
Childhood Obesity in the United States and Germany: Trends, Risk Factors, and Initiatives

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ABSTRACT

Obesity in childhood has become a public health problem in the United States and elsewhere. The prevalence of childhood obesity in Germany has lagged somewhat behind that of the U.S. but still threatens health at numerous levels. This paper examines initiatives in both countries and reports on challenges and progress in altering the course of this epidemic.

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Introduction

Over the past three decades obesity has developed into an immense public health and economic problem in the United States (Frayer, Carroll, & Ogden, 2012b; Yale Rudd Center for Food Policy and Obesity, 2013). Trends in Germany have been somewhat less dramatic (Mensink et al., 2013) but still have significant potential for catastrophic effects on the country's federal healthcare budget. Excess caloric intake as compared with caloric expenditure is the root cause of this epidemic. High caloric intake, highly prevalent in both countries (Centers for Disease Control and Prevention, 2009; Lampert, Mensink, Romahn, & Woll, 2007), is a primary risk factor for overweight/obesity. Sedentary lifestyles support the development of this health condition. Public health interventions in this field encompass educational efforts and policy initiatives/community action to decrease obesogenic effects of built environments, including community food systems, urban infrastructure and transportation options. Food supply and distribution networks set the parameters for area residents' caloric intake, while cultural and psychological factors will affect individual choices. Certain aspects of built environments, such as dense developments with sidewalks, positive public perceptions of personal safety in the areas and convenient public transport options, may promote more daily physical activity and thus higher caloric expenditures. These aspects have been found to correlate with lower levels of obesity (Papas et al., 2007). Cross-cultural comparisons and appropriate

sharing/adaptations of successful initiatives may decrease disease and economic burdens in both nations.

Hormonal changes and decreasing metabolism over the lifespan are physiologic givens that make age a risk factor for obesity. Data from both the United States and Germany confirm this association: obesity prevalence is higher in older age groups. However, both societies have been alarmed by significant levels of obesity among their youngest citizens. Attention to this phenomenon is warranted due to concern for the concomitant lifelong health problems (and their financial consequences) of children who grow into obese adults and the level of disability that these adults will inflict on the future work (including defense) force. The situation is exacerbated by the fact that both of these nations predicate their future existences on a relatively small number of young people financially supporting growing elderly populations. Numerous public health efforts have focused on reducing obesity in both countries; many initiatives have potential to affect everyone, others target groups that may affect children (i.e. parents, especially pregnant women), and, due to the above-expressed concerns, numerous projects aim to change environmental factors specific to children.

Childhood Obesity in the United States

National Health and Nutrition Examination Survey (NHANES) data on childhood obesity (defined as having a BMI \geq the 95th percentile of the Centers for Disease Control and Prevention's 2000 sex-specific

BMI-for-age growth charts), summarized in Table 1, show remarkable increases in obesity over the past three decades, resulting in 16.9% of 2-19 year olds being obese including 12.1% of 2-5 year olds, 18.0%

of 6-11 year olds and 18.4% of 12-19 year olds. Racial/ethnic differences in the levels become apparent during the adolescent years (Frayser, Carroll, & Ogden, 2012a).

Table 1. Prevalence of obesity among children and adolescents aged 2–19 years: United States, selected years 1963–1965 through 2009–2010

