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Obesity in sub-Saharan Africa: development of an ecological theoretical framework

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SUMMARY

The prevalence of overweight and obesity is increasing in sub-Saharan Africa (SSA). There is a need for theoretical frameworks to catalyze further research and to inform the development of multi-level, context-appropriate interventions. In this commentary, we propose a preliminary ecological theoretical framework to conceptualize factors that contribute to increases in overweight and obesity in SSA. The framework is based on a Causality Continuum model [Coreil et al. Social and Behavioral Foundations of Public Health. Sage Publications, Thousand Oaks] that considers distant, intermediate and proximate influences. The influences incorporated in the model include globalization and

urbanization as distant factors; occupation, social relationships, built environment and cultural perceptions of weight as intermediate factors and caloric intake, physical inactivity and genetics as proximate factors. The model illustrates the interaction of factors along a continuum, from the individual to the global marketplace, in shaping trends in overweight and obesity in SSA. The framework will be presented, each influence elucidated and implications for research and intervention development discussed. There is a tremendous need for further research on obesity in SSA. An improved evidence base will serve to validate and develop the proposed framework further.

Key words: obesity; sub-Saharan Africa; theory

INTRODUCTION

Rates of overweight and obesity are increasing across the globe. The World Health Organization has estimated that by 2015, 2.3 billion adults will be overweight and 700 million adults will be obese (WHO, 2010a). Sub-Saharan Africa (SSA) is not immune to the obesity epidemic, despite the continued burden of undernutrition in many SSA countries (Lopez *et al.*, 2006; Bleich *et al.*, 2008). Increases in the rates of overweight and obesity are being identified in SSA, especially among women and people dwelling in urban

populations (Afolabi *et al.*, 2004; Renzaho, 2004; Kruger *et al.*, 2005; Abubakari *et al.*, 2008; Kimani-Murage *et al.*, 2011). A study by Ziraba *et al.* (Ziraba *et al.*, 2009) found that prevalence of overweight and obesity grew by almost one-third between 1992 and 2005 in a sample of women from SSA countries (Bleich *et al.*, 2008; Ziraba *et al.*, 2009). The prevalence of obesity in urban West Africa more than doubled (increased 114%) from 1995 to 2005 (Mbanya and Ramiya, 2006). Fifty-six percent of South African women and 29% of men are overweight or obese according to a 2002 study (Puoaane *et al.*, 2002).

Overweight and obesity are risk factors for a number of non-communicable diseases (NCD), including heart disease, hypertension and cancer. Accordingly, as rates of overweight and obesity rise in SSA and the rest of the developing world, rates of NCD are on the rise as well. WHO has predicted that NCD deaths will increase by 17% over the next decade, with the greatest increase in the African region (27%) (WHO, 2010a). The ‘double threat’ of communicable disease (CD) and NCD to the people in developing countries calls for the development of creative health interventions across the continuum of care (Nwankwo *et al.*, 2008; Maher *et al.*, 2010; WHO, 2010a).

Despite the threat posed by overweight and obesity, and the need for strategic intervention development, there are relatively few studies addressing this issue in SSA (Amoah, 2003; Steyn *et al.*, 2005). The literature that does exist is primarily epidemiological, assessing rates and predictors of overweight and obesity in specific populations (Haslam and James, 2005; Ziraba *et al.*, 2009). Other researchers have produced thoughtful reviews of various factors thought to be contributors to these increases across the developing world (Renzaho, 2004; Abubakari *et al.*, 2008). However, there is a paucity of literature looking at theoretical frameworks that might aid this discussion. Such frameworks are vital to the development of context-appropriate interventions for overweight and obesity in SSA (Greenberg *et al.*, 2011). An improved evidence base will serve to validate and develop the proposed framework further.

A range of frameworks have been used to inform obesity research in developed countries. Many of these have been adaptations of psychological theories that focus largely on individual behavior, such as the transtheoretical model and social cognitive theory (Kumanyika and Obarzanek, 2003). In recent years, however, there has been acknowledgement that individual-level approaches have had little success in slowing the epidemic in developed countries (Lang and Rayner, 2007; Huang *et al.*, 2009). No country has reversed the rising prevalence of obesity; all instead show ‘variations in speed of generally upward trends’ (Lang and Rayner, 2007), even in the presence of high-income and multi-billion-dollar ‘diet industries’ (Unwin and Alberti, 2006). In this landscape, there is a growing consensus on the implementation of multi-level frameworks that address

pivotal contextual forces (Bradshaw *et al.*, 2007; Lang and Rayner, 2007; Huang *et al.*, 2009). For example, Huang *et al.* (Huang *et al.*, 2009) have argued that ‘obesity should be framed as a complex system in which behavior is affected by multiple individual-level factors and socioenvironmental factors (i.e. factors related to the food, physical, cultural, or economic environment)’. In 2007, the US’ National Institute of Child Health and Human Development (NICHD) convened the conference ‘Beyond Individual Behavior: Multidimensional Research in Obesity Linking Biology to Society’. The conference participants proposed a multi-level model for obesity research, in which behaviors are constrained by ‘risk regulators’ such as the built environment, area deprivation and cultural norms (Huang *et al.*, 2009). In the realm of obesity health policy, the UK’s (Lang and Rayner, 2007) argued for a multifaceted ecological approach, one that examines the issue within (i) the physical world, (ii) the physiological world, (iii) the social world and (iv) the cognitive world (Lang and Rayner, 2007). They decry the ‘cacophony’ of frameworks that isolate the individual from her environment and confound sound policymaking. In considering theoretical frameworks to address obesity in SSA, therefore, researchers in developed countries point the way to multi-level, ecological models that enable interdisciplinary, society-wide response.

