Scalable Obesity Solutions (S.O.S.)

James A. Levine

The know-how is available to reverse the obesity epidemic. Reversing obesity is a societal necessity because it is the predominant contributor to chronic ill health in developed countries and a growing precipitant of illness in middle and low-income countries. In the United States, for example, obesity is the chief driver of health care costs in a country that can no longer afford health care. Although some might advocate population-wide medication use to mitigate the effects of obesity on health, the more direct response is to end obesity. The goal of this paper is explain how mass-scalable obesity containment can be designed, built, and disseminated. Scalable Obesity Solutions (S.O.S.) are discussed from concept through deployment.

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Knowledge of the Past

To arrive at a salient solution to the obesity epidemic, it is first necessary to review the temporal context of weight gain.

Primitive humans descended from African forests, lost the advantage of prehensile footing, gained dexterity their hands and arms and left the forests on foot. Because of the availability of expansive land, primitive humans lived in small groups that ranged in size from family units to about 100 individuals. These early alliances congregated to attack other groups or as a means of defense against aggressors. Within these groups family units became well defined and substantial inbreeding occurred. Fossil evidence suggests that territorial boundaries were marked and defended. Early *homo sapiens* evolved to walk many miles each day; at this time *per capita* land allocation approximated 2 square miles which is 15,000 times greater than in modern Tokyo. For the past 2 centuries people have been exposed to diametrically opposite forces to those that molded them; peaceful habitation, nutritional plenitude, and the liberation from manual labor (note that in modern history, war and physical hardship have consistently been associated with thinness). Peaceful plenitude is associated with obesity.

For the first time in its history, people are living on a planet they have conquered. The average American does not live in fear of flight, starvation or back-breaking work. It is far more likely that the average American will drive a car, participate in war only on a website, watch hard labor on television while eating in excess and be chained—only with invisible shackles—to a chair.

Ending obesity has been challenging only because we are facing an invisible enemy the human body was never designed to oppose—effortless plenitude.

Knowledge of the Present

Noting this background, information on the pathogenesis and treatment of obesity can be contextualized. On one hand obesity is simply a state of positive energy balance but on the other, it is a mysterious, multilayered multifaceted multicomponent disease. This paradox warrants closer examination.

Simplicity

Based upon thermodynamic principles, obesity can only manifest when energy expenditure is persistently less than energy consumption. This is equally true for individuals and populations. Overall, obesity is the result of sustained positive energy balance that results from low levels of physical activity and food that is consistently consumed in excessive of needs. Thus, for both individuals and
societies, obesity has resulted from sustained positive energy balance. That noted; were obesity explained by a thermodynamic mathemetic alone, why do 1 to 2 billion have obesity—and why can obesity not be halted? It is clear that a variety of influences—biological, cultural, psychological, and sociocultural—overlay the afore-
mentioned energetic equation. Regardless, the obesity epidemic is underpinned by a thermodynamic law that can be extrapolated from individuals to populations.

Individuals do not gain weight in a linear fashion, but in a series of step-wise increments. Thus, people gain weight through periods of sustained positive energy balance whereby they gain excess body fat, then fail to lose it. Events such as marriage, or childbirth are examples of when a person may gain weight and subsequently not lose it. It may be true that lean people periodically gain excess body weight, but then lose it. Nonetheless, it is sustained positive energy balance that explains, without exception, why a person gains body fat.

Reflecting these observations onto a population is more complex because the overt mediators of positive energy balance, whether they are cheap cars or low food prices, are more difficult to pinpoint. Factors such as changes in smoking rates, the world-wide trend in urbanization and epigenetic factors may, in actuality, be more important than poor access to daily activity and food marketing/composition. Hence, an increase in population body weight over time, in a high-income country, is difficult to dissect. Overall, it is commonly viewed that the combination of increasing obesogenic cues, opportunities to be sedentary combined with inexpensive, readily available processed food along with a variety of other subtle factors has resulted in population weight gain.

