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An interdisciplinary analysis of obesity: theory and empirical evidence

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An interdisciplinary analysis of obesity: theory and empirical evidence

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[§] Any analyses, interpretations, or conclusions reached to the Author (recipient of the file) and not to the National Survey of Children Health and to National Longitudinal Study of Adolescent Health, which is responsible only for the initial data.

In Aristotle the mind, regarded as the principle of life, divides into nutrition, sensation, and faculty of thought, corresponding to the inner most important stages in the succession of vital phenomena.
Wilhelm Wundt

To Lorenza, Jarl and Giulia and to Alberto

Abstract

The dissertation is structured in three parts. The first part compares US and EU agricultural policies since the end of WWII. After reviewing the literature on the subject, I conclude that there is not enough evidence for claiming that agricultural support may have a negative impact on obesity trends. Then I discuss the possibility of an exchange in best practices and policies between the United States and the European Union in order to fight the obesity epidemic. My conclusion is that there are relevant economic, societal and legal differences between the US and the EU. However, partnerships and platforms for finding common strategies against obesity are more than welcomed, because they enhance and improve the quality of the public debate on how to tackle obesity effectively. Moreover, I stress the positive role that Corporate Social Responsibility has in fighting obesity. In fact food companies possess the know how to promote healthier food choices, know how they can use through marketing strategies.

The second part presents a socio-ecological model of the determinants of obesity. I argue that in order to understand obesity we need to employ interdisciplinary models because they capture the simultaneous influence of several variables. Although further evidence is needed, I suggest that for developing incisive public policies, synergic approaches are more effective than spot interventions based on isolated measures. Obesity is in fact the result of a complex interaction of pre-birth, primary and secondary socialization factors. To empirically test the relative significance of each of those factors, I use data from the National Longitudinal Survey of Adolescent Health. I compare the average body mass index across several different populations. In almost all the cases differences in means are statistically significant and follow the theoretical predictions.

In the last part I use the National Survey of Children Health. I analyze the effect that family characteristics, the built environment, cultural norms and individual/behavioral factors have on a categorical transformation of the body mass index (BMI). I use Ordered Probit models and I calculate the marginal effects. I use also State and ethnicity fixed effects to control for unobserved heterogeneity. I find that southern US States tend have on average a higher probability of being obese; among the non-southern States, perhaps surprisingly, the District of Columbia has a higher BMI respect to other non-southern States. On the ethnicity side, White Americans have a lower BMI respect to Black Americans, Hispanics and American Indians Native Islanders. On the other hand, being Asian is associated with a lower probability of being obese with respect to other ethnicities. Further evidence shows that in neighborhoods where trust level and safety perception are higher, children are less likely to be overweight and obese. Similar results

are shown for higher level of parental income and education. As predicted, I find that higher parental income has a negative effect on the probability of being obese. Breastfeeding as well has a negative impact. Finally, higher values of measures of behavioral disorders (bullying, emotional disorders etc …) have a positive and significant impact on obesity, as predicted by the theory.

PART 1

The changing objectives of US and EU agricultural and food policies: a review of their history and implications on obesity policy

Introduction

In the last forty years agricultural policies and their priorities have changed significantly all over the world. The relative importance of agriculture as a component of the GDP decreasedin all industrialized Western countries. These changes are grounded in both the demand and the supply of agricultural products. The domestic demand for food commodities is no longer satisfied by national production. Import and export volumes increased significantly after the creation of the World Trade Organization in 1995. Increased attention towards food safety, food quality and environmental protection has changed – and is changing – consumer attitudes towards food choices. Thanks to new technologies, consumers have easier access to information and can make healthier food choices. One of the most interesting aspects in the history of modern agriculture is the change in the general goal of agricultural policies: from food security to food safety. This is true for both United States and Europe. If after World War II countries were interested in providing food to the highest number of their people, nowadays – and especially after the disaster of the "mad cow" and similar food scandals – the principal goal of agricultural policies is to assure food safety. As a natural consequence of changing objectives, policy and measures employed by policy makers have changed as well. Consider for example the "evolution" of food labels that from a simple indication of basic nutritional facts are now more informative. Many products contain health and nutritional claims.

The agricultural history of the United States and of the European Union presents many similarities, but the two systems remain substantially different: United States is a market-oriented economy where the role of government is reduced to its minimal terms, while public intervention plays an important role in the European Union. This has several implications that influence, for example, consumer beliefs. Individual freedom is more important in a liberal economy while consumer protection is more important in economies based on the welfare state model. For example there is a different attitude towards the so-called "obesity epidemic". In the United States the most common opinion is that obese individuals are responsible for their condition because they voluntarily chose their lifestyle. On the other side in the European Union predominates the opinion for which obesity is the result of factors that go beyond personal choices. As we will discuss in the next chapters, the example of obesity it is not casual. The paper indeed focuses on the relation between agricultural policy and obesity epidemic in both the United States and Europe.

Part I is structured as follows. The first chapter is a review of the history of agricultural policies in the United States and in the European Union. We discuss the main features of the two systems as well as some research findings upon the relation between agricultural policies and obesity. Chapter two discusses the philosophical roots of policy intervention, with particular focus on nutrition policies. We provide some explanation of the historical differences between United States and Europe and discuss the problem of policy certitude as treated by Manskithrough examples related to obesity (1). Chapter three collects concrete examples of realized and on-going policies for reducing overweight and obesity ratesin the EU and US. Chapter 4 draws conclusions and discusses the upwards and

downwards of an eventual exchange of best practices between United States and Europe for tackling increasing rates of obesity. It also underlines the role of Corporate Social Responsibility in strengthening US-EU partnership.

Contents

CHAPTER1
Agricultural Policies in the United States and Europe

1.1 The agricultural environment: a comparison between US and EU

The United States and the European Union are two of the world's largest agricultural producing, consuming and trading entities (2). Although these two realities present a lot of similarities, many are the differences in the production and consumption systems.Table 1.1 reports some macro indicatorsand other statistics of the main features of the two agricultural systems.European Union is treated as single entity because agricultural policy is managed by the European Commission under the name of Common Agricultural Policy (henceforth CAP).Nutritional policy are also managed at the EU level through policy guidelines. It is important to keep in mind that Europe is an aggregate of countries that differ by politics, culture and economics. The United States is a Federal Republic of fifty States and one District. Trade in goods and services are tariff-free and other barriers are minimal. The US economy is market-oriented, highly industrialized and characterized by a highly productive agricultural sector. The European Union is also a

market oriented economy but with an average higher public sector involvement. European agriculture has for long been more protected than US agriculture and it favors internal trades more than external trades. The agricultural sector is highly productive and characterized by a more intensive production than the US.In both EU and US, technological changes led to an increased efficiency and production scale, as well as better skills of operators.

