CHAPTER 4

Conceptualizing Ecobiosocial Interactions: Lessons from Obesity

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Introduction

In 1997, the World Health Organization (WHO) recognized obesity as an emerging global public health concern (WHO, Division of Noncommunicable Diseases 1998). It convened an expert consultation on obesity with the aim of reviewing epidemiological data and making recommendations for future research, treatment, and prevention. The report from the meeting reiterated the existing clinical perspective: that obesity is fundamentally a result of sedentary lifestyles and the consumption of high-fat, energy-dense diets. It also pointed to new research attention being paid to the role of environments in population-level weight gain (WHO 1998). The report suggested that exposure to unfavorable environments may accelerate obesity, but acknowledged that identifying and studying environmental factors that contribute to weight gain was extremely challenging.

By the time of the WHO's recognition that environments may play a role in obesity emergence, researchers had already begun to argue for a shift in thinking about obesity. In 1997, Egger and Swinburn proposed an ecological framework

A Companion to the Anthropology of Environmental Health, First Edition. Edited by Merrill Singer.

for understanding obesogenesis which took into account biological, behavioral, and environmental factors. They described examples of "micro" and "macro" environmental factors (for example, food in the home and food industry policies respectively) and argued that a "paradigm shift to understanding obesity as 'normal physiology within a pathological environment' signposts the directions for a wider public health approach to the obesity pandemic" (Egger and Swinburn 1997: 480). Similarly, following the publication of the WHO report, Hill and Peters argued that "to stop and ultimately reverse the obesity epidemic, we must 'cure' this environment" (1998: 1373). Swinburn and colleagues continued to develop their argument and published a framework describing the "obesogenic environment" in 1999 (Swinburn, Egger, and Raza 1999). This is one of two frameworks further elaborated in this chapter.

More recent reviews focusing on obesogenic aspects of the environment illustrate the extent to which these and other calls for a shift in thinking about obesity resulted in a proliferation of ecological approaches to obesity in the years that followed. For example, literature on the built environment and obesity has largely been published since 2002 (Papas *et al.* 2007). Food environments, initially through the analytical category of the "food desert" – an area characterized by limited access to healthy, affordable food – began to be associated with obesity in 1995 (Lang and Caraher 1998). Literature on retail planning and geographical implications for obesogenesis is recent (White 2007). In 2009, Harris and colleagues reviewed existing data and called for new approaches to studying the implications of the media and marketing environments for childhood obesity (Harris *et al.* 2009). A review of the relationships between physical activity and obesity highlighted the need for policy makers to consider not just recreation facilities, but also broader features of location, including socioeconomic context, neighborhood, workplaces, and land use (Fox and Hillsdon 2007). Various pathways have been hypothesized to link the environment to obesity; these continue to be investigated but are increasingly framed as complex and multifactorial. Genetics, epigenetics, social change, and cultural change may all play a role.

The proliferation of research relating to obesity and the environment has resulted in the description of a series of discrete yet intersecting environments and environmental factors which have been linked to obesogenesis through evidence from a wide range of disciplines. Environments at once shape our diets and are shaped (often degraded) by large-scale food production (Leatherman and Goodman 2005). Industrial agriculture, for example, is linked in numerous ways to environmental and public health outcomes (Horrigan, Lawrence, and Walker 2002). Built environments, and our interaction with them, impact on activity levels and access to food (Papas *et al.* 2007). Activity levels, for instance, may be linked to the walkability of streets or access to green space, while food access may depend on the relative proximity of retailers of fast or fresh food (Beaulac, Kristjansson, and Cummins 2009). Local food environments are shaped by social determinants and political-economic and commercial factors (Drewnowski 2004), while prenatal or fetal environments can shape future body fatness through metabolic, genetic, and epigenetic mechanisms (Whitaker and Dietz 1998).

The resultant "cacophony" of obesogenic environmental factors, ecological analyses, and policy solutions (Lang and Rayner 2007) added to the complexity of the obesity-related policy challenge. In an effort to overcome this challenge, the UK government, through the Foresight think tank process, used systems science to link diverse forms of evidence. The resultant "obesity system," graphically represented as the Foresight Obesity System Map (FOSM) (Butland *et al.* 2007; Vandenbroeck, Goossens, and Clemens 2007), remains one of the most complex political ecological models of obesity today. This is the second framework further elaborated in this chapter.