Thus, simple physical principles can explain both individual weight gain and how populations’ become obese. However the link between physics and actuality is complex; a variety of obesogenic forces are at play. How these forces interact and codominate to result in obesity, is ill defined.

Complexity

When examined from a mechanistic perspective, the pathogenesis of obesity is remarkably complex—but not mysterious.

When deciphering the mechanisms of individual fat cell accumulation, albeit hyperplasia or hypertrophy, it is necessary to appreciate that concomitant biological forces are simultaneously impacting an energetic system; namely, energy intake, energy expenditure and fuel storage. Weight gain represents the net effect of the dynamic integration of these 3 simultaneously changing biological systems. For obesity to occur, these systems which have genetic and epigenetic modulators are acted upon by environmental factors. As a result energy balance becomes tilted so that energy excesses are conserved and even promoted; over time, obesity results.

Although underpinned by straightforward thermodynamic principals, multiple factors impact the host to result in the obesity phenotype. The term, “Actors” is used to describe the factors that influence the outcomes of complex biological systems. In human obesity, the Actors are manifold and multiplex.

The Actors that impact obesity are societal-wide. For example, these Actors include those who promote work practices whereby people sit in front of computer monitors daylong, noting that labor-tools have evolved from manually sharpened flints to computers. There has been a million years of tool & weapon manufacture which has focused on enabling the human to produce more while burning fewer calories. Russell summarized the modernization of labor practice: “Gandhi, realizing these dangers (of automation), attempted to put the clock back by reviving hand-loom weaving throughout the continent. He was half right, but it is folly to reject the advantages that science gives us.” The Actors that have facilitated low energy-cost labor are not only employers but also computer, automobile, and furniture manufactures, architects, city planners, and clothing and policy makers—to highlight only a few. Modern labor has been designed for financial profit, to enable people to be productive while immobile but at the cost of health.

Just as human movement has been modernized, so too has nutrition. Consider hunting on the Midwestern plains for buffalo. Once the buffalo was caught, it was manually skinned, bled, butchered, and carried home. Contrast this to driving a car to buy a hamburger at half a penny per kcal.

The Actors are those who craft modern society whether they are employers, media personnel, food industrialists, policy makers or car manufacturers. It was not their intent to design an unhealthy society because with capitalism, the principal obligation of these Actors is to their shareholders. Thus, changing the modus operandi of the Actors to benefit health and end obesity will necessitate devising a value-based proposition that is attractive to the shareholders.

Individuals who live in an, ‘obesogenic’ society, have collectively sustained population-wide positive energy balance. The human energy reserves stored in body fat exceed 300 trillion Kcal. On one hand the human energy crisis is simply one of low output combined with excess input but from a different perspective, obesity is a remarkably complex integration of multiple dynamic moving elements.

How can this assimilation of knowledge be linked to an ‘End Obesity Epidemic scenario’?

Solution Bridge: Linking Knowledge to Solution

Were obesity not associated with substantial health, psychological, social, and fiscal cost, there would not be an urgent need to act. Population-wide weight gain would simply reflect the dissolution of the evolutionary pressures to flee and actively feed, protect, and nurture. However, this is not the case. Obesity is of catastrophic
societal importance because it has plunged 11/2 billion people into a quagmire of ill health, low mood, and social isolation. Obesity has compromised the capability of advanced civilizations to live well.

The key to precipitating the end to obesity, the author believes, is to leverage a cost-to-benefit equation. This represents the critical solution bridge to connect knowledge to solution.

The cost of obesity can be expressed variably depending upon the value system the individual or Actor participates in. For individuals, obesity is costly not only because of its health sequelae such as, diabetes, hypertension, heart disease, sleep disorders, arthritis, and back pain, but also because of psychological and social consequences, including depression and low-income job status. In contrast, for a large business, the price of obesity is most often expressed relative to health-associated fiscal costs noting that many U.S. companies are either self-insured or offer insurance. A person with significant obesity suffering from metabolic complications may cost a company $7,000/year more than an individual who is lean without those complications. For a company with 30,000 employees, obesity associated costs might thereby approximate, $10 to 100 million. A principal reason a new company goes out of business in the United States is because of obesity-associated health care costs.

