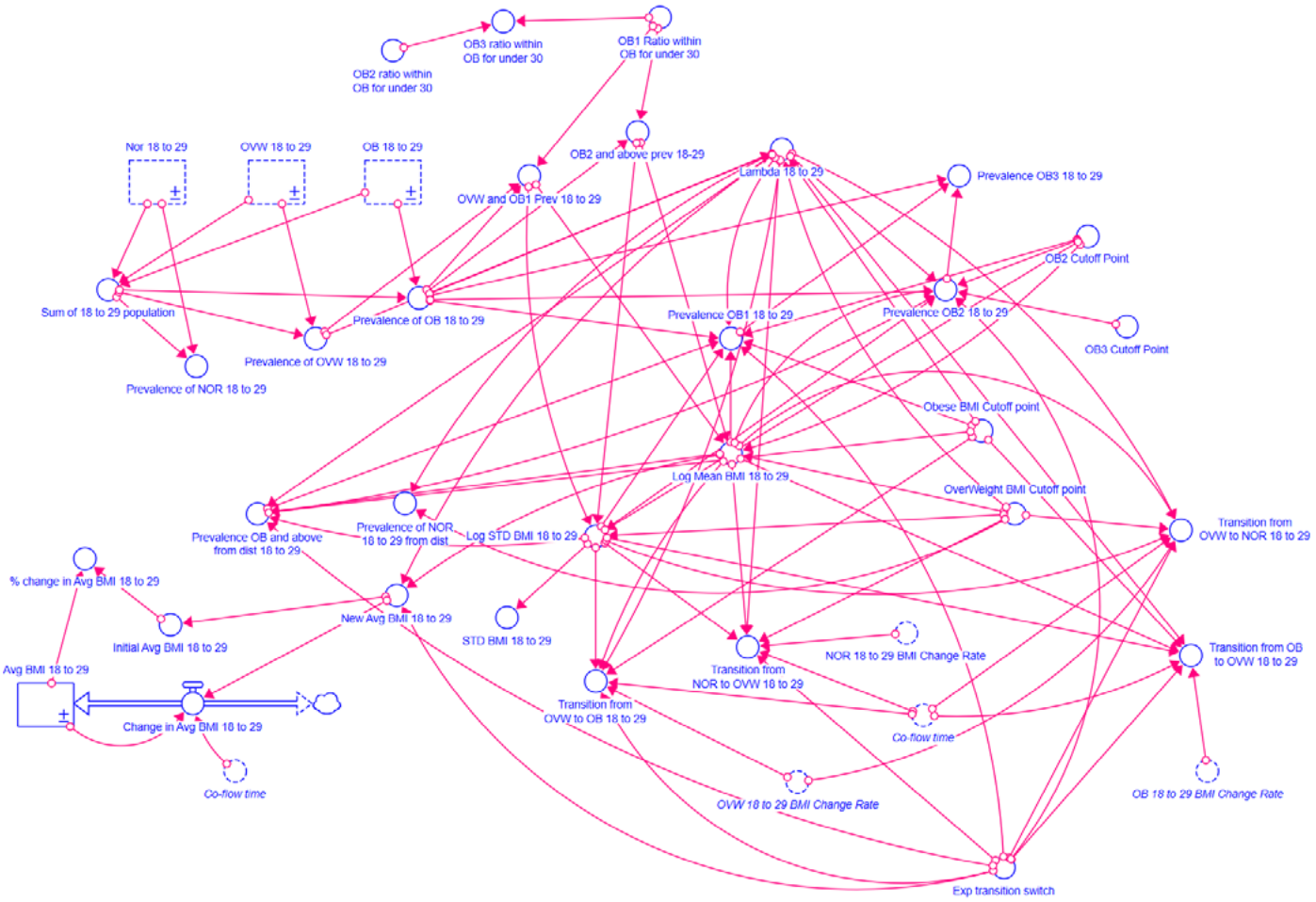
The use of this aging chain allows for a deeper understanding of obesity prevalence trends over time within a defined population. It offers a more comprehensive perspective on how related economic indicators evolve, rather than presenting a static snapshot of the current situation.

2 – BMI Dynamics

This module forms the core of the model, driving all changes. The model distinguishes among three primary BMI categories—Healthy, Overweight, and Obesity. When necessary, the Obesity category is further divided into three sub-categories of BMI (Obesity type I, II, and III).

Combining the three main age categories (18–29, 30–59, above 60) with the three primary BMI categories results in nine distinct BMI dynamics. The BMI change rates (Section 2.1) and the transition probabilities (Section 2.2) are drawn from several published studies referenced throughout this explanation.

Sample view of BMI Dynamics from the System Dynamics model in the Stella software



2.1 – BMI change rates (logic mainly driven from Crielaard et al., 2020; Fallah-Fini et al., 2013)

For each of the nine sub-groups, the following steps outline the BMI dynamics per time period:

1. Consider a representative individual—an "average" member of the sub-group. The individual's BMI is influenced by group norms (socio-cultural factors) and personal attributes (wage and education).
2. A gap exists between this individual's current BMI and an ideal BMI, defined by both individual and group factors. The inclination to reduce this gap is affected by personal characteristics (wage and education).
3. Based on this gap and the intent to close it, the representative individual's BMI changes each time period.
4. After registering the change, the BMI resets to its original value, and the process repeats in the next time period.

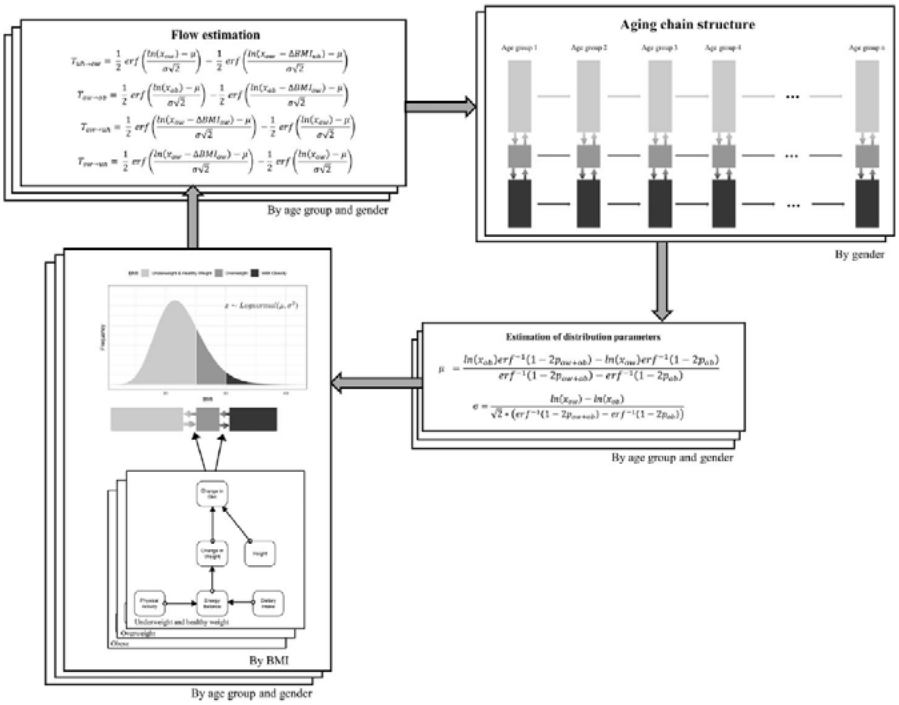
2.2 Transition probabilities (logic mainly from Chiu et al., 2023)