In this commentary, we propose the use of an ecological theoretical framework to conceptualize factors that contribute to increases in overweight and obesity in SSA. The framework is based on a causality continuum model (CCM) (Coreil *et al.*, 2001) that illustrates the importance of interacting factors along a continuum, from the individual to the global marketplace, in shaping trends in overweight and obesity in SSA. The framework will be presented along with descriptive factors at each level. Lastly, implications for intervention development will be discussed.

A theoretical framework for overweight and obesity in SSA

The value of multi-level or *ecological*, theoretical frameworks to examine complex public health issues is being increasingly acknowledged (BeLue *et al.*, 2009; Greenberg *et al.*, 2011). These frameworks illustrate the interplay of factors related to individual behavior, the social

world, laws, economics and the physical environment in producing health outcomes. They are critical to the examination of the social determinants of health, defined by WHO as ‘the conditions in which people are born, grow, live, work and age’ (WHO, 2010a).

The ecological framework presented here employs Coreil *et al.* (Coreil *et al.*, 2001)

CCM as a foundation. The CCM considers contributing forces that are *distant, intermediate and proximate* to a health outcome (Coreil *et al.*, 2001). Distant forces include macro-level; ‘fundamental’ causes related to social and economic factors (Coreil *et al.*, 2001). Intermediate forces include community-level influences such as the built environment; these forces mediate the relationship between proximate and distant forces (Coreil *et al.*, 2001). Proximate forces have the most direct impact on health outcomes and include individual behaviors (Coreil *et al.*, 2001).

Proximate forces, such as diet and exercise in the case of overweight and obesity, are targeted most frequently by public health interventions. However, attacking proximate forces alone without corresponding changes in intermediate and distant forces often proves to be insufficient (Millard, 1994). This is because individual behaviors and choices are shaped, constrained or catalyzed by forces at the intermediate and distant levels; ignoring this reality leads to what Farmer has dubbed ‘exaggeration of personal agency’, which can lead to devastating results (Farmer, 2003). Distant forces are sometimes called ‘upstream’ forces, and proximate forces called ‘downstream’ forces, to highlight this continuum of causality (Coreil *et al.*, 2001). Using this analogy, to focus only on proximate factors is akin to reacting to a leaking dam by giving people down the river swimming lessons (Farmer, 2003).

Ecological frameworks are imperative to advancing understanding of the global epidemic of overweight and obesity and to designing appropriate interventions (BeLue *et al.*, 2009). As detailed earlier, early efforts to combat obesity in the West have been criticized for an over-emphasis on proximate effects, namely diet and exercise behavior change interventions directed at individuals, many of which have proved minimally successful (BeLue *et al.*, 2009). To have a greater impact, frameworks utilized in SSA and the rest of the developing world also need to address intermediate and distant factors, which have been key to the skyrocketing overweight and obesity rates (WHO, 2010a).

The theoretical framework that we propose here (Figure 1) incorporates distant, intermediate and proximate forces pivotal to the increases in overweight and obesity rates in SSA. These forces, while presented discretely, interact and overlap in many cases, with distant forces such as globalization directly impacting on forces at other levels, such as occupation and diet. The distant forces incorporated include *globalization and urbanization*, with *sedentary occupations, cultural perceptions of weight, built environment and social relationships* at the intermediate level. *Caloric intake and physical inactivity* lie at the proximate level and reflect the health behaviors most directly related to overweight and obesity. These behaviors are, however, influenced heavily by the distant and intermediate forces listed earlier. *Genetics* is a third proximate force that may pose risk of overweight and obesity. While by definition a biological issue, the environment has been shown to play a pivotal role in how genes are expressed, placing genetics inside the causality continuum that produces overweight and obesity in SSA. In this article we will explore each of the factors in the framework in detail and discuss how they are oriented within the causality continuum.

DISTANT FORCES: GLOBAL ECONOMIC AND DEMOGRAPHIC CHANGE

Globalization

Globalization is described by Chapman (Chapman, 2009) as ‘a process characterized by the growing interdependence of the world’s people, involving the integration of economies, culture, technologies, and governance’ (Chapman, 2009). Globalization may bring positive changes to developing countries, such as increases in socioeconomic status (SES) and education and reduced mortality due to CDs (Bhagwati, 2004; Misra and Khurana, 2008; Aikins *et al.*, 2010). Globalization has been touted for its potential to benefit developing countries through increases in employment, productivity and quality of life (Sachs, 2005).