Age (years) ¹	NHES 1963–1965	NHANES I 1971–1974	NHANES II 1976–1980	NHANES III 1988–1994	NHANES 1999–2000	NHANES 2001–2002	NHANES 2003–2004	NHANES 2005–2006	NHANES 2007–2008	NHANES 2009–2010
2–19	(³)	5.1	5.5	10.0	13.9	15.4	17.1	15.4	16.8	16.9
2–5	(³)	4.8	5.0	7.2	10.3	10.6	13.9	10.7	10.1	12.1
6–11	4.2	4.0	6.5	11.3	15.1	16.2	18.8	15.1	19.6	18.0
12–19	4.6	6.1	5.0	10.5	14.8	16.7	17.4	17.8	18.1	18.4
Boys:										
All	(³)	5.2	5.4	10.2	14.0	16.4	18.2	15.9	17.7	18.6
2–5	(³)	4.9	4.6	6.2	9.5	10.7	15.1	10.4	9.3	14.4
6–11	4.0	4.3	6.7	11.6	15.8	17.5	19.9	16.2	21.2	20.1
12–19	4.5	6.0	4.8	11.3	14.8	17.6	18.2	18.2	19.3	19.6
Girls:										
All	(³)	5.0	5.7	9.8	13.8	14.3	16.0	14.9	15.9	15.0
2–5	(³)	4.8	5.4	8.2	11.2	10.5	12.7	11.0	10.9	9.6
6–11	4.5	3.6	6.4	11.0	14.3	14.8	17.6	14.1	18.0	15.7
12–19	4.7	6.2	5.3	9.7	14.8	15.7	16.4	17.3	16.8	17.1

¹Excludes pregnant females starting with 1971–1974. Pregnancy status not available for 1963–1965 and 1966–1970.

²Data for 1963–1965 are for children aged 6–11 years; data for 1966–1970 are for adolescents aged 12–17, not 12–19.

³Children aged 2–5 years were not included in surveys undertaken in the 1960s.

NOTES: Obesity is body mass index greater than or equal to the 95th percentile from the sex- and age-specific 2000 CDC growth charts. NHES is National Health Examination Survey; NHANES is National Health and Nutrition Examination Survey.

SOURCES: CDC/NCHS, NHES and NHANES.

U.S. children are known to consume too much fat (a high calorie nutrient) and too little fiber (a nutrient associated with lower calorie diets) (American Dietetic Association, 2008). The 1980s and 1990s were decades where the number of meals consumed away from home per week increased greatly. This eating pattern increased the portion sizes and total calories consumed (Adair & Popkin, 2005). Soft drink consumption also skyrocketed during this time period and continues to contribute high levels of “empty” (= non-nutritive) calories to Americans including very young Americans’ diets (Nielsen, Segal-Riz, & Popkin, 2002).

The Institute of Medicine reviewed numerous environmental factors in the process of creating its Early Childhood Obesity Prevention Policies. In recognition of the trends toward obesity, decreased physical activity and increased sedentary behavior and because higher levels of physical activity have been associated with a decreased risk of excessive weight gain in young children, the IOM recommends that childcare providers and teachers should increase children’s opportunities to be physical active throughout the day. Parents should also be educated on the need for their children to be more active at home as well. The IOM also counsels parents and other

childcare providers to decrease screen time available to children. This is based on its interference with more active pursuits and the detrimental effects of food and beverage advertising delivered via TV and Internet media. In addition, sleep duration among children has decreased over the past twenty years and reduced amount of sleep is showing up as a risk factor for obesity among all age groups. Thus, childcare providers and parents are encouraged to provide healthy napping and sleeping environments (Institute of Medicine, 2011).

Childhood Obesity in Germany

The German trend toward rising obesity (BMI \geq 30.0) prevalence has lagged somewhat behind that of the U.S. However, increases in obesity between 1990/1992 and 2008/2011 national surveys show particularly significant increases in younger age groups (25-34 years) ($p_{\text{trend}} = .01$). In the context of concern about the consequences of long-term obesity and relatively high adolescent (ages 14-17) obesity prevalence (8.2% for boys and 8.9% for girls according to the first German Health Interview and Examination Survey for Children and Adolescents (KiGGS 2003-2006) (Mensink et al., 2013), government and community efforts may justifiably prioritize childhood and adolescence anti-obesity campaigns.

