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Residential mobility, socioeconomic context and body mass index in a cohort of urban South African adolescents

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ABSTRACT

Adolescents who are changing residence, as well as their social and economic circumstances may experience lifestyle changes that have an effect on body composition outcomes such as undernutrition, overweight or obesity. This paper uses data from Birth to Twenty, a birth cohort of South African urban children, to determine the relationship between residential mobility and body mass index (BMI) amongst Black adolescents aged 15 ($n=1613$), and to examine the role of changes in household socioeconomic status (SES). The prevalence of overweight and obesity in the sample was 25% in females and 8% in males. Amongst the females, a strong positive association between residential mobility and BMI was observed for those who also experienced an increase in household SES between birth and 15 years ($\beta=0.42$, SE$=0.13$), while no effect was identified for males. The study shows the potential for environmental change and increased resources to influence the risk for obesity. It also highlights the value in considering the range of social environmental factors and changes across the early life course that might play a part in evolving nutritional patterns in urban transitioning environments.

1. Introduction

The prevalence of overweight and obesity is increasing in low- and middle-income countries (LMICs). Urbanisation and economic development have resulted in a nutrition transition characterised by a shift to a higher caloric diet and/or a reduction of physical activity (Popkin, 2003). While some populations continue to experience undernutrition, escalating levels of obesity have been observed amongst both higher, and increasingly lower, socioeconomic groups in countries across the globe (Monteiro et al., 2004; Popkin, 1999). In many LMICs this rising prevalence of overweight and obesity is experienced concurrently with persistent high levels of undernutrition, meaning that such societies are double burdened (Varela-Silva et al., 2012). Within the African region, overweight and obesity are associated with a raised incidence of non-communicable diseases (NCDs), especially cardiovascular disease (Popkin and Doak, 1998). It is anticipated that by the year 2020, deaths resulting from NCDs will increase by over 20% on the African continent (World Health Organization, 2011). Thus there is a strong incentive to understand the environmental and lifestyle factors and processes that may be associated with body composition changes and in particular, risk of developing obesity within these settings.

In LMICs, the process of urbanisation has been highlighted as a key contributor to the nutrition transition (Vorster et al., 1999). This is because movement to urban areas is associated with changes in dietary patterns and lifestyles which may lead to overweight and obesity (Popkin and Gordon-Larsen, 2004). With the United Nations predicting a significant increase in the rates of urbanisation and internal migration within the African continent over the coming decades, dynamics associated with population mobility are important in order to facilitate a broader understanding of the nutrition transition (United Nations, 2010). Population movement may take a variety of forms, occur over a range of distances, and with varying degrees of permanence (Boyle et al., 1998). According to the theory of migration selection, movement of individuals may be prompted by the search for opportunities and improved socioeconomic conditions (pull factors), or driven by adversities or difficulties experienced at locations of origin (push factors) (Lee, 1966). Whether pull or push, relocation results in an altered set of environmental and socioeconomic conditions which may have either positive or negative consequences for individuals' health and well-being (Brockerhoff, 1990; Garenne, 2006).

It is well established that nutrition interventions need to focus on the complex interactions between ecological factors involving the individual within their interpersonal, community and societal

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context, because all of these levels are important in influencing body composition outcomes (McLeroy et al., 1988). Movement of an individual from one context to another, even within a small geographical area, would result in changes in community, facilities (e.g. parks and open spaces), food purchasing opportunities and access, and interpersonal relationships (Lopez and Hynes, 2006). Thus it follows that relocation may influence body composition and risk for poor nutrition outcomes such as overweight and obesity due to shifts in diet, health practices, or behaviour brought about by such changes in environment (Zezza et al., 2011). Establishing causality is complex, and the relationship between mobility and body composition may be mediated by a number of factors. In particular, the effects of changes resulting from movement are likely to be felt differently among different socioeconomic groups. These groups have different levels of access to individual and household resources that influence the way that the environment and changes in environment are experienced. For example, in a study of international migrants it was found that movement alone did not results in obesity unless it was also associated with improved socioeconomic conditions (Renzaho, 2004). This is because such conditions are required to promote the consumption of energy dense diets and more sedentary lifestyles. While the relationship between SES and body composition has been well documented (McLaren, 2007; Sobal and Stunkard, 1989), previous studies have not expressly considered the relationships concurrently between changes in residence, SES and body composition in the African context.

