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Chapter 2

The Mismeasure of Obesity

Emily Yates-Doerr

> The spirit of Plato dies hard. We have been unable to escape the philosophical tradition that what we can see and measure in the world is merely the superficial and imperfect representation of an underlying reality. Much of the fascination of statistics lies embedded in our gut feeling… that abstract measures summarizing large tables of data must express something more real and fundamental than the data themselves.
>
> — Stephen Jay Gould, *The Mismeasure of Man* (1981)

In *The Mismeasure of Man*, now written three decades ago, Stephen Jay Gould illustrated the fallacies of reducing the "wondrously complex and multifaceted set of human capabilities" into a standardized measure of intelligence (1996: 24). In this chapter, I draw from Gould's emphasis on the fallacy of reification, applying his argument to the measurements of obesity rather than intelligence. Whereas Gould critiqued the use of skull size and IQ tests to record intelligence, my concern lies with the presupposition that *health* can be located in the metrics of body size that

have come to dominate the dietary ideals promoted by the field of public health. I argue that metrics of weight and size are neither representative nor metonymic of health, and though they may be well-suited to some needs—indeed, they form the basis of much international research on metabolic illness—they occupy too much public attention.

<Insert Figure 2.1>

This chapter catalogs three techniques for measuring obesity in clinical practice, comparing the different forms of knowledge about obesity produced by each. It then draws attention to a non-numerical understanding of fatness to ask what kinds of experiences of the body become foreclosed by contemporary concern for obesity metrics. Unlike *The Mismeasure of Man,* which is interested in the "unconscious fraud" found in the science of intelligence measurement, scientific fraud does not play a part in my paper. Although I am concerned with "liars," I do not set out to unravel scientific accuracy on its own terms. Instead, my argument that measures cannot be trusted runs deeper than fraud—be it intentional or not. In analyzing not just the inaccuracies of measurement, but the impossibilities of measurement, I follow Gould's warning about the powerful temptation of reification: "The idea that we have detected something 'underlying' the externalities of a large set of correlation coefficients, something perhaps more real than the superficial measurements themselves can be intoxicating" (1981: 239).

In cataloging various numerical methods for assessing obesity—from waist circumference to body mass index to bioimpedance analysis—I suggest that the public health community has become swept up with the idea that measurements can reveal the interior health of the body. In their concern for ever more accurate measures of body size, the representational quality of numbers—and the experiences and people they purport to represent—become easily forgotten.

Body Mass Index

Julia Monterrosa first came to the highland Guatemalan hospital where I was carrying out fieldwork because of headaches.[1] The attending doctor asked her a few quick questions—there were many people waiting to be treated—and then sent her away with a slip for laboratory blood work and a referral to the hospital's "outpatient obesity/nutrition clinic." She might need to lose some weight, he told her.

A few days later, after waiting several hours in the hospital lobby, the nutritionists of the clinic called her into the consultation room, requesting to see the results of her blood work along with her identity card, where her weight and height were written. They then asked her to take off the jacket and sweater that shielded her from the chill of the Guatemalan highland morning and to step on the scale. Julia placed her hand against the wall for balance and began to lift herself up when the nutritionists stopped her—they had forgotten to calibrate the scale and it might not be accurate (in Spanish, *exacta*).

It took some time to level the scale to zero. The machine was old, having arrived to the hospital years earlier in a crate of used medical equipment donated from Spain. Once the beam had stabilized at the center point, they asked her step onto the scale again. She balanced on the platform, albeit a bit shakily, as they moved the weights right and then left, whispering between themselves as the level balanced and they settled upon a number. The scale was in kilos, so they converted this before announcing the result: 130 pounds.

"No, that can't be," said Julia, easing herself off of the scale. "I just had my weight measured at the pharmacy yesterday and it was 120."

The nutritionists made a few more calculations, before one of them continued, ignoring

her protest: “Ma’am, when we take your weight and the height from your card and calculate your body mass index, then I am sorry to tell you that you have the diagnosis of overweight (*sobrepeso*).” They pointed to a chart displaying information from the World Health Organization (WHO) that explained that an adult with a BMI between 25 and 29.9 was considered overweight and between 30 or higher was considered obese. “You want to be at a healthy weight,” one of the nutritionists explained, signaling the BMI range between 18.5 and 24.9. “Excess weight causes many kinds of illness. In your case it might be causing your headaches.”

Julia protested again. “But this can’t be. Look at my card. My card also says 120. This scale is a liar.”

“Ma’am, scales don’t lie,” the second nutritionist explained.[2]

<HDA>Abdominal Circumference

<FL>“Scales don’t lie” was the exact phrase I had heard the previous weekend at a meeting for scientists who were studying metabolic illness. Yet they also qualified this with an important caveat: “But they can be hard to standardize.” Many of the women treated for metabolic illness in Guatemala wore heavy *huipiles* (woven blouses) that would substantially change one’s measured weight. The typical adjustment the public health community advised was to subtract between five and eight pounds from the weight reported by the scale—but sometimes public health workers subtracted ten, and sometimes they forgot to do this at all.

One of the topics of the day’s meeting was the shortcomings of the BMI. Though BMI represents the ratio of weight to stature (it is calculated by dividing weight in kilos by height in meters squared), it says nothing about one’s distribution of weight. The concern was that while

BMI could assess "excess body mass," it left unrecorded a variable the scientists thought more closely correlated to metabolic health: the presence of centralized abdominal fat, which the scientists viewed as more dangerous than fat found elsewhere on the body. The scientists in the room referenced studies, such as one conducted by Moreno et al. (2002), that tested different anthropometric predictors of metabolic illness in children.[3] When correlating metabolic illness with waist circumference, BMI, and triceps/subscapular skinfold ratios, this study found waist circumference to be more tightly correlated with illness than were the other methods:

> A large waist circumference reflects high total body fatness and is also recognized as a good measure of abdominal fat, particularly the most metabolically active intra-abdominal fat, in both adults and children. From our results, simple waist circumference measurements appear to have a similar performance to that of BMI in screening for the metabolic syndrome. Moreover, a single measurement, not a ratio, reduces the chance of error (Moreno et al. 2002: 1311)

To be clear: the scientists I worked among in Guatemala were primarily concerned with cataloging and tracking regional and national trends and did not use these numbers to speak of "health." But elsewhere—in hospitals and public health circles, for example—the reliance on body size measurements to indicate or predict a person's wellbeing was becoming widespread (see figure 2.1). This tendency to transport body size metrics from the field of epidemiology to the realm of personal care was increasingly common outside of clinics and sites of formalized health education. Many women I knew during my fieldwork in Guatemala used the tape measure from their sewing kit to keep track of their weight. While they could not afford the home scales

that are typical in the United States, the tape measurer, normally intended for fabric, cost nothing extra. And even women who did not read or write with ease—women for whom a WHO fact sheet about BMI would be meaningless—could follow their doctors' directive to measure the size of their stomachs.