However, globalization may also create serious problems for developing countries, some of which impact on nutrition (Chopra and Darnton-Hill, 2006; Unwin and Alberti, 2006). For one, in SSA, recent years have seen a continuing decline in agricultural productivity,

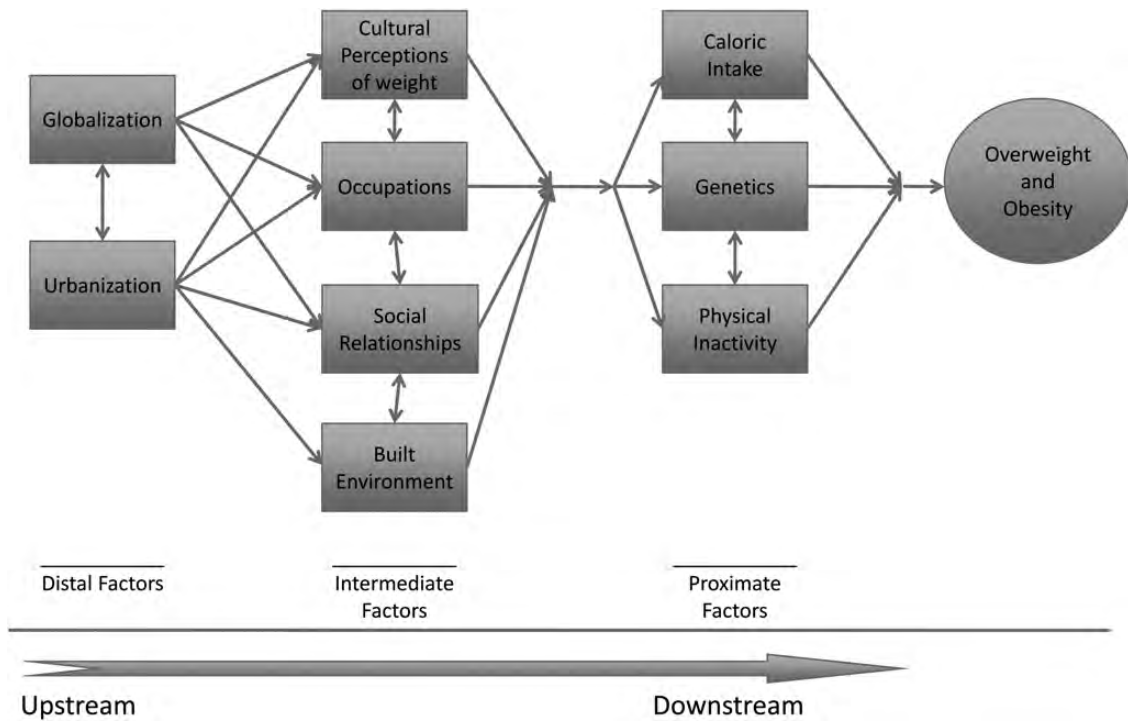


Fig. 1: A causality continuum model for obesity in sub-Saharan Africa.

partly because of declines in agricultural and rural investment by governments and aid agencies such as the World Bank (Chopra and Darnton-Hill, 2006). This, in turn, stems partly from the globalization of crop markets. Crops from countries such as the USA, whose agricultural sector is highly subsidized, are priced well below the costs of production, effectively displacing farm products from developing countries such as those in SSA (Chopra and Darnton-Hill, 2006). In addition, control of food supplies has become increasingly concentrated in the hands of a few transnational corporations (TNC's) (Unwin and Alberti, 2006). For example, one TNC (Cargill), controls 80% of the world's grain distribution (Chopra and Darnton-Hill, 2006). These aspects of free trade have resulted in SSA moving away from internal production and consumption of staple foods and toward imports of both staples and obesogenic processed foods (Abdulai, 2010). Africa has seen the largest increase in food imports of any region since 2000, with agriculture in SSA shifting toward commercial farming of 'high-value' products such as exotic fruits or cut flowers for export (Chopra and Darnton-Hill, 2006).

This globalization of food markets has resulted in the introduction of unhealthy low-cost and processed foods to urban centers of SSA (Abdulai, 2010). For example, low-cost vegetable oils from industrialized countries have become widely available and have been linked to increases in fat consumption in the developing world (Popkin and Doak, 1998). Foods imported through global trade are often marketed aggressively, with the goal of increasing consumption; brands such as McDonald's and Coca-Cola are now promoted globally (Labonte and Schreker, 2007). Ironically, as obesogenic food sources make their way to cities in SSA through global trade, the decline in staple production in rural areas has caused concurrent increases in undernutrition in some areas of SSA (Chopra and Darnton-Hill, 2006).

