Urban Design, Mobility and Obesity: A Study of Obesity in Germany

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Abstract
Considerable research has been undertaken in recent years to understand the relationship between urban planning and obesity. This paper examines the implications of transferring this problematic from North America to Europe. Some US academics have shown a positive correlation between suburbanisation and obesity. This issue has recently become a research topic in Europe. The case of Germany is described here, as this country positively encourages the compact city but also has a high level of obesity. To understand this contradiction, statistics are used to quantify the ‘obesity epidemic’ according to administrative districts. The quantitative study is complemented by a qualitative dimension, with an empirical survey among children and observing urban structure, neighbourhood recreational opportunities, food choices and purchases. Areas of obesity and poverty are coterminous, but no evidence is found on the possible links between obesity and urban form.

Introduction
People who are overweight or obese are usually described by an accumulation of fat, which is due to an imbalance between energy expenditure and calorie intake. This medical situation is most often defined by the Quetelet or Body Mass Index² (BMI), which is easy to determine using the patient’s height and weight, and the value is obtained by calculating the body mass (kg) divided by the squared height (m²). The causes of obesity are now more or less well-known (Basdevant and Guy-Grand, 2004), and include consuming too much food with (saturated) fats and sugars (World Health Organisation, 2009), such as ready meals and fast food dishes. When this is combined with lack of exercise, it results in people being overweight or obese. However, these reasons are not sufficient to explain the growth of what the World Health Organisation (WHO) is calling the ‘epidemic of the 21st century’. The prevalence of obesity has increased since the 1980's, and according to 2005 WHO statistics, at least 400 million adults were obese worldwide. This figure will increase by 300 million to 700 million in 2015.

This is a global problem for both the health care and the economic sectors. In addition to the absolute increase, there is alarm over the speed with which the obesity rate is rising. Researchers are now considering the obesity question from four angles: (1) the biomedical approach, based on genetics and metabolism; (2) research related to food intake; (3) research dedicated to physical activity; and (4) research considering the local external environment. Although medicine as a discipline has a key role in understanding these issues, it is also a topic of interest to social science researchers in general, and to urban planning in particular. Researchers are trying to identify and understand the causes of this problem. The idea that urban planning could help to fight the ‘obesity epidemic’ is in the same vein as the Defensible Space Theory of Oscar Newman, which was developed in the 1970s and posits the argument that urban design can increase inhabitants’ security. There is a changing

¹ Clotilde was a Visiting Researcher at the Transport Studies Unit, School of Geography and the Environment, University of Oxford in 2009.
² The BMI produces a value that determines whether an individual is normal, overweight or obese – under 25 is normal, 25-30 is overweight and over 30 is obese.
viewpoint amongst academics, where research fields (from medicine to, among others, urban planning) and the vocabulary (illness to epidemic) both demonstrate that a medical problem has also become a subject for research in the social sciences.

In 2000 urban planners started to study the relationship between obesity, mobility, and urban design. Their research has been related to understanding the links between obesity and green spaces and proximity (WHO, 2007), or to the food environment (Burde and Whitacker, 2004; Currie, et al., 2004; Bovell-Benjamin, et al., 2009), or to the means of transportation (Bell, et al., 2002; Du, et al., 2002; Gordon-Larsen, et al., 2005), or to the time spend in cars (Frank, et al., 2004), or to the number of cars (Froquel, 2000), or even to the built environment (Srinivasan, et al., 2003). Few results are proven, and some studies are contradictory, as researchers may be working in the same country, but with different methods. The common theme underlying these studies is, that the post-Second World War city may be responsible for the obesity-epidemic because its concentrates everything needed to cause obesity. This includes 24-hour fast food, supermarkets with fatty foods, and this food culture is added to by the size and the form of the cities, such as urban sprawl and associated car dependency. The net result is that less use is made of the means of transport that involves the human body as a power system (i.e. walk and cycle).