German epidemiologists tend to define childhood obesity as having a BMI \geq the 97th percentile of population and sex-specific BMI-for-age-growth charts. The KiGGS (2003-2006) study produced results showing a doubling of childhood and adolescent obesity prevalence over the past three decades. The percentages of obese children/adolescents in various age groups in the 2003-2006 study were respectively: 2.8% for 2-6 year olds, 6.4% for 7-10 year olds and 8.5% for 14-17 year olds. For completeness it can be noted that the figures for overweight status (having a BMI \geq the 90th percentile) were 10% for 2-6 year olds, 15% for 7-10 year olds, and 17% for 14-17 year olds. Prevalence did vary by immigrant status: girls and boys from Turkey, girls from central and southern Europe, and boys from Poland had increased risk of being overweight/obese compared with German-born children. On the other hand, children from the former Soviet Union had less risk of being overweight/obese compared with German-born children. However, the longer these children had lived in Germany, the more their prevalence of overweight/obesity increased (Kurth & Schaffrath Rosario, 2010). Multivariate analysis of the KiGGS results showed low socioeconomic status and having overweight/obese

parents to be the most important risk factors. Additional determinants relate to the pregnancy that produced the child: maternal smoking and weight gain and the child's birth weight. These variables as well as the child's amount of screen time were all associated with increased weight outcomes of the children. Getting sufficient sleep had protective effects for the children.

As expected, dietary analyses completed as part of the KiGGS study showed total energy intake to be correlated with overweight/obesity. Specific food groups that showed significant associations for overweight/obesity include beverages and meat. Soft drinks and fast food were both positively related to overweight and obesity, although the association was only significant for the overweight category. Children with higher amounts of screen time (a proxy measure for physical inactivity) were also more likely to be obese (Kleiser, Schaffrath Rosario, Mensink, Prinz-Langenol, & Kurth, 2009). KiGGS did show that children ages 3-10 participate in sports regularly: about three-fourths of them do sports once a week and more than a third of them are doing sports three or more times per week. However, children from low SES backgrounds, immigrants (as well as those from former East Germany) are less likely to pursue sports activities (Lampert et al., 2007). This information supports the above-mentioned findings relating SES and immigrant status to obesity.

KiGGS found that during the past two decades mean weight gain during pregnancy has increased by 2 kg and mean birth weight has increased by 50 grams. There has been no significant time trend for smoking during pregnancy, but 17-18% of the women in the study were smoking during pregnancy and the prevalence was four times as high among lower social class women as among higher social class women (Bergmann, Bergmann, Ellert, & Dudenhausen, 2007).

Built Environments in the United States and Germany: General Considerations

The major components to consider when researching the effect of built environment on weight status and fitness are the food supply system and the impact of regional infrastructures on active versus sedentary lifestyle choices including the reality and public perception of crime rates that influence citizens' transportation and physical activity decisions. At the outset of this review, it is appropriate to review two relatively non-modifiable environmental differences between the U.S. and Germany. First, the overall size of the countries which affects long-distance travel is radically different: U.S. = 9,826,675 square kilometers,

Germany = 357,022 square kilometers (Central Intelligence Agency, 2013), i.e. the U.S. is about 27 times larger than Germany and necessitates different travel strategies: plane and car in the U.S. versus train (and recently bus) in Germany. Second, population density differences which are more nuanced. The U.S. population is 82% urban; the German population is 74% urban (World Bank, 2013). This would portend a greater feasibility and use of public transportation in the U.S. compared with Germany. However, urban sprawl must be considered. Iconic American urban sprawl, having its roots in Levittown and white flight, makes funding and popularizing public transportation an uphill battle in many areas of the U.S. Still, Europe has undergone a subtler growth in suburbs over the past 20 years and urban planners there are engaged in fights to preserve/go back to dense city landscapes that can support less obesogenic transportation infrastructures (Stutz, 2009).

Built Environments in the United States

Modern urban centers concentrate obesogenic elements such as fast food and urban sprawl/car dependency/increased sedentary behavior such that they are likely a potent cause of the obesity epidemic. Most published research shows significant correlations between these factors and obesity. However, most of the studies are cross-sectional in nature and inconsistent measurement of variables among research groups makes comparisons difficult (Papas et al., 2007). One example of work in this area is a 2009 study of 1048 fifth and sixth graders in New Haven, Connecticut used multilevel modeling to relate built and socioeconomic factors to the children's BMIs and physical activity levels. Living close to fast food restaurants was associated with more frequent unhealthy eating and higher BMIs; living closer to grocery stores was related to more frequent healthy eating and lower BMIs. Access to parks and low crime rates were associated both with healthier diets and increased physical activity. Children from higher SES areas had less screen time and better diets (Carroll-Scott et al., 2013).