These forces of globalization have played a role in the beginnings of a 'nutrition transition' in some areas of SSA, where traditional staple diets rich in whole grain, fruits and vegetables are replaced by 'Westernized' diets rich in fat, sugar and nutritionally poor calories (Drewnowski and Popkin, 1997; Popkin, 1998a, b). This nutrition transition, which has

already occurred in most developed and in some developing countries, brings with it increases in obesity and related illnesses and social costs (Drewnowski and Popkin, 1997; Popkin, 1998a, b).

The consequences of structural adjustment programs also come into play here. In previous decades, in response to economic crises, many countries in SSA applied for loans from the World Bank or the International Monetary Fund. As stipulations for receiving loans, 'structural adjustments' to domestic policies were often required, including cuts to government assistance in the agriculture and health sectors, as well as a range of social services (Chopra and Darnton-Hill, 2006; Labonte and Schreker, 2007). Deregulation of trade and removal of protections for local products was often involved (Labonte and Schreker, 2007). Such policy changes catalyzed the changes to food production and distribution discussed earlier.

These new food production and distribution patterns, when combined with increases in sedentary occupations and rapid urbanization that often come with globalization, create a milieu in which overweight and obesity risk can soar (Kadiri, 2005; Maher *et al.*, 2010). As a distant factor, globalization is a driver for many of the intermediate and proximate factors discussed earlier and a critical component of any discussion about the 'roots' of SSAs increases in overweight and obesity.

Urbanization

With the rise of globalization, urbanization is occurring rapidly in many parts of the developing world, including SSA (Steyn *et al.*, 2005). It is predicted that by 2020 half of all Africans will reside in cities (Misra and Khurana, 2008). Nigeria and Tanzania, two of SSAs most populous countries, are expected to see 14 and 17% increases in urbanization over the next two decades, respectively (Misra and Khurana, 2008), with rural residents migrating to the cities to take advantage of perceived opportunities for employment and better quality of life ('pull' factors) (Puoane *et al.*, 2005). There are also 'push' factors present in many rural areas, as changes in trade and food production due to globalization, and the shift away from small farming, make rural life less tenable (Chopra and Darnton-Hill, 2006). Urbanization may offer economic and social advantages to some,

but many migrants languish in urban centers, resulting in rising income inequalities in some SSA countries (Chopra and Darnton-Hill, 2006).

Urbanization also has been linked to increased risk of obesity and chronic disease in SSA. For example, Aspray *et al.* (Aspray *et al.*, 2000) conducted population-based surveys of urban and rural communities in Tanzania and found significantly higher rates of overweight, obesity and diabetes in the urban sample. A study in the Gambia found higher rates of obesity in urban areas, as well as striking differences by sex, with an obesity rate of nearly a third (32.3%) in urban women (van der Sande, 2003). This disparity by sex is noted elsewhere (Kimani-Murage *et al.*, 2011). Urban relocation often results in drastic changes in diet and activity levels (Popkin, 1998a, b; WHO, 2010b) for reasons related partly to globalization, as already described. People living in urban areas often consume diets that are significantly different from those in rural areas of the same country (Popkin, 2001). In rural areas, many people grow and consume traditional staple foods that are low in fat and calories (Renzaho, 2004; Caballero, 2005; Bleich *et al.*, 2008). As a result of globalization, urban residents have increased access to imported high-calorie, high-fat 'Western' food choices (Puoane *et al.*, 2005), which are marketed to them through print and television (Bourne, 1996). These foods are often available at subsidized, affordable prices, making it cost-effective to substitute cheap vegetable fats and convenience and fast foods for traditional staples (Stiglitz and Charlton, 2005; Misra and Khurana, 2008). There is also an increase in food consumed outside of homes, especially in middle-class areas. In addition, more urban women work outside of their homes, spending less time preparing meals and increasing families' reliance on prepared or packaged foods (Stiglitz and Charlton, 2005; Nugent, 2008). Over time, these foods may partly or completely replace traditional foods (Renzaho, 2004). There is evidence that in SSA the longer a person from a rural community is part of a more urbanized community, the more she is at risk of obesity (Bourne, 1996; Renzaho, 2004; Abubakari *et al.*, 2008).

Obesity in SSA and other developing countries has been described as limited to higher SES population segments in urban areas, who

have access to the ‘Westernized’ diet and activity patterns described earlier (van der Sande, 2003; Montiero *et al.*, 2004). However, SES and urban lifestyle do not adequately explain the disparities found in obesity rates between SSA men and women. In addition, recent studies are probing the relationship between SES and obesity in developing countries and finding it to be a more complex dynamic. A 2004 review of recent literature on links between SES and obesity in developing countries concluded that obesity was no longer limited to higher SES groups (Monteiro *et al.*, 2004). Rather, as GNP increases, the burden of obesity tends to shift back toward lower SES groups, with that shift happening at lower GNP for women than for men (Monteiro *et al.*, 2004). Abdulai (Abdulai, 2010) argued that it may be only up to a certain level of development that wealth determines access to food and how much physical activity is part of a person’s day; beyond that point, obesity risk of the rich and the poor may converge somewhat (Abdulai, 2010). Abdulai’s Ghanaian findings bear out the likely complexity of the relationships between urbanization and obesity in SSA. The findings in urban Accra showed obesity risk to be negatively related to maternal education (secondary and tertiary) and women working outside the home, but positively related to household expenditure and ethnicity (Abdulai, 2010). Much needs to be done to understand forces that produce obesity in urban environments in SSA and to track the trajectory of obesity spread across the SES spectrum.