Indeed, initiators of a project called “Go to School on Foot” conducted in Germany have shown that 30 years ago, children spent four hours per day outside as opposed to only one half-hour per day today. They also spend nine hours per day seated. Between 1977 and 1985, the walk trip rate in the USA decreased from 25 to 10%. The situation was summarised in 2001 by columnist Neal Pierce (quoted by Sui, 2003): “We sit in cars. We don’t walk to the store at the corner. […] Residents often live on curvy, dead-end streets (often cul-de-sac) that feed into high-volume highways leading to segregated uses. […] Sidewalks are often missing. Roadways […] make foot or bike downright dangerous”. Researchers are not the only ones to work on this question, as obesity has been regularly featured in the media, and this has increased public awareness of this problem.

Is there a particular form of urban design for poor areas, which results in a high obesity rate? Geographers performing obesity research along sociological lines in North America (e.g. Sobal and Stunkard, 1989; Crossraw and Falkner, 2004; Ogden et al., 2002), France (Salem, 2000), and Germany (Kolip, 2004) have all discovered a positive correlation between obesity and poverty. These researchers have shown that the obesity map is largely coterminous with the poverty map. In light of this finding, it seems appropriate to study the link between urban design, mobility and obesity, and to reassess the effect of town planning on individual mobility and the obesity rate. A perspective is given in this paper on the links between urban design, mobility and obesity, and the question is asked about the relevance of town planning in the growth of the obesity rate.

Although researchers have obtained few strong results, the idea and concept of the ‘anti-obesogenic environment’ appeared among scientists and then politicians with the objective of helping inhabitants to stay thin and healthy. The ‘anti-obesogenic environment’ is defined as a space (a city or an area) where people could use active means of transport to stay fit, and thus, stay healthy, instead of becoming fat. Indeed, there is some evidence that overweight or even obesity are related to an elevated risk of cancer, cardiovascular disease, etc. This analysis is now being transferred from North-America to a European context (Schmid, 2006; Winkin and Lavadinho, 2008), but the relevance and appropriateness of transferring such research is not proven. The royal commentator, Prince Charles is concerned about obesity, and his charitable Foundation for the Built Environment is planning to build a town in Scotland to help inhabitants stay fit (Watson, 2008). In order to examine the transference of this research topic from North America to Europe, a study in Germany has been undertaken, as this is a country where the urban culture is based on the model of the compact city, but where the obesity rate is high. The study seeks to explain why, in a less suburban country than the USA, 15% of all children and adolescents in Germany are overweight or obese, as compared with 10% worldwide.
Methodology

Because of its many-faceted features, research on the relationship between urban design, mobility and obesity presents a complex problem, namely producing evidence of causality between space and health. In order to address this underlying issue, a methodological approach has been constructed that is based on municipal statistics, self-completion questionnaires, observations, and interviews. This cross sectional approach over time presents a global view of city context and a detailed view of inhabitants’ behaviour, and hence, a deeper understanding of obesity.

Choice of field of study

The relationship between urban design, mobility and obesity is a worldwide issue which must be examined on a large scale if an understanding of the relationship between health and space is to be obtained. Bottrop is a medium sized German city located in North Rhine-Westphalia, the westernmost Land (region) of Germany. It has an area of 10 square kilometres and about 120,000 inhabitants (2007), and density rates that vary across the districts from 61 to 7970 inhabitants per square kilometre (Stadt Bottrop, 2007). This figure compares with 529 inhabitants per square kilometre in North Rhine-Westphalia and 230 inhabitants per square kilometre in Germany.

The selection of a German city reflected the apparent paradox between high urban density and high rates of active means of transport (walk and cycle), and the obesity rate. Additionally, German researchers consider obesity as a societal problem and not as an urban design problem. The study of this divergent position presents an interesting case.

According to the Bottrop (2007) municipal statistics, 13% of girls and of boys aged 6 years old were overweight or obese. More generally, 11.3% of children living in North Rhine-Westphalia were overweight and 4.8% were obese (Moss, et al., 2007). As with many cities in the Ruhr area, Bottrop is still an industrial city, and the unemployment rate was 12%, compared to about 10% in North Rhine-Westphalia (Stadt Bottrop, 2007).