Though the scientists were not themselves presuming to measure health, their reasons for adopting this technique for measurement paralleled the reasons given by doctors and their patients. As they wrote in their study of the efficacy of waist circumference: "The measurement of abdominal circumference is simple and practical" (Alvarado et al. 2010: 19). Whether waist was measured at the narrowest point or at the umbilical level, this method provides "an advantage over techniques for measuring body-fat that require privacy and precision equipment" (Alvarado et al. 2010: 19).

Measuring Health

The two examples presented above illustrate different techniques for measuring obesity. In the first, obesity was determined through what the scientists I worked with called the "Quetelet BMI." In the 1830s Adolphe Quetelet, a Belgian statistician widely regarded as the father of quantitative social sciences, developed a mathematical model for determining the "average man" (*l'homme moyen*), tracing mean values of measured variables along a normal distribution curve (also known as a bell curve). Trained in astronomy, he sought to assess population-wide indicators of weight and height through laws of proportionality. Quetelet himself was not interested in the deviations or risk factors that would come to dominate later interest in obesity (Hacking 2007). Instead, as historian Theodore Porter writes: "He revered statistical laws partly as a source of metaphysical consolation—tokens of stability in a time of revolution—and partly

as evidence that this domain could be made properly scientific" (1995: 16). It was only toward the turn of the twentieth century that a so-called scientific association of excess weight with poor health began to emerge, and this association was driven less by concerns of public health than by the concerns of life insurance companies. As Porter explains this, "In estimating risk from height and weight, insurance companies were not drawing on established medical knowledge. Information on build became a reliable basis for projecting differential mortality only as the result of efforts by the companies themselves" (2000: 241).

By the start of the twentieth century many U.S. life insurance companies had defined overweight as "an excess accumulation of body fat," using correlations of weight with height in their determinations of what constituted excessive fat. While these companies generally held that *over*weight was not healthy, the precise cutoffs used to distinguish normal weight, overweight, and obesity remained considerably fluid through the twentieth century. Different industries as well as different governmental organizations employed a variety of methods for measuring a healthy body size—some as simple as a graph of recommended weight for age—as well as different demarcations for determining when, exactly, someone's body size was healthy.

In 1972 an influential paper first-authored by epidemiologist Ancel Keys compared various ways of measuring obesity against one another. This paper ultimately selected the Quetelet index because, of all the different methods tested, it was best at representing different geographical regions in like terms (1972: 330). In other words, the standard it created made population X, population Y, and population Z look, in numerical terms, most like one another so that they could be most easily compared to one another. It is important to note that Keys, as with Quetelet, was not interested in finding a metric that would compare an individual against a normal curve but sought to find a means of calibrating vast amounts of data about body size to

make comparisons between populations: business professionals in St. Paul, Minnesota, Bantu working-class South Africans, and Japanese fisherman. Keys renamed the Quetelet Index the body mass index—BMI.

The BMI became a gold standard for assessing relative overweight and obesity following the publication of Keys's paper. Still, it was not until 1998 that the WHO and the National Institutes of Health standardized these terms as underweight: BMI <18.5; overweight: BMI 25 to <30; and obesity: BMI ≥30 (see also Rubin and Joseph, this volume).[4] Even then, scientists could not show that a diagnosis of overweight had a direct impact on death rates—only that it correlated with other risk factors for poor health (Flegal et al. 2005). And some countries, such as Japan and Singapore, have since altered the designations to more closely match epidemiological risk profiles in these countries, shifting the presence of overweight and obesity downward so that the diagnoses fall at lower BMIs.

Whereas Keys saw the BMI as a primarily a demographic tool, the implementation of the formula has quickly shifted. Today the BMI is not limited to population-level comparisons, but is commonly used to make assessments about individual health. Above, Julia's personal BMI was calculated by the nutritionists, who warned her on the basis of the number that her BMI might be causing her headaches. Julia protested, suggesting that her weight had not recently changed and they must have been calculating it incorrectly. But the nutritionists, though they often had to recalibrate and adjust the scale, ignored the possibility of measurement error. After all, a reason that the BMI has spread so widely is due to its "simplicity of calculation" (Keys et al. 1972: 341). This simple calculation then leads to cleanly organized fact sheets, such as those offered by the WHO. "What are the common health consequences of overweight and obesity?" the WHO fact sheet about obesity asks. The answers it provides are directed toward concerns of health:

> Cardiovascular diseases (mainly heart disease and stroke), which were the leading cause of death in 2008; diabetes; musculoskeletal disorders (especially osteoarthritis—a highly disabling degenerative disease of the joints); some cancers (endometrial, breast, and colon). The risk for these noncommunicable diseases increases, with the increase in BMI.[5]

Once this seemingly simple measurement is made, who is Julia to argue with the facts?

The second example—waist circumference—presents a different set of concerns. Whereas WHO officials might be content to rely on scales, the scientists I worked with were more dubious about their utility. Though "scales do not lie," human error can bring doubt to their results. Given that Guatemalan scales were typically old or expensive, researchers saw clear advantages in the use of the single measurement of waist circumference that bypassed weight and height. That this single measure also targeted abdominal adiposity, which they held to be a better predictor of morbidity than weight alone, was also beneficial. Accordingly, one Guatemalan public health worker who I spent time with refused to speak of "overweight." In his words, "You can't change your height, so when you rely on the BMI, people tend to focus on weight. But weight itself is not necessarily the problem. We need to be more precise in our language and our measures." Aiming to shift attention away from the "imprecise" measure of weight and toward the presence of fat, he spoke of "over*fat*" instead of "over*weight.*" Reasoning that fat was a better indicator of health than was the general measure of weight, he also advocated the use of abdominal circumference instead of the BMI.