INTERMEDIATE FORCES: ENVIRONMENTS, WORK AND RELATIONSHIPS

Occupation

Shifts in occupation, which are partly the result of urbanization and globalization, also have implications for obesity rates in SSA. Urban jobs are often more sedentary than the rural jobs workers did before, leading to drops in physical activity at work (Misra and Khurana, 2008; WHO, 2010b). Globally, shift to more sedentary work is found looking at the proportion of people working in agriculture, industry and services, but also in the types of work that make up many jobs (Popkin, 1998a, b). Given

that adults spend much of each day working, the impact on total daily energy expenditure can be significant (Allman-Farinelli *et al.*, 2010). Decreased activity associated with work is also found in increased use of transportation to get to work or school, more technology at home and more passive leisure time (Popkin, 1998a, b). Access to television and computers replaces more active leisure activities, especially in settings where going outside is not safe or desirable (Popkin, 2001). This phenomenon is more prominent in, but not relegated to, urban areas (Abubakari *et al.*, 2009).

As new technologies penetrate rural SSA, occupations there will begin to become less physically demanding as well (Misra and Khurana, 2008). In a study carried out in Cameroon, obesity in men increased as jobs became more professional (and more sedentary), with physically demanding jobs appearing to protect people from overweight and obesity (Fezeu *et al.*, 2005). A study in Ghana found that women engaged in farm or garden work were significantly less likely to be overweight compared with those who were not employed (Abdulai, 2010). This is in agreement with studies in developed countries. For example, in Australian workers, a strong association was found between ‘occupational sitting time’ and obesity (Mummery *et al.*, 2005). Even with leisure-time activity, sufficient energy expenditure may not be attained to offset the effects of sedentary occupations in relation to overweight and obesity (Allman-Farinelli *et al.*, 2010). This is not to say that movement of SSA workers into jobs with higher wages and better working conditions always represents a negative trend; however, there needs to be awareness that these developments create vulnerability for the development of overweight and obesity and the myriad of related health problems.

Social relationships

It is widely established that social relationships can have powerful impacts on health, both physical and mental (Berkman *et al.*, 2000; Seeman, 2009). Benefits of social relationships can be emotional (intimacy, sense of belonging, comfort), instrumental (guidance, advice, physical assistance) and material (money, goods, other resources) (Berkman *et al.*, 2000; Kana Iaupuni *et al.*, 2005; Pridmore *et al.*, 2007). Social integration can reduce mortality and

disability risks (Kana Iaupuni *et al.*, 2005; Seeman, 2009), improve disease recovery rates (Kana Iaupuni *et al.*, 2005) and protect against mental illness (Harpham, 1994; Seeman, 2009). The complex interplay between people's social relationships and health can be explored using structured social network analyses, and through use of more qualitative concepts such as social support and social capital (Berkman *et al.*, 2000).

In the realm of obesity, US studies have shown social support to be important in maintaining healthy diet and exercise behaviors (Sallis *et al.*, 1987) and to be a potential predictor of healthy weight (Gerald *et al.*, 1994). Studies have found that lower levels of social support can be tied to greater caloric intake and weight (Newman, 2003; Renzaho *et al.*, 2006; Ziraba *et al.*, 2009; Hall *et al.*, 2011). Eating as a comfort mechanism, in the absence of other emotional support, has been found to have physiological roots (Kruger *et al.*, 2005). In a 2007 study, social network analysis suggested that obesity may spread through social ties, perhaps as the result of peer normalization (Christakis and Fowler, 2007). There is also a growing body of research exploring links between chronic stress related to poverty and discrimination and increased obesity risk, through metabolic changes related to the stress response (Bose *et al.*, 2009; Vicennati *et al.*, 2009). Social support may serve as a buffer against the physiologic effects of stress and as such, may moderate stress-related obesity risk.

In the context of SSA, recent research related to social relationships has focused on the HIV epidemic, the role of social support in HAART adherence, voluntary counseling and testing and comorbid mental illness (Sethosa and Peltzer, 2005; Ncama *et al.*, 2008). There is a vacuum of literature discussing potential links between social relationships and obesity risk in SSA. However, contextual factors suggest that this link may be important, given the social disruption and stress associated with poverty, urbanization, conflict and other struggles endemic in SSA. As individuals and families uproot themselves from rural areas and move to cities, long-standing social networks may be disrupted (Renzaho, 2004; Maher *et al.*, 2010). While urban population densities are high, relocated individuals may face increased isolation, having left behind family, friends and community structure (Maher *et al.*, 2010). This isolation is juxtaposed with the new stresses of urban life, which

may include the struggle to find work and poor living conditions (Hall *et al.*, 2011). In addition, individuals may emulate new social contacts' eating behaviors, which in urban settings may involve consumption of more processed and other low-quality foods, and may become part of new social networks where overweight is more normative, placing them at risk as well. The deep importance of social ties is acknowledged in SSA, as exemplified by the proverb 'Sticks in bundles are stronger' (Pridmore *et al.*, 2007).