In this chapter, we use the *obesogenic environment* (as framed by Swinburn, Egger, and Raza 1999) and the *obesity system* (as described by Butland *et al.* 2007) frameworks as the basis for exploring the potential for ecobiosocial conceptualizations of obesity. In the following section we discuss the two frameworks in more detail, describing the context of their development and the way in which they conceptualize environmental impacts on health. We then examine each of them to identify the ways in which environmental, biological, and social factors are synthesized. Application of anthropological data to the two frameworks points to several places where ethnographic data detailing lived experience do not fit well into these frameworks. Social relations and historical processes are particularly absent. We conclude by suggesting that an ecobiosocial framing of obesity has the potential to contribute a greater understanding of this global health concern. A focus on processes (and not simply factors), which is rooted in ethnographic inquiry, may be a useful way to develop such a framework.

Frameworks for Conceptualizing Obesity

The Obesogenic Environment

The concept of the obesogenic environment, and the analytical framework with which it was described, was developed by researchers in the field of public health in the late 1990s. It was developed in response to an identified need for methods that would allow the environment – which was increasingly being acknowledged as a contributor to population-level obesity – to be rigorously and systematically studied.

The ANGELO (Analysis Grid for Environments Linked to Obesity) framework, which Swinburn *et al.* (1999) proposed as a tool to systematically describe and analyze the obesogenic environment, was an extension of their ecological framework for understanding obesity (Egger & Swinburn 1997). It permitted them to progress obesity theory from acknowledging the environment's contribution to obesity in broad terms, to identifying individual factors and features of the environment that could be studied, measured, and potentially modified. The framework was refined and tested in collaboration with communities in Australia and the Pacific islands, and it continues to be used for the purposes of policy making, intervention design, and priority setting.

The ANGELO framework is a grid that divides the environment into one of two sizes and one of four types; each environmental factor can be placed

Table 4.1 The ANGELO framework developed by Swinburn *et al.* (1999). All environmental factors are classified into one of eight grid cells.

Size \ Type	*Physical*		*Economic*		*Political*		*Sociocultural*	
Micro (settings)	Food	Physical activity	Food	Physical activity	Food	Physical activity	Food	Physical activity
Macro (sectors)	Food	Physical activity	Food	Physical activity	Food	Physical activity	Food	Physical activity

Source: Modified from Swinburn *et al.* (1999: 565).

somewhere in this eight-cell grid (Table 4.1). In terms of size, the environment is classified as either micro (local settings with which individuals interact, which are to some degree modifiable by the individual) or macro (broader sectors which are generally beyond the control of an individual). Examples of each are given by the authors: micro settings include festivities, neighborhoods, schools, homes, churches, and markets; macro settings include transport and the health regulatory system. Within each of these settings there are different types of environments. Swinburn *et al.* (1999) categorize these as being physical, economic, political, or sociocultural. Food and physical activity are subcategories within each of the eight grid cells.

Factors may be identified by researchers, policy makers, or local community representatives; the framework is a tool which facilitates communication between different stakeholders. They are then sorted into one of the grid squares. In the small Pacific island of Nauru, for example, one significant barrier to physical activity is the ferocious feral dog population which roams the streets. These dogs limit the extent to which people walk, especially in the mornings and evenings. This community opinion was formalized in the World Health Organization STEPS survey, where 58 percent of respondents reported that the presence of dogs in their area was a barrier to walking (Government of Nauru & World Health Organization 2007). Such a factor would be considered in the ANGELO framework to be micro level (and so somewhat modifiable at the individual and local level) and part of the physical environment. Other factors, such as international trade agreements that facilitate the import of some foods and drinks and are barriers to others, would be classified as macro level (not modifiable at the local level) and part of the political environment.

The ANGELO grid is not only a tool for researchers to classify aspects of the environment. It can also be used by community health workers and nutritionists to systematically think about the ways in which the environment may impact health in their local communities, as well as to systematically list factors alongside each other so that their relative importance and feasibility of intervention can be discussed and assessed. It could be used, for example, to discuss, debate and compare factors as diverse as feral dogs and trade policy: which could be feasibly addressed, by whom, in which timescales, and to what ends? Swinburn *et al.* (1999) tested their framework amongst nutritionists from across the Pacific islands. After initially populating the grid through brainstorming,

participants could then use the tool to prioritize interventions and future research. Each factor was ranked according to three key criteria: validity (based on existing research evidence for its influence on diet and physical activity), relevance (to the community in question), and changeability (or its potential as a target for intervention). Scores for these areas could be aggregated to prioritize interventions. This framework continues to be useful for prioritizing research attention and intervention design in particular locales.