Most of the quantitative data for Bottrop has come from the Statistisches Jahrbuch (2007), which is an annual abstract of statistics that covers economic, financial, social, educational, cultural, and health variables, such as the childhood obesity prevalence data indicators. These data are given on a statistical district scale, with these districts covering between 0.66 and 25.47 square kilometres, and representing between 1,550 and 13,000 inhabitants.

Self-completion questionnaires

A survey was conducted among children in order to understand inhabitants’ points of view. As there was already data for children who started elementary school in 2007, the same cohort of children was studied in this research. It was necessary to seek approval from the schools and the parents, and 15 children accepted to take part to this survey. Children were asked about their perceptions of their local neighbourhood, including playgrounds, green spaces, and their perceptions of security. Some questions were also related to the “obesity equation”, whose parameters are energy expenditure (questions referring to recreational sport behaviour, and active mobility habits) and calorie intake (questions about frequency of fast food restaurant consumption, weekly budget for sweets). They were also asked about their weight and height, and this data were used to determine their weight status by using the Kromeyer-Hauschild method (Kromeyer-Hauschild, et al., 2001).

Observation methods

As suggested by Sui (2003), observations were made at two levels, using both meanings of the word ‘city’: ‘urbs’ (buildings), and ‘civitas’ (people). The first step was to observe the city as urbs, meaning it covers the built environment, including homes, schools, recreation areas, and workplaces, as well as the outdoors physical and social environments (Srinivasan, et al., 2003). The second step was to examine the city as civitas, meaning a more sociological approach to an area. The question was to know how the various obesity rates can be explained, given the same urban design. Whereas the first step was dedicated to the explanation of obesity through urban design and mobility, in this
second step, another approach was adopted, based on observations of inhabitants' behaviour, and analysing whether those behaviours may become obesity practices. Finally, the intention was to determine whether urban design could underlie those behaviours.

Observational surveys were also carried out in two stores of the same supermarket chain, to understand inhabitants' alimentary behaviour in different statistical districts and to understand 'what eating means' among various populations (Mead and Guth, 1945, quoted by INSERM, 2004). Four observation periods were spent in each store, with at least one each on Wednesday and Friday between 17.00 and 19.00, and one on Saturday between 10.00 and 14.00.

**Interviews**

In order to complete the observations and to arrive at a deeper understanding of the city framework, interviews were conducted with policy makers and medical workers, including medical doctors and psychologists specialising in eating disorders. Those interviews were not only informative but also helped the avoidance of cultural bias in the interpretations. Indeed, as a foreigner conducting a study such as this, false conclusions can be easily drawn about social observations. Interviews were conducted with the intention of grasping perceptions and understanding subjective behaviours, but questions were always raised at an objective level. Interviews also were a good opportunity to compare any differences of views between the researchers and those of German professionals, to learn about the local lifestyle and to make the research less culturally biased.

**Results**

The purpose of this research is to examine the ‘German paradox’ according to which cities are described as compact and thus seem to be anti-obesogenic, but where the obesity rate is high. Because of the many-faceted causes of illness, a cross sectional study has been carried out over time investigating obesity and urban form (as measured by density).

**Distribution of obesity rate**

The distribution of childhood obesity in Bottrop is mapped (Figure 1) and higher obesity rates can be observed in the areas of higher density (Figure 2). These areas with the higher obesity rates have a higher morbidity rate than other districts. Indeed, other medical data demonstrates that children living in Southern Bottrop suffer from more medical diseases (language disorders, deficits in motor control, etc) than children living in the North of the city. Statistical data were used to show a positive correlation between obesity rate, unemployment rate and the recipient of social security benefits rate (here Hartz IV). The well-known relationship between obesity and poverty is apparent in the Bottrop data, but this time it is at a larger scale (Figures 3 and 4). These two Figures show areas with high levels of unemployment (left) and those in receipt of social security benefits (right), and both are coterminous with areas of high obesity. The obesity map is largely coterminous with the map showing the higher population density. Almost all obese children live in statistical districts where the number of cars per inhabitants is low (0.41 to 0.56 as against 0.60 to 0.62 in statistical districts with lower obesity rate), and where the majority of trips are made by active or public means of transport.