Still, measuring waist circumference was not without challenges. There was, for example, the problem of what researchers referred to as the "cultural norms of modesty." When working

with Guatemalan children, researchers had to wait until the day of gym class, when children wore uniform T-shirts that were thinner than other clothes. With adults, researchers encountered the bulk of *huipiles* that would throw off measurements—should three centimeters be subtracted to adjust for the fabric? Or five? Or one? There was additionally the concern about where exactly on the body one could find the "natural waist"—the site at which researchers were directed to take the measurement. Theoretically, it was measured at the narrowest point along the lower torso, just above the iliac crest and which would be encountered by running a "constant-tension tape" along the lower abdomen, stopping where the tape provided resistance. Point to your belly button, the researcher could ask, looping the tape just above the place where the person's finger rested. But in practice, breathing might change the number, and with round stomachs the narrowest circumference was not always near the "natural waist."

While ease of application was a reason that many championed the technique of waist circumference, others were concerned about its potential for inaccuracies. In the Netherlands, where I interviewed several public health nutritionists, I heard numerous complaints about imprecision in the traditional methods of measuring obesity. As one nutrition scientist explained, "We use BMI and abdominal circumferences as proxies for poor health. But these are such crude measures. Really we should be using techniques such as bioimpedance or DEXA scans.[6] These methods will tell us a lot more about what's happening within a person's body. They give us a better sense of *true* obesity."

As I will explore further in the next section, the idea that a person had a true level of obesity that could be revealed by increasingly accurate devices of measurements was prevalent within public health debates about obesity measurements. Rather than view obesity as a sociomaterial construction that could be produced in different ways by varying devices of

measurement, it was treated by public health workers that I spoke with in both Guatemala and Europe as an underlying bodily trait that could be objectively reported—if only the right tools could be developed and applied.

Bioelectrical Impedance Analysis (BIA)

After a second doctor I interviewed during postdoctoral research in Europe referred me to the Internet when I asked for clarification about his explanation of bioelectrical impedance analysis, I decided to take the advice seriously.[7] After all, although there are clearly limits to drawing material for ethnographic analysis from online performances, BIA patients (and prospective patients) also told me they commonly used the Internet to find information about devices for weight or fat assessment. Additionally, many of the ideas of accuracy that I came across in online depictions of the BIA echoed ideas present in my conversations with doctors and health workers. The following explanation of BIA from an online video—one of the first results when searching the phrase in Google—provides a nice entry into the social imaginaries surrounding this technology.[8]

"Hello everyone, I am going to take my body fat via bioimpedance." A man—let us call him Juan—is holding his smartphone to a mirror, while projecting the image to an audience through the Internet. "As you can see, I have a set of abs so I'm definitely in single digits," he says, patting the well-defined muscles in his stomach. "Now then, I'm going to use this scale which uses bioimpedance as a conductor which transmits electrical signals, down, and then up and then back down and tells you how much fat, and how much water and how much you weigh and stuff." He then presents his audience with a challenge: "Whoever guesses right online about how much my body fat might be via bioimpedance, right here, will win a free protein container.

So let's do it three times and take the average of the three."

Juan sets the camera down to continue the experiment, picking it up only after he has stepped on the scale to show those watching its response. "7.3 percent body fat," he says and then points the camera at the scale, showing the proof of the number. He repeats the process two more times, and both times the scale repeats the number: 7.3 percent. "This has a 2 percent error rate for bioimpedance, but this method is actually really accurate," he reports. Nonetheless, despite the alleged accuracy when it comes to the meaning of the measurement, confusion remains: everyone who responded to his challenge with a guess of his body fat percentage had underestimated: 3 percent, 4 percent, 4.4 percent, 1 percent, 4.1 percent, 4 percent, 4.3 percent. "It looks like nobody got it right," Juan says before turning off the camera.

<FL>Bioelectrical impedance analysis (BIA)—which measures the resistance to conductivity of tissue when an electric current is passed through it—was a body fat assessment strategy that many public health scientists touted for its accuracy. "I like this because it's truly scientific," one woman who went to a weight-loss clinic in Amsterdam that used a bioimpedance monitor in its fitness program explained. When I asked her to tell me more, she said that its results were "trustworthy" (unlike Julia, above, she did not worry that the scale was a liar). Doctors who promoted BIA would explain to prospective patients that this form of body assessment would fill in missing data, helping them make diagnoses and treatment plans that were more complete than they would be able to make otherwise. As one Italian doctor explained, "It can give us a lot of great information about your body composition. With this information we're better able to make up a treatment plan targeting your needs. You see, it gives us the critical information about your muscle mass, fat mass, and phase angle." A brochure for bioimpedance that I came across at one clinic summarizes the technique:

> Bioimpedance is a means of measuring electrical signals as they pass through the fat, lean mass, and water in the body. Through laboratory research we know the actual impedance or conductivity of various tissues in the body, and we know that by measuring the current between two electrodes, and applying this information to complex proven scientific formulas, accurate body composition can be determined.