Through the application of the ANGELO framework, it becomes clear that certain environmental factors are more significant than others in different places, and to different people. For governments, for example, addressing feral dogs and individual physical activity levels is a much more feasible target for intervention than engaging in renegotiation of trade policies. This is especially the case in small island nations, which have comparatively little power in global trade policy negotiations, including those concerning poor-quality cuts of meat or industrially processed foods like two-minute noodles (e.g., Gewertz and Errington 2010; Errington, Fujikura, and Gewertz 2012; Snowdon and Thow 2013). Matters such as global economic power and inequality, colonial histories of exploitation, and changing local social relations are not considered by the model, which deals more with the factors resulting from these complex processes.

The description of the obesogenic environment using the ANGELO framework progressed the conceptualization of the environment because it permitted systematic analysis of what had previously been a somewhat nebulous concept. This research succeeded in breaking the environment down into analytically manageable units or factors. Early application of the framework highlighted the complexity of factors in the environment that contribute to obesity and health more broadly, as well as the powerlessness of individuals and communities to address many of these factors. This remains somewhat discordant with the clinical and health promotion approaches to obesity which largely continue to focus on the individual as the key locus of change.

Application of the framework also highlighted the balance of attention that had already been paid to different aspects of the environment. While a great deal of research had already been carried out regarding economic factors, for example, the authors pointed to the ongoing difficulties in measuring sociocultural aspects of the environment. Over the subsequent years, increasing numbers of social, technological, economic, behavioral, political, biological, and psychological factors were identified as contributing to the obesogenicity of the environment.

The Obesity System

The obesity system, graphically represented as the FOSM (Butland *et al.* 2007; Vandenbroeck *et al.* 2007), was developed almost a decade after the obesogenic environment construct of Swinburn *et al.* (1999). It was the result of a policy-making initiative, and the outcome of an identified need to bring many forms of evidence about the obesogenicity of environmental factors together along with biological ones, for the purposes of long-term policy planning.

The obesity system characterized by the FOSM is arguably the most complex political ecological framing of obesity to date. It was constructed over a period of two years in consultation with over 200 experts from a broad range of non-governmental organizations and academic, commercial, and governmental sectors, and captured both evidence-based research findings and expert opinion. The FOSM features 108 "nodes," each representing a factor thought by experts to contribute to obesity etiology. Nodes are grouped in four major areas: human physiology, physical activity patterns, psychology, and the food environment (Vandenbroeck *et al.* 2007). These areas are, in turn, divided into seven thematic clusters, also described as subsystems or themes, on the system map (Butland *et al.* 2007: 82–85): physiology (which is interchangeably labeled as "biology" in some parts of the report), individual physical activity and physical activity environment, individual psychology and social psychology (which is interchangeably labeled as "societal influences" in some parts of the report), and food consumption and food production.

Each thematic cluster, and each node therein, feeds into a central loop of energy imbalance. Nodes are linked according to the systems designers' observations of the experts' discussions of how the factors associated with obesity are connected. While the nodes themselves are of equal size, the weighting of linkages between them (indicated by the weight of the lines drawn between nodes) varies depending on the extent to which a particular factor has been shown (or hypothesized) to impact the factor to which it is connected. The map is intended to be dynamic, with countless feedback loops of positive and negative reinforcement between nodes.

The *walkability of the living environment*, which may include factors such as feral dogs, as seen on Nauru, is one of the nodes on the FOSM. The node is located in the physical activity cluster, and is iteratively connected to the node representing the *dominance of motorized transport*, through which it contributes to *overall level of transport activity* and hence *overall physical activity levels*. The *walkability of the living environment* is also directly connected to *perceived lack of time*, a node in the social psychology cluster which is closely connected – via *stress* – to *psychological ambivalence*.[1] In this way, the matter of feral dogs in Nauru may be understood through the framework as being associated with obesity via at least two major pathways: dogs reduce physical activity because walking is (often correctly) perceived to be dangerous, they increase stress, and they contribute to psychological ambivalence as people struggle to follow health guidelines. The FOSM depicts all of these factors feeding into generating positive energy balance in individual bodies. While this depiction is complex, comparison with ethnographic data shows that it does not capture the interwoven social, economic, political, and historical underpinnings of the factor. Understanding how factors (or nodes) on the map have contributed to obesity – itself a phenomenon which has emerged over time – is complicated insofar as factors on the map remain asocial and ahistorical.