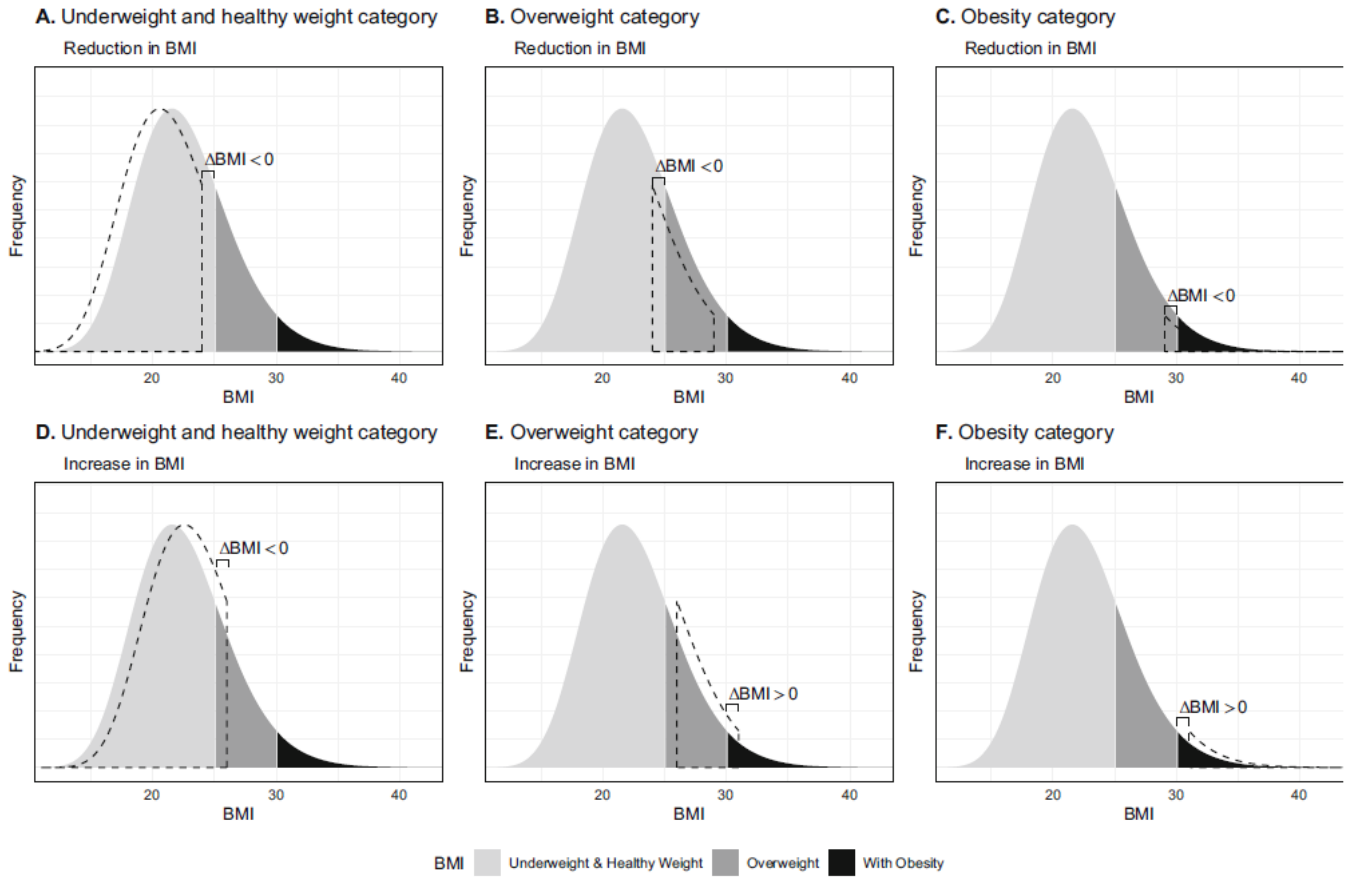
Once BMI change rates are determined for each of the nine sub-groups—specifically, the three BMI change rates per age category—transition probabilities between BMI categories can be calculated.

Empirical data indicates that the BMI distribution for the 18–29 age group resembles an exponential distribution, while the 30–59 and above-60 groups follow a lognormal distribution. For the 18–29 group, the key exponential parameter (Lambda) is determined by the combined Overweight (OVW) and Obese (OB) categories. For the lognormal distributions (30–59 and above 60), the lower cutoff corresponds to the Overweight BMI threshold, and the upper cutoff corresponds to the OB2 BMI threshold.

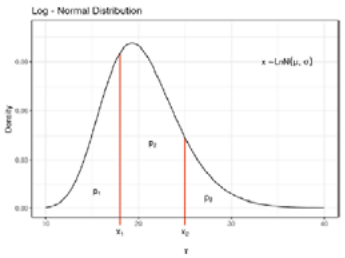
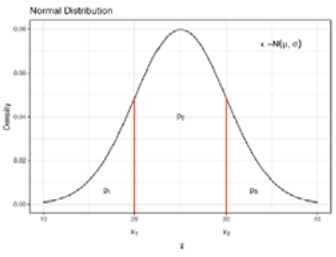
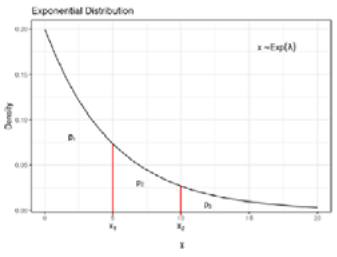
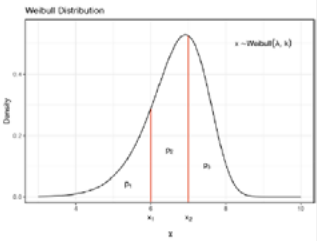
Each time period, the mean and standard deviation of the BMI distribution within each age category are updated based on BMI change rates and category prevalences. As the distribution shifts—moving left or right depending on changes—transition probabilities are recalculated accordingly. This process updates BMI category prevalences after each time period.

