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Estimated minimum prices and lowest available national prices for antiobesity medications: Improving affordability and access to treatment

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Abstract

Objective: Novel antiobesity treatments are highly effective in recent clinical trials. Access to these medications is needed to supplement lifestyle and surgical interventions for millions living with obesity worldwide, but high prices are limiting. This study aimed to review current treatment costs and calculate potential estimated minimum prices (EMPs).

Methods: The authors searched national drug price databases across various countries for orlistat, naltrexone-bupropion, topiramate-phentermine, liraglutide, semaglutide, and tirzepatide. EMPs for antiobesity medications were calculated using established methodology, using active pharmaceutical ingredients (API) from the Panjiva database. EMPs were calculated per 30-day course and include costs of active pharmaceutical ingredients, excipients, formulation, taxation, and 10% profit margin.

Results: National prices of antiobesity medications were significantly higher than calculated EMPs. Semaglutide 30-day course prices ranged from $804 (United States) to $95 (Turkey) while the EMP was $40. Liraglutide prices ranged from $1418 (United States) to $252 (Norway) while the EMP was $50. Some oral treatments could be generically manufactured at very low costs per course ($7 for orlistat; $5 for phentermine/topiramate combination tablets), while naltrexone/bupropion was more expensive ($54).

Conclusions: This study shows that certain weight loss treatments can be manufactured and sold profitably at low costs, but prices currently range widely between countries, limiting access for those in need.

INTRODUCTION

Obesity rates have tripled over the past 50 years, with various proposed reasons including globalization, increasingly Westernized diets, and less active lifestyles [1]. The obesity pandemic affects both wealthy and poor populations across high-, middle-, and low-income countries [1, 2]. More than one in three people are now living with obesity in many countries, including South Africa, the United States, Mexico, and Saudi Arabia [1]. Clinical obesity, defined as body mass index (BMI) > 30 kg/m^2, increases the risks of cardiovascular disease, hypertension, chronic renal disease, strokes, type 2 diabetes (T2DM), liver disease, obstructive sleep apnea, cancers, adverse birth outcomes, poor mental health, and significantly higher mortality from COVID-19 [1, 3, 4]. The Global Burden of Disease study identified

that living with a high BMI (>25) contributed to 4.7 million deaths worldwide in 2017, which is more than the annual number of deaths caused by HIV, malaria, tuberculosis, and viral hepatitis combined [5].

In response to this, the World Health Organization (WHO) created a global action plan in 2016, aiming to halt increasing obesity rates by 2025 [6]. Although it emphasizes the importance of healthy eating and encourages national policies to restrict marketing of unhealthy foods, the plan does not address the need for improved access to antiobesity medications (AOMs), nor does it highlight the current global gap in access to these medications. Currently, all countries are significantly off track to meet the 2025 targets [7].

For people living with obesity, losing 5% to 10% of body weight can lead to a substantial reduction in risk factors for diabetes, cardiovascular disease, and stroke [8]. Unfortunately, evidence has shown that lifestyle interventions alone, such as dietary and exercise incentives, advice, and organized programs, are often insufficient to maintain significant weight loss in the medium to long term for most people or to arrest progressive weight gain [3, 9]. Furthermore, bariatric surgery has limited availability, even in high-income countries, alongside greater cost and significant risks of complications [3, 8].

The increasing recognition that exercise and dietary change alone are unlikely to result in sustained weight loss has led to renewed interest in medication to supplement lifestyle changes. Randomized controlled trials (RCTs) have demonstrated remarkable results with oral and injectable medications, in some cases beginning to rival results seen with bariatric surgery [3, 10, 11]. However, these medications remain prohibitively expensive in most countries; for example, tirzepatide (recently approved for T2DM treatment), which has demonstrated more than 20% of body weight loss after 72 weeks in people living with obesity without T2DM [11], is likely to be priced at around $1000 per month in the United States. This will make it inaccessible to millions of people who could potentially benefit. It is well established that high prices are barriers to access to medications, particularly for AOMs [12]. Furthermore, liraglutide prices are more than 50% higher in the United States when prescribed for the indication of antiobesity treatment compared with when prescribed for its antidiabetic effects, adding to stigma around obesity and demonstrating pricing injustice [13].

With the obesity pandemic growing rapidly worldwide, and recent data from clinical trials showing that new AOMs are highly effective, we urgently need to improve access to these medications for people living with obesity. Our study objective was to review current treatment costs across a range of different representative countries around the world and subsequently calculate the potential estimated minimum prices (EMPs) of various AOMs.

Study Importance

What is already known?