In the obesity system, many different factors are brought together in a map that connects them conceptually. Importantly, this highlights the complexity of obesity and the interdependence of environmental factors which contribute to

it. At the time, it also demonstrated the discordance between environmental factors as they interact in practice, academic categorizations of them, and governmental sectors in whose jurisdictions they fell. The FOSM has continued to inform UK government action and further international research on the drivers and prevention of obesity (Morgan and Dent 2010; Department of Health for England 2011). It is one of a number of approaches that aim to incorporate increasingly sophisticated systems modeling techniques (including agent-based modeling, data modeling, and mathematical modeling) into conceptualizing global concerns such as obesity or climate change.

The obesity system added two new dimensions to framing obesogenic environments. First, it attempted to unite data from different academic disciplines and to overcome the delineations between the factors they elaborated (Foresight 2005). Second, it attempted to capture, using systems mapping and concepts such as feedback loops, the iterative interactions between different factors. This is particularly important for understanding the broader impacts of intervening at any one point in the system; it is also useful for understanding the cross-sector and cross-departmental collaboration likely to be required to effect population-wide change.

Disentangling the Environmental, Biological, and Social Factors in Each Framework

The ANGELO framework and FOSM were developed for different reasons, at different times, and based on different bodies of evidence. In the obesogenic environment, environment is framed as all encompassing. The purpose of the ANGELO framework is to describe elements of this environment in systematic detail. A range of factors, including the four types explicitly listed in the framework (physical, economic, political, and sociocultural), are conceptualized as falling within a person's environment. Environment is also framed as multilayered: factors may be either micro-environmental or macro-environmental. The micro environment is framed as being local (and potentially amenable to local change) while the macro environment is defined by larger structures that cannot be altered by local action or local actors. Micro-environmental settings are described as places, people, and groups who gather for physical activity and/or food; examples include homes, schools, neighborhoods, gyms, churches, or supermarkets. These are embedded in, and shaped by, geographically diffuse macro-environmental sectors such as industry, media, food production, and transport systems.

The obesogenic environment defined using the ANGELO framework is described as being linked to obesity in the way that it impacts an individual's eating and physical activity behavior; this, in turn, acts through biological metabolic systems to effect weight change. For example, poor access – physically and financially – to fresh food and comparatively close proximity of processed food vendors to schools and places of work may result in increased calorie intake and obesity (Mitchell, Cowburn, and Foster 2010). An illustrative example of this is

described in Warin's (2011) ethnographic analysis of obesity in Rotherham, a northern English town at the center of a reality TV show highlighting poor health and nutrition. Alternatively, a neighborhood equipped with well-maintained footpaths, accessible sporting facilities and safely lit streets may encourage people to walk, cycle, and spend more time outdoors, which would directly impact on their physical activity levels.

The ANGELO conceptualization aligns well with epidemiological data which indicate that obesity emergence has, for example, coincided with changing physical activity behaviors in a variety of domains. At the micro level are transportation, everyday (or incidental) activity, work, and play (Wareham 2007). These are shaped at the macro level by changes to the natural environment, loss of outdoor green space, and urbanization. Urban environments vary in their physical infrastructure, access to services, and availability of food and green space. However, the population-level change that comes with the nutrition and behavior transition of urbanization has been linked to shifts in body composition and higher levels of obesity in diverse settings (see Popkin 1999, 2004). This resultant built environment has been associated with increased levels of physical inactivity and obesity emergence (Fox and Hillsdon 2007).

In the obesity system characterized by the FOSM, the environment is framed as one part of a broad range of factors contributing to obesity. Environmental factors are concentrated in four of the seven thematic clusters: "food production" and "food consumption" (which together constitute the food environment), "individual activity," and "activity environment." Food production structures possible food consumption patterns, while the activity environment structures possible individual physical activity patterns. Both food consumption and individual physical activity are framed as acting through energy imbalance to produce obesity. The food supply chain – as part of a food environment – and the multinational corporations and government stakeholders that control it, impacts on the prices and fiscal accessibility of food (e.g., Hawkes 2006). In this way, transportation, everyday activity, built environment, space for recreation, food production and consumption, for example, are all depicted as exerting iteratively interacting forces in the overall system.