Health scores accompany the numbers produced by BIA machines so as to explain the significance of the results. As we saw in the failure of Juan's audience to approximate his body fat percentage scores adequately—viewing him as fit, they all underestimated his body fat—the numbers themselves must be put into context to be made meaningful, and these scores help provide this context. Although widely agreed upon standards do not exist, the charts that many clinics use cross-reference exam results with gender and age to provide cutoff points for "excellent," "good," "fair," or "poor." One company that markets bioimpedance scales explains this process as follows:

> We continue to refine our body composition technology with modern day algorithms derived from databases encompassing thousands upon thousands of physical measurements. Extrapolated data includes body composition profile, total body fat, total body water, fat free mass, body mass index, basal metabolism or resting energy expenditure. A personal, informative, colorful 5-page professional printout assessment is available that provides accurate individual Body Composition Analysis but also dietary guidance

recommendations related to weight loss control.[9]

In contrast to the measuring tape used by many Guatemalan women, BIA required elaborate technology. Although some bathroom scales claiming to measure fat percentages through bioimpedance advertised their "low error rate," many of the researchers I spoke with dismissed these methods as "unreliable." Even though scales could consistently reproduce the identical results—within 2 percent of one another, as Juan had stated—researchers were doubtful that the resultant number corresponded with a person's "real" body fat percentage and also pointed out that most bathroom bioimpedance scales measure bone density, relying on their own formulas to make body fat percentages meaningful. The instruments commonly advocated by European scientists I spoke with were much more intensive than Juan's bathroom scale. Indeed, the requirements for "reliable" BIA were extensive enough to transform "person" into "patient" because measurements had to be taken by an expert, often in a clinic setting. As one researcher explained, to measure bioimpedance correctly the subject "needs to lie completely still for ten minutes before electrodes are strapped to the wrist, hand, and feet—equidistantly from one another." He clarified that it was not difficult, but it was also not something one could do without guidance.

Many scientists who advocated the use of abdominal circumference and BMI for measuring obesity praised these methods for their simplicity. From an entirely different angle, the BIA was also described as "simple." One doctor explained that the potential for human error seen in other methods—i.e., the concern that scales would not be correctly calibrated to zero or that natural waist would not be correctly located—was mitigated by a reliance on the sophisticated design of the machine: "We just press the button, and it does the measuring. In a few seconds we have the information. We put this into our computer and it will give us

everything we need to know to get started with the treatment program."

This promoted purported simplicity of BIA, however, came at a significant economic price. The WHO, in pointing out that there are more accurate techniques for assessing obesity than the BMI, also acknowledges that "the cost of such technologies and the practical difficulties involved in applying them limit their usefulness to research" (2000: 7). Whereas bathroom scales marketed with bioimpedance capabilities can be found online for as little as $100, not only did scientists discount these as being unreliable, but the public hospitals where I carried out much of my fieldwork in Guatemala had no budget for even the "inexpensive" $100 scales. Meanwhile "professional" BIA machines could cost upward of $5,000, making the technique, despite its theoretical accuracy, ineffective for most health clinics in the world.[10]

In sites where it was used, the high cost of the equipment was justified through numerous promises. For example, one company that sells high-tech bioimpedance scales called "inner scan body composition monitors" reports that the scans will give both doctors and patients greater knowledge of, and greater control over, their bodies. An advertisement pamphlet explains:

> Tanita knows you inside and out, so you can have more information about your body than ever before. Not just body fat and body water, but total body composition: Bone mass, metabolic age, muscle mass, basal metabolic rate indicator, visceral fat and physique rating…. Know all this and you have an amazingly accurate picture of your true fitness level….

This "amazingly accurate" knowledge was presumed to be accompanied by increased personal control over the body. In the words of one health worker, "Bioimpedance can be used to monitor fat and muscle. When people know their body composition, they can more easily

maintain healthy cells." In the words of a bioimpedance proponent, "Any diet or fitness program needs this information."

When talking about BMI, doctors and scientists were always quick to mention that it takes the ratio of weight and height as a *proxy* for health, but that there was much that it did not measure. Many referred to the situation of the Olympic wrestler whose relatively high weight is made up not of unhealthy fat, but of "healthier" (and heavier) muscle. "According to the BMI, this athlete could be categorized as obese!" they would tell me to illustrate the shortcomings of the index. "Not all pounds are equal" was a common critique made of the BMI. Meanwhile, BIA was repeatedly emphasized as being more accurate, more sophisticated, more replicable (and thus more predictable and reliable), and as overall providing a truer assessment of the body than the ostensibly cruder measures of BMI or waist circumference. The ability to assess the specificities of bodily substance (fat, muscle, bone) took away guesswork. As a technique of "surgery without the scalpel,"—as it was advertised—this was an instrument that would reveal interiors, removing mystery about the inner workings of the body. This ability to monitor one's body would, in turn, improve the health of those using it. Still, the promise of the BIA was not simply health, but also the possibility of going beyond the "superficial and imperfect" representations, getting close to the "underlying reality" (Gould 1981: 239).

Limitations to Measurement

Above I have described three techniques for the measurement of obesity, detailing the methodological strengths and weaknesses of each. BMI is the mostly widely established strategy for assessing obesity and has the incumbent advantage. Though its emergence as a front-runner following Keys's 1972 article was less than certain, its use has since gained momentum. Today it

is the method of determining a diagnosis of obesity employed by clinics ranging from city centers in Europe to rural mountain clinics in Guatemala. Many people know their BMI, and the calculation of weight and height—though certainly not without situational divergences so that someone's weight might be significantly different from one scale to the next—requires information about just height and weight and can be done on a pocket calculator.

Abdominal circumference, which requires no scale at all, was also advocated for its simplicity. This technique is not without inconveniences: the person taking the measurement will come in contact with the body of the person being measured, which can challenge norms of modesty in some places; bulky clothing can interfere with the number; and the location of what they called the natural waist may not be obvious. But researchers generally liked that it targeted abdominal adiposity, citing current research that suggests that its single measurement is comparable to—or better than—BMI at indicating or predicting metabolic illness.

In the words of one French researcher I spoke with, the internal scans offered by BIA present "a new frontier" of obesity measurement. It opens up the human body, allowing researchers and patients previously unobtainable insight into cellular composition and, presumably, function. It promises to move beyond the potential superficiality of indirect measurements to yield knowledge about an internal reality that remained, until now, only known in the abstract.

It is notable that whether their chosen method for assessing obesity was BMI, abdominal circumference, or bioimpedance, scientists and health workers defended their choice through the measurement's accuracy. Whether discussing BMI, waist circumference, or BIA, the phrase "This is more accurate" is scattered throughout my field notes. Journal articles defending the use of each particular method invariably cite the method's accuracy. Used in conjunction with

exactitude and reliability, these references to accuracy implied an ability to gain correct and precise knowledge about a person's objective level of obesity. Historians of science Lorraine Daston and Peter Galison have drawn attention to the flexibility of the notion of objectivity, which can refer to "everything from empirical reliability to procedural correctness to emotional detachment" (1992: 82). The term *accuracy*, which is used in conjunction with each of these versions of objectivity, is a similarly amalgamated concept.