Built Environments in Germany

German community food systems seem to offer consumers good opportunities to choose healthy meals. Produce prices are favorable in Germany (Numbeo, 2013a), as compared with the United States (Numbeo, 2013b), with organic vegetables and fruits available at affordable rates in low cost supermarkets (Spiegel online international, 2006). The interest in growing one's own food has grown to include over 1 million

Germans who belong to community garden associations (Gröning, 1996). These garden plots allow city dwellers to enjoy the potential advantages of urban life along with the pleasures and benefits of at least partial control over one's food supply.

Policy makers need to determine the appropriate amount of resources to devote to urban design focused anti-obesity initiatives in Germany. An 'anti-obesogenic' environment, where citizens use active transport (walking and cycling) as part of efforts to stay fit, may benefit the German population, but whether this sensible idea can have long-term effects in this European context remains to be seen. In fact, researchers are curious about the German paradox: in a country with a tradition of compact cities and relatively high rates of active transport, why are about 15% of children and adolescents overweight or obese compared with a worldwide rate of 10%?

A cross-sectional study investigated this question based on the example of children living in Bottrup, a medium-sized city in the western German state of North Rhine-Westphalia, in 2007. In Bottrup, higher levels of childhood obesity were observed in the most densely populated parts of the city. The majority of travel in these areas was done by active or public transport. There was no significant correlation between weight status and type of transport used most frequently (active versus public versus car). In fact, half of the overweight/obese children lived in families without cars and only 13% of the normal weight children were in families without cars. These relations, which seem counterintuitive from an American perspective, were also found in a study in Luxembourg by Ory (as cited in Minster, 2010). There was actually a negative relationship between weight status and sports activities (the overweight/obese children did more sports than the normal weight children). Children in the areas of higher obesity were noted to spend more time outside than their counterparts in other parts of the city. The study investigator notes that the former group of children have less resources to participate in organized extracurricular activities and thus spend more time outside in unstructured (and free) activities (Minster, 2010). A limitation of the study is that the intensity of these unstructured activities was not measured, e.g. no differentiation was made between children sitting around and socializing versus children playing basketball.

Measures of SES did correspond to other findings on obesity determinants. The areas with high childhood obesity tended to have more unemployment and use of social security benefits. Dietary studies of the inhabitants also exemplify findings from other studies:

those in the healthier areas bought fewer ready-made meals and fewer soft drinks. The investigator speculated on some of the causes of these consumption patterns. Economic reasoning (cost per calorie) was discounted as a rationale. Immigrant children in the study (who were concentrated in the poorer, more obese areas) ate more fast food meals than non-immigrant children. This was not, however, related to the presence of more fast food restaurants in those families' vicinities. It may be due to health illiteracy in that non-German speaking inhabitants would have less access to German anti-obesity educational campaigns. Fast food and/or a high-fat Western style diet may be seen as an exemplary part of assimilation to the adopted culture. In addition, many cultures have traditionally idealized a fat body as an ideal. This may partially explain persistent obesogenic behavior in spite of attempted health education efforts (Minster, 2010). In summary, it seems that SES, when compared with urban design, likely had a more consistent relationship with obesity prevalence. Still, the mediation of the relationship is complex and seems to differ in the German compared to the American environment.

Initiatives in the United States

Nationwide, there are a plethora of grass roots initiatives, intervention trials, policy changes, and infrastructural planning efforts all aimed at preventing childhood obesity and its comorbidities. The following description of a few representative projects aims to give a taste of the variety of implementations along with past and potential results as a basis for comparison with the German situation.