- The obesity pandemic is growing worldwide, in both rich and poorer countries, with the Global Burden of Disease study showing that high BMI (>25 kg/m^2) contributed to 4.7 million deaths worldwide in 2017. This is more than the total annual deaths from HIV, malaria, tuberculosis, and viral hepatitis combined.
- However, recent data from clinical trials show new antiobesity medications (AOMs) are highly effective, but prices are high, limiting access for those in need.

What does this study add?

- AOMs range in price significantly between countries.
- Many treatments could be manufactured and sold profitably for a low price, with estimated minimum prices up to 20-fold cheaper than some countries' current prices, potentially improving access for millions of people worldwide.

How might these results change the direction of research or the focus of clinical practice?

- Our results offer hope to people living with obesity, demonstrating that affordable prices are possible for highly effective AOMs.
- Governments and the World Health Organization are updating their approach to obesity and improving access to AOMs is key to a successful response, alongside public health-based policies toward high-sugar diets, as well as lifestyle advice and surgery.
- This research can be used to build on addressing the gap in access to AOMs for people around the world living with obesity.

METHODS

We estimated the costs of production for several commonly used, effective, and new AOMs. We searched for and collected active pharmaceutical ingredient (API) export data and national list prices for the following oral (PO) and subcutaneous (S/C) US Food and Drug Administration (FDA) approved medications: orlistat (PO), naltrexone/bupropion (PO), topiramate/phentermine (PO), liraglutide (S/C), and semaglutide (S/C). We also searched for data on oral semaglutide, which has demonstrated good weight loss effects in clinical trials and which is sometimes used off-label for treatment of obesity in the absence of diabetes, and the new subcutaneous medication tirzepatide, which is FDA approved for use in T2DM but is currently not yet approved for use in obesity alone. We did not include lorcaserin (PO) because of its withdrawal following safety concerns. We selected these medications as they are proven to be effective and because they illustrate a range of different monotherapies, combination tablets, and injectable treatments.

For all treatments analyzed we calculated EMPs of 30-day courses at recommended dosages. For calculating course prices, we used the WHO's Defined Daily Dose [14] where available or used the most effective adult maintenance doses that most patients would be taking.

Orlistat EMP was calculated for 120 mg three times per day. Topiramate/phentermine EMP was calculated for 92 mg/15 mg once per day (OD). Because of a lack of national list price data on topiramate/phentermine combination tablets, we also calculated course prices based on available data for each individual drug. EMP for naltrexone/bupropion was calculated for 8 mg/90 mg four times per day; only prices of combination naltrexone/bupropion tablets were researched, as there were sufficient national list price data for comparison. EMP for semaglutide was calculated for 14 mg OD (PO) and for 2.4 mg (S/C) once per week (rounded to 10.25 mg per 30 days), and liraglutide EMP was calculated for 3 mg OD (S/C). Prices were also searched for tizepatide (S/C) at a single 15 mg dose per week.

A range of high-, middle-, and low-income countries with publicly available drug price data was selected to illustrate price variations across different economic and geographical parts of the world. We searched for list prices of these medications in 16 countries: Australia, Bangladesh, China, France, Germany, India, Kenya, Morocco, Norway, Peru, Pakistan, South Africa, Turkey, the United Kingdom (UK), the United States, and Vietnam, with sources listed in Supporting Information Table S1. For the United States, which often represents the higher price points globally, we searched for both private pharmacy prices and for public insurance-covered prices (the US Veterans Health Administration). In each country we assessed multiple online national price databases and selected the lowest available price from each of the sources. All prices were converted into US dollars based on the average 2021 national exchange rates from the World Bank online database.

The minimum price estimates were calculated from export data using an established and published methodology based on costs of API [15, 16] extracted from Panjiva, a global shipping records database [17]. Shipments with a price per kilogram <15% or >85% of the average were excluded to reduce the effect of outliers. For oral treatments, we excluded shipments <1 kg to remove price data not intended for large-scale production. However, in order to have enough data for calculating weighted average API costs for subcutaneously injectable drugs, we only excluded shipments <1 g.

All EMPs for oral medications include the losses that occur during tablet formulation (5%), the cost of formulation ($0.01 per tablet), the cost of excipients (which has been shown to average $2.63 per kilogram of finished pharmaceutical product [18]), and an average Indian taxation on profit of 27%, as well as allowing for an overall 10% margin for profit. An example of this methodology is shown in Figure 1 for the oral tablet orlistat.