According to the OED, the word *accuracy* emerged in the second half of the seventeenth century along with experimental science and an emphasis on exactitude in record keeping. The term made headlines in 1850, when James Joule set out to convince the scientific community of his methods for determining heat by using extensive tables of numbers to prove the accuracy of his laboratory measurements. As historian of science Otto Sibum explains, "Absolute standards were imposed in order to make local knowledge work elsewhere. Instruments of precision controlled skill and became representatives of accuracy" (1995: 74). Accuracy in the case of measuring what would become known as caloric heat was achieved by standardizing differences in both climate and research skill so as to make results in one place comparable with those in another. A slightly different version of accuracy is seen in the concerns about whether a warhead can hit its target (Mackenzie 1999). Here, the concern for accuracy imagines that the most accurate measures best indicate an object's distance, size, etc. This is the accuracy professed by skilled mapmakers whose accurate representations are purported to best guide the viewer along an intended route.

But though the different techniques of obesity I have outlined above operate in different ways, enacting different forms of accuracy, when applied to the realm of personal health care, they share an assumption that health can be located in the tissues of the body and that accurate

measurements of these tissues can be used for both comparative purposes and to assess an individual against a norm.

In Guatemala I encountered a different way of understanding fatness, in which one person's corporeality was incomparable to another's. I present this account here in an attempt to open up discussions of obesity foreclosed by a focus on metrics. It asks us to rethink our assumptions about the metric-based character of obesity; it also asks us to consider whether there might be forms of accuracy that have nothing to do with replicability or mechanical precision. Although my focus here is on Guatemala because this is where I have done research, I am not interested in emphasizing the distinction between Guatemalan and so-called Western understandings of weight in this account. Following presentations of my research to U.S. and European audiences, audience members often suggest that their own understandings of weight are less precise than it might appear given a public health promotion of metrics. Moreover, both Guatemalan and the U.S. variegated understandings of and desires for fatness and thinness often coexist. Rather than suggest categorical distinctions between Guatemalan and Western visions of fatness, my research, by pointing to the nuances and complexities surrounding fatness in one region, opens up the possibility that these complex experiences of body size exist elsewhere as well.

Nevertheless, because the idea of fatness that I will draw attention to is substantially different from the indices of obesity I described above, I want to present a brief summary of a longstanding vision of dietary health in the Guatemala region where I conducted fieldwork. Alternatively referred to as humoral or indigenous medicine, it is no longer widely or systematically used today. But given its historic influence, and its resonance with the view of fatness that I outline below, it is helpful to summarize it briefly. In this logic of dietary health, a

person's well-being could not be abstracted from a specific meal or from the meal's interactions with the body at the moment of eating. Instead, well-being was conceived through sensory characteristics of foods and their immediate interaction with a body that was, necessarily, situated in a specific environment at a specific time. The classic descriptions of humoral/indigenous practices given by anthropologists Robert Redfield and Alfonso Villas Rojas specify that it would be a mistake to try to overlay categories onto these practices because the "categories are blurred and run into one another" (1971: 160). Guatemala's humoral systems were necessarily expansive, drawing upon an understanding of balance that comprises textures, colors, and tastes. Abstract—that is, distanced or universalized—guidelines are anathema to these practices of dietary health, which depended upon listening to, and making decisions around, the circumstances surrounding the body and its immediate ecological contexts. Anthropologist Susan Weller describes the desire of health care professionals to create rules out of humoral medicine–i.e., orange juice is *cool,* measles is *hot* (1983: 256). Although they sought to establish these rules to simplify and expand the delivery of health care services, this led to widespread misunderstanding about the workings of humoral medicine, which resists classification. From a humoral approach, an individual food would never—could never—be understood as healthy or unhealthy on its own; rather, its health is determined through its relation to the different foods consumed and the state of the individual at the time of consumption.

Similar to this refusal to make situated knowledges about food and health abstract, fatness was also not something that Guatemalans necessarily associated with measureable size and definitive body weight categorization. Instead fatness related to a specific and mobile state of a person's body. Calling someone fat could be a way of saying he or she was happy and blessed in life. This sense of the term has the connotations of ephemerality also seen in beauty—something that was, indeed, related to fatness. "*Donde no hay gordura, no hay hermosura*" is a

local expression that translates loosely to "Where there is no fat, there is no beauty." Likewise, "*Tan bonito el gordito*" (or, "What a beautiful little fattie") was a rhyme I heard several times. The use of these statements illustrates a sense among many of the people I met that fatness was desirable. For many, fatness was also healthy.[11] When traveling to Guatemala's rural communities I often heard some form of the following expression, spoken here by a middle-aged *campesina*: "In the countryside, to be fat is to be healthy" ("*Ser gordo es ser sano*"). From the perspective of the field of public health, it can be easy to dismiss this idea: to hear it and to think it provides evidence of the erroneous—and provincial—thinking of someone who does not understand the consequences of weight gain. But I came to understand that when people were saying "to be fat is to be healthy," their meaning was literal: they were not mistakenly considering obesity to be healthy, but they were understanding health as a quality of the body that could not be directly assessed through body size.

Whereas obesity, as discussed in public health, is typically contingent upon both body size metrics and the occurrence of illness, the understanding of fatness I describe here, while related to food and more loosely related to size, more generally encompassed an experience of abundance. One could be fat in a moment, the way one might feel content— for example, when surrounded by friends and family at a meal where food and conversation were plentiful. To be fat meant life was going well, and on several occasions I heard someone that did not *look* fat in shape to me (accustomed, as I was, to associating fat with size and measure) claim to be fat. When I heard someone refer to another as fat, I would try to ask for clarification about how they came to this assessment. Although people did not generally understand my question—they did not, after all, treat fatness as a *thing* to be assessed—their responses emphasized relationships, suggesting to me that intimate knowledge of a person would produce this kind of understanding.