Overall, or an individual or an employer (as an example of a societal Actor) the cost-to-benefit equation unequivocally argues in favor of ending obesity. How can present knowledge impact a cost-for-benefit to facilitate individual weight loss and end obesity?

Scalable Obesity Solutions (S.O.S)

Taking the United States as an example; the population comprises approximately 300 million people; 100 million have obesity and 100 million are overweight and hence are at risk for becoming obese. A scalable End-Obesity-Scenario must embrace weight loss in such a way that it can be scaled to 200 million people. When one considers the scalable solutions that have been deployed to promote connectivity and alleviate loneliness, 190 million Americans visited at least 1 social network Internet site (eg, www.Facebook.com) in 2008. It is now entirely feasible to propose scalable weight loss solutions of this magnitude.

What might a S.O.S. look like and how would it be disseminated? The core components of a S.O.S. (Figure 1) can be described based on current knowledge of success weight loss strategies. In any S.O.S. components are needed that promote and sustain high levels of daily physical activity and reverse nutritional excess. For example, accurate and mass-produced research-grade activity monitors can be combined with validated algorithms to predict a person’s energy expenditure. This information can be used to define a nutritional prescription that ensures negative energy balance and weight loss. This mass-producible scalable solution can in turn be combined with life-skills coaching, social-networking, multimedia information plus trained providers to deliver a personalized approach for weight loss that is mass scalable, a Scalable Obesity Solution.

Figure 1 — The core components of a scalable obesity solution (S.O.S.).
S.O.S. PHASE 1: Proof of Concept (n < 100,000)

In the first phase, proof-of-concept studies are needed to define applicability for a variety of people-types and client-settings. Examples include

- Sex-specific interventions (eg, women frequently have problems with work-site activity interventions because of shoe types)
- Age-specific adaptations (eg, food & beverage marketing to children is different than for adults. ‘Tweens’ have different market preferences even compared with teens)
- Cross health issues (eg, smoking, unsafe sexual practices)
- Psychological variables (eg, low self-efficacy associated with depression is a barrier to weight loss)
- Biology-specific programs (eg, weight gain often follows childbirth, marriage, or bereavement)
- Disease-specific interventions (eg, components of a diabetes prevention may include glucose testing)
- Different types of worksites (eg, office versus factory versus school)
- Different geographical paradigms (eg, Midwest compared with Southern climates)

Proof-of-concept testing is not only necessary to examine the feasibility of delivery but also how the S.O.S. needs to be adapted to meet real needs. Such pilot studies might include simple, scalable measurements to demonstrate efficacy such as for, (a) body weight and fat, (b) health variables (eg, glucose and lipids), (c) psychosocial variables (eg, mood and quality of life inventories) and potentially (d) physiological variables (eg, exertional tolerance and appetite measurements).

S.O.S. PHASE 2: Adopter Scaling Phase (n = 100,000 to 1 Million)

Once the proof-of-concept testing of the S.O.S. is complete, its scalability needs to be evaluated. For example, a S.O.S. with multiple options may be high adaptable but not scalable. A simpler S.O.S. may not meet all subpopulations’ needs BUT be readily scalable to millions of users.