Table 1.1 Key facts on US and EU agricultural policy

	EU	USA
Population (2011) Per capita GDP (2010) Total GPD (2010)	502,486,718 32,480USD 16,249,920.34 (millions of USD)	312,422,826 47,000 USD 14,582,400 (millions of USD)
Agriculture as a contributor to GDP Arable land	1.8% 44% including agricultural land, livestock included)	1.1% 18.01%
Farm structure	Smaller farms generally family owned	Fewer but larger farms
Average farm size	+50% < 12 acres 8% > 124 acres and more	22% between 10-49 acres 47% > 140 acres
Economic size	59% small or medium small (revenues of $17,000 or less in the value of gross margins)	92% small (revenues more than $250,000 per year)
Average age of farmers	57	55.3 years old
% Agricultural Outputs: Cattles and calves Fruit and vegetables Oilseeds Poultry and eggs Pigs Milk Grains Sugar beets Tobacco Other	 11% 18% 4% 9% 13% 19% 10% 3% - 7%	 17% 13% 10% 11% 6% 10% 18% - 1% 8%
Agricultural Trade	Largest Exports Aug-Oct-2011, millions of USD): Grain and feeds (31,657)	Main Exported Agricultural products average 2008-2010

	Red meats & products (10,358) Animal feed and oil meal (8,270) Soybeans (19,006) Largest Imports July-Oct-2011, millions of dollars): Grains & feeds (7,6489) Fruits and preparations (9,117) Vegetables & preparations (9,2959)	(million USD) Wine (8,673) Cereal preparations (7,238) Wheat (grains) (5,267) Main Imported Agricultural products Tropical - fruits & spices (10,122) Oilcakes (9,781) Tropical - coffee & tea & mate (8,852)

Various sources: Eurostat, US Census Bureau, FDA, CIA (The World Fact book), BCE, World Bank, OECD, FAO, USDA, EU DG of Agricultural and rural development

Most indicators are easily comparable, with some exceptions. Economic size of farms is difficult to compare because data are collected in a different way. In the United States farms fall in different classes according to the sales amount (from a minimum of less than $1,000 to a maximum of $5,000,000 or more). Data from the Census of Agriculture are collected by the National Agriculture Statistic Service of the USDA. In the European Union data are collected by the Farm Accountancy Data Network (FADN). The economic size is measured in ESU[2](European Size Unit) and the greatest difference respect to US farms is that it accounts for holdings and not for sales. In the Unites States a farm, for being qualified as such, must have only $1,000 of sales per year. European Union defines an *agricultural farm household* as one where the principal income source comes from agriculture. Concerning agricultural output, the United States isone of the world's largest producers of corn, soybeans, beef, poultry and cotton.Recent data show that except for tobacco, US agricultural exports increased significantly between 2010 and 2011. According to the Economic Research Service of the USDA, agricultural exports are

[2]a farm economic size of 1 ecu has a total standard gross – value of production minus some variable costs – of 1,200 ecu

forecast to grow up to $1.5 billion for 2012 (one billion comesfrom Asia, China and South Korea). Export volumes to Canada, Mexico, and the EU have remained unchanged in the last year, while exports to the Middle East and North Africa raised due to an increasein purchases from Egypt, Turkey, and Saudi Arabia (3). A similar growth has been observed for imports. USmost of all imports from Canada, China, Mexico and other Central and South American countries (as Guatemala, Nicaragua, Honduras, Chile, Peru etc). The increasing pattern of US agricultural trade depended on the increasing food demand of growing economies, China at the forefront (4). According to the Organization for Economic Cooperation and Development (OECD), the United States provides the third-lowest amount of government policy-generated support to its agricultural sector among OECD countries. The United States' average applied tariff for agricultural products is estimated by the World Trade Organization to be 8.9%, a little more than twice the average applied tariff for non-agricultural products (2).

Agricultural trade of the European Union has remained stable in these few years. Europe remains the largest world importer, especially from developing countries. As it will be explained later, European agricultural policies are nowadays more liberaland less protective than they were at the beginning of CAP. The practice of giving loans to farmers for their environmental stewardship in both US and EU, together with the importance given to environmental protection, led some scholars to claim that developed countries are experiencing a process of *ecological modernization* (5). An important feature of this renovated interest towards environment is the growing number of voluntary quality assurance schemes, both in the European Union and in the United States. Although the increasing number of voluntary quality assurance schemes, it is also

recommendable to build standardized certification, as for example happens in Europe with the DOC, DOP or IGP labels and in the United States with USDA organic labels.

Consumers in both US and EU started to be concerned about the healthy diets and food safety.Food consumption patterns differ between US and Europe, yet food consumption is changing in a similar way in response to similar trends (such as greater consumption of prepared food, increasing occasions of eating outside, increasing number of overweight and obese individuals). Both agricultural economies are highly integrated and farmers usually are in charge of production only and rarely process their food products. More often they sell their products to others companies that follow the transformation and distribution phases.

The role of agriculture is declining in the US and EU and both agricultural systems have been experiencing significant structural adjustments since the middle of nineties. The most important change was the reduction in trade distortive subsidies and their replacement with direct payments to farmers.

US farm policy has been largely influenced by the so-called "*Corn Belt*", one of the most fertile area in the world in the Midwest region of the United States. On the other side, the European landscapes present a greater variety of territories and agricultural land shares differ from country to country. The highest shares of agriculture are in France (20.3%), Italy (14.2%), Spain (12.7%) and Germany (12.6%). Agricultural activities include many different functions ranging from food and non-food agricultural products to countryside management, nature conservation, and tourism (6). In Europe agricultural policy goals were firstly set in the Treaty of Rome (art.33) signed in 1954 in a post-war

environmentcharacterized by scarcity and food security.The goals of agricultural policy wereto increase productivity, ensure fair standards of living for the agricultural community, stabilize markets, secure availability of supplies and provide consumers with food at reasonable prices. Since then things radically changed. New challenges haveemerged and need to addressed: the increasing surplus of agricultural production, the need of expanding exports and be more competitive on international markets as well as concerns about environmental issues (included animal welfare) and consumer protection in terms of food safety and food quality. Rural policy and the need of diversifying agricultural activities have contributed to a broader definition of the concept of agriculture. At the European level decisions and policies are managed by the Agriculture and Rural Development DG (AGRI) and with some extent by the Environment and by the Health and Consumer DGs.

The history of US agricultural policy dated back to 1820 with the establishment of the Land Act. It was a developmental policy with the goal of developing and supporting families, farm and their land, research and human labor. First measures were antitrust legal actions (such as the Packers and Stockyards Act of 1921) followed by other measures aimed at protecting farmers and their income or at curbing overproduction. Nowadays the goals of US agricultural policies have completely changedas happened in Europe. Environment and consumer protection, for example, are objectives of increasing importance. Decisions are taken by the United States Department of Agriculture (USDA) that is also actively involved in the nutritional policy. Food safety and quality are managed by the Food and Drug Administration.