The injectable medications (semaglutide, liraglutide, and tirzepatide) are administered as a liquid for subcutaneous injection with prefilled disposable injection devices, often called "pens," consisting of prefilled syringes, needles, and packaging. In order to estimate the lowest price for these pens, we looked at prices of devices for commonly used generic medications such as low-molecular-weight heparin and insulin in a range of countries. The cheapest pens were available for as little as $0.81 in India and $1.60 in Australia and as high as $2.29 in the United States and $5.27 in the UK (Supporting Information Figure S1). We therefore chose a conservative estimate of $2 per pen to include in our model, which also accounts for the cost of needles, as these are available for $0.20 per 100 needles [19]. The flowchart in Figure 1 shows the methodology used for calculating EMP of liraglutide (S/C), which includes the added estimated cost of pen devices. Manufacture of injectable medications is assumed to have higher losses of API and excipients at formulation, which is also factored into these calculations.

We also demonstrate how we calculated EMPs of combination tablets of phentermine/topiramate (Figure 1C), individual tablets for topiramate (Figure 1D) and phentermine (Figure 1E), and combination tablets of naltrexone/bupropion (Figure 1F). All data were quality checked by two researchers (JL and JW) between July 2021 and August 2022.

RESULTS

Our main summary results of maximum and minimum national list prices and EMPs calculated from API data, along with results from the key RCTs, are shown in Table 1. Some, but not all, oral treatments can be generically manufactured at very low costs per 30-day courses, whereas injectable medications are more costly. Prices were found to range significantly between countries.

Oral medications

Orlistat (PO)

Orlistat is a lipase inhibitor, which leads to reduced fat absorption. RCTs have shown a weight reduction of −8.8% for those taking orlistat 120 mg three times per day compared with −5.7% for placebo after a 52-week course. Prices for a 30-day course of treatment with orlistat (Figure 2A) were >$100 in the United States and <$1 in Vietnam, whereas the EMP calculated from export API data was around $7 per 30-day course.

Phentermine/topiramate (PO)

Phentermine is a norepinephrine-releasing agent and topiramate is a γ-aminobutyric acid (GABA) receptor modulator; in combination, they work synergistically to reduce appetite. RCTs have shown a −9.8% weight reduction for those taking maximum dose (15 mg/92 mg) phentermine/topiramate combination tablets compared with −1.2% for those on placebo after a 56-week course. Phentermine/topiramate is not licensed for use for weight loss in several countries because of safety concerns, and, of the 16 countries searched, price data were available only in the United States, where it ranged from $120 to $199 per course, in comparison with