Currently, the most well-known U.S. reaction to childhood obesity is Michelle Obama's *Let's Move* initiative which is based on five action areas: "1. creating a healthy start for children 2. empowering parents and caregivers 3. providing healthy food in schools 4. providing access to healthy, affordable foods 5. increasing physical activity" (Let's Move, 2013a). One result is the Healthy, Hunger-Free Kids Act, which increased federal funding for the National School Lunch and Breakfast Programs and mandates the Agriculture Department to regulate nutrition standards for food sold in school vending machines, a la carte lines and school stores as well as in the standard meal programs (Child Nutrition Reauthorization Healthy, Hunger-Free Kids Act of 2010, 2010). Let's Move also incorporates the private sector, for example several supermarket chains have pledged to build stores in locations that have low access to produce and after exhortation from Michelle

Obama many restaurant chains are offering healthier children's meals (Let's Move, 2013b). Such broad efforts are aimed at changing the American environment and, thus, the expectation is for differences in outcomes over a generation, not specific BMI changes publishable within a few years.

One example of a community intervention with wide applicability is the Walking School Bus program. The idea is for parents, adult volunteers or school staff to accompany groups of children as they walk (or bike) to and from school. A pilot cluster randomized control trial (N =149) of fourth-graders in Houston, Texas showed significant increases in active transportation to school (+127% in the intervention group vs. -19% in the control group ($p < .0001$)) and in daily moderate to vigorous physical activity (+4.7% in the intervention group vs. -10% in the control groups ($p = .029$)). Parent outcome expectations were a borderline significant covariate for active commuting ($r = 0.165$, $p = .052$); the researchers connect this finding with cultural differences in that acculturated Latino children were more likely to actively commute during this intervention when compared with non-acculturated Latino children. Acculturation was assessed with proxy measures: country of origin and years lived in the U.S. (Mendoza et al., 2011). This is one of numerous studies showing positive short-term outcomes for behaviors. Research funding realities likely dictate this approach to the field: instilling healthy self-manageable habits early in life may be the most cost-effective way to aim for improved health outcomes over the long term.

German Initiatives

Germany also has numerous obesity prevention efforts launched from the national as well as local levels. Surveying the intervention/policy landscape along with early results there may inspire adaptations for use in other European nations and beyond to the U.S. and the numerous other countries battling overweight/obesity trends.

An example of a large (300,000 German families nation-wide are affected by their connection with 5500 day care centers) comprehensive multi-component intervention that may help to prevent obesity in young German children is the Tiger Kids program, supported by the AOK health insurance company and the Stiftung Kindergesundheit. This initiative, which focuses on nutritious eating and frequent physical activity to balance caloric needs and expenditures for growing children, has the potential for a great benefit-cost ratio in that more than ninety percent of German children between the ages of 3 and 6 attend day care

and the program's financial investment is relatively low. At the time of the pilot study, the daily goals were for the children to be active for 30 minutes per day, to have two servings of vegetables or fruits as snacks and to have mostly water or no sugar added drinks with no more than one sugar added drink per day. Results from the pilot program which involved 2658 children in 64 day care centers showed higher fruit and vegetable consumption in the control groups (adjusted OR = 1.59 at 6 months and 1.48 at 18 months). Subgroup analyses of the higher risk groups of overweight children and the children of parents with lower educational levels showed similar results. Trends toward decreased overweight and obesity outcomes in the intervention groups did not reach statistical significance. The researchers considered diffusion of treatment and reporting bias as well as lack of power and the need for longer follow-up as possible reasons why overweight/obesity outcomes were not significant (Bayer et al., 2009). The day care interventions include a physical education component, evaluation of breakfasts brought from home, nutrition lessons, vegetable and fruit snacks provided by parents and prepared and eaten by the children, and a drink station with no and low-calorie drinks (Institut für Betriebliche Gesundheitsförderung BGF GmbH, 2013). Tip cards (available in German and Turkish) sent home to the families attempt to extend the intervention to the home setting (Tiger Kids, 2013a). New goals have been added to the program since the pilot study, namely that children should be active for 60 rather than 30 minutes per day, they should have enough relaxation time during the day, they should participate in fewer sedentary activities (Tiger Kids, 2013b). Results after two years show significantly higher fruit and vegetable intake, significantly decreased intake of high calorie beverages with the strongest effects in day care center with a high proportion of low SES children (Institut für Betriebliche Gesundheitsförderung BGF GmbH, 2013).