Despite similar objectives and policies, the history of agriculture in the United States and Europe remains substantially different and has shaped different policies measures and tools. The main different is that the United States have never experienced a target price policy.

Table 1.2 Timeline of the US and EU agricultural policy

Time period	EU	USA
1950 -1959	*1957* Treaty of Rome and creation of the Common Agricultural Policy (CAP) in was signed by the six original Member States	*1954* Agricultural Trade Development and Assistance Act. It facilitates agricultural exports and foreign aid *1954 – 1955* Rural development program *1956* Soil Bank Program - Farmers were paid for retiring land from production for ten years
1960 - 1969	*1962* The CAP became effective in with the intent of assuring a stable agricultural market. It was characterized by a higher degree of public intervention. *1968* **First CAP reform**.The Mansholt Plan – set of target prices and levies for agricultural commodities above the international market level to protect agriculture and farmer income.	1964 Food Stamp Act. It provides assistance to low- and no-income people and families in either urban, suburbs and rural areas. *1964* War on Poverty social welfare program implemented by Johnson with focus on education and health. *1965* Food Agricultural Act . It was the first multiyear farm legislation, it provided for four year commodity programs for wheat, feed grains, and upland cotton, it also continued payment and diversion programs for feed grains and cotton *1966* Child and Nutrition Act – Section 17 institutionalized the Women, Infants and Children Programme. The Act increased funds for the National School

		Lunch Programme firstly institutionalized in 1946 by Truman.
1970 - 1979	*1970* Implementation of three Directives of the European Commission as stated in the Mansholt Plan: modernization of agricultural holdings (1), support abandonment of farming (2) training of farmers (3).	*1970* Environmental Quality Improvement Act.It regulated the activities with a higher environmental impact.
1980– 1989	*1984* Introduction on quotas on dairy products to contain the amount of agricultural surplus. *1988* **Second CAP reform**.Delors Package I establishedthe level of agricultural expenditure, budgetary discipline, the system of own resources and the reform of the Structural Funds.	*1980* Biotechnology became a viable technique for improving crop and livestock products *1985* Food Security Act.It lowered Government farm supports, promoted exports, and set up the Conservation Reserve Program. The CRP was implemented for receiving annual rental payments and cost-share assistance to establish long-term, resource conserving covers.
1990 – 1999	*1992* **Third CAP reform.** TheMac Sharry Reform of PAC introduced **t**hree main changes: 1. a substantial cut in the target prices of agricultural products in order to make them more competitive on internal and external markets; 2. full and sustained compensation of this drop in farmers' income by compensatory amounts or premiums not linked to the quantities produced; 3. recourse to measures limiting the use of means of production (set-aside of arable land, withdrawal of part of the land for major crops, limits on livestock numbers per hectare of fodder area) New input was given to environmental protection: increase measures to conserve the environment and landscapes, encourage the early retirement of certain categories of farmers with the transfer of their land to other	*1990* Farm Bill that is the Food, Agriculture, Conservation, and Trade Act. It is a market oriented reform, it freezes target prices and introduces flexibility in planting. It also regulates grant concessions and rural development. *1990* Organic Food Production Act.It authorized the U.S. Department of Agriculture to establish a nationwide definition for organic food *1996* Federal Agriculture Improvement and Reform Act. It increased reliance on market signals and introduced decoupled payments *1998* HACCP – Hazard Analysis and Critical Control Points - was implemented to target and reduce the presence of pathogens in meat and poultry *1999*

	uses and facilitate the use of farmland for other purposes, such as afforestation or leisure. *1997* **Fourth CAP Reform**. Extension of CAP reform with "Agenda 2000" in order to reduce the degree of agricultural protection and go ahead with the CAP reform of 1992. The greatest change was a shift from a price support to an income support policy. The policy was characterized by a substantial drop in the common support prices for cereals and beef and veal offset by an increase in income premiums for Community farmers	Increased demand for farm programs. We assisted at the drop in many commodities prices, combined with disastrous weather in many parts of the country.
2000 - 2009	*2003* **Fifth CAP reform**. Middle Term Review. It provided for a single farm payment for European Union farmers, independent from production (decoupled direct payment) and subject them to compliance with environmental, food safety, animal and plant health and animal welfare standards, and requirements to keep all farmland in good agricultural and environmental condition ("cross-compliance"). *2008* Health Check–it was the agreement abolishes arable set-aside, increases milk quotas gradually leading up to their abolition in 2015, and converts market intervention into a genuine safety net. Ministers also agreed to increase modulation, whereby direct payments to farmers are reduced and the money transferred to the Rural Development Fund.	*2002* Farm Bill. It consisted in aset of policies aimed at enhancing environmental protection and sustainability of the production. Conservation Security Program (began in 2003). Institution of the Fresh Fruit and Vegetable Program (initially in 4 States and 1 Indian Tribal Organization). *2004* Child Nutrition and WIC Reauthorization Act. *2008* Food and Conservation and Energy Act.It was basically a continuation of Farm Bill of 2002. New areas on intervention were identified: energy, conservation, nutrition, and rural development. Food Stamps benefits increased.
2010 -	2013 expected reform of CAP	*2010* Healthy, hunger-free kids act *2012* Farm Bill (forthcoming)

Sources: USDA and European Commission – DG Agriculture and Rural Development

Before discussing key moments in the US and EU agricultural policy, we need to distinguish between agricultural policy and nutrition policy. In the online encyclopedia a nutrition policy is defined as follows: "*a set of concerted actions, based on a governmental mandate, intended to ensure good health in the population through informed access to safe, healthy, and adequate food*[3]*"*.

The free online dictionary by Farlex defines agricultural policy in the following way: "*agricultural policy describes a set of laws relating to domestic agriculture and imports of foreign agricultural products. Governments usually implement agricultural policies with the goal of achieving a specific outcome in the domestic agricultural product markets. Outcomes can involve, for example, a guaranteed supply level, price stability, product quality, product selection, land use or employment*[4]*"*.

It is evident that agricultural and nutrition policies are strictly interconnected. In the United States, Farm Bills includes regulations for nutritional policy, while in the European Union nutrition policies are managed at State level (only general guidelines are given by the European Commission).

1.1.1 United States

Thefirst *spartiaque* in the US agricultural policy has been marked by the Farm Bill of 1996. The opening of a new chapter not only in the US but also worldwide was the creation of the World Trade organization in 1995.These agreements established a

[3]See http://www.encyclopedia.com/doc/1O39-nutritionpolicy.html
[4] See: http://thesaurus.babylon.com/agricultural%20policy

reduction of the public support in agricultural markets, with the only exception of those policies falling in the so-called “green box”(7). Before 1996 farmers received paymentsin accordance with the type and quantity produced in return for reducing production by not planting some acres of the farm. The overall goal was increasing prices by controllingagricultural production. With the Farm Bill of 1996 funds were drastically reduced and prices were set by market forces. Some forms of support was however maintained. Decoupled payments– payments to farmers’ independent from the production – were introduced under the form of the Production Flexibility Contract, Agricultural Market Transition Act (AMTA) and Market Loss Assistance (MLA). Payments were based on history production and not on production decisions. An effect of this policy wasa rapid fall of prices of agricultural commodities and thus an increased competition.Therapid disappearance of the government from agricultural policy led many farmers to bankruptcy during the next years, yielding the Congress to intervene – for example $28 billion were set in 2000, accounting for half of all money made by farmers (10).