The framework of the obesogenic environment proposed by Swinburn *et al.* (1999) mentions biology in several places. All environmental factors act through metabolic systems to effect weight change. This reflects the classic biomedical framing of obesity as an imbalance between energy intake (eating) and energy expenditure (exercise). This means that any obesogenic environmental factor is seen as ultimately either increasing people's calorie consumption or decreasing physical activity levels. Biology is also depicted as something that ultimately drives behavior; all aspects of behavior which cannot be attributed directly to biological causes are depicted as arising from environmental impacts. The biological has two places in the FOSM as well. Biological drivers feature prominently as mediators at the center of the model, as all factors on the model are depicted as ultimately influencing energy balance in an individual. But within the model there is also a separate thematic domain, one of seven in total, for "physiology" (it is also referred to as "biology" in some parts of the report

which accompanies the systems map). This includes nodes for resting metabolic rate, predisposition to activity, quality and quantity of breastfeeding, and genetic or epigenetic predisposition.

In Swinburn *et al.*'s (1999) framework, the "sociocultural environment" is one of four different parts of the overall environment, the others being political, physical, and economic components. Social factors as depicted in the model include local attitudes, beliefs, and values explicitly related to physical activity or food, such as the cultural importance of high-fat foods. In the obesity system, the label of "social psychology"/"societal influences" is given to one of seven thematic clusters. Factors that fall within this cluster include media consumption, peer pressure, education, acculturation, and conceptualization of obesity as a disease.

For anthropologists, a number of factors that fall outside of this thematic cluster also have social dimensions. Food and its use, for example, are inherently social. Food environments are not simply physical settings; rather, people are involved in food preparation, production, distribution, and consumption. Political and economic factors can significantly alter this setting through policies, subsidies, import restrictions, marketing regulation, and taxes. Taxes or duties are not simply fiscal measures but have deeply rooted social links based on political, economic, and historical context (Timpson, Lavin, and Hughes 2013). Timpson *et al.* (2013), for example, describe how attitudes and beliefs about taxes differ based on socioeconomic status and geographic location of individuals and communities. A number of taxation models have been developed to suggest the health benefits of taxes placed on specific ingredients (for example, certain amounts of salt, sugar, or saturated fat) or on specific types of food (for example, cookies or soft drinks), the thinking being that people will change their buying and then their consumption behaviors if the price of food changes drastically (Landon & Graff 2012; Mytton, Clarke, and Rayner 2012; Barquera, Campos, and Rivera 2013). Longstanding tobacco excise taxes have proven to be a powerful environment-changing tool for reducing tobacco use globally by shifting consumption patterns through cost (Chaloupka, Yurekli, and Fong 2012). However, even models of taxation schemes are fraught with political debate, conflicting stakeholder interests, local dissention, and passionate arguments both for and against them (Landon and Graff 2012) and are just one part of an individual's environment. Such matters are inherently social, but are largely considered in both models to fall within political or economic domains.

Both ANGELO and FOSM integrate the environmental, biological, and social into one model, but they do so in very different ways. ANGELO frames environment (of which the social is one discrete part) as all-encompassing, biology being the mediator between environment and health outcomes. ANGELO does not take into account the mediating role culture and social factors play between environment and health. In FOSM, environmental factors, biological factors, and social factors are each separate and are depicted as iteratively intersecting. Metabolic systems are the mediator between all of these factors and health outcomes. Comparison with anthropological examples highlights the assumptions implicit in both frameworks. Environments and

the foods produced in them, for example, are shaped by complex social, cultural, and economic forces. This was demonstrated well by Mintz in his classic anthropological research documenting the rise of sugar consumption in Britain (Mintz 1985).

Ecobiosocial models have previously been developed for studying infectious diseases such as dengue fever, as a way to bring together environmental, biological, and social data about disease patterns (Arunachalam *et al.* 2010). Insofar as both of the obesity models discussed here illustrate the extent to which obesity is the product of the interaction of environmental, biological, and social factors, both illustrate that obesity may be considered to be an ecobiosocial phenomenon. Reframing obesity from a biomedical to an ecobiosocial phenomenon invites attention from nonmedical fields of research and links it to other complex global phenomena such as climate change.