Unlike weight that can be determined by a stranger, fatness—in the sense in which I am describing it here—must be made through dialogue and interaction and could only be understood through effort, time, contact, and the strength of intimate relations. In contrast to the BMI designation of healthy weight—which is a *standard* in the dual use of the term, i.e., both an "exemplar measure" and a "value which is treated as invariable" (OED)—fatness could not be determined through a scale.[12] Instead, an understanding of fatness and an evaluation of the quality of food that followed required extensive knowledge of a person's life and of the specific contexts in which this food was eaten. Fatness was not a condition, but a fluid experience. It could not be measured.

Conclusion: The Inadequacies of Numerical Accuracy

At the American Anthropological Association meetings in 2010, I presented a summary of my research on fatness in Guatemala on a panel containing several other papers that critiqued public health nutrition's reductive measurement-focused approach to the complex problem of international obesity. Many of the papers were based on fieldwork undertaken in places where people suffered from a range of dietary-related disorders: diabetes, hypertension, metabolic syndrome, etc. On the whole, we were not discounting the suffering experienced by those with these illnesses. We were, rather, interrogating the way that this suffering was often reduced to the problem of weights and measures—and we raised concerns about how this might exacerbate, and not treat the illnesses experienced by those with whom we lived and worked (see especially Hardin and Rubin and Joseph in this volume).

During the discussion held after we had presented our papers it was clear that a vocal contingent of our audience was disinterested in our challenge to the goal of creating single,

universal standards for assessing dietary related illness (see also McCullough, this volume, for analysis of these events). Presuming that obesity was a condition that existed independently from the specific measurement practices that brought it into being, their concern lay in finding more accurate obesity standards. One man suggested that we abandon the BMI because abdominal fat was a better index of health (presumably the we he spoke of was the public health community and anthropologists whose primary goal was the collection anthropometrical information). Another person declared that it was premature to see abdominal fat measurements as a panacea and took the position that BMI was too entrenched to be abandoned. The audience discussion shifted focus away from the inadequacies of any measurement system—and from our interest in evoking other ways that people might know and relate with obesity—to the problem of finding the best measurements of obesity. In this shift, the concerns presented by our papers were largely ignored.

In the years I have been studying obesity, I have seen this happen often. In discussions, numbers hold remarkable weight. Many reasons exist for this. When it comes to assessing physical health or measuring weight, waist centimeters, or BIA, reading scores take less time than does the process of becoming familiar with people's lived experiences of eating and movement. To know fatness, as my Guatemalan interlocutors spoke of it, was to have contact, proximity, and a kind of expertise dependent on interpersonal investment. Clearly there are reasons why a country whose overburdened, underfunded health care system would desire fast and inexpensive health care strategies. It takes but a moment to step on a scale or measure one's waist. It takes much longer to develop the kind of intimacy necessary to make a determination of the kind of fatness I described in Guatemala above. Though I would hesitate to convert this intimacy into a price—to make this form of expertise comparable with the cost of a BIA

instrument, for example—it certainly requires commitments of time and energy that Guatemala's official public health infrastructure is not prepared to handle.

The translation of bodily experiences into numbers may also be desirable because of the distance, and the ostensible objectivity or safety of metrics. The argument might go: "In making differences comparable, universes are brought together." But the universality achieved by numbers is only possible with a flattening, a silencing of diversity. Donna Haraway explains this well, writing: "Science has been about a search for translation, convertibility, mobility of meanings and universality—which I call reductionism—which one language (guess whose) must be enforced as the standard for all the translations and conversations" (1988: 580). With numbers, other knowledges about bodies become harder to see, and though they certainly do not disappear, they become more difficult for scientists and public health workers to value.

I suggest that numerical connotations of most uses of accuracy further contribute to this devaluation. When accuracy refers to an ability to hit an external target, to precisely follow a formula, or to find replicable results, it makes sense that the methods we follow to achieve accuracy will push us toward a world of measurements and standards. Yet we must also remember that whether the assessment of metabolic health is made through weight, width, or composite indices, all of these numbers remain abstract representations. Quetelet, in his framing of the idea of the average man understood that this measure was an abstraction. Yet he held that "Abstraction was essential to social science. Real individuals were too numerous and diverse for psychological study to contribute much to an understanding of the social condition" (Gigerenzer 1989: 38). Although the method of abstraction might have its place in epidemiology (indeed, the field would not exist without this), this method is less obviously accurate in the realm of dietary health, where accuracy—if we shift the term away from mechanical connotations—might depend

upon staying close to people, bodies, and experiences as they are lived. We must remember that the attempt to diagnose and treat Julia's headache through a graph of international standards made very little sense to her. She, like many patients, did not return in my remaining months in the clinic, and I cannot say whether her headache was *caused* by weight or even if the scale used reported her *accurate* weight (whether she was *truly* 120 or 130 pounds). But this is not a failure on my part, but rather is a part of the story. Cause and effect, as lived, do not manifest with clear directionality the way numbers and formulas would have us believe. There is no true accuracy existing within measures, and, in this sense, all scales that are used to diagnose problems of health are liars.

The three metric-based methods for assessing obesity I have described above do not have identical effects. They follow different techniques, operate around different distinctions, and produce different versions of obesity.[13] These various measurements and their corresponding classifications of overweight and obesity do not just produce different categories of people (cf. Hacking 1986) but produce different ontologies of the body. When using BMI, because height is fixed, people's attention tends to focus upon their weight. When using abdominal circumference, the focus shifted to concern for stomach fat (hence the attention to over*fat* instead of over*weight*). And with bioimpedance, the object of interest is the previously invisible interior cellular composition of the body.

Yet despite their differences, all of these practices of measuring—in contrast to the notion of fatness I saw in Guatemala—presume that the health of the body can be known by calculating the composition of the body. They reify health, purporting to quantify something that may not, if my Guatemalan interlocutors are to be taken seriously, lay embedded within a substance and that may not be revealed through a metric. They transform people's experience of their bodies into a

proxy of weight, centimeters, or fat percentages, and then they replace the experience with the proxy, leaving people to ask "What is my size?" rather than looking toward less tangible qualities of eating. They also encourage the public health community to look for better, more precise, and more accurate measures of health at the cost of ignoring those experiences and practices related to weight, and eating, and health that cannot be fixed into metrics.