The second *spartiaque*of US agricultural policy was the Farm Bill of 2002. The significant change consisted in a shift from a policy based on liberalizationmeasures to a policy based on environmental conservation. Keeney and Kempfrom the Minnesota Project (8) welcomed this second turning point.Funds for environmental protection doubled (for a total spending of $39 billion between 2002-2012)and a specific programme for environment conservation was instituted, named the Conservation Security Program. Referring to the Farm Bill of 2002, Keeney and Kemps said: “*while it continued to support crops through commodity subsidies, many conservation and*

environmental provisions were included that will, if funded, lower pollution, enhance the landscape, and support small farmers. The new Conservation Security Program promises to financially reward farms for the environmental benefits they provide, and if successful could become the model for a national green payment program.The vision for the Conservation Security Program (CSP) is to reward farmers who voluntarily implement effective conservation on their working lands, thus integrating production of economic products and environmental benefits on the land. The goal is to improve a robust range of environmental concerns, including surface water quality, groundwater protection, air quality, fish and wildlife habitat, energy conservation, soil quality, biodiversity, and genetic preservation. Farmers receive annual payments as they provide public benefits to the nation's natural resources and environment" (8).The CSP introduced also some forms of responsibility: farmers who did little to preserve environment, would have not disproportionally rewarded.

Concerning the mid-terms effects of decoupled payments,several studieshave been carried out.For example, an empirical evaluation of how decoupled payments may affect production decisions is given by Goodwin and Mishra (7). They claim that farmers can decide how to allocate their production according to their risk aversion, expectations over future payments and other psychological factors. They use farm-level data collected by the USDA and focused on Corn Belt. Specifically they evaluated to what extent farmers decisions were distorted by decoupled payments. For example, they found that direct (or fixed payments) may delay or prevent farmers to exit production when they actually would be better doing it so.In general, this and similar analysis are useful for improving financial allocation of the coming farm bills. Concerning nutrition policy, the Farm Bill

of 2002 introduced the Fresh Fruit and Vegetable Programme with the scope to offer to public schools an opportunity for buying fresh fruits and vegetables from local farmers and to improve children health.

The *third*milestone of US agricultural policy was markedbythe 2008 Farm Bill. It was a continuation of the previous Farm Bill. It introduced a new crop revenue programme, permanent disaster assistance, provisions for beginners and low-income farmers, enhanced support for most of the titles of the programme with the addition of organic agriculture, livestock and poultry sector (9). For example, the Conservation Stewardship Programme redesigned and expanded the Conservation Security Programme application. An important aspect of the 2008 Farm Bill was the increased amount of investments for Food Stamp recipients. The Food Stamp Programme was renamed the Supplement Nutrition Assistance Programme (SNAP).The Fresh Fruit and Vegetable Program togetherwith projects on farmer markets and food distribution programs – also received additional funds.The Act created a new institution – the National Institute of Food and Agriculture (NIFA) – in charge of coordinating education, research and grantsmanagement. A step towards the enhancement of nutrition programs has been taken with the signature in 2010 of the Hunger-free kids Act. The goals of the Act are basically two: improving the nutrition of American kids and fighting childhood obesity. Although the effectiveness and the implementation of the programme will only be evaluated in the long-run term, the key legal requirements and tool designed for US federal schools can be summarized in the following points (10):

Table 1.3 Goals of the Hunger Free Kids Act

Improves Nutrition and Focuses on Reducing Childhood Obesity
Gives USDA the authority to set nutritional standards
Provides additional funding to schools that meet updated nutritional standards
Helps communities establish local farm to school networks, create school gardens
Builds on USDA work to improve nutritional quality of commodity foods
Expands access to drinking water
Increases Access
Increases the number of eligible children enrolled in school meal programs by approximately 115,000 students
Helps certify an average additional 4,500 students per year
Allows more universal meal access for eligible students
Expands USDA authority to support meals
Increases Program Monitoring and Integrity
Requires school districts to be audited every three years
Requires schools to make information more readily available
Includes provisions to ensure the safety of school
Provides training and technical assistance for school food service providers foods

Sources: Hunger Free Kids Act, 2010

In these days the new Farm Bill – expected to be effective by summer 2012 – is under discussion. Basically it will continue the work of the former Farm Bill with some adjustments and new challenges. Given the cuts of public expenditure due to the debt crisis, a reduction of $23 billion is expected. However the exact reduction amount has not been decided yet. According to USDA there are three issues that need to be maintained and also strengthen in their efficacy. *Firstly* the so called safety net. Strengthening the safety net is an indirect tool to create incentives to build up a new farm. The *second* principle is to strengthenthe agricultural productivity. And to do it so, one tool is increasing research funds to sustain production and protection of the agricultural system. Together with research, conservation is also a key factor to maintain a sustainable agriculture. Farmers need to be properly informed for using the right programme to preserve the soil and, also, they should be enrolled rather than only in voluntary conservation programs, also in local certified programs. For example, consider this passage from the agricultural secretary Vilsak: "*Now, if we can measure, and if we can*

verify the positive results of conservation, we can encourage the development of local markets in which businesses can purchase that result which will allow them to meet one of their regulatory requirements. Leveraging private sector resources will avoid a decline in conservation practices in the face of fewer dedicated federal resources". The *third* principle is to point on a strong agriculture through the enhancement of trade exports programs and home consumption. Agricultural exports – as shown in the Table above – increased a lot in the past two and three years and, after the financial crisis, this growth helped to build new jobs. The strategy of sustaining exports can indirectly contribute to lower unemployment rate. Also, enhancing direct sales – for example encouraging local producers to sell their products to schools or in the local green market thus skipping a lot of unnecessary passages of the agri-food system – would help to create local jobs. Personal sales may increase trust levels between producers and consumers and help to fulfill the goals of other nutrition program, such as the SNAP programme. Finally, investments for the so-called bio-based economy is expected to be maintained and increased (11).The new Farm Billwill be a result of external forces and internal policy tradeoffs. External forces are largely related to changes in demographics, political and budgetary environments (9). Concerning the political environment the new Farm Bill could be influenced by the Tea Party which gained seats of the Congress in the election of November 2010. Although agricultural budget has been never used as an argument in political campaign, the general pressure of cutting federal budget may indirectly affect decisions over the next Farm Bill. Since demographic areas with at least the 15% of population employed in the agricultural sector are concentrated only near to Mississippi, politicians have less incentive to use agricultural financial sustain as a trigger for gaining

votes. This could thus "obscure" the necessity of sustaining the agricultural sector in the way it is currently sustained. A key role is expected to be played by all the stakeholders. For example the main advocacy group for nutrition assistance programs is the Food Research Action Center (FRAC) that since its foundation in 1970 has been significantly active in promoting public and political debate on food and nutrition programs in the US and on the necessity of sustaining poor family's income. However the provision of funds for nutrition programs will be not significantly touched since it still represents the greater voice of the budget itself. As reported by (14) "*in the 2008 Farm Bill, in which the name of the food stamp program was formally changed to the Supplemental Nutrition Assistance Program (SNAP), funding for SNAP and related nutrition activities accounted for more than two-thirds of total spending over the next ten years as projected by the Congressional Budget Office (CBO)*".