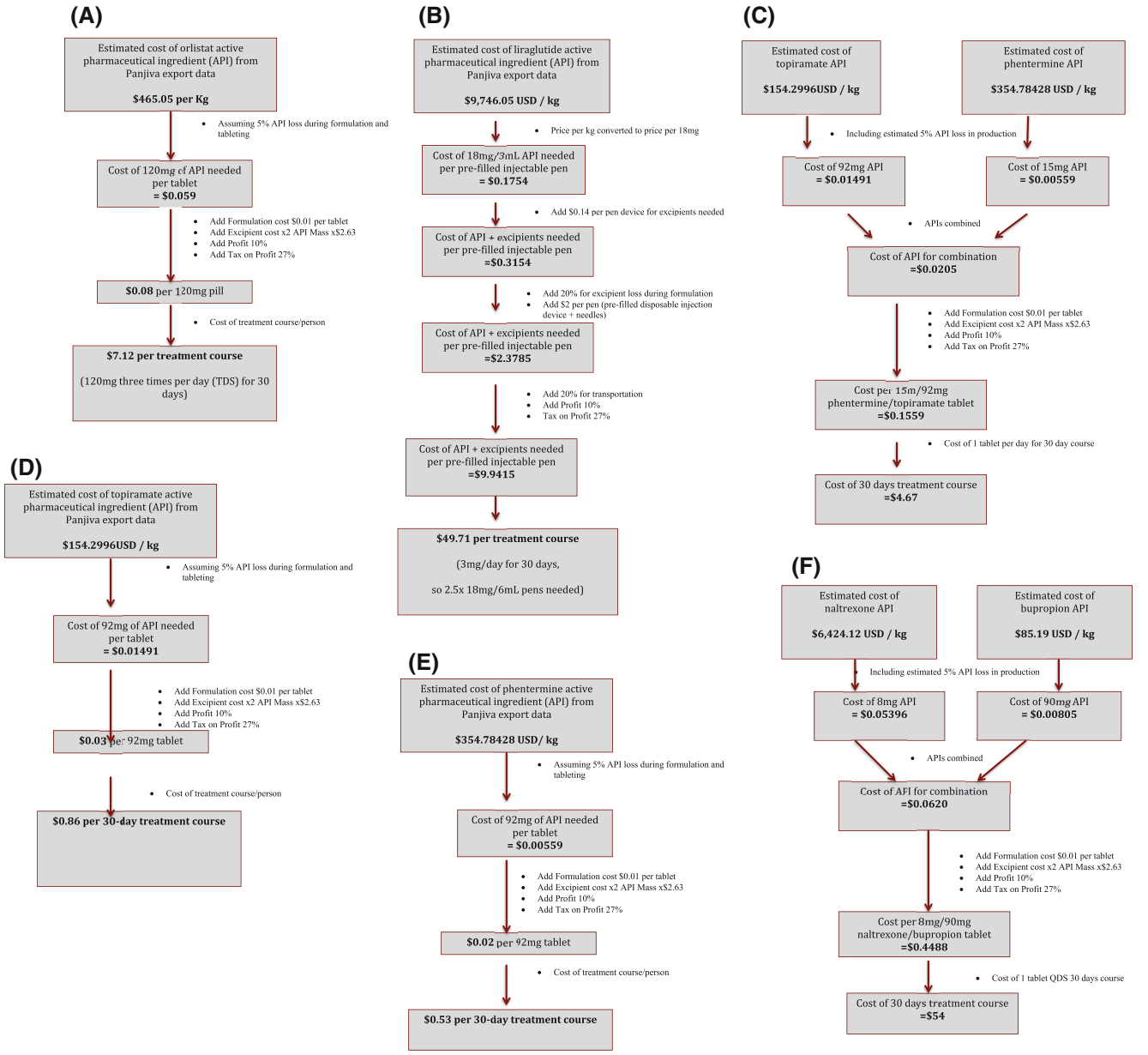

FIGURE 1 Flowcharts showing estimated minimum price calculation for (A) orlistat (PO), (B) liraglutide (S/C), (C) phentermine/topiramate (PO), (D) topiramate (PO), (E) phentermine (PO), and (F) naltrexone/bupropion (PO). PO, oral; S/C, subcutaneous

the EMP of the combination tablets ($5) in Figure 2B. Therefore, we also searched for individual national prices of topiramate and phentermine separately and combined the available data together (from the United States, South Africa, and Kenya), which are also shown in Figure 2B. EMPs for each drug individually were $0.86 for topiramate and $0.53 for phentermine (total of $1.39 per course) based on API export data.

Naltrexone/bupropion (PO)

Naltrexone is an opioid antagonist and bupropion is a dopamine and norepinephrine reuptake inhibitor, and they work together on nervous system pathways to reduce appetite. RCTs have shown a −6.4% weight reduction for naltrexone/bupropion combination tablets (8 mg/90 mg) four times per day compared with −1.9% for placebo after a 56-week course. Figure 2C shows the prices available for naltrexone/bupropion combination tablets, ranging from $326 in the United States to $56 in South Africa, compared with an EMP of $55 per 30-day course. As there were sufficient national price data on naltrexone/bupropion combination tablets, we did not analyze separate tablet prices.

Semaglutide (PO)

Semaglutide is a longer acting glucagon-like peptide-1 (GLP-1) receptor agonist, reducing appetite and slowing digestion in the stomach. RCTs in patients with obesity and T2DM have shown a −5.3% weight

TABLE 1 Comparison of antiobesity medications showing treatment effect from RCTs, highest and lowest available national prices, and estimated minimum price per course

Drug (route) [course duration]	Average weight loss on treatment vs. placebo, % (kg) [study duration]	Highest national price	Lowest national price	Estimated minimum price
Oral treatments				
Orlistat (PO) [120 mg TDS for 30 days]	Treatment −8.8% (−8.7 kg) vs. placebo −5.7% (−5.8 kg) [after 52 weeks] [20]	$100 (US VETS)	$1 (Vietnam)	$7
Naltrexone-bupropion (PO) [8 mg/90 mg QDS for 30 days]	Treatment −6.4% (−6.2 kg) vs. placebo −1.9% (−1.3 kg) [after 56 weeks] [21]	$326 (US PHARM)	$56 (South Africa)	$54
Topiramate-phentermine (PO) [92/15 mg/d for 30 days]	Treatment −9.8% (−10.2 kg) vs. placebo −1.2% (−1.4 kg) [after 56 weeks] [22]	$199 (US PHARM)	$1.3 (Kenya)	$1.4–$5
Semaglutide (PO) [14 mg/d for 30 days]	Treatment −5.3% (−5.0 kg) vs. placebo −1.3% (−1.2 kg) [after 20 mg OD for 26 weeks, in patients with T2DM] [23]	$578 (US VETS)	$65 (India)	NA
Subcutaneous treatments				
Semaglutide (S/C) [2.4 mg/wk, price calculated for 10.25 mg per 30 days]	Treatment −14.9% (−15.3 kg) vs. placebo −2.4% (−2.6 kg) [after 68 weeks] [10, 24],	$804 (US PHARM)	$95 (Turkey)	$40
Liraglutide (S/C) [3 mg OD for 30 days]	Treatment −8.0% (−8.4 kg) vs. placebo −2.8% (−2.8 kg) [after 3 mg OD for 56 weeks] [25]	$1418 (US PHARM)	$252 (Norway)	$50
Tirzepatide (S/C) [15 mg once weekly, price calculated for 12.67 mg per 30 days]	Treatment −20.9% (−21.4 kg) vs. placebo −3.1% (−3.2 kg) [after 72 weeks] [11]	$1100.70 (US PHARM)	$715.56 (US VETS)	NA