Additionally, this part of the SD model was calibrated using empirical weight transition data, spanning over half a million weight transitions across age groups and genders. This data was derived from large-scale longitudinal studies led in the United States, namely the Health and Retirement Study, as well as the National Longitudinal Study of Adolescent to Adult Health. While these studies are led in the United States, the large sample pool, similar obesity prevalence between the United States and KSA, and immutable psychological factors such as gender and age, make the data relevant for use in calibration.





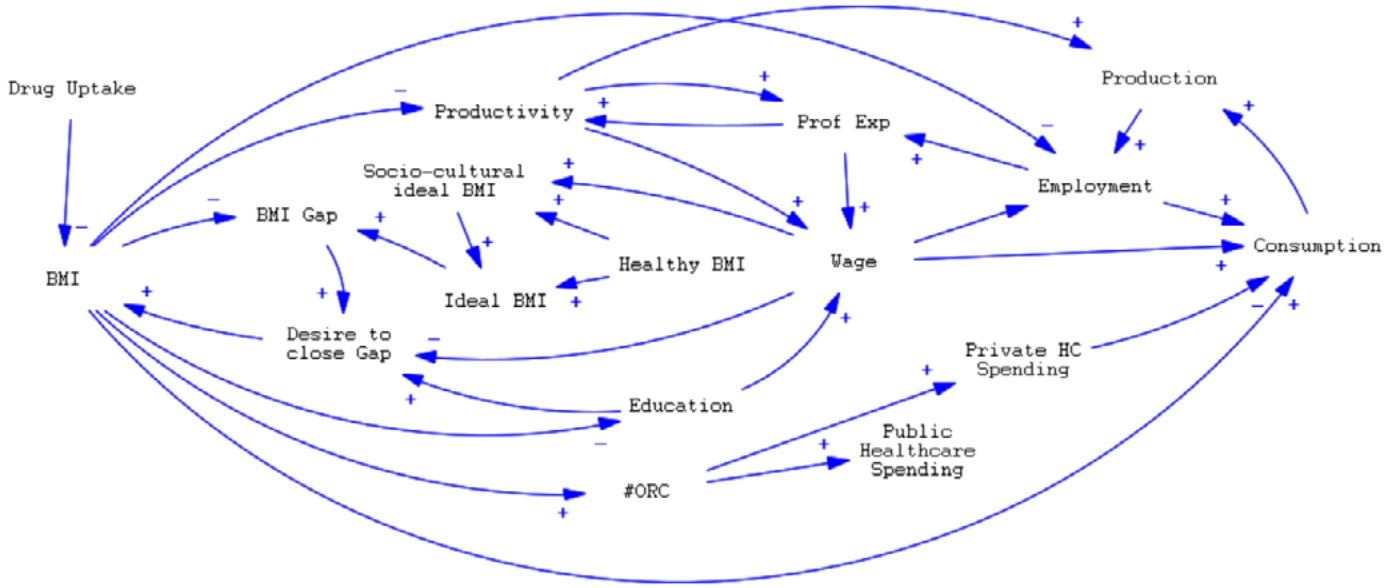
Transition probabilities

Log-Normal	Normal	Exponential	Weibull
			
Distribution parameters[a]			
$\mu = \frac{\ln(x_2)erf^{-1}(1-2(p_2+p_3))-\ln(x_1)erf^{-1}(1-2p_3)}{erf^{-1}(1-2(p_2+p_3))-erf^{-1}(1-2p_3)}$ $\sigma = \frac{\ln(x_1)-\ln(x_2)}{\sqrt{2}(erf^{-1}(1-2(p_2+p_3))-erf^{-1}(1-2p_3))}$	$\mu = \frac{x_2erf^{-1}(1-2(p_2+p_3))-x_1erf^{-1}(1-2p_3)}{erf^{-1}(1-2(p_2+p_3))-erf^{-1}(1-2p_3)}$ $\sigma = \frac{x_1-x_2}{\sqrt{2}(erf^{-1}(1-2(p_2+p_3))-erf^{-1}(1-2p_3))}$	$\lambda = \frac{-\ln(p_3)}{x_2}$	$k = \frac{\ln(-\ln(p_2+p_3))-\ln(-\ln(p_3))}{\ln(x_1)-\ln(x_2)}$ $\lambda = \frac{x_1}{(-\ln(p_2+p_3))^{1/k}}$
Flow between segments			
$T_{1\to2} = erf\left(\frac{\ln(x_1)-\mu}{\sigma\sqrt{2}}\right) - erf\left(\frac{\ln(x_1-\Delta x)-\mu}{\sigma\sqrt{2}}\right)$	$T_{1\to2} = erf\left(\frac{x_1-\mu}{\sigma\sqrt{2}}\right) - erf\left(\frac{(x_1-\Delta x)-\mu}{\sigma\sqrt{2}}\right)$	$T_{1\to2} = exp(-\lambda x_1)(exp(\lambda\Delta x)-1)$	$T_{1\to2} = exp\left(\frac{-kx_1}{\lambda}\right)\left[exp\left(\frac{k\Delta x}{\lambda}\right)-1\right]$
$T_{2\to1} = erf\left(\frac{\ln(x_1+\Delta x)-\mu}{\sigma\sqrt{2}}\right) - erf\left(\frac{\ln(x_1)-\mu}{\sigma\sqrt{2}}\right)$	$T_{2\to1} = erf\left(\frac{(x_1+\Delta x)-\mu}{\sigma\sqrt{2}}\right) - erf\left(\frac{x_1-\mu}{\sigma\sqrt{2}}\right)$	$T_{2\to1} = exp(-\lambda x_1)(1-exp(\lambda\Delta x))$	$T_{2\to1} = exp\left(\frac{-kx_1}{\lambda}\right)\left[1-exp\left(\frac{k\Delta x}{\lambda}\right)\right]$
$T_{2\to3} = erf\left(\frac{\ln(x_2)-\mu}{\sigma\sqrt{2}}\right) - erf\left(\frac{\ln(x_2-\Delta x)-\mu}{\sigma\sqrt{2}}\right)$	$T_{2\to3} = erf\left(\frac{x_2-\mu}{\sigma\sqrt{2}}\right) - erf\left(\frac{(x_2-\Delta x)-\mu}{\sigma\sqrt{2}}\right)$	$T_{2\to3} = exp(-\lambda x_2)(exp(\lambda\Delta x-1)$	$T_{2\to3} = exp\left(\frac{-kx_2}{\lambda}\right)\left[exp\left(\frac{k\Delta x}{\lambda}\right)-1\right]$
$T_{3\to2} = erf\left(\frac{\ln(x_2+\Delta x)-\mu}{\sigma\sqrt{2}}\right) - erf\left(\frac{\ln(x_2)-\mu}{\sigma\sqrt{2}}\right)$	$T_{3\to2} = erf\left(\frac{(x_2+\Delta x)-\mu}{\sigma\sqrt{2}}\right) - erf\left(\frac{x_2-\mu}{\sigma\sqrt{2}}\right)$	$T_{3\to2} = exp(-\lambda x_2)(1-exp(\lambda\Delta x))$	$T_{3\to2} = exp\left(\frac{-kx_2}{\lambda}\right)\left[1-exp\left(\frac{k\Delta x}{\lambda}\right)\right]$