Testing of the scalability of a S.O.S. is pivotal as it enables

1. Identification of high health risk patients who may qualify for interventions of greater intensity
2. Application of neural net software algorithms to detect strategies that are most effective for weight loss and weight gain prevention in subsets of individuals; for example people living in warm climates may do better with cycling programs than those from cold climates
3. Effective social-networking algorithms to be developed (eg, a skateboarding club may be more popular in teenagers than adults)
4. Return on investment data can be calculated; this may be subsequently tailored for different settings (eg, factories versus colleges) or even individual companies
5. Measures of quality of life and economic productivity data can be defined
6. High-grade biological variables for predicting and hence preventing disease can be deployed (eg, confidential DNA analysis to identify a person at risk for metabolic illness)
7. Systems and procedures can be delineated for different settings (eg, the regulations for school deployment are different to a corporate office)
8. Enticing the Actors. Data on the efficacy of a S.O.S. enables its cost-to-benefit equation to be leveraged with societal Actors (eg, insurance companies and manufactures of clothes, furniture, and food).

S.O.S. PHASE 3: Mass Scaling (n > 1,000,000 to 300,000,000 in United States)

The larger a S.O.S. becomes the more cost effective (pounds of fat lost/$ spent) it is likely to be. In addition, with mass scaling, the S.O.S. improves in the depth and the quality if its capabilities (compare the first computer word processing software with current programs). This is true for several reasons:

- With mass scaling experience improves regarding the features associated with optimum response; improved individual tailoring
- Mass-scaling generates research and development resources to improve the technologies and bring to the user improved technology plus improved technological convergence (eg, an activity sensor that is integrated with the user’s cell phone, supermarket, desk, computer, car, gym, fridge, health insurance premiums, or school grades)
- Since obesity is associated with multiple medical and psychological complications, the S.O.S. can become a site of health care integration. The S.O.S. system described above via its Internet portal could be used to alert the user for breast, prostate or colon cancer screening. The S.O.S. could be used to track immunization, as a portal to full health provision and for medical records storage. A mass-scaled S.O.S. can convert a user from being a passive patient to an active, self-empowered, ‘general’ of their own health and health care.

A mass-scaled S.O.S. improves the quality of the offering not only for an individual user but also for populations.
1. In the United States for example, there are approximately 50 million people without health insurance. The S.O.S. not only mitigates against obesity and its comorbidities but also provides a channel to cost-contained and cost-effective health care to people previously without insurance who now receive it as a consequence of health care reform.

2. Consider the example of an employer of 30,000 people where $50 million/year in health care costs could be saved through obesity reversal. It is thus likely to be cost effective for an employer to provide a S.O.S. at no charge to employees and even, coinsured relatives.

3. When a S.O.S. has enrolled >5 million people it starts to influence the ‘Actors.’ Enrollees develop purchasing and lobbying ‘power’ with respect to product development and environmental provision. For example, the cohort can leverage shoe and clothing designers to develop activity-permissive clothing. Electronics manufacturers realize a market proposition to include activity-promising hardware and software in their device designs (eg, cell phones). Food companies will want to target the S.O.S. enrollees. City planners, for example, will have scalable ‘test-sites’ to evaluate health-driving environments. Bulk purchasing power (for example on bicycles and treadmills) can dictate price.

Mass scalability enables not only improved cost-efficiency but also improved quality of service. With mass scaling of a S.O.S., the end to obesity becomes a fulfilled prophecy. It becomes normative for individuals to live lean.

Conclusion

Obesity will end through the successful implementation of scalable individual-to-population solutions. There is individual and collective will for such solutions and the convergence of technologies that render this possible. In the same way that individuals necessarily adopted strategies to impose negative energy balance to lose weight, so too Actors, once the cost-to-benefit relationship is recognized, will want to facilitate population-wide solutions in increase daily activity and improve nutrition. Scalable obesity solutions can be devised, built, and disseminated to the millions of people who need them. For population-wide implementation and for obesity to end, there will need to ‘buy-in’ not only from the individuals within society but also from societal Actors. In conclusion, the end of obesity is necessary for the physical, mental, and fiscal health of modern civilization. It is tenable and possible to build, test, and mass-disseminate Scalable Obesity Solutions. Individual-to-population scalable obesity solutions will enable people to live in health and enjoy the beautiful earth they left the forests to see. Let us end obesity.

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References

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