1.1.2 Europe

Constantchanges in the European agricultural systemyieldedMember States to reform the European Common Agricultural Policy at an increasing rhythm since 1968. The CAP has been reformed five times since it was created. The *first* reform was the Mansholt Plan.The principal goals was to harmonize the agricultural policies across the original six Member States and to isolate agricultural policy from the rest of the economy sectors. During the seventies and eighties European agriculture was highly protected through a price support policy.Not significant reforms had been made except for *Delors Packages*. All agricultural commodities were sustained through a target and an intervention price,

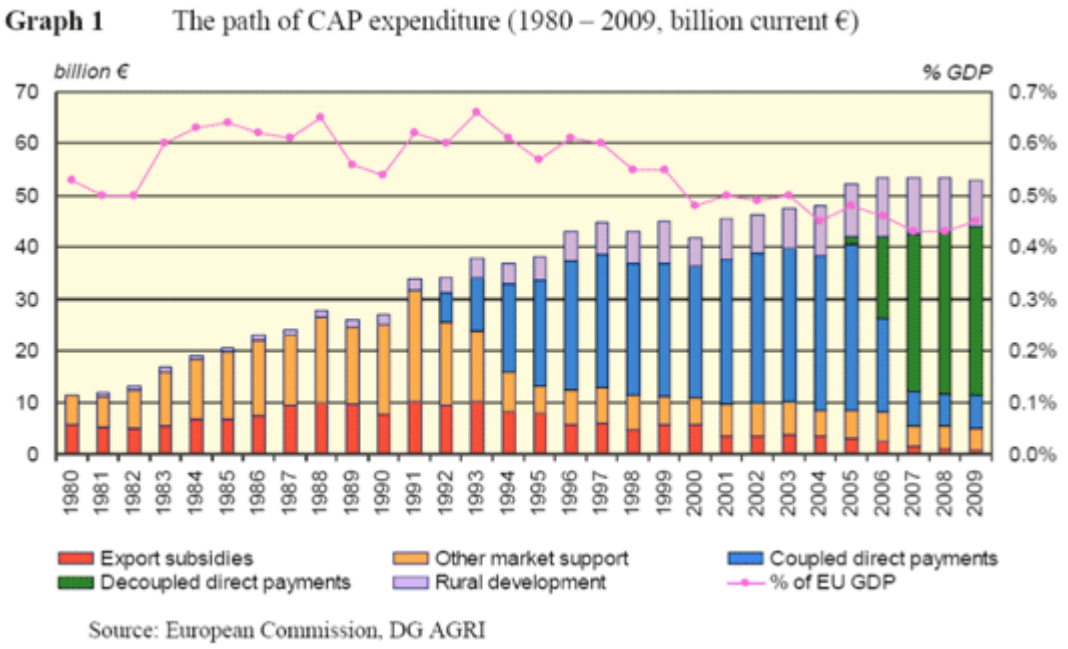
direct payments and import quotas. In the long run term this policy determined overproduction and high costs.

Although the history of the CAP was marked by five reforms, only in 1992 we can talk of a structural reform (*Mac Sharry Reform*). It aimed at increasing the competitiveness as a response to thenew requirements established within the WTO. This reform included a drastic reduction of support, set-aside payments (farmers were paid to withdraw from production), and incentives for deforestation. According to an analysis of the French National Institute of Agricultural Research (INRA), the 1992 reform was characterized by three main successes but also by the emerging of new challenges (13). The three successes were first the reduction in grain price disparities between UE and the rest of the world with the consequent reduction of budgetary expenditure, second the slowing down of the expansion of yields due to the fact that lower prices and subsidies acted as a negative land tax and third the liberalisation of agriculture did not appear to lead to a transformation of the mainly family-based production into large capitalist businesses or into enterprises of the Eastern European state farms type. Among the downsides, there were the problem of price volatility and the increasing disparities among regions. In the long-run term, an increase in regional disparities may have consequences on other sectors related to agriculture such as respect of food safety schemes and, ultimately, in human nutrition (13).

The next step of the CAP was *Agenda 2000* introduced in 1999. It went on with the Mac Sharry Reform and introduced an important shift: from a price support to an income support policy. According to (12) to evaluate the impact of the third reform, there is need to understand to what extend the 1992 reform has solved the problem of the budget in

terms of percentage of the European GDP. If we look at the figure reported below, it seems that the cost of the CAP reform, starting as of 1992, decreased significantly, especially if we look at the line representing the cost of the percentage of the EU GDP. Although things significantly improved, these high costs are incoherent with the problem of overproduction and the related costs of destroying commodities surplus (14).

Figure 1.1 The path of CAP expenditure 1980-2009



TheMiddle Term Review (2003) introduced new requirements for the environmental protection, tightening farmers' grants to the compliance tosome environmental standard.

The 2008 *health-check*– that may be considered the sixth reforms –helped to accelerate the process towards facilitation of international trade. As stated on the website of the

European Commission the main goal of the Health Check was to "*modernize, simplify and streamline the CAP and remove restrictions on farmers, thus helping them to respond better to signals from the market and to face new challenges*".

As in the United States the new Farm Bill is under discussion, the same can be said for the next CAP reform of 2013. It is expected to be in line with the Europe 2020 growth strategy that includes five main domains: employment, innovation, education, social inclusion and climate energy. During the preparatory work of 2010 the debate about the future of the CAP, four questions resulted to be particularly urgent:

- Why do we need a European Common Agricultural Policy?
- What are society's objectives for agriculture in all its diversity?
- Why should we reform the CAP and how can we make it meet society's expectations?
- What tools do we need for tomorrow's CAP?

The need of reforming CAP arises from the willingness to provide solutions to new global challenges. *Firstly* there are economic issues as the problem of price volatility (see the global crisis on market prices at the end of 2008), food security and economic crisis. *Secondly* there are environmental challenges related to the need of implementing greenhouse gas, soil depletion, water and air quality and the need to preserve different environment and habitat.*Thirdly* there are territorial challenges including the need of preserving the vitality of rural areas and the diversity of EU agriculture. These challenges constitute the framework of new policy implementation. How this framework will be translated into actual policy tools is still under discussion. There is need to understand what is the best scenario to follow.