What Is Missing from These Ecobiosocial Frameworks?

The processes behind the development of both ANGELO and FOSM moved the obesity research agenda forward in striking ways. However, despite the conceptual links between obesity and the environment that have been firmly established over the past decades, interventions largely continue to target individuals and their eating and physical activity behaviors, habits, and choices (Swinburn *et al.* 2011). This is in part because population-wide measures to impact food and physical activity environments are often politically difficult to implement and may not be allowed the lifespan needed to see long-term change in a population. Examples of this can be seen in various attempts to impose taxes and other fiscal measures on fats, sugars, and alcohol across Europe (Landon and Graff 2012). There is a contradiction between the ecobiosocial framing of obesity and the individualist intervention strategies for it.

Other factors also contribute to this evidence/practice contradiction. Both frameworks reviewed here are based on implicit biomedical assumptions about obesity, health, and the body; they ultimately still depict individual diet and exercise to be the locus of health and therefore of change. Interventions which target individuals can be delivered through existing clinical services, are more cost-effective, and are less politically charged. Ecobiosocial interactions do not conform to a cause-and-effect model and so it is difficult to gather sufficient longitudinal evidence to politically justify ecobiosocial intervention. In addition, environmental determinants are often linked to large industrial organizations or institutions, which have comparatively more power to resist change than individuals. At the same time, obesity remains a significant global public health concern, and the stigmatization of obese individuals is perpetuated on an increasingly global scale (Brewis *et al.* 2011). Underlying social values may unknowingly bias research and intervention design and implementation. This can be partly attributed to challenges – such as those outlined by Swinburn *et al.* (2011) – faced in creating and evaluating policies based simultaneously on environmental, biological, and social principles.

Our examination of the two models, and attempts to fit ethnographic data into them for the purposes of illustrating how they might be applied, highlight additional points of contradiction between the frameworks and lived experience which may contribute to the mismatch between ecobiosocial framings of obesity and the interventions that arise from them. Stray dogs were not a problem on Nauru in the 1960s, but they are today. Likewise, obesity has emerged in Nauru between the 1960s and today; for this reason, a historical perspective may be informative. In the 1960s, dogs had to be registered with the government (non-registration was punishable by fines), most were de-sexed by local veterinarians, and stray dogs were impounded by environmental health officers. Over time, and with increasing national liberalization, registration was less strictly enforced and fines no longer administered. Environmental health budgets were redirected as a result of increasing concerns about communicable and noncommunicable diseases (which were, at the time, largely attributed to individual diet and exercise). Rapid political changes meant that longer term policies were difficult to adopt and enact. An economic downturn had several impacts: for instance, veterinary and environmental health services were further reduced, and changing social relations meant that personal security became an increasing concern and increasing numbers of households invested in ferocious guard dogs which they could not always afford to feed. While people continue to call on the government to address the issue, government spending priorities lie elsewhere. For example, the Department of Transport struggles to maintain roads and sewerage systems, and the Department of Health struggles to provide adequate acute care; both of these are of greater concern to local people, and to international aid donors, than stray dogs. The classification of stray dogs as part of the micro-level physical environment does not acknowledge that the walkability of the environment is as much political, economic, and social as it is physical. Likewise, it is as much a macro-environmental matter as it is micro-environmental. Issues of class, power, race, and (global) inequality are also omitted. Such points of contradiction between lived experience and the existing ecobiosocial models may form additional barriers to the design and implementation of interventions based on the two frameworks.

Neither ANGELO nor FOSM explicitly considered how environmental, biological, and social factors come together and are negotiated and experienced in everyday life over time and cross-culturally. Anthropologists have recently defined the term "ecobiosocial" as referring to interacting "economic, ecological, biological and social relational forces that impact human health" (Singer and Erickson 2011: 517). This is distinct from the epidemiological application of ecobiosocial modeling discussed in the previous section insofar as it emphasizes the importance of "social relational forces" or processes, and not simply "social factors," for understanding human interactions with the environment.