At the same time, the impact of urbanization and globalization in SSA on social ties, and potential consequences for obesity, should not be oversimplified. Smit's (Smit, 1998) study in Durban, South Africa, showed that low-income migrant households in Durban often maintained ties with their rural homesteads, engaging in complex patterns of 'circular migration' (Smit, 1998). The genesis of these patterns is historical, dating back to the apartheid migrant labor system. How family members, time and resources were split between rural and urban households in a given family unit was complex and varied (Smit, 1998). Maintained rural ties could provide a buffer against the stresses and changes of urban life; it could also serve as an additional stressor, especially if added financial demands were involved. There is a need for research that explores the evolving dynamics of social ties, and their ramifications for obesity, in different SSA contexts.

Built environment

The spaces in which people live, work, play and eat, referred to as the 'built environment', are critical in the determination of both energy consumption (diet) and energy expenditure (physical activity) (Caballero, 2007). Policies and interventions designed to make built environments less obesogenic are critical to addressing the obesity epidemic in developed and developing countries alike. That said, there is a dearth of research exploring the evolving links between built environments and obesity risk in SSA or other developing countries. There is discussion of the built environment in SSA as it relates to sustainability and climate change (McMichael, 2000; Hill *et al.*, 2002), and targeted sociological research such as Czegledy's (Czegledy, 2004) analysis of social and political

aspects of public transportation in South Africa (Czegledy, 2004).

Anecdotal evidence in SSA and evidence from other regions suggest that built environments in SSA, especially in urban areas, may play a role in increases in overweight and obesity (Tagoe and Dake, 2011). Life in urban areas often involves less walking than in rural areas to get to schools, markets and work, to fetch water and fuel, and to wash clothes (Renzaho *et al.*, 2006). Development of cities in SSA often precludes sidewalks, parks and play fields to encourage physical activity (Misra and Khurana, 2008). In addition, rapid population growth in cities resulting from urbanization may compromise recreational areas and ‘green spaces’ that do exist. A 2008 study outlined the decay of urban built environments in Nigeria, which included destruction of beaches, parks and other recreational facilities due to overcrowding (Ahianba *et al.*, 2008). Narrow roads congested with vehicles and motorbikes, especially in business districts, were also cited as an issue, which would be a barrier for walking and cycling. Lack of zoning to create residential corridors with outdoor living space was an additional issue (Ahianba *et al.*, 2008). (Of note, the Nigerian study linked decaying urban spaces to a range of health risks, but overweight and obesity were never mentioned, highlighting the perception that these are non-issues in SSA.) Also paramount in many areas is the issue of safety; where urban crime rates are high, people hesitate to venture outside their homes more than is necessary (Nugent, 2008). Low air quality and high population density have also been found to impede physical activity in cities (WHO, 2010b). Increased global access to technology has introduced televisions and computers into SSA life, another factor linked to increased obesity risk (Renzaho, 2004). Beyond TV’s and computers, globalization has increased access, especially in cities, to cars and other mechanized tools and labor-saving technologies, both in the home and workplace (Renzaho, 2004; Misra and Khurana, 2008; Nugent, 2008; Oldridge, 2008; WHO, 2010b). While no one disputes the benefits of such modern amenities, they are an additional environmental factor that contributes to sedentary life. Again, there is a tremendous need for research that looks explicitly at built environments in SSA contexts, through the lens of obesity prevention.