According to the Executive Summary of the Impact Assessment by the European Commission, released in October 2011, three are the possible scenarios that may shape the new CAP. The first is the *adjustment* scenario is a continuation of the current policy with some reinforcement as regard rural attention and redistribution of direct payments. The *integration* scenario is the "something in between option" and consists in an enhanced policy framework geared towards support for competitiveness, sustainable development and innovation in the sector. It would also aims at fostering conditions under which farmers, either individually or collectively, would be better able to face upcoming economic and environmental challenges. Finally the *re-focus* scenario would point on a restructure of the sector with a phasing out of direct payments followed by a strong restructuring in the sector and much larger and more towards a capital intensive farms production system. The three scenarios with the respective policy options are summarized as follows:

Table 1.4 CAP scenarios for future policies

	Market instruments	**Direct Payments**	**Rural Development**
Adjustment Emphasizing the CAP's achievements and addressing major shortcomings	Streamlining and simplification of existing instrument Improving farmers' cooperation within competition rules.	Redistribution; enhanced cross compliance	Moderate increase in budget; used for competitiveness/innovation or environment
Integration Improving the targeting of CAP to its objectives	Streamlining and simplification of existing instrument Focus on food chain and improved	Redistribution; no direct payment; architecture; greening scheme; enhanced cross compliance; capping;	Redistribution between Member States; Innovation, climate change and environmental as guiding principles; Reinforced strategic target and common

	bargaining power of farmers (3 sub-options)	small farmer young farmer scheme	strategic framework with other funds
Re-focus Limiting the CAP interventions to environmental aspects	Abolished	Phasing out	Substantially increased funding; focus on change and environment

Source: European Commission

According to the evaluations made so far, the most favorable option is integration. The evaluation has been based on selected indicators: viable food production, sustainable management of natural resources and climate action, balanced territorial development, EU value added, cost effectiveness (15).

1.2 Agricultural policy measures in the US and in UE

In this paragraph we briefly review and compare the agricultural policy instruments employed by the United States and European Union. Agricultural policies can be divided into three broad categories: income support, price support and other minor measures (2). Each policy uses specific tools that may be implemented for certain commodity goods. In both United States and Europe income support measures are the most used, especially after the introduction of decoupled payments. Nevertheless price support measures are still used for specific commodity programs that set target price (in particular this happens

for sugar, tobacco and diary in the US). In Table below we briefly report the main instruments used by US and EU for each of the group.

Table 1.5. Agricultural policy measures of United States

UNITED STATES: commodity Policy by type					
	INCOME SUPPORT				
Measure	**Direct Payment**	**Counter-cyclical payments**	**Ad Hoc Assistance Programme**	**Marketing Assistance loans and loans deficiency payments**	**Crop and revenue insurance**
Description	DPs provide income support to producers based on historical yields (es. AMTA payments or PFC production flexibility contract)	CCPs are available for certain commodities when the effective price is less than the target price. CCP substituted the MLA (Market Loss Assistance) Payments effective from 1998 to 2001. (es. National Diary Market Loss Payment, NDLP)	This category includes direct payment under the form of disaster aid.	Allow repayment of commodity loan at less of the original loan rate plus accrued interest when the market price is below that level.	Available at a subsidized rates, these revenues make indemnity payments to producers.
Other Features	Farmers are given maximum flexibility in deciding what crops to plant and are not related to market prices (that's why are decupled).	The target price is set by legislation; the effective price is the amount of direct payment and of market	The goal is to offset financial losses due to severe weather or stressful economic conditions (such as low	Providing for the marketing loan gain rather than accepting a forfeit of the commodity under loan,	Payments are based on current losses related to below average yields or below average revenues.

		price or loan programme (if prices are below the loan rate). CCP rate is thus calculated as PR =TP – DPR – (MP or LR).	commodity prices or unusual economic events)	eliminates the potential effect of supporting market prices through removal of supplies from the market into government stocks.	
Commodities object of the policy	Wheat, corn, other grains, soybeans, other oilseeds and rice	Wheat, feed grains, rice, upland cotton, oilseeds and peanuts).	Wheat, corn, other grains, soybeans, other oilseeds, rice, sugar, diary, beef, pork, poultry, sheep, fruit and vegetables, upland cotton.	Wheat, rice, corn, grain sorghum, barley, oats, upland cotton, soybeans, other oilseeds, peanuts, mohair, wool, honey, legumes.	Available for a variety of crops

	PRICE SUPPORT			
Measure	**Non-recourse Loans**	**Government Purchase**	**Tariffs and Import quotas (TRQs)**	**Export Subsidies**
Description	Provided with no marketing loan provisions or government purchase. Commodity loan programs allow producers to receive a loan from the government by pledging production as loan collateral.	Support milk production by removing product from the market.	Tariffs provide price support for commodities by limiting imports of lower priced products.	ESs are provided through two programs: the Dairy Export Incentive Program (DEIP) and the Export Enhancement Program (EEP). Exporters are awarded cash payments or commodity certificates

				redeemable for government – owned commodities
Other Features	Nonrecourse loans allow producers to forfeit their crop to the government without penalty if the market price at repayment is below the loan rate plus interest. Usually the choice between one of the two depend on the type of commodities.	Government purchase ensures that prices for the milk used to make these dairy products averages at least the same price as the government support price set for milk sold for bottling.	Tariff measures play a minor role in agricultural policy of the United States and can be considered as an exception. The US has only 24 agricultural mega tariffs and a relatively small number of TRQs.	
Commodities object of the policy	Other oilseeds, sugar and diary	Butter, cheddar cheese, nonfat dry milk.	Significant tariffs are those of diary, sweeteners and tobacco. Totally there are 24 mega-tariffs and a relatively small number of TRQs which apply primarily to imports of peanuts, tobacco, beef, diary, sugar, cotton and some other related products.	