The survey was carried out in a statistical district where the obesity rate was high. In spite of the high prevalence of overweight and obesity, only one child did not practice any sport at all. The majority of other children in the survey participated in swimming (66%) or football (25%). On average overweight or obese people practiced more sport than children who had a normal BMI (4.15 hours against 3.48 hours each week). The results do not show a link between weight status and means of transport for daily trips (to and from school, and to and from extracurricular activities –Table 1). Buses and active means of transport (walking and cycling) are used by both overweight and non-overweight children.
Figure 1: Childhood obesity rates\(^3\)

Figure 2: Population density

Figure 3: Areas of High Unemployment

Figure 4: Areas in Receipt of Social Security Benefits

\(^3\) Figure 1, the northern statistical district has a high obesity rate. Few children in that district had a medical examination (2007), but this result is probably the consequence of a statistical distortion due to the low number of people. We did not observe the same trend for the other years.
Table 1: Means of Transport for Children's Daily Trip, as related to weight status

<table>
<thead>
<tr>
<th></th>
<th>Active means of transport</th>
<th>Bus</th>
<th>Car</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-overweight</td>
<td>38.9 %</td>
<td>50 %</td>
<td>11.1 %</td>
</tr>
<tr>
<td>Overweight or obese</td>
<td>41.7 %</td>
<td>41.7%</td>
<td>16.6 %</td>
</tr>
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Related to this result, it is also evident that children have a positive perception of their local neighbourhood, as 60% of surveyed children answered that they feel safe and 27% said that they feel safe ‘most of the time’. There was no difference between children with respect to energy expenditure. However, one must acknowledge some difference among children regarding calorie intake. Indeed, foreign children eat more often in fast-food restaurants than do German children (on average 2 meals weekly, as opposed to 1 meal weekly by German children).

**Alimentary behaviour of residents**

Although the products sold are the same in both supermarkets, there were clear differences in alimentary behaviour between Northern and Southern inhabitants of Bottrop. Those who shopped in the North bought more vegetables, some meat and few ready-meals. In the South, people bought fewer vegetables, and they purchased potatoes or ready meals, like Bavarian sausage salad. Some differences in beverage buying habits were also observed. People from the South bought much more sweetened carbonated drinks than people from the North, who preferred fruit juice. Beverages are bought in six-pack in the South, but individually in the North.

**Inhabitants’ use of public space**

From the observational studies differences were seen in how inhabitants used public space between the districts in Bottrop. In all districts, the road speed is limited. Most residential areas are traffic calmed areas, and many streets have dead-ends, meaning that few cars enter into residential areas. The sense of security is much the same in both North and South districts, but people living in the South of Bottrop spend more time outside than people living in the North. Green areas, playground areas and streets are used as playing areas by children from the South. However in the North, where almost all dwellings are detached houses, there are no people outside and very few children play in the street. However, observations of very similar apartment blocks located on the two sides of Bottrop, one located in the North and the second located in the South, revealed that people from the North do not spend time outside, and the reverse is true for those in the South. Lifestyle seems to depend on the characteristics of the neighbourhood, and not on the type of building.

**Discussion**

Analysis of statistical data shows that one can speak of ‘two Bottrops’, the denser, historic city to the South and the more recent neighbourhood of Kirchhellen to the North, which was its own municipality until 1976 reforms changed the structure of local governance (Gebietsreform). The literature pays particular attention to the relationship between population density and obesity (Edwing et al., 2006; Peytreman-Bridevaux et al., 2007; Jokela et al., 2009), and it has been informative to compare two different urban contexts in the same town. A cross sectional study is a good methodology because it permits a comparison that is focused more on urban structure, where changes are slower and overlapping with various population features.