Cultural perceptions of body weight

An important issue that is often overlooked when considering overweight and obesity in an SSA context is cultural perceptions surrounding weight. Obesity is a concept that is viewed differently across cultures, and seeing it as a disease is a distinctly Western phenomenon (Renzaho, 2004; Puoane *et al.*, 2005). In many areas, overweight and obesity have been historically associated with wealth, health and happiness. This was the case in the USA at the turn of the twentieth century, where, to quote Grivetti (Grivetti, 2001), ‘fat cheeks and ample stomachs were visual cues that individuals were healthy, not infected with the dreaded slim tuberculosis’ (Grivetti, 2001). These same issues are at play today in SSA, where HIV, tuberculosis and other diseases associated with wasting are highly prevalent, along with undernutrition, chronic poverty, war and natural disasters (Renzaho, 2004). In this context, it makes sense that ample weight marks privilege and power. A range of derogatory terms are used across SSA to denote thinness, from ‘mkonda’ in Kenya (a thin, malnourished lady) and ‘caato quruntay’ in Somalia (a skinny lady). Women who would be considered overweight in a Western context are referred to as ‘nzele ya vundese’ in central Africa (a lady with a good bottom) or ‘hibib fiican’ in Somalia (a lady with good flesh) (Renzaho, 2004). Across SSA, there is a universal preference for a curvy body shape among women (Bourne, 1996). In some places in Nigeria and other parts of SSA, young women may be sent to ‘fattening houses’ to prepare for marriage (Nasser, 1988; Markey *et al.*, 2002). Once married, extra weight is seen as an indicator that her husband is caring for her well; in turn, a chubby husband is being well-fed by his wife and as a symbol of social status (Brown, 1990; Renzaho, 2004; Puoane *et al.*, 2005). A study in Cameroon found that heavy men were perceived as imposing and authoritative; thinness was antithetical to power (Kiawi *et al.*, 2006). In addition, few overweight and obese Africans regard themselves as overweight (Chesler, 1961; Kumanyika, 1993; Puoane *et al.*, 2005; Kiawi *et al.*, 2006; Pocock *et al.*, 2009).

These cultural norms may serve to catalyze increases in overweight and obesity and act as a significant barrier to success of any intervention program (Brown, 1990; Kumanyika, 1993). The capacity to obtain and consume ‘chakula ya

wazungu' (Swahili) or 'bileyi ya bandele' (Lingala), both of which roughly translate into 'food of white people', is a marker of status and a way of gaining respect (Renzaho, 2004). This 'luxurious' food includes meat, sodas, fried foods, butter and margarine, sugar, packaged foods, and other foods associated with the West, which have traditionally been very expensive. Vegetables, legumes, and fruits are seen as foods for survival, or poor people's food (Renzaho, 2004). As 'food of white people' becomes more broadly available, this system of symbolism could accelerate the nutrition transition and the prevalence of obesity across SSA. As such, it is pivotal that anthropological research help set the stage for interventions in any context, to identify and seek to address local meanings surrounding obesogenic foods.

PROXIMATE FORCES: DIET, ACTIVITY AND GENES

The combined effects of distant and intermediate factors set the stage for proximate factors, which include individual behaviors and risks that result in overweight and obesity. These include caloric intake, physical (in)activity and genetics. They are the common currency of obesity risk around the world, and what is distinct in SSA is the forces shaping, constraining and enabling them.

Increased total caloric intake has a direct link with development of overweight and obesity (Misra and Khurana, 2008). As discussed earlier, the current trend worldwide is toward an increase in calories consumed as more countries undergo 'the nutrition transition' to more Western style diets (Bourne, 1996; BeLue *et al.*, 2009). This transition involves replacement of fruits, vegetables and whole grains with foods rich in animal and vegetable fats and simple sugars, but low in fiber (Popkin and Doak, 1998; Food and Agriculture Organization [FAO], 2004; Renzaho, 2004; Nugent, 2008). SSA shows signs of moving in this direction as well. In South Africa, the total energy consumed from fat increased by more than half in five decades to 26% of total calories in 1990 (Puokane *et al.*, 2002). 'Luxury foods' such as meat, fried foods, soft drinks, butter, mayonnaise, sugar, bottled beer, tinned food and cheese are being consumed in greater quantities (Renzaho, 2004; Bleich *et al.*, 2008). Increases in caloric intake

cannot be separated from the issues of globalization and urbanization, which have rapidly increased access to, and affordability of, processed and imported foods (Misra and Khurana, 2008; Nugent, 2008). Imported high-calorie convenience foods have replaced staple foods, including dried beans, dried maize, grains, legumes and vegetables (Renzaho, 2004).

Decreases in *physical activity* levels, which are directly related to caloric imbalance and weight gain, are being seen globally (WHO, 2010b). WHO reported in 2010 that 60% of the world's population does not obtain the level of physical activity recommended for health benefits (WHO, 2010b). Physical inactivity rates have been found to vary greatly (from 17 to 91%) in developing countries (Oldridge, 2008). Fast-paced economic transition has resulted in reduced physical activity levels, decreased hours of rest and increasing levels of stress (Tague and Dake, 2011). In a survey conducted with Ghanaian adults, both men and women reported decreases in physical activity from 2003 to 2008 (Tague and Dake, 2011). However, as discussed earlier, decreases in physical activity have been linked to increased urbanization, which is occurring at a rapid rate in SSA, along with introduction of technologies that make work and play more sedentary (Kruger *et al.*, 2005; Abubakari *et al.*, 2008; BeLue *et al.*, 2009). In a small comparative study in SSA, data show that rural dwellers are classified as active or moderately active, while urban dwellers are classified as sedentary or lightly active (Assah *et al.*, 2009). To understand trends toward obesity in SSA at their most basic level, there is a need for research that tracks both dietary consumption and physical activity levels in different populations over time.