Table 1.6 Agricultural policy measures of United States

European Union: commodity Policy by type				
	INCOME SUPPORT			
Measure	**Compensatory Payments then became Direct Payments**		**Other producer payments**	
Description	Compensatory payments were introduced in 1002 to compensate producers of arable crops for support price cuts. Successively they became "direct payments". Today they are link to environmental measures.		Other direct payment type designed for producers' income who have beef and cattle.	
Other Features	Payments are made are made on a per-hectare payment and are based on the average historical yields,		Eligibility for these payments requires producers to comply with certain supply limiting features.	
Commodities object of the policy	Wheat, corn, other grains, oilseeds, rice, sugar, dairy, beef, pork, poultry, sheep-meat, fruit and vegetables, non-commodity specific		Diary, beef and fruit and vegetables	
	PRICE SUPPORT			
Measure	**Intervention**	**Import protection**	**Production/Marketing Quotas**	**Export Subsidies**
Description	Intervention purchasing involves purchase by authority of surplus when market prices threaten to fall below established minimum threshold.	Most EU agricultural imports are subject to high tariffs to ensure that imports do not undercut the prices for several commodities.	Limit overproduction and support outlays fro sugar and milk.	These subsides – also known as export refunds or restitutions – help support the domestic price by funding the removal of surplus commodities from the market.
Other Features	Products are usually stored temporarily or exported. Since 1993 however product withdrawal has been	Import protection has been a crucial feature of the CAP both to uphold the CAP principle and preference for EU-produced	Quotas help strengthen prices by reducing domestic supply.	These subsides are available for most price supported commodities. A subsidy is paid to the exporters to enable them to sell competitively in the market. If a

	reduced and replaced with compensatory payments.	goods and to prevent lower-priced imports from undermining domestic price support mechanisms. In some cases EU agricultural tariffs were in excess of 100%.		market prices are above EU internal market prices an export tax may be imposed to limit the outflow of and EU product to stabilize prices for EU commodities.
Commodities object of the policy	Wheat, corn, other grains, rice, sugar, diary, beef, fruit and vegetables	Wheat, corn, other grains, rice, sugar, diary, beef, pork, poultry, sheep meat, fruit and vegetables	Sugar, diary	Wheat, corn, other grains, rice, sugar, diary, beef, pork, poultry, sheep meat, fruit and vegetables

Beside income and price support there are other policy measures that are not classifiable in none one of the two categories. In the United States these other tools include marketing orders for milk and fruit and vegetables to stabilize markets and environmental programs (such as the Conservation Reserve Program). In the European Union the third group includes supply control measures, implemented through land set-aside programs.

CHAPTER2
Food policies: definition, classification and caveats

2.1 An introduction of food policy

At the end of Chapter First we introduced the distinction between agricultural and nutritional policy. As we have seen, in the Unites States, Farm Bills are not strictly related to agricultural policy but also regulate nutrition policy. In both United States and the European Union, the increasing importance of nutrition policy is related to the need of tackling the increasing rates of overweight and obese individuals.

In general, to understand if and why a public policy is usefulfor overcoming market failures or for readjusting economic equilibriums, the first question we need to answer is *when* do we need a public policy? Philosophical and economic reasons that justify government intervention are found in Constitutions, in Treaties and in legal regulations developed within countries or regions. A good point of departure for policy evaluation is to consider the context of application. It is straightforward that in some areas – such as education – public policy plays an key role while in other context, especially for new global issues such as finance or environment, justifying policy intervention is harder due to the recentness of the subjects.

A comprehensive definition of food policy can be found in Timmer et al. (1983):*"Food policy encompasses the collective efforts of governments to influence the decision-making environment of food producers, food consumers, and food marketing agents in order to further social objectives. These objectives nearly always include improved nutrition for inadequately nourished citizens and more rapid growth in domestic food production. Many countries also seek more equal income-earning opportunities and security against famines and other food shortages. Food policy analysis is the process of research and thinking designed to discover the complementarities and trade-offs among food policy objectives and to identify government initiatives in the project, program, and policy arenas that can best achieve these objectives. The ultimate goal of food policy is to respond to the satisfaction of a basic need of human population: provide nutrition and food to as many people as possible through a redistribution of scarce resources. However the problem of providing minimum requirements of essential nutrition is unlikely to be strictly related to food scarcity, but more to food production and distribution. For example, it has been calculated that per capita worldwide food production, even in years with most unfavorable conditions, would have satisfied the minimum calories intake need for the world population. The reason why these differences exist is more likely to reside in the food price fluctuations that – under unfavorable conditions – hit the countries that depend on others' food grain markets. Another aspect that should be further discussed is how the price of other raw materials such as oil, influence food prices, production and distribution"*(17).

In developed countries the problem is nowadays reversed: we are not worried about food shortage but by the excess of food. However it is still a problem of redistributing food resources.

Public policy may also be interpreted as a corrective intervention ofhuman limits, starting from standard economic principles. Gary Becker offers a typical account of these principles. *"All human behavior can be viewed as involving participants who maximize their utility from a stable set of preferences and accumulate an optimal amount of information and other inputs in a variety of markets"*. Another interesting perspective, recently emerged, is the one of "law and economics" (18). The goal of this discipline is to explore actual human behavior from the point of view of law with integration from economics. This approach highlights that real people differ from the ideal of the homo economicus because of three bounds that systematically limit their rational behavior: bounded rationality, bounded willpower and bounded self-interest. The concept of *bounded rationality* was created by Herbert Simon in 1955 and it is related to the fact that human cognitive abilities are limited, for example is self-evident that we have limited computational skills and limited memories. An important amount of research has also been done by Tverski and Kanheman (19) who stressed how actual judgments are usually based on rule of thumbs and that personal experience is often use as a basis for inference. Actual choices diverge in important ways from rational choices. The key question is to understand if policy makers have the right to try to adjust the bounded rationality, for example when the government try to change eating behaviors of overweight and obese individual. An assumption to justify the intervention is that individuals value their health status (and a healthy weight) but their bounded rationality lead them to overeating and

impede them to significantly change their eating habits. As reported in (18) Arrow underlines the process of habit formation and shows how non-optimal or irrational choices are not necessarily inconsistent with economic principles: behavior can be incorporated into a theory by supposing that people choose goods with an eye towards minimizing changes in their consumption. The second concept is *bounded willpower*. Human beings systematically overvalue their capacity in sticking with goals or doing multiple tasks. It is the gap between intention and actions. Bounded will-power is the other side of self-control problems: the literature on hyperbolic discounting argues that people would want to refrain from certain actions if they only could. For example individuals plan to stay on diet but their short-run term utility collides with their long-run utility. The result is procrastination of the costly action of giving up to eating pleasures. Policy makers may correct this fallacy by helping people to stick with their goals. There are some private organizations that help people to reach their long-run term goals, such as Christmas Clubs – that help people to save money for Christmas gifts. Finally there is *bounded self-interest*. Jolls, Sunstein and Thaler (18) defined the concept as follows: "*Finally, we use the term bounded self-interest to refer to an important fact about the utility function of most people: They care, or act as if they care, about others, even strangers, in some circumstances. (Thus, we are not questioning here the idea of utility maximization, but rather the common assumptions about what that entails.) Our notion is distinct from simple altruism, which conventional economics has emphasized in areas such as bequest decisions. Self-interest is bounded in a much broader range of settings than conventional economics assumes, and the bound operates in ways different from what the conventional understanding suggests. In many market and bargaining settings*

(as opposed to nonmarket settings such as bequest decisions), people care about being treated fairly and want to treat others fairly if those others are themselves behaving fairly. As a result of these concerns, the agents in a behavioral economic model are both nicer and (when they are not treated fairly) more spiteful than the agents postulated by neoclassical theory" (18). The relation between bounded self-power and obesity is less straightforward. Bounded self-power may be function as a deterrent in sticking to healthy goals and indulging in bad habits for pleasing or behaving similarly to other people. Individuals are extremely subject to social influences and errors easily result from external stimuli. What policy makers and legislation could do to correct this phenomenon is unclear.