Germany's relative tendency to avoid urban sprawl has helped the society to maintain a strong tradition of active transport (walking, cycling, and by extension use of public transport) as a natural part of daily life. As an example, in 2008 10% of German transportation was by bicycle and in 2014 that proportion rose to 14%. Some large city streets like Munich's Leonradstraße have room for 2 ¼ meter (about 7.4 feet) wide bike paths, but even more dense areas like Cologne's downtown are being rethought to benefit bicyclists. There the city is no longer requiring cyclists to use bike paths because the City Council believes

that drivers are more careful when the bikers are sharing the lanes (Sobiella, 2013). Such infrastructure decisions benefit everyone, including parents and children traveling together as well as children traveling alone. A recent University of Westminster study surveyed youth in Cologne (downtown), Witten, Cologne Chorweiler, Wuppertal-Langensfeld and Bochum and reported that 76% of the elementary schoolchildren respondents travel home from school without parental supervision (i.e. on foot, by bike or public transport). The researchers saw this as advantageous due to earlier studies citing greater energy expenditure by children engaging in activities outside of the home when compared with after-school clubs (Shaw, Watson, & Frauendienst, 2013). German bikers still dream of Copenhagen where there are 5 meter (~15 foot) bike paths and the Copenhageners spend about 20 million Euro yearly to improve their bike path network. The EU may help Germany become more bike friendly: its Parliament is trying to set a 30 kilometer speed limit for European cities (Sobiella, 2013).

The German government supports active transport of children to school. This means that in addition to subsidizing the citizenry's use of public transportation (albeit at lower levels than in the United States (Buehler & Pucher, 2012)), the administration encourages children to walk or ride bicycles to school. The Federal Highway Research Institute publishes pertinent surveillance data (atlases of traffic accidents involving children) as a source of background data for efforts to improve children's safety. Incidentally, the number of such accidents has decreased considerably between 2001 and 2010 (Bundesanstalt für Straßenwesen, 2012b). The Institute also completed a research project on school route maps for pedestrians and cyclists. These maps publicize routes that are recommended to families as safe choices for active transport to school. Whereas the researchers note that society-wide changes in children's levels of mobility are creating ample demand for this information, there are problems with the school route information currently provided to parents (safer routes are available and could be recommended). One of the results of this research is a "Guideline" which outlines the process of choosing the best school route and provides ready-made materials to help local citizens create guides to the routes for their areas (Bundesanstalt für Straßenwesen, 2012a).

Conclusion

Childhood obesity has been recognized as a significant and growing public health problem in the

U.S. and Germany. Both nations see this trend as a threat to their healthcare systems' capacities and to economic wellbeing. The problem demands attention to its root cause, caloric imbalance, as well as to additional risk factors such as weight gain during pregnancy, birth weight, SES and likely mediators such as screen time and built environments that affect lifestyle activities such as active transport. Public health professionals should also consider diverse cultural backgrounds represented in both countries that likely affect varying ideals of beauty and different outlooks on appropriate types of diet. Cultural norms about physical activity and lifestyle activities for boys versus girls can vary even within a homogenous culture. Thus far, individual public health efforts show benefits for the risk factors of high amounts of nonnutritive calories and sedentary lifestyles, while improvements in BMI levels are rare. This may relate to limitations inherent to BMI (i.e. increasing muscle increases BMI) or to the need for larger sample sizes or longer duration of follow-up. U.S. data on the national level of prevalence of childhood obesity does show a stabilization of the levels between the 2007-08 NHANES data and the 2009-2010 cycle, so the multitude of national and local efforts may be effective over the long run. Germans aim to limit the (admittedly less dramatic increase) in childhood obesity prevalence in their country. Adoption of strategies shown to be successful in one country (or one region) may be limited by local difference; however, planners can capitalize on numerous similarities as well. German city infrastructure improvements may translate well to American downtowns. American school programs may be useful in German localities as well. Researchers, policy makers and officials worldwide need to remain open to learning from each other's experiences and to tweaking foreign ideas to fit domestic specifications, so that regionally appropriate interventions can turn obesogenic environments into healthy societies.

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