3 – Socio-Economic Indicators

BMI dynamics influence a range of socio-economic indicators. Some are explicitly modeled with feedback loops, while others are treated as exogenous. The following indicators are linked through a causal loop diagram:

Relationships between socio-economic indicators



- **Employment:** Influenced by labor force participation, production, and wages, each of which is in turn influenced by BMI dynamics.
- **Wage:** Affected by worker productivity, education, and experience, all of which are tied to BMI.
- **Education:** Shaped by BMI.
- **Productivity:** Determined by BMI and experience.
- **Experience:** Depends on productivity and employment levels.
- **Production:** Influenced by labor productivity and consumption.
- **Consumption:** Driven by employment, wage levels, BMI, and private healthcare spending.
- **Healthcare (HC):** The number of obesity-related conditions (ORC) per person depends on BMI and age category. Private and public healthcare spending also responds to BMI and age distributions.
- **Gross Domestic Product (GDP):** Influenced by three main components—household consumption, government expenditure, and capital formation—all of which are functions of production, consumption, and public spending.

Infertility, QALY (quality-adjusted life years), extra calorie intake, mental health, and life expectancy are primarily exogenous, though their values depend on endogenous BMI prevalence.

Each socio-economic indicator is associated with specific BMI values. For example, unemployment rates are distributed across different BMI levels based on academic research that highlights variations in unemployment between weight categories. When the data from the literature lacks granularity, a mathematical equation is used to extrapolate unemployment rates across BMI values. For instance, if the data indicates that unemployment rates increase exponentially with BMI, a best-fit exponential equation is applied to accurately assign unemployment risk ratios to each BMI level. This data is then applied to the actual unemployment rate of each demographic cohort. To clarify with an example (all data points discussed in this example are purely illustrative): Research might show that individuals with a BMI of 35 (mid-point of obesity class I) are twice as likely to be unemployed compared to those with a BMI below 25 (healthy weight). If the average BMI in a group is 30

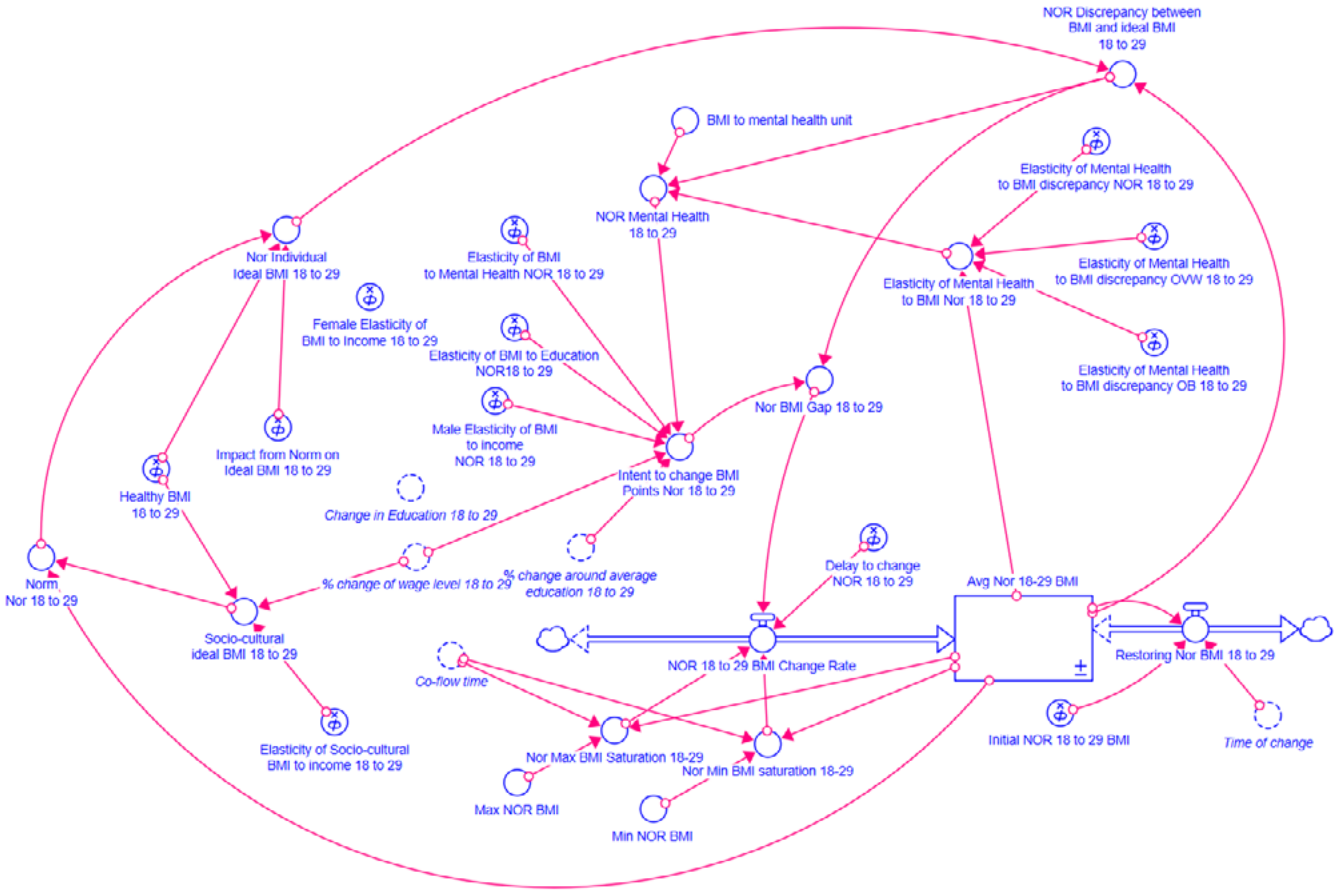
(overweight range), then unemployment risk ratios would be adjusted accordingly:

- A risk ratio above 1 would be applied to obese individuals (BMI ≥30). Meaning that they are more likely to be unemployed than average.
- A ratio below 1 would be applied to individuals in the healthy weight (BMI <25) and overweight (BMI 25–29.9) categories. Meaning that they are less likely to be unemployed than average.