Third, *genes* play a crucial role in how the body obtains, stores and expends energy, which has direct implications for overweight and obesity (Caballero, 2005). Genes have been identified that influence an uncontrollable urge to eat; an inclination to physical inactivity; an increased capacity to store fat; and a minimal ability to expend dietary fat (Centers for Disease Control and Prevention, 2010). However, genes do not function in isolation (Idemyor, 2010). They are impacted by environmental factors, and this gene-environment interaction can create additional risk of overweight and obesity (Idemyor, 2010). This relates to the fact that exposure to undernutrition in early life, or in utero, may increase the risk of

developing obesity later on because of epigenetic changes in metabolic function (Oken and Gillman, 2003). This 'thrifty gene' programming enhances survival in situations where food calories are not plentiful, which has been the traditional situation in many rural areas of SSA (Walker and Adam, 2002). However, when placed in the context of abundant, energy-dense food, this translates into excess storage of food energy as fat and increased risk of metabolic diseases such as diabetes (Walker *et al.*, 2004; Caballero, 2005; Tsei *et al.*, 2010). Thus, SSA and other parts of the developing world may be uniquely vulnerable to increases in obesity, given the high prevalence of undernutrition among the poor, coupled with the rapid introduction of calorie-dense, increasingly affordable imported food. As Africans increasingly migrate to cities and come across imported foods and Western-style diets, this gene-environment interaction is likely to contribute to increases in overweight and obesity (Walker *et al.*, 2004; WHO, 2010a).

DISCUSSION

Public health significance

The ecological theoretical framework presented here incorporates forces at multiple 'levels' that are critical to increases in overweight and obesity in SSA. By situating these forces in distant, intermediate and proximate tiers, the framework emphasizes the consequences of 'upstream' social forces, including globalization and urbanization, for a range of 'downstream' contexts and lived realities for SSAs, both environmental and behavioral (Greenberg *et al.*, 2011). More generally, all the forces working together create an environment in which overweight and obesity rates can skyrocket, adding an additional health burden to an already overburdened regional health system (BeLue *et al.*, 2009).

SSA, like many regions of the developing world, is still straining under the weight of infectious diseases such as HIV and malaria, as well as high rates of undernutrition (Walker *et al.*, 2004). Facing these issues in conjunction with the chronic diseases that accompany high rates of overnutrition is a daunting task (BeLue *et al.*, 2009, Salman *et al.*, 2011) and one that cries out for a comprehensive, strategic approach (Salmon and Timperio, 2007; Duda *et al.*, 2011;

Kimani-Murage *et al.*, 2011; Salman *et al.*, 2011). The development of frameworks such as the one presented here is critical to thinking systematically about the emerging obesity epidemic in SSA. It is also pivotal in making decisions about the best ways to use scant resources to address the problem in the context of the other problems that SSA faces (Maher *et al.*, 2010). Policymakers and researchers must move past description to action, and ecological theoretical frameworks such as this can aid in that transition. It is important to note again the relative paucity of empirical evidence for obesity in SSA contexts, which is a limitation of this framework. It can, however, serve as a starting point for further inquiry, which can validate, reject or expand the model.

Implications for intervention

A common thread binding every piece of this framework is the limited number of obesity-related studies focused on, or conducted in, SSA (Popkin, 1998a, b; Unwin and Alberti, 2006; Lang and Rayner, 2007; Abdulai, 2010). In a region whose inhabitants are distributed among more than a thousand tribal groups, with a vast range of cultural, environmental and economic lived experiences, there is a tremendous need for multi-disciplinary inquiry that involves anthropologists, sociologists, public health researchers, environmental health researchers and policy analysts (Sobngwi *et al.*, 2001). The development of a SSA-specific evidence base at each level of this theoretical framework is critical to the development of policy and intervention responses.

There is growing consensus that obesity interventions need to be multi-level, focusing on individuals, families, institutions, policies and global forces (Unwin and Alberti, 2006; Bradshaw *et al.*, 2007). Lessons can be learned from the multi-level approach to global tobacco control, which has blended taxation and legislative penalties, smoking cessation services, health education and changes to the built environment, underpinned by the WHO Framework Convention on Tobacco Control (Unwin and Alberti, 2006). Like obesity, tobacco addiction does not observe national boundaries and is deeply connected to issues of globalization and the activities of TNC's.

There cannot be a single formula for obesity intervention in SSA, but the theoretical framework presented here seeks to present some of the

likely issues at play. Interventions developed will need to draw tools including laws and regulations (to influence advertising and distribution), taxation and pricing (to promote or limit consumption of foods), changes to the built environment (to encourage physical activity), attention to cultural perceptions and norms surrounding food and weight and efforts to address sources of chronic stress and social isolation (Unwin and Alberti, 2006). Approaches will need to reflect local circumstances, challenges and resources. Given the powerful role of globalization and urbanization in creating obesogenic environments, it will be necessary to engage policymakers and regulators at the international level as well and to ask questions related to governance as well as those related to public health infrastructure (Hall et al., 2011). There is a tremendous amount of work to be done, with much that can be gleaned from the few successes and many failures of developed countries.

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