While social factors are incorporated as individual research nodes in both frameworks of obesity considered here, social relations infuse all environmental factors the frameworks contain. In the ANGELO framework, physical, economic, and political environments (and not simply those in the sociocultural category) are inherently relational. Physical environments are constructed,

designed, shaped (intentionally and unintentionally), and lived in by people. Economic and political factors, such as farm subsidies, agribusiness, socioeconomic status, or household spending are linked to relations of power, gender, and ethnicity. The FOSM captures some of the interaction between different factors and its conceptualization of the relational is more sophisticated.

Practices that anthropologists have studied as being inherently social do not necessarily fall within the social portion of the FOSM. Quality and quantity of breastfeeding, for example, is listed as a "biological" factor in the obesity system, but has been anthropologically linked to historical, political, gender-related, and economic factors (Wall 2001). Even ambient temperature, a node that appears in the physical activity environment portion of the FOSM, is relational. Buildings or vehicles may be climate-controlled, and hours spent working or traveling are related to patterns of employment, socioeconomic status, political power (or lack thereof), kinship, exchange practices, and so on. The outdoor ambient temperature is equally relational, being linked to urban design, the balance of built and natural environments, and complex issues such as global climate change, risk, and vulnerability (Baer and Singer 2009; Baer and Singer 2014).

Another reason for the contrasts between ANGELO and FOSM and their operationalization into policy and practice emerges when comparing them to the phenomenon of obesity they seek to describe. While obesity emergence has occurred over the past 60 years, which in itself should suggest focusing on changes in social and political processes, both frameworks consider only the contemporary environment. This contrasts with evidence suggesting that insecurity linked to neoliberal political systems emergent in the past 30 years or so contributes to obesity (Offer, Pechey, and Ulijaszek 2012). This is important, because the environment and our interaction with it are rooted in historical and political economic processes (e.g., Mintz 1985; Steel 2009). The purpose of ANGELO is to describe and analyze the contemporary environment; it makes no claim to study historical processes, and these would not be expected to be captured in the model. The FOSM aims to capture processes of change and interaction between nodes of influence. However, while inter-nodal relationships are depicted as having the potential for dynamicity, the structure of the overall environment (or the nodes depicted in the system) remains fixed. Thus the nodes represent factors at a specific point in time and they are dynamic only in their relationships to each other, not through time.

Obesity has emerged gradually as a population-level phenomenon in the latter half of the twentieth century. Some authors have shown that trends in increasing BMI (body mass index) can be identified in even earlier time periods (Komlos and Brabec 2010). However, neither framework considered here has a time-depth that matches, or exceeds, the historical emergence of obesity over time, and neither refers to historical data in its construction. The environment, as well as the iterative human–environment interactions that shape our relationships with and within it, has changed markedly over the past century. This historical dynamicity is yet to be captured in the modeling of obesity. While obesity could be considered an outcome of ecobiosocial interactions over time, social relational interactions and time remain less well elaborated in the frameworks we have discussed.

Conclusion

In this chapter we argue that obesity is an outcome of ecobiosocial interactions, but that frameworks representing these interactions remain to be developed. Anthropological understandings of ways in which the environment can make and unmake health may be useful in developing ecobiosocial frameworks of obesity. In practice, social relations and historical processes are central to shaping environments and human interactions within them, which rebound in diverse ways on individual health, and these are likely to be important in the case of obesity.

A reason that the relational is important is because it permits abstract models to connect with everyday lives. While the ANGELO framework was practical in policy-making terms, as illustrated by its successful trial with stakeholders from island communities, it did not take into account the complex and iterative interactions between different factors that could, for instance, undermine interventions put in place (Finegood, Merth, and Rutter 2010). The FOSM took these interactions into account where possible, but in doing so it became a complex tool for policy development and design and became removed from everyday realities. A focus on social relations in addition to social factors may permit future frameworks, including ecobiosocial ones, to move more readily from theory to practice. While it is difficult to capture the fluid nature of human relationality, some efforts have been made to situate the production of obesity within social relations. For example, social relations and their links to population-level obesity emergence have already begun to be elucidated in research focusing on social networks (Christakis and Fowler 2007), social capital (Ulijaszek 2012), socioeconomic status (Offer *et al.* 2012), and cultural consensus modeling (Ulijaszek 2007).