Abbreviations: NA, not available; OD, once per day; PO, orally; QDS, four times per day; RCT, randomized controlled trial; S/C, subcutaneous; TDS, three times per day; T2DM, type 2 diabetes mellitus; US PHARM, US Drug Online Pharmaceutical Drug Price Database; US VETS, US Department of Veterans Affairs Medical Insurance Drug Price Database.

reduction for those taking semaglutide (20 mg) tablets compared with −1.3% for those on placebo after a 26-week course. National list prices for oral semaglutide (Figure 2D) ranged from $578 (United States) to $65 (India) per 30-day treatment course. We were not able to calculate an EMP for oral semaglutide as all API shipment data available were for injectable semaglutide.

Injectable medications

Liraglutide (S/C)

Liraglutide is a shorter acting GLP-1 receptor agonist. Studies have shown a −8.0% weight loss for 3 mg liraglutide injections compared with −2.6% for placebo after 56 weeks. Figure 2E shows injectable antidiabetic and weight loss agent liraglutide costing $1418 in the United States and $252 in Norway, whereas our EMP per 30-day course was $50. This price is calculated assuming that the most efficient concentration and dosage of available pens for injection are used.

Semaglutide (S/C)

RCTs for subcutaneous weekly semaglutide have shown a −14.9% weight reduction compared with −2.4% for placebo after 56 weeks. The EMP of subcutaneous semaglutide was calculated to be about $40 per 30-day course. National price data available for subcutaneous semaglutide (Figure 2F) were all higher than our EMP, ranging from $804 (United States) to $95 (Turkey) per 30-day course.

Tirzepatide (S/C)

Tirzepatide is a new glucose-dependent insulinotropic polypeptide (GIP) analogue with both GLP-1 and GIP receptor agonist function. It has showed −20.9% weight loss after 72 weeks in RCTs, compared with −3.1% for placebo, but it is not yet licensed for treatment of obesity alone. There were insufficient data available in Panjiva for tirzepatide (Figure 2G) to calculate an EMP and national price data were available only in the United States, where tirzepatide was recently licensed for use in T2DM by the FDA and prices per 30-day course ranged from $715.56 to $1100.70.

DISCUSSION

These results demonstrate that national prices of AOMs are much higher than EMPs calculated from costs of production in most countries. However, some AOMs are already available in many countries at a low price and they have low costs to manufacture. We show that many of these drugs could be sold profitably at even lower EMPs, all of which include a 27% tax and 10% profit margin.