In his critique of the powerful influence that the normal curve has had on scientific thought, Gould writes:

> The primary desideratum in all experiments is reduction of confusing variables: we bring all the buzzing and blooming confusion of the external world into our laboratories and, holding all else constant in our artificial simplicity, try to vary just one potential factor at a time. But many subjects defy the use of such an experimental method—particularly most social phenomena—because importation into the laboratory destroys the subject of the investigation (1994: 139).

Many Guatemalans were attuned to this destruction. For them, the act of measuring the human body and relating this measurement to health was incomprehensible. This was something one did with commodities bought and sold—sacks of corn or sugar in the market. But humans? Many people laughed at the request that they wrap a tape measurer around themselves, seeing this as ridiculous because they did not control their size. Some people became angry. This anger is no doubt complex, defying any singular analysis or source. But I think it can be linked, in part, to the way the act of measurement separates the person from the environment—the tape measure literally binding the body into a circumference whole, the scale reporting a specific weight.

During the moment of measurement the fluid connections between skin and surroundings become frozen. The waist becomes both literally and figuratively demarcated from the world, bounded by a single measurement that in turn individualizes the body. BMI and BIA scores, when translated into the realm of population health, require "thousands upon thousands of physical measurements" to be made intelligible, but at the end of the measurement an individual body is labeled with a single number or score. In this way, body weight measurement is not only an act of reporting, but an enactment of health that many people in my fieldwork found objectionable.

Science studies scholar Donald Mackenzie has argued that although accuracy is no "mere fiction," it is also always thoroughly political (1999: 356). Sociologist Steven Epstein makes a similar claim in pointing out that Quetelet's *l'homme moyen* (average man) "was 'normal' in the double sense; he was the midpoint of natural variation, but also the way that people were supposed to be" (2009: 38). Epstein suggests that, similarly, standards today are not only invoked to strengthen biological and cultural norms, but to also justify the correction of existing deviations. If we could measure health, then the correction of such "deviation" would be most likely celebrated. But we can never measure health; we measure body size and take this as a substitution for health. Though health can supposedly be seen in the standards and graphs that accompany the instruments for body size measurements, health, like Gould's notion of intelligence, is multifaceted, nebulous, and always in flux.

I conclude by drawing attention to the WHO's own answers to the question: "Why classify overweight and obesity?" In their obesity fact sheet they suggest that classification is valuable because it allows:

- meaningful comparison of weight status within and between populations;

- the identification of individuals and groups at increased risk of morbidity and mortality;
- the identification of priorities for intervention at individual and community levels; and
- a firm basis for evaluating interventions (2000:7).

Certainly this chapter cannot unravel all of these explanations for the utility of obesity classification—the use of measurements is far too ingrained within the field of public health. Instead, I hope to create space for additional questions to be inserted into each of these ostensibly canonical bullet points. Meaningful comparisons for whom, and to what end? How are increased risk of morbidity and mortality determined; what remains unspoken and what concerns are not attended to by using weight as a key determinant of health? How will priorities for intervention be determined on the basis of size? How can calculating weight ever say anything about the evaluation of interventions? How useful are the methods of measuring body size, when transported from the realm of international comparative research projects into the realm of personal and public health? What happens when the statistical projections of body weight indices replace the interpersonal attention that might be provided in situated clinical care?

It is my hope that by asking these questions we might challenge an easy translation between obesity classification for the purposes of epidemiological research and obesity classification for the purposes of an individual's health. In drawing attention to the translation of bodies into numbers, we might also begin to consider other, nonmetric ways of relating to size, weight, and fat. Quetelet's approach to knowledge may have become the basis for worldwide standards of obesity, but there are many other versions of obesity—and health—yet to be explored.

References

Alvarado, V .J., E. Mayorga, S. Molina, and N. W. Solmons. 2010. "Correspondence of Two Procedures to Measure Abdominal Circumference in a Convenience Sample of Urban, Middle-class Schoolchildren in Guatemala City." *Asia Pacific Journal of Clinical Nutrition* 19, no. 1: 14–21.

Brietzke, S. A. 2007. "Controversy in Diagnosis and Management of the Metabolic Syndrome." *Medical Clinics of North America* 91, no. 6: 1041–1061.

Daston, L., and P. Galison. 1992. "The Image of Objectivity." *Representations* 40: 81–128.

Epstein, S. 2009. "Beyond the Standard Human?" In *Standards and Their Stories: How Quantifying, Classifying, and Formalizing Practices Shape Everyday Life*, eds. M. Lampland and S. L. Star. Ithaca: Cornell University Press, 35–53.

Flegal, K. M., B. I. Graubard, D. F. Williamson, and M. H. Gail. 2005. "Excess Deaths Associated with Underweight, Overweight, and Obesity." *Journal of the American Medical Association* 293, no. 15: 1861–1867.

Gigerenzer, G. 1989. *The Empire of Chance: How Probability Changed Science and Everyday Life*. Cambridge, New York: Cambridge University Press.

Gould, S. J. 1981. *The Mismeasure of Man*. New York: Norton.

———. 1994. "Curveball." *The New Yorker*, November 28, 139–149.

———. 1996. *The Mismeasure of Man*. Revised and expanded edition, New York: Norton.

Hacking, I. 1986. "Making Up People." In *Reconstructing Individualism: Autonomy, Individuality, and the Self in Western Thought*, eds. T. C. Heller, M. Sosna, and D. E. Wellbery. Stanford: Stanford University Press, 226–236.

———. 2007. “Where Did the BMI Come From?” In *Bodies of Evidence: Fat Across Disciplines*. Newnham College, Cambridge University.

Haraway, D. 1988. “Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective.” *Feminist Studies* 14, no. 3: 575–599.

Janssen, I., P. T. Katzmarzyk, and R. Ross. 2004. “Waist Circumference and Not Body Mass Index Explains Obesity-related Health Risk.” *American Journal of Clinical Nutrition* 79, no. 3: 379–384.

Keys, A., F. Fidanza, M. J. Karvonen, N. Kimura, and H. L. Taylor. 1972. “Indices of Relative Weight and Obesity.” *Journal of Chronic Diseases* 25, no. 6–7: 329–343.