South Africa provides an appropriate setting in which to investigate patterns of mobility and corresponding health outcomes within the context of individuals' socioeconomic environments. An urban transition is underway in post-Apartheid South Africa, which is characterised by unique patterns of population mobility to and within urban areas (Collinson et al., 2007). High levels of urbanisation have been documented particularly amongst Black South Africans, with temporary and circular mobility also common (Kok and Collinson, 2006). Such internal mobility is strongly linked to socioeconomic circumstances with movement associated with both higher and lower levels of resources (Kok et al., 2003). Relocation may occur both in the case of adults and amongst children or adolescents who might move independently of a parent or primary caregiver for a variety of reasons linked to children's own circumstances (e.g. to gain access to school), or for reasons prompted by a connected adult (Kok and Collinson, 2006; Van der Waal, 1996). Children and adolescents are particularly vulnerable to changes of residence and numerous international studies have linked residential mobility among children to a range of negative health and social consequences (Jelleyman and Spencer, 2008). However, no South African research has focused on the role of such changes in environment on risk factors for poor health outcomes such as overweight or underweight. With studies identifying an increased prevalence of overweight among females during late childhood and adolescence (Kimani-Murage et al., 2011; Reddy et al., 2009), further empirical research is needed to disentangle the risk factors and potential positive impacts of internal mobility on health among South African children and adolescents. Given the differing levels of resources and inequality in incomes which persist in the South African context (May, 2000) and the transitory nature of SES within this setting (May and Woolard, 2007), the possible ways in which SES may alter these relationships is likely to be significant.

Against the background outlined, the aim of this paper is to determine the association between residential mobility and BMI, and to establish whether the association is moderated by the effect of changing household SES in a cohort of South African urban adolescents aged 15.

2. Methods

2.1. Study sample

The paper uses data from Birth to Twenty (Bt20), a longitudinal birth cohort study of urban South African children. Bt20 commenced at the onset of South Africa's transition to democracy in 1990 with the enrolment of a cohort of singleton children born during a seven-week period in the Greater Johannesburg area in the Gauteng Province. Of the 5449 births that took place during the period, a sample of 3273 children identified from the total as permanently resident in the area were recruited into the longitudinal birth cohort (Richter et al., 2004). The main aim of Bt20 was to study children's physical and social development in an environment of rapid social change (Richter et al., 2007). The Gauteng Province was selected because it is South Africa's most densely populated urban area, home to approximately 10.5 million residents (Statistics South Africa, 2009). This region provides the ideal transitioning environment to study child health, well-being and household environments.

At enrolment, the Bt20 cohort had similar proportions of males (48.6%) and females (51.4%). The cohort were predominantly Black (78.5%); with White, Coloured, and Asian children comprising 6.3%, 11.7% and 3.5% of the cohort respectively, which was roughly representative of the population proportions at the time. At birth, 10.8% of children were considered underweight (<2.5 kgs). Characteristics of the biological mothers of the cohort members show that the majority were single (56.5%), and most had not completed secondary school (58.4%). Data collection activities among the cohort have taken place at intervals of either one or two years, beginning with questionnaires administered antenatally to pregnant women. Previously reported retention statistics for the cohort indicate that the Bt20 study had maintained contact with 70% of the cohort by the start of the 16th year (Norris et al., 2007). Reasons why participants were lost to follow-up include caregiver or child mortality, study fatigue or movement out of the study area.

During the study's 15th year, a residential mobility questionnaire was administered to all participants in contact with Bt20. The questionnaire aimed to verify all historical address records as correctly reflecting the children's primary places of residence over the 15 year period, and to complete any missing or partial address information. The questionnaire data enabled the construction of a residential history for each child from birth to 15 years from which movements could be identified (see Ginsburg et al., 2009 for a more detailed description of the study of residential mobility within the cohort). During the course of this same year, anthropometric assessments of the cohort were also conducted. The current analytical sample comprises those cohort participants who completed the residential mobility questionnaire at age 15, and had growth (weight and height) measurements taken at age 15. The sample was restricted to Black participants ($n=1613$) as this is the population most affected by the nutrition transition, and smaller numbers of participants from the other ethnic groups meant that these relationships could not be fully investigated within these sub-groups. The available samples for White, Coloured and Asian participants with complete data numbered 46, 200 and 24, respectively.

2.2. Variables

For the purposes of analyses, BMI Z-scores were derived using the WHO reference (World Health Organization, 2009). Raw BMI measures were also categorised using the age and sex appropriate classifications proposed by Cole et al. (2000, 2007) for underweight, overweight and obesity. The models included a measure