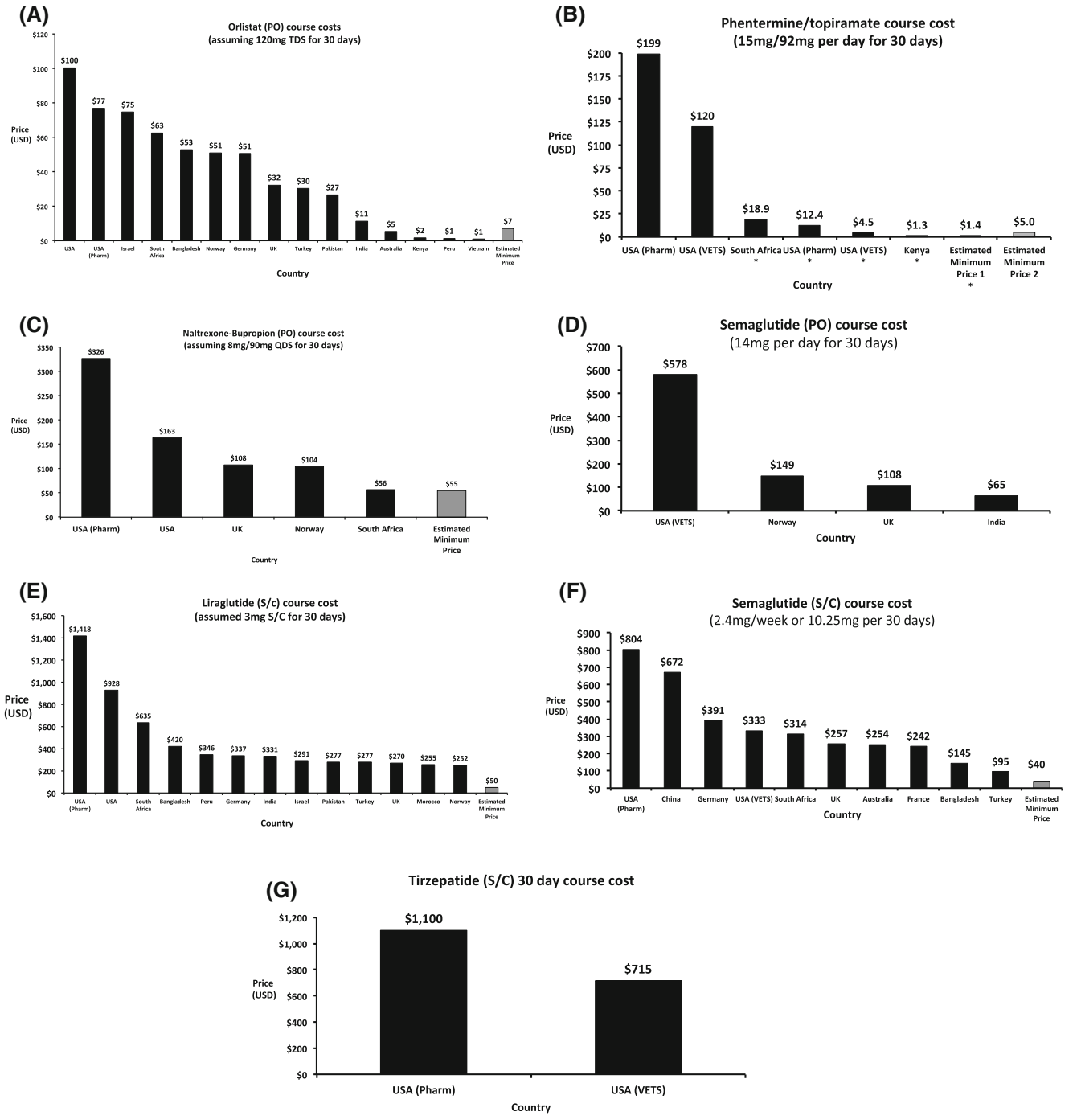

FIGURE 2 (A) Course prices for orlistat (PO). (B) Course prices for phentermine/topiramate (PO). Few prices were available for combination tablets so * (including EMP1) marks prices calculated by adding together price data for courses of individual tablets of topiramate and phentermine. Prices without * (including EMP2) are for combination tablets. (C) Course prices for naltrexone/bupropion (PO). (D) Course prices for semaglutide (PO). (E) Course prices for liraglutide (S/C). (F) Course prices for semaglutide (S/C). (G) Course prices for tirzepatide (S/C). EMP, estimated minimum price; PHARM, US Drug Online Pharmaceutical Drug Price Database; PO, orally; QDS, four times per day; S/C, subcutaneous; TDS, three times per day; VETS, US Department of Veterans Affairs Medical Insurance Drug Price Database

Older, off-patent medications such as orlistat and phentermine/topiramate could be provided for eligible patients for $7 and $1.4 per course respectively. Phentermine/topiramate has shown a placebo subtracted weight loss (PSWL) of up to −8.8 kg [22], whereas orlistat has demonstrated a PSWL of −2.6 kg [20]. There is a lack of national price data available for phentermine/topiramate combinations, as, despite FDA approval in 2012, it was not approved by the European Medicines Agency because of safety concerns [26]. Oral naltrexone/bupropion combination tablets, which have shown a PSWL of about −4.9 kg [21], are significantly more costly, at $54 per course, and are

already available in some countries (South Africa) near this price. We investigated oral semaglutide, despite not yet being approved for use as a weight loss agent in the absence of diabetes, because it is sometimes used off-label for this effect, and Novo Nordisk is planning to conduct further studies for patients who are needle-phobic [27]. Furthermore, we felt its inclusion would be useful for price comparisons with the approved subcutaneous form. In patients with diabetes, oral semaglutide has shown a PSWL of about −3.8 kg after 26 weeks, depending on the dose [23], but further data are needed in those living with obesity, without diabetes.