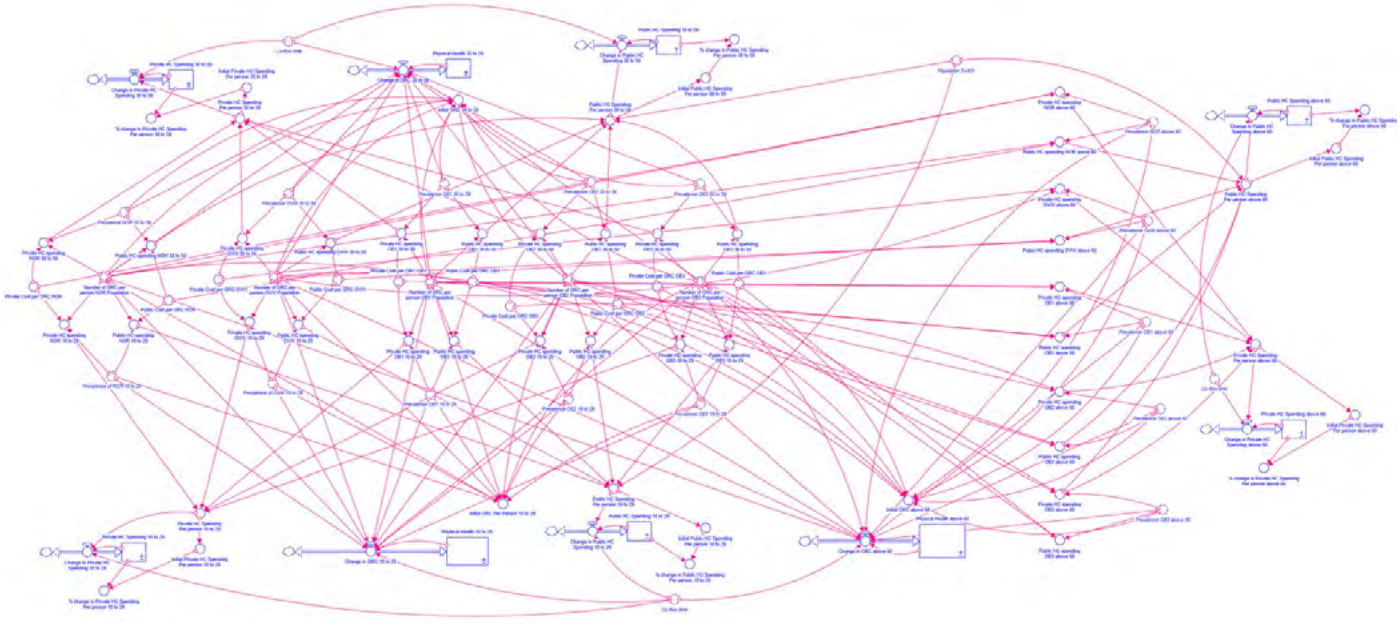
This approach ensures that unemployment risk is accurately aligned with both BMI categories and real-world demographic data. By applying this process to all socio-economic indicators, using the most detailed information available from the literature, the model delivers precise insights into how these variables change with BMI.

This approach allows for a nuanced understanding of differences across demographic groups and uptake scenarios, closely reflecting real-life conditions.

Sample view of the socio-economic dynamics from the System Dynamics model in the Stella software



Sample view of the health and healthcare dynamics from the System Dynamics model in the Stella software

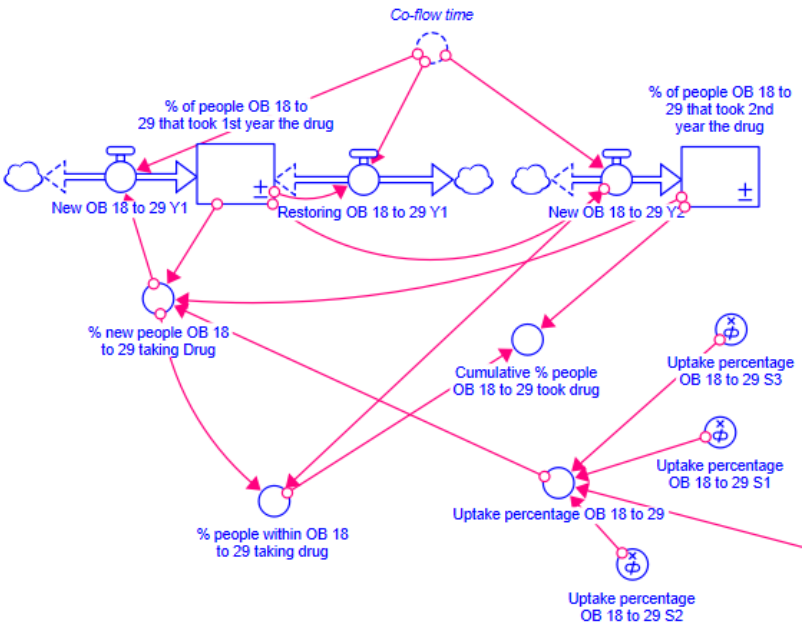


4 – Drug Uptake

Drug uptake is inputted based on the scenario analysis parameters. Its effects are based on clinical data. For individuals who lose weight but remain in the same BMI category, assumptions were made on the number of BMI points lost.

Individuals in the model taking the drug typically experience weight loss and may transition between BMI categories. The model tracks the proportion of individuals starting treatment, those in their second year, and the cumulative percentage who have completed two years and cease to lose weight (as observed in clinical trial data).

Sample view of the drug uptake stock from the System Dynamics model in the Stella software



Fixed effect regression analysis

The authors employed a fixed-effects panel regression model to examine the relationships between Body Mass Index (BMI), demographic, and environmental factors as independent factors and Gross Domestic Product (GDP) as a dependent variable. The dataset encompasses eleven countries—United States, United Kingdom, United Arab Emirates, Saudi Arabia, Singapore, Iceland, Switzerland, Morocco, Pakistan, Chile, and Slovenia —over the period 2000–2016, capturing a timespan during which obesity and its associated economic implications have become increasingly salient.

This econometric analysis was led to further ensure the validity of the findings resulting from the System Dynamics model. The objective of this analysis was to confirm the direction of the relationship between GPD and BMI, rather than finding an exact value for the relationship. This focus was selected because GDP–BMI was the most critical feedback loop in the model influencing long-term health and economic outcomes.