This study has found expected results from a socioeconomic point of view, namely that the poverty map is coterminous with the obesity one (Salem, 2000). From the municipal statistics, fewer children are overweight or obese in the North of Bottrop, which is the richest area of Bottrop but which is not as ‘anti-obesogenically’ designed. Higher childhood obesity rates were found in the higher-density areas. These areas were located in the South and they meet anti-obesogenic requirements. Indeed, these areas provide playing areas, green spaces, bicycle lanes, and a high level
of security for pedestrians thanks to traffic calming zones and speed limits on cars in residential areas, usually of 30 km per hour (18 mph). The findings indicate that children have a positive perception of their local security and use public space to play and walk or cycle to reach their local destinations. These results confirm the conclusion of another study which showed a clear association between perceptions of the local neighbourhood and the use of active means of transport among children (Timperio et al., 2004). These results also corroborate the study conducted by Pucher and Dijkstra (2003) where they have showed that German pedestrians and cyclists have a safe environment in which to move.

In this study, nearby residential public spaces are used to very different degrees according to population features. People spend more time outside in areas where the obesity rate is high. Both overweight children and non-overweight children play sports and spend time outside with friends. These results were unexpected. The use of the public space is limited by family constraints and by the time spent at home, and this means that the members of the poorest families have fewer extracurricular activities and thus more time to spend outside than the richest families do. The families' options in terms of time spent in leisure activities were not always related to the time spent at home or to their expendable income, but also to the priorities given to extracurricular activities for their children. Additionally, outside activities cost nothing for parents (Tudor-Locke et al., 2001; Timperio et al., 2004). This research supports and reinforces previous research that has found no association between obesity and urban design.

Although researchers in the USA have paid particular attention to the role of car use in causing an increase in levels of obesity (Frank et al., 2004; Eid et al., 2007), the results here show no relationship between mobility habits and obesity. As stated previously, the number of cars per inhabitant in the South of Bottrop is lower than in the North. Pedestrians and cyclists have many facilities in Bottrop. According to an official survey conducted by policy makers, two thirds of public transport users have a free parking place provided by their employer. Southern areas meet anti-obesogenic requirements from a mobility point of view, as districts have mixed land use and the level of accessibility via public transport is very high. 50% of overweight or obese children among those surveyed had no car compared to only 13% of children with a normal weight status. It was surprising to find no significant association between private motorised means of transport and the obesity rate, but even more surprising was the positive link between obesity rate and availability of public transport.

Here again, the results reveal the differences found in Bottrop as compared with the US literature. However, the Bottrop findings confirm those obtained in another European country, the Grand Duchy of Luxembourg, where a recent study shows that obese people own fewer cars than inhabitants of normal weight status (Ory, 2008). In the Bottrop case study, the numbers of cars per inhabitant is lower in districts where obese people live (the Southern part of the city), but it is not clear whether they make more trips or spend more time in their cars than Northern inhabitants. It is not known why obese inhabitants have fewer cars (no need, no money to buy one, etc). However, these initial results based on a statistical and morphological approach to the city may suggest that the poorest inhabitants of an American city do not fit the same profile by their spending capacity as the poorest inhabitants of a Western European city.

This study is one of the first to examine the relationship between obesity and urban design through a cross-sectional study. Most researchers agree that there is a correlation between the obesity rate and other parameters (e.g. lack of green spaces, presence of fast food restaurants, lack of infrastructure for active transport, etc). In order to understand how inhabitants interact with the city, a novel approach to geographic research has been added by choosing not only to focus only on the morphological aspect of the urban design, but also on the city as civitas (people).

Food eating habits can vary according to neighbourhood. By observing two low-cost supermarkets, it was found that food buying habits are not only related to food prices. This finding is surprising, considering that researchers agree that eating behaviour is related to the price of the food, and in
particular to price per calorie (Darmon and Drewnowki, 2008). According to a study conducted by the Robert Koch Institut, Germans eat much more fat than the recommended daily amount (Robert Koch Institut, 2002). However, in the Bottrop case study, the social-economic distribution (North-South) affects the number of calories per grams of food and the quality of products bought. These differences corroborate the results obtained from the questionnaire, where there were differences in food habits among children.