Time, and change over time, is also important. A comparison of the frameworks described illustrates the progress from systematic description of a static environment to beginning to conceptualize relations of feedback and reinforcement within it. However, both models depict the environment as a fixed framework. For the purposes of policy design, models are used to project and predict future outcomes at a hypothetical level. Historical analysis, and an understanding of the processes through which a certain environment has taken shape, may contribute to developing interventions based not on hypothetical projections but on evidence. In order to capture historical processes, however, frameworks must somehow depict the environment as a dynamic relational field rather than a fixed framework of factors.

Obesity is a good example of where human interaction with the environment can make and unmake health in many societies. The two frameworks examined here conceptualize the links between obesity and our environment. In doing so, they also illustrate how obesity can be understood as an ecobiosocial phenomenon, resulting from complex and intersecting environmental, biological, and social factors. Close examination of these frameworks in the context of ethnographic data, however, points to places where they – as well as the concept of ecobiosociality more broadly – might be further refined in the future.

Anthropologists have recently highlighted the importance of social relations and processes, and not simply social factors, in developing such models. Social relations weave environmental and biological factors together. They encompass a multitude of important aspects of everyday life which contribute to health outcomes, including ethnicity, power, politics, and exchange relations, as well as habits, social values, and historical changes in all of these. Through the example of obesity, it is possible to see that "ecobiosocial" is not simply the sum of environmental, biological, and social *factors*. These domains could also be seen as dynamic relational *processes*, iteratively interrelated over time, and negotiated by people in their everyday lives. Ecobiosocial frameworks informed by anthropological inquiry and focusing on processes rather than factors may be useful in describing obesity emergence in future.

NOTE

1 See an interactive version of the FOSM at: http://www.shiftn.com/obesity/FullMap.html.

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CHAPTER 5

Environmental Racism and Community Health

Melissa Checker

Beryl Thurman, president of the North Shore Waterfront Conservancy (NSWC) of Staten Island, New York liked to joke that her neighborhood looked like an industrial "Girls Gone Wild Video." This 5.2-acre stretch of waterfront on Staten Island's north shore contained approximately 21 contaminated properties including two private waste transfer stations, a Department of Sanitation garage, a Con Edison plant, a sewer treatment plant, several bus depots, a former lead paint factory, and a radioactive site that was part of the Manhattan Project. Four properties were on the federal Superfund list, and another seven appeared on New York State's priority cleanup list. Just 70 feet away from these sites, the North Shore's dense residential neighborhoods housed the city's fastest growing populations of Hispanics, African Americans, and low-income families (Checker 2009). Unsurprisingly, the North Shore also reported the borough's highest asthma rates, and children on the North Shore exhibited lead levels that were up to 15 percent higher than New York City averages (NYC DOHMH 2010, 2006). Long before Hurricane Sandy, residents here raised alarms about the risks they faced from contamination as well as increased flooding caused by rising sea levels and storm surges. They constantly lobbied city, state, and federal officials to mitigate both contaminants and flooding, and to permit new development with these issues in mind (Checker 2012).

Several hundred miles to the south, in the mid-sized city of Augusta, Georgia, low-income residents of the Hyde Park neighborhood also coped with extensive and long-term contamination. This neighborhood was originally set aside for

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This edition first published 2016

Registered Office
John Wiley & Sons, Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK

Editorial Offices
350 Main Street, Malden, MA 02148-5020, USA
9600 Garsington Road, Oxford, OX4 2DQ, UK
The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK

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Library of Congress Cataloging-in-Publication Data

Names: Singer, Merrill, editor of compilation.
Title: A companion to the anthropology of environmental health / edited by Merrill Singer.
Description: Chichester, UK ; Malden, MA : John Wiley & Sons, 2016. | Includes bibliographical references and index.
Identifiers: LCCN 2015044829 (print) | LCCN 2015050092 (ebook) | ISBN 9781118786994 (cloth) | ISBN 9781118786925 (ePub) | ISBN 9781118787137 (Adobe PDF)
Subjects: LCSH: Environmental health. | Public health–Anthropological aspects.
Classification: LCC RA565.A3 C66 2016 (print) | LCC RA565.A3 (ebook) | DDC 362.1–dc23
LC record available at http://lccn.loc.gov/2015044829

A catalogue record for this book is available from the British Library.

Cover image: Getty/greg0070

Set in 10/12.5pt Galliard by SPi Global, Pondicherry, India
Printed and bound in Malaysia by Vivar Printing Sdn Bhd

1 2016

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