Mackenzie, D. 1999. “Nuclear Missile Testing and the Social Construction of Accuracy.” In *The Science Studies Reader*, ed. M. Baigioli. New York: Routledge, 342–357.

Mol, A. 2010. “Layers or Versions? Human Bodies and the Love of Bitterness.” In *Routledge Handbook of Body Studies*, ed. B. Turner. New York: Routledge, chapter 8.

Moreno, L. A., I. Pineda, G. Rodriguez, J. Fleta, A. Sarria, and M. Bueno. 2002. “Waist Circumference for the Screening of the Metabolic Syndrome in Children.” *Acta Pædiatrica* 91, no. 12: 1307–1312.

Porter, T. M. 1995. “Statistical and Social Facts from Quetelet to Durkheim.” *Sociological Perspectives* 38, no. 1: 15–26.

———. 2000. “Life Insurance, Medical Testing, and the Management of Mortality.” In *Biographies of Scientific Objects*, ed. L. Daston. Chicago: University of Chicago Press, 226–246.

Redfield, R., and A. Villa-Rojas. 1971. *Chan Kom, a Maya Village*. Chicago: University of Chicago Press.

Seidell, J. C. 2007. “The Metabolic Syndrome Does Not Exist [Article in Dutch].” *Ned Tijdschr Geneeskd* 151, no. 14: 812.

Sibum, H. O. 1995. “Reworking the Mechanical Value of Heat: Instruments of Precision and Gestures of Accuracy in Early Victorian England.” *Studies in History and Philosophy of Science Part A*, 26, no. 1: 73–106.

Smith, S. C., and D. Haslam. 2007. “Abdominal Obesity, Waist Circumference and Cardio-metabolic Risk: Awareness among Primary Care Physicians, the General Population and Patients at Risk in ‘the Shape of the Nations Survey.’” *Current Medical Research and Opinion* 23, no. 1: 29–47.

Weller, S. C. 1983. “New Data on Intracultural Variability: The Hot-Cold Concept of Medicine and Illness.” *Human Organization* 42, no. 3: 249–257.

WHO (World Health Organization). 2000. *Obesity: Preventing and Managing the Global Epidemic*. Geneva: WHO.

Yates-Doerr, E. 2011a. “Bodily Betrayal: Love and Anger in the Time of Epigenetics.” In *A Companion to the Anthropology of the Body and Embodiment*, ed. F. E. Mascia-Lees. Malden, MA: Wiley-Blackwell, chapter 16.

———. 2011b. “The Weight of the Self: Care and Compassion in Guatemalan Dietary Choices.” *Medical Anthropology Quarterly* 25, no. 1: 136–158.

Notes

1. I have been conducting ethnographic fieldwork in Guatemala since 2000, with an intensive period of research between January 2008 and April 2009. Numerous organizations have funded my research, including the Wenner-Gren, Fulbright Hays, the SSRC/Ford Foundation, and the

Tinker Foundation. New York University has also provided me with several research and writing grants. Emily Martin, Tom Abercrombie, Rayna Rapp, Sally Merry, and Renato Rosaldo advised my dissertation research, and I am grateful for their endless support. I am currently conducting research in the Netherlands on an ERC funded project supervised by Annemarie Mol. I thank Annemarie for her critical reading of this text and all the members of the Eating Bodies project for their ongoing collaboration.

2. For a more detailed and nuanced view of the work of the nutritionists see Yates-Doerr (2011a); for an overview of how many of these technologies of measurement intertwine with concerns of gender and reproduction see Yates-Doerr (2011b).

3. In this particular study, the presence of metabolic syndrome was assessed through the presence of four or more risk factors, determined by rates of systolic and diastolic blood pressure, glucose, uric acid, fasting insulin, triglycerides, and HDL-C. However, it should be noted that the metabolic syndrome refers to a cluster of symptoms and is itself a contested diagnostic category (Brietzke 2007; Seidell 2007).

4. As reported in mainstream media outlets around the United States, because the demarcations for overweight and obesity shifted downward, "Millions of Americans became 'fat' overnight—even if they didn't gain a pound." See http://www.cnn.com/HEALTH/9806/17/weight.guidelines/, last accessed April 15, 2011.

5. http://www.who.int/mediacentre/factsheets/fs311/en/index.html, last accessed April 15, 2011.

6. Although I do not have space to explore Dual Energy X-ray Absorptiometry or DEXA scans here, brochures for DEXA scans described them as "very accurate and precise," claiming they were fast becoming the new "gold standard" because they "provided a higher degree of precision in only one measurement" and have the ability to "show exactly where fat is distributed

throughout the body."

7. My research on international and public health nutrition in Europe was conducted through a postdoctoral fellowship based in Amsterdam, with research conducted throughout Western Europe. During this fellowship I have followed the development and circulation of ideas about global health nutrition, also interviewing several nutrition scientists—some of whom serve on advisory boards of the World Health Organization and the Food and Agriculture Organization—nutritionists, nutrition students, and doctors.

8. http://www.youtube.com/watch?v=TaxCELxwmas, last accessed April 15, 2011.

9. http://www.bodycompscale.com/, last accessed April 15, 2011.

10. The word *ineffective* might look strange here, given the technique's mechanical achievements. But I mean it quite literally—bioimpedance is *ineffective* in places where it cannot function.

11. Several theories, both economic and evolutionary, have been put forth about why this might be the case, some of which are summarized in Hardin, this volume. I do not have space to explore the validity of these theories, which is largely irrelevant to my interest here—i.e., *that* people in Guatemala saw fatness as healthy, not why this was the case.

12. My Guatemalan informants were unaware of a formalized Health at Any Size movement and had not heard of fat activism, but for an interesting comparison between their practices and these movements in the United States and Europe, see Rubin and Joseph, this volume. For a nice complement to Guatemalan notions of feasting and sociality, compare the examples I have presented with the descriptions of feasting and fasting in Samoa provided by Hardin, this volume.

13. I borrow the idea of versions from Annemarie Mol, who writes that versions, which are

simultaneously physical and social "emerge in different circumstances…. Versions of the body are performed, orchestrated enacted. They are done in practices" (Mol 2010).