According to the survey, foreign children eat more fast food dishes than German children. Two comments can be made to explain this phenomenon. First, most foreigners do not speak German. Thus, they have no access to obesity prevention campaigns. People in charge of health prevention in Bottrop have taken the initiative to increase foreign inhabitants’ awareness of childhood obesity. In one program, about 10 foreign housewives who spoke German received information on obesity and illness prevention, and they were charged with spreading the information in their mother tongues. A second hypothesis is that fast food restaurants or even fatty food is one of the representations of ‘Western modernity’ (INSERM, 2004) for immigrant populations. Consequently, as this is a ‘model’ to follow, foreign parents want to offer the best to their children, and may think that fast food restaurants represents the best of what they can offer to their children. In these two cases, it is hard to find a relationship between alimentary behaviour and urban design. There are few fast food restaurants in Bottrop, and it seems hard to find any association between the presence of fast-food restaurants and the obesity rate. Behaviour patterns could also be related to a worldwide trend for people to eat outside their homes (Foresight, 2010), but these behaviour patterns may also be related to the social function associated with eating.

The meaning of eating habits (Mead and Guth, 1945) is a very important theme studied by sociologists including Fischler (1979 and 1990), Herpin (1988), Corbeau (1995), Poulain (1985 and 1997), or Lah lou (1998). Few geographical studies on obesity have taken a sociological perspective, but this approach may help to understand the geographical phenomenon. Brown and Konner have observed that 81% of the 51 traditional cultures, which researchers studied, consider a fat body as the ideal beauty (INSERM, 2004). Consequently, it is easier to understand that the normal weight status lauded by the WHO is not always understood by immigrant populations. In fact, it would be interesting to understand the impact of community values on individual behaviour, on individual systems of values and its dynamics. It should also be interesting to understand why communities remain together, and why foreign inhabitants live in the same areas. In Bottrop, vulnerable inhabitants live together in former company neighbourhoods built in the 19th Century. These areas are not places where people of different ethnicities can meet and interact. Thus, it may have an impact on the system of norms and the frames of reference (for example, in terms of weight standards) among a group of people.

Potential limitations

The current study has limitations, as the survey was conducted among young schoolchildren at the school. Although it was explained that the survey was not an examination, it may have been seen by some children that there was a ‘right answer’ so that they ticked the same box as that of their classmates. Second, the survey was conducted among children from the same area who grew up together. It may be that friends escape one of their weight status’ critical eyes. Overweight children are still well integrated with the other children. But after elementary school, they may leave this group of childhood friends to go to pursue their studies at another school. Here they will meet other children who will see them and consider them to be overweight. Stigmatisation may cause then to stop all physical expenditure, increase compensatory food intake (INSERM, 2004), and they then become obese teenagers. Further research should be conducted through a longitudinal study on a group of children, in order to determine at what point in their lives children reduce their physical activity counted in hours or increase their calorie intake (or any other cultural behaviour), but at the same time controlling for the urban structure, so that it remains the same in different kind of towns.
Conclusions

Overweight and obese children spend more time playing sports than non-overweight children. By examining calorie expenditure, it was observed that Bottrop Southern children play outside more than children living in the Northern part, but that overweight and obese children have fewer extracurricular activities. No relationship was found between road safety, the presence of neighbourhood recreational opportunities and the obesity rate. There was no evidence that low population density causes obesity. The car ownership rate is higher in the North than in the denser South of Bottrop. However, the higher car ownership and statistical data suggest that people living in these Northern areas have higher purchasing power than residents of the denser Southern part of the city. The difference in the obesity rate could be explained by the pattern of wealth distribution.

Calorie intake differs markedly among the population, meaning that although residents have access to healthy food choices in all districts, food purchasing habits differ significantly within the population. Foreign children are more likely to be obese than German children. Foreign children are almost located in the denser South, but also eat much more fattening food than German children. No link between mobility, urban design and obesity was found.

Conclusions reached in North America relating to the relationship between mobility, urban design, and obesity seemed to be different to the empirical results found in the medium-sized German city context. Obesity expresses itself differently between different countries, with each country having its own urban structure (e.g. the size and the organisation of the city), and its own cultural behaviour that may bear on the country's obesity rate. This case study illustrates the important role of the city as civitas or as a place for people. Future research should focus on understanding of the community-level factors in the study of obesity.

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