Key variables include the log-transformed Body Mass Index (log_BMI), serving as a central explanatory factor, along with several controls. These controls are Gender_encoded (capturing gender-specific effects), log-transformed population (log_Pop) to account for scaling effects, unemployment rate as a labor market indicator, and log-transformed healthcare expenditure (log_HC) as a proxy for healthcare system robustness. Furthermore, the model incorporates a measure of physically fit population (log_PFP), corresponding to non-obese or overweight people, and demographic and environmental factors, namely life expectancy, fertility rate, and CO_2 emissions. A country-specific constant term is included to represent unobserved, time-invariant characteristics.

A fixed-effects approach is employed to isolate within-country variation over time and mitigate biases that might arise from unobserved heterogeneity across countries. This method is appropriate given the structural, institutional, and cultural differences among the sampled nations, ensuring that the estimated relationships are not confounded by persistent country-level factors.

The model's within R^2 value of 0.8833 indicates a robust ability to explain temporal variation in GDP within countries. While the negative overall R^2 is not unexpected for fixed-effects models—which focus on within-country dynamics rather than between-country differences—this does not detract from the reliability of the estimates.

Among the predictors, log_BMI emerges as particularly influential, with a 1% increase in BMI associated with a 0.53% decrease in GDP. This result underscores the economic costs potentially linked to obesity, including multiple socio-economic variables included in the System Dynamics model. The unemployment rate exhibits a strong negative impact on GDP, reinforcing the importance of robust labor markets for economic stability. In contrast, higher healthcare spending (log_HC) shows a positive correlation with GDP, suggesting that investments in health systems may enhance economic growth, potentially by improving workforce longevity and productivity. The fertility rate negatively affects GDP, whereas longer life expectancy contributes positively.

In the System Dynamics model, as demonstrated by the literature, weight loss is linked to these socio-economic indicators. The impact of these factors on GDP validates the findings of the System Dynamics model.

Table: Model Results

	BMI	GDP	Ratio	Comment
System Dynamics Model	-5.6%	+1.5%	-0.25	The system dynamics outputs a modest variation in GDP when BMI decreases significantly at the population level (2030 values)
Fixed Effect regression	+1.00%	-0.53%	-0.53	The Fixed Effect regression signals a strong relation between BMI and GDP, and is statistically significant

Both analyses indicate the same relationship between GDP and BMI, where an increase in BMI negatively correlates with GDP. This alignment in the direction of the relationship supports the validity of the System Dynamics model.

The difference in the magnitude of the relationship can be explained by the limited number of variables included in the fixed-effects analysis, which can exaggerate the strength of the correlation. However, the key finding remains the statistical significance of the relationship, as establishing this significance is the primary goal of the analysis.

Table : Fixed effects regression results

PanelOLS Estimation Summary

Dep. Variable:	log_GDP	R-squared:	0.8833
Estimator:	PanelOLS	R-squared (Between):	0.4062
No. Observations:	374	R-squared (Within):	0.8833
Date:	Tue, Jan 21 2025	R-squared (Overall):	0.4106
Time:	16:50:42	Log-likelihood	519.32
Cov. Estimator:	Unadjusted		
		F-statistic:	384.87
Entities:	11	P-value	0.0000
Avg Obs:	34.000	Distribution:	F(7,356)
Min Obs:	34.000		
Max Obs:	34.000	F-statistic (robust):	384.87
		P-value	0.0000
Time periods:	17	Distribution:	F(7,356)
Avg Obs:	22.000		
Min Obs:	22.000		
Max Obs:	22.000		

Parameter Estimates

	Parameter	Std. Err.	T-stat	P-value	Lower CI	Upper CI
log_BMI	-0.5315	0.2405	-2.2099	0.0277	-1.0046	-0.0585
Gender_encoded	0.0907	0.0199	4.5592	0.0000	0.0516	0.1298
log_Pop	0.0922	0.0173	5.3164	0.0000	0.0581	0.1263
Unemployment rate	-0.0027	0.0035	-0.7799	0.4359	-0.0097	0.0042
log_HC	0.3288	0.0179	18.329	0.0000	0.2935	0.3641
log_PFP	-0.2344	0.0476	-4.9193	0.0000	-0.3281	-0.1407
Life expectancy	0.0286	0.0044	6.5249	0.0000	0.0200	0.0373
const	22.481	0.7480	30.054	0.0000	21.010	23.952

F-test for Poolability: 884.38
P-value: 0.0000
Distribution: F(10,356)

Limitations

While this report presents evidence-based analysis and forward-looking projections on the potential impact of obesity reduction in the KSA, some limitations should be acknowledged:

1. **Data Availability and Gaps:** Although the analysis draws from the best available national and international sources, there are gaps in localized, disaggregated data—particularly around behavioural, socioeconomic, and regional variations in obesity prevalence and treatment access within KSA.
2. **Intervention Efficacy in Local Context:** While the report references the success of interventions such as GLP-1 medications in countries like the US, the long-term efficacy, scalability, and adherence rates in the KSA context may differ due to cultural, regulatory, and healthcare system differences.
3. **Excluded Variables:** Some aspects that may influence obesity trends—such as mental health conditions, urban planning and walkability, or food system dynamics—have not been fully explored within the scope of this report due to time and data constraints.
4. **Evolving Landscape for Obesity Management:** The field of obesity research and intervention is rapidly evolving. New therapies, preventive strategies, and policy developments may emerge that could either reinforce or reshape the findings presented here.

Disclaimer

This report has been developed for informational and analytical purposes only in an attempt to understand the socio-economic benefits of reducing obesity in the KSA. The content herein reflects independent research and modelling conducted by Whiteshield, without influence from any external parties. All policy references, intervention outcomes, and projections are based on publicly available data and expert literature. Final interpretation, local relevance, and implementation decisions remain at the discretion of relevant stakeholders and authorities.

References

1 Beyond Weight Loss: Added Benefits Could Guide the Choice of Anti-Obesity Medications - PubMed. https://pubmed.ncbi.nlm.nih.gov/37209215/

2 Obesity and overweight. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight.

3 Saudi Arabia. World Obesity Federation Global Obesity Observatory https://data.worldobesity.org/country/united-arab-emirates-225/.

4 Obesity and overweight. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight.

5 Ng, M. et al. Global, regional, and national prevalence of adult overweight and obesity, 1990–2021, with forecasts to 2050: a forecasting study for the Global Burden of Disease Study 2021. The Lancet 405, 813–838 (2025).

6 GBD 2021 Obesity Collaborators. (2025). Global, regional, and national prevalence of adult overweight and obesity, 1990–2021, with forecasts to 2050: A systematic analysis for the Global Burden of Disease Study 2021. The Lancet

7 Grover, S. A. et al. Years of life lost and healthy life-years lost from diabetes and cardiovascular disease in overweight and obese people: a modelling study. Lancet Diabetes Endocrinol. 3, 114–122 (2015).