Regarding the subcutaneous treatments, the EMP for semaglutide was similar to liraglutide, whereas semaglutide has been shown to be more than twice as effective, with a PSWL of −12.7 kg versus −5.6 kg respectively, although this was after a longer treatment course of 68 weeks [10, 24, 25]. No API data were available yet for tirzepatide, the most effective AOM in clinical trials, causing a PSWL of −19.1 kg after 72 weeks [11]. Unfortunately, all of the subcutaneous GLP-1 agonists are currently inaccessibly priced in most countries; therefore their potential global impact is significantly limited.

Of course, cost is not the sole determinant of treatment choice, and each of these medications has benefits and side effects or as yet uncharacterized potential safety concerns that are beyond the remit of this paper. Additionally, some patients will not tolerate regular injections, whereas others may find high daily pill burdens unappealing. Of note, there have been concerns regarding adverse effects associated with some oral AOM combinations, including psychiatric concerns, impaired cognition, paresthesia, insomnia, and concerns about possible teratogenicity, limiting use in women of childbearing age, but further research, as well as a "risk evaluation and mitigation" strategy and individual patient-choice led approach, is needed [28, 29]. Combination therapy is often needed alongside lifestyle changes and surgical options in fighting obesity in order to target multiple mechanisms of action, while reducing side effects. Many other drugs are in development, including peptide-YY analogues, incretin coagonists, and other fat-absorption inhibitors [30]. However effective these medications are, they also will not have a global impact unless they are made affordable and accessible.

Limitations

Our methodology for calculating drug EMPs has previously accurately predicted how low medication prices can go when they are produced generically [31]; however, this methodology is based on multiple assumptions. Although many pharmaceutical companies operate at a higher profit margin, the generics market is able to produce on an economy of scale. The average margin for the Indian pharmaceutical market ranged from 8.8% in 1995 to 15.4% in 2005 [15]. We factored in a profit margin of 10% to our calculations, but we know that many pharmaceutical companies prioritize higher profits. With hundreds of millions of people worldwide who could benefit from these treatments, an economy of scale would bring down the cost of these medications while maintaining a fair profit.

Treatment course prices were calculated based on the WHO Defined Daily Dose, but some patients may require reduced or increased dosage or administration frequency based on weight, age, renal or hepatic function, or treatment effect, and this, of course, would impact the course price. Furthermore, we have provided prices per 30-day course, but some treatments may be more or less cost-effective than others over longer time periods.

API export costs and national drug list prices fluctuate regularly depending on demand, availability, and various political and economic factors, so we present these data intended as a snapshot of the market at the time of writing. We also recognize that market and social forces that influence AOM pricing vary between countries; for example, the type of national health care coverage may mean that some patients are forced to pay out-of-pocket, and in some countries pharmacy benefit managers are used to lobby and advocate to improve access to prescriptions. Although the prices presented are the lowest available on national list price databases, publicly unavailable data may exist; for example, governments and nongovernmental organizations that bulk-buy medications may be able to negotiate discounts that aren't made publicly available.

Furthermore, with estimating prices of injectable medications, the cost of devices and concentrations used is important. For example, with liraglutide, although the pen devices alone were estimated to cost $2, for an 18 mg/6 mL concentration device, we estimated each finalized pen to cost $9.94, and therefore, five devices would be needed per 30 days (total $49.71 per course). However, if a lower concentration or volume device were used, such as the 3 mg/1 mL liraglutide pen, this would cost less to manufacture ($4.10 per device) but would require 30 devices per 30 days, costing $123 per course.

We have not factored in the costs for building and maintaining drug-manufacturing facilities, pharmaceutical research and development (R&D), or running a sales team into our calculations. Our EMPs are meant as realistic targets for competitive generic production, rather than patented versions. However, the following factors are important to acknowledge but are too variable to include in our calculation model. It is extremely difficult and controversial to estimate the average costs of R&D, which can span from 3 months to more than 30 years [32]. Although some industry associated and funded studies have claimed it costs $1 billion to $2 billion to bring a drug to market [33], this estimate has been heavily criticized, first because the data were not made publicly available and were from a small handpicked selection of industry respondents chosen for interview and second because they do not include the huge federal tax breaks companies get for R&D. Third, about half of this figure derives from assuming how much profit could have been made if companies had instead invested in an index fund increasing in value 11% annually, compounded over 15 years [32]. Furthermore, almost half of the remaining figure for R&D is actually paid for by public funds (such as universities, the WHO, the Gates Foundation, and NIH), bringing the estimate down to $90 to $300 million [32, 34]. Although the absolute amount spent on R&D globally has increased between 1995 and 2010, the revenues of pharmaceutical companies actually increased six-fold more [32], and most pharmaceutical companies spend

between double and 19-fold more on advertising and marketing than they spend on R&D [32].