8 Obesity, diabetes, and the moving targets of healthy-years estimation - The Lancet Diabetes & Endocrinology. https://www.thelancet.com/journals/landia/article/PIIS2213-8587(14)70242-6/abstract.

9 Sarwer, D. B. & Polonsky, H. M. The Psychosocial Burden of Obesity. Endocrinol. Metab. Clin. North Am. 45, 677–688 (2016).

10 Tirthani, E., Said, M. S. & Rehman, A. Genetics and Obesity. in StatPearls (StatPearls Publishing, Treasure Island (FL), 2025).

11 Weight Reduction with GLP-1 Agonists and Paths for Discontinuation While Maintaining Weight Loss. https://www.mdpi.com/2218-273X/15/3/408.

12 Beyond Weight Loss: Added Benefits Could Guide the Choice of Anti-Obesity Medications - PubMed. https://pubmed.ncbi.nlm.nih.gov/37209215/

13 Bilger, M., Finkelstein, E. A., Kruger, E., Tate, D. F. & Linnan, L. A. The Effect of Weight Loss on Health, Productivity and Medical Expenditures among Overweight Employees. Med. Care 51, 471–477 (2013).

14 Diaz-Serrano, L. & Stoyanova, A. P. The relationship between overweight and education revisited: a test of the selection hypothesis based on adolescents' educational aspirations. Public Health 225, 237–243 (2023).

15 Thorpe, K. E. & Joski, P. J. Estimated Reduction in Health Care Spending Associated With Weight Loss in Adults. JAMA Netw. Open 7, e2449200 (2024).

16 Ishida, M. et al. The association between obesity, health service use, and work productivity in Australia: a cross-sectional quantile regression analysis. Sci. Rep. 13, 6696 (2023).

17 Yong, W., Wang, J., Leng, Y., Li, L. & Wang, H. Role of Obesity in Female Reproduction. Int. J. Med. Sci. 20, 366–375 (2023).

18 Vasilopoulos, F. & Ellefson, M. R. Investigation of the associations between physical activity, self-regulation and educational outcomes in childhood. PLOS ONE 16, e0250984 (2021).

19 CDC. Unfit to Serve. Centers for Disease Control and Prevention https://www.cdc.gov/physicalactivity/resources/unfit-to-serve/index.html (2023)

20 Obesity and overweight. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

21 Global obesity trends in adults | Obesity Evidence Hub. https://www.obesityevidencehub.org.au/collections/trends/adults-global.

22 Journal of Occupational and Environmental Medicine. https://journals.lww.com/joem/fulltext/2018/01000/obesity_in_the_workplace__impact,_outcomes,_and.15.aspx

23 Ranking (% obesity by country). World Obesity Federation Global Obesity Observatory https://data.worldobesity.org/rankings/.

24 Obesity Data and Statistics | Obesity | CDC. https://www.cdc.gov/obesity/data-and-statistics/index.html.

25 Romieu, I. et al. Energy balance and obesity: what are the main drivers? Cancer Causes Control 28, 247–258 (2017).

26 Hebbar, P. et al. A Perception on Genome-Wide Genetic Analysis of Metabolic Traits in Arab Populations. Front. Endocrinol. 10, 8 (2019)

27 Abdelhay, O., Altamimi, M., Abdelhay, Q., Manajrah, M., Tourkmani, A. M., Altamimi, M., & Altamimi, T. (2025). Perceived barriers to physical activity and their predictors among adults in the Central Region in Saudi Arabia: Gender differences and cultural aspects

28 Althumiri NA, Basyouni MH, AlMousa N, et al. Obesity in Saudi Arabia in 2020: prevalence, distribution, and its current association with various health conditions

29 Salem, V., AlHusseini, N., Abdul Razack, H. I., Naoum, A., Sims, O. T., & Alqahtani, S. A. (2022). Prevalence, risk factors, and interventions for obesity in Saudi Arabia: A systematic review. Obesity Reviews, 23(7), e13448

30 Salem, V., AlHusseini, N., Abdul Razack, H. I., Naoum, A., Sims, O. T., & Alqahtani, S. A. (2022). Prevalence, risk factors, and interventions for obesity in Saudi Arabia: A systematic review. Obesity Reviews, 23(7), e13448

31 Economic impact of overweight and obesity to surpass $4 trillion by 2035 | World Obesity Federation. https://www.worldobesity.org/news/economic-impact-of-overweight-and-obesity-to-surpass-4-trillion-by-2035.

32 Whiteshield System Dynamics Model

33 Economic impact of overweight and obesity set to reach 3.3% of global GDP by 2060 | World Obesity Federation. https://www.worldobesity.org/news/economic-cost-of-overweight-and-obesity-set-to-reach-3.3-of-global-gdp-by-2060.

34 Dettoni, R., Bahamondes, C., Yevenes, C., Cespedes, C. & Espinosa, J. The effect of obesity on chronic diseases in USA: a flexible copula approach. Sci. Rep. 13, 1831 (2023).

35 Hallak, R., Onur, I. & Lee, C. Consumer demand for healthy beverages in the hospitality industry: Examining willingness to pay a premium, and barriers to purchase. PLoS ONE 17, e0267726 (2022).

36 Obesity and its impact on female reproductive health: unraveling the connections - PMC. https://pmc.ncbi.nlm.nih.gov/articles/PMC10803652/.

37 Nagi, M. A., Almalki, et al ClinicoEconomics and Outcomes Research, 17, 233–246. https://doi.org/10.2147/CEOR.S504462

38 Goel, Ramen, et al. "Complications after Bariatric Surgery: A Multicentric Study of 11,568 Patients from Indian Bariatric Surgery Outcomes Reporting Group." Journal of Minimal Access Surgery, vol. 17, no. 2, 2021, pp. 213–220. https://doi.org/10.4103/jmas.JMAS_12_20.

39 Goel, Ramen, et al. "Complications after Bariatric Surgery: A Multicentric Study of 11,568 Patients from Indian Bariatric Surgery Outcomes Reporting Group." Journal of Minimal Access Surgery, vol. 17, no. 2, 2021, pp. 213–220. https://doi.org/10.4103/jmas.JMAS_12_20.

40 Nagi, Mouaddh Abdulmalik, et al. "The Burden of Obesity in Saudi Arabia: A Real-World Cost-of-Illness Study." ClinicoEconomics and Outcomes Research, vol. 17, 2025, pp. 233–246. https://doi.org/10.2147/CEOR.S504462

41 Ministry of Health, KSA

42 GLP−1 receptor agonists for the treatment of obesity: Role as a promising approach - PMC. https://pmc.ncbi.nlm.nih.gov/articles/PMC9945324/.

43 Schreiber, M. Weight-loss drugs could be key reason why US obesity rates falling, experts say. The Guardian (2024).

44 Oster, G., Thompson, D., Edelsberg, J., Bird, A. P. & Colditz, G. A. Lifetime health and economic benefits of weight loss among obese persons. Am. J. Public Health 89, 1536–1542 (1999).

45 Prevalence of obesity among adults, BMI >= 30 (age-standardized estimate) (%). https://www.who.int/data/gho/data/indicators/indicator-details/GHO/prevalence-of-obesity-among-adults-bmi-=-30-(age-standardized-estimate)-(-)

46 Global Wellness Market is Now Three Times Larger than Worldwide Pharmaceutical Industry. Global Wellness Institute https://globalwellnessinstitute.org/press-room/press-releases/global-wellness-institute-study-34-trillion-global-wellness-market-is-now-three-times-larger-than-worldwide-pharmaceutical-industry/.

47 Kloock, S., Ziegler, C. G. & Dischinger, U. Obesity and its comorbidities, current treatment options and future perspectives: Challenging bariatric surgery? Pharmacol. Ther. 251, 108549 (2023).

48 Shumnalieva, R., Kotov, G. & Monov, S. Obesity-Related Knee Osteoarthritis—Current Concepts. Life 13, 1650 (2023).

49 Fontaine, K. R., Redden, D. T., Wang, C., Westfall, A. O. & Allison, D. B. Years of Life Lost Due to Obesity. JAMA 289, 187–193 (2003).

50 Sarwer, D. B. & Polonsky, H. M. The Psychosocial Burden of Obesity. Endocrinol. Metab. Clin. North Am. 45, 677–688 (2016)

51 Kolotkin, R. L., Meter, K. & Williams, G. R. Quality of life and obesity. Obes. Rev. Off. J. Int. Assoc. Study Obes. 2, 219–229 (2001)

52 Kolotkin, R. L., Meter, K. & Williams, G. R. Quality of life and obesity. Obes. Rev. Off. J. Int. Assoc. Study Obes. 2, 219–229 (2001)

53 Sheehan, P., Rasmussen, B. & Sweeny, K. The Impact of Health on Worker Attendance and Productivity in the APEC Region : final report. ABAC/LSIF Study. VU Research Repository | Victoria University | Melbourne Australia http://vises.org.au/documents/2014_VISES_Impact_of_Health_on_Productivity.pdf (2014).

54 Health, absence, disability, and presenteeism cost estimates of certain physical and mental health conditions affecting U.S. employers - PubMed. https://pubmed.ncbi.nlm.nih.gov/15076658/.

55 BMI and Labor Market Participation: A Cohort Study of Transitions Between Work, Unemployment, and Sickness Absence - PubMed. https://pubmed.ncbi.nlm.nih.gov/31544342/

56 Goettler, A., Grosse, A. & Sonntag, D. Productivity loss due to overweight and obesity: a systematic review of indirect costs. BMJ Open 7, e014632 (2017).

57 UK to offer weight-loss jabs to unemployed with weight issues in economy boost | Euronews. https://www.euronews.com/business/2024/10/15/uk-unveils-new-productivity-plan-fat-busting-jabs-for-jobless-obese

58 Kingdom of Saudi Arabia: 2024 Article IV Consultation-Press Release; and Staff Report

59 World Obesity Federation and RTI International. The Economic Impact of Overweight & Obesity in 2020 and 2060: 2nd Edition with Estimates for 161 Countries

60 Wetzel, C. Council Post: What Will The Growing Adoption Of Weight Loss Drugs Mean For Customer Behavior? Forbes https://www.forbes.com/councils/forbestechcouncil/2024/07/29/what-will-the-growing-adoption-of-weight-loss-drugs-mean-for-customer-behavior/.

61 Obesity Drugs' Ripple Effects. Morgan Stanley https://www.morganstanley.com/ideas/obesity-drugs-market-expanded-opportunity.

62 Corporate America weighs business impact of new weight-loss drugs | Reuters

63 The Impact of Obesity on Reproductive Health and Pregnancy Outcomes - PMC. https://pmc.ncbi.nlm.nih.gov/articles/PMC10726091/.

64 Lee, H., Ahn, R., Kim, T. H. & Han, E. Impact of Obesity on Employment and Wages among Young Adults: Observational Study with Panel Data. Int. J. Environ. Res. Public. Health 16, 139 (2019)

65 Full Text of Saudi Arabia's Vision 2030." Eye of Riyadh, 26 Apr. 2016

66 Itriyeva, K. The effects of obesity on the menstrual cycle. Curr. Probl. Pediatr. Adolesc. Health Care 52, 101241 (2022).

67 Sarwer, D. B. & Polonsky, H. M. The Psychosocial Burden of Obesity. Endocrinol. Metab. Clin. North Am. 45, 677–688 (2016)

68 The bidirectional relationship of obesity and labor market status - Findings from a German prospective panel study | International Journal of Obesity. https://www.nature.com/articles/s41366-022-01105-3.

69 Fowler-Brown, A. G., Ngo, L. H., Phillips, R. S. & Wee, C. C. Adolescent Obesity and Future College Degree Attainment. Obes. Silver Spring Md 18, 1235–1241 (2010)

70 Obesity and inflammation: the linking mechanism and the complications - PMC. https://pmc.ncbi.nlm.nih.gov/articles/PMC5507106/.

71 Lanza, H. I. & Huang, D. Y. C. Is obesity associated with school dropout? Key developmental and ethnic differences. J. Sch. Health 85, 663–670 (2015)

72 Lasikiewicz, N., Myrissa, K., Hoyland, A. & Lawton, C. L. Psychological benefits of weight loss following behavioural and/or dietary weight loss interventions. A systematic research review. Appetite 72, 123–137 (2014)

73 Tan, S., Chen, W., Kong, G., Wei, L. & Xie, Y. Peripheral inflammation and neurocognitive impairment: correlations, underlying mechanisms, and therapeutic implications. Front. Aging Neurosci.

74 CDC. Unfit to Serve. Physical Activity https://www.cdc.gov/physical-activity/php/military-readiness/unfit-to-serve.html (2024)

United Arab Emirates

Dubai
27, ICD Brookfield Place
Trade Centre
DIFC - Dubai

Abu Dhabi
Al Bateen Tower, C6
Bainunah, C103,
Street 34
Abu Dhabi

Kingdom of Saudi Arabia

Riyadh
Rubeen Plaza, Alsafarat
1364, Riyadh Province
Riyadh

WHITESHIELD

Website:
www.whiteshield.ai

Further contact details:

Tom Flynn – Partner
Alexander Crean – Decision Support Lead