Another reason that we have not linked the cost of R&D with EMP calculations for AOMs is that many are now off-patent or were originally developed for diabetes, epilepsy, and other indications. Many of these drugs are effectively now "ever-greened," a tactic that manufacturers use to extend patents (e.g., for insulin in the United States for more than 90 years [35]) beyond their intended monopoly duration to maximize profit, with minimal to no biochemical innovation [35]. For example, semaglutide (Ozempic and Wegovy, the exact same subcutaneous medication) costs threefold as much in Australia, and 50% more in America, if prescribed for obesity rather than diabetes, which is furthermore unjust and stigmatizing to people living with obesity [13]. In fact, *de-linkage* [36] of the prices of medications from the cost of R&D is a policy that, along with voluntary licensing agreements, could improve access to new medications. "Delinking" would incentivize needs-driven and cost-effective R&D and improve equity around the world in terms of access to new medications [36]. Although no voluntary licenses have yet been set up for AOMs, the recent announcement in October 2022 of the first voluntary license for an anticancer medication [37] shows this is possible for noncommunicable disease treatments like AOMs.

Potential global impact

The World Obesity Federation estimates that high BMI is associated with more than 13% of annual global health care expenditure at $990 billion per year [7]. Around 650 million adults are currently living with obesity [2, 6], and although obesity in many patients can be managed with lifestyle changes or bariatric surgery, only a fraction of those who could benefit currently can access effective AOMs. Even in the United States, where more than 40% of adults suffer from obesity, only <2% are on AOMs, and of those, many are undertreated, with reports showing that many receive courses that are too short, specifically because of price constraints [38]. A recent economic analysis published in *Obesity* showed that up to half of Americans could be eligible for AOMs, and a conservative estimate of 15% coverage could generate $1.2 trillion in lifetime societal value, especially for younger individuals from Black and Hispanic backgrounds [38]. In many rapidly developing countries where the obesity rate is rising rapidly, such as South Africa, India, and Mexico, the ratio of people who could benefit from AOMs compared with those who are able to afford them is even more unbalanced.

There are many examples of researchers working together with community stakeholders to improve access to new life-changing medications through price reductions. A fundamental part of this puzzle is showing that these medications can be physically produced and sold profitably for a low price. For example, when combination antiretroviral therapy was found to be safe and effective in the 1990s, millions of people living with HIV needing medication could not afford treatment amid this rapidly growing epidemic. Community organization, generic drug manufacturing, research, and advocacy allowed the massive up-scaling of treatment after assessment of pharmaceutical costs suggested that profitable manufacturing could be achieved while meeting patient need globally [39]. Similarly, when direct-acting antivirals were developed for hepatitis C 10 years ago, courses were $84,000 per person ($1000/pill); however, with cost-based pricing research similar to this, alongside advocacy groups and political will, treatment courses were brought down to <$100 per 12-week treatment course [31, 40]. Nowadays, 90% of HIV-positive people diagnosed are on treatment worldwide and millions of people have been cured of hepatitis C globally [41]. A similar up-scaling of production and a community led approach may be needed to improve access to AOMs in order to bring prices closer toward the cost of production.

The WHO recently added long-acting insulin analogues and sodium/glucose cotransporter 2 (SGLT-2) inhibitors to the Model List of Essential Medicines, alongside short-acting insulin, gliclazide, and metformin for people with diabetes [42], but there are still no AOMs on the list [43]. Governments have found it difficult to successfully implement much-needed policies like sugar taxes to address the environmental drivers promoting diets high in fat, sugar, and salt. The global health and research community continues to combat the intricate web of biological and sociological factors that create inherent human vulnerability toward weight gain [44], but in the meantime millions already living with obesity lack affordable access to treatment.

CONCLUSION

This research shows that many effective AOMs can be manufactured and sold at prices that include a 10% profit margin for almost 20-fold less than they are currently available for in a wide range of countries. Health care systems should prioritize lowering prices and improving access to effective AOMs to help fight the growing obesity pandemic.

FUNDING INFORMATION

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CONFLICT OF INTEREST

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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