2.2 Food Policy and different approaches: collective versus individual responsibility

Behavioral economics is also interested in studying to what extent government should intervene with regulations for changing people behavior. For example those who consider bounded rationality as a structural limit of human utility maximization, strongly favor government intervention. However this practice has been criticized by some economists and labeled as too paternalistic. Following the analysis of Glaeser (20) we discuss how different policy approaches have been labeled and interpreted. The first approach of public policy intervention is the so called *hard paternalism*. The basic assumption is that

policy makers can maximize utility of their citizens better than they would do. The second approach is the *soft paternalism* (also known as *debiased, asymmetric or libertarian paternalism*), introduced by Sunstein and Thaler (21). It is still assumed that policy makers know how to maximize the utility of their citizens; however their intervention is less evident and is actualized through "nudges". The government engages in debiasing, changing default rules and other policies that will change behavior without limiting choices. For example they pointed out how readjusting the choice architecture of food exposure in canteens – that means giving more visibility to fruit and vegetables – would contribute to help people to improve their choices. This mechanism is a well-known marketing strategy, often employed by private companies to "pilot" consumers choices. To understand if paternalism – either hard or soft –works, there is need to understand if psychological errors are exogenous or endogenous. In the first case there is room for paternalism to work since governors may reasonably correct fallacies (there is little reason to believe that these errors will be greater among public or private decision makers), while in the second case paternalism is less likely an answer because policymakers themselves are biased in their judgments.

According to Glaeser both the supply and the demand of errors are endogenous. On the supply side he underlines how purveyors of opinions contribute to build false beliefs. For example opinions on certain issues may radically vary across countries. Among the many examples me makes he reported that: "*60% of Americans believe that the poor are lazy but only 26% of European share this opinion. By contrast 60% of Europeans think that the poor are trapped in poverty but only 29% of Americans share that opinion. In reality, the American poor generally work harder that their European counterparts and have a*

lower probability of exiting from poverty". Glaser shows how the large expenditure on advertising is the best evidence that beliefs can be supplied.

On the demand side of errors, he started from the fact that correcting errors is costly and for adjusting beliefs and actions individuals should have a payoff greater than the cost they have to bear. However Glaeser points out that the existence of substantial industries specialized in advice and information suggests that in many contexts people are really interested in knowing the truth. This should thus clear up the fact that individuals are aware of their errors but they have not enough incentives to change and to correct them. Glaeser after having explained why he assumes that errors are endogenous, demonstrates that economic theory pushes us to think that private decisions will be often more accurate than public decisions. Without entering in the details, the models proposed by Glaeser are the following three:

1. Consumers face stronger incentives to correct errors than public decision-makers;
2. If errors comes from the influence of firms or other interested parties and if it is cheaper to persuade a small number of bureaucrats than a vast number of consumers, then government decision-making will be particularly flawed;
3. Consumers have more incentives when making private decisions that they do when voting

According to this perspective, for example, an individual who suffers of health or weight problems instead of paying a tax on soft-drinks if seriously concerned about his current and future health status may have incentives of being informed and making better eating choices. Glaeser also individuates seven arguments against soft-paternalism which I briefly describe below:

1. *Soft paternalism is an emotional tax on behavior that yields no government revenues*

Some studies show how educational campaigns against obesity have the effect of turning eating into an exercise that produces shame and guilt. This because the effect of the tax lowers the amount of the activity and decrease the enjoyment of those who continue the activity.

2. *Soft Paternalism can cause bad decisions just as easily as hard paternalism*

According to Glaeser this argument is verified under the assumption that errors are endogenous to human choices and thus may be committed by policy makers too.

3. *Public monitoring of soft paternalism is much more difficult than public monitoring of hard paternalism.*

If interventions based on hard paternalism are measurable and evaluable, this it is not true for soft paternalism because effective soft paternalism must be situation specific and creative in the messages.

4. *Although hard paternalism will be limited by public opposition, soft paternalism is particularly attractive because it builds public support.*

Soft paternalism may be favored by those who neglect hard paternalism. According to Glaeser the risk of soft paternalism is that, due to a potential increase in its popularity, will be abused.

5. *Soft paternalism can built dislike or even hatred of subgroups of the population.*
6. *Soft paternalism leads to hard paternalism.*
7. *Soft paternalism complements other government persuasion*

The last three arguments stressed how the greatest risk is that soft paternalism will become as risky as hard paternalism it is.

Summing up, Glaeser claims that "*rules that prevent interventions (soft or hard) in areas where there are potential providers of bias that have extremely strong incentives may reduce supplier created bias"*.

The third and last alternative to hard or soft paternalism is *libertarianism*, with all its forms of variations. Without entering in details, we will consider some of these distinctions. The first one is between *consequential and deontological libertarianism*. Consequentialist libertarianism poses freedom as the starting point and it believes that it leads to favorable consequences such as prosperity, efficiency or peace. Deontological libertarianism (also known as rights-theorist libertarianism, natural rights libertarianism, or libertarian moralism) still considers freedom as the most important principle of human action, but recognizes some limits of it that lead ultimately to the use of force intiation. Men are free to do what they want and government should intervene minimally with the only exception of the principle of non-aggression.

The second distinction is related to the role of private property and, in particular, *hether private property is legitimate or not* (proprietarian and no-proprietarian libertarianism) The third distinction of libertarianism is the one between *statism and anarchism* – two opposite views on the degree the State should intervene to correct people behavior (22).

2.2.1 A different approach to public policy: United States and Europe

Given the differences in their history, culture and jurisdictions, United States and Europe present a lot of differences in public intervention. Far from being exhaustive, we argue here that these differences are originated in discrepancies upon the concept of the State and its founding principles and, in particular, to moral philosophy and the concepts of *deontology and teleology*. According to deontology, the ethical principles determine the action itself (in our case policy interventions) and are inspired by a sense of duty, equality and superior goodness. What dignifies an action is thus the intention and the conventional definition of what is good and what is bad. On the other side the teleological approach poses the accent on the result of the action itself and what counts is the result that is expected to be a "triumph" of what is considered good. Teleological moral theories locate moral goodness in the consequences of our behavior and not the behavior itself (22). The definition of what is good and what is bad is built through a dynamic process and it is the result of an application of techniques employed to solve a problem. We suggest here that policy decision framework of the European Union is based on a deontological perspective, while the policy framework of the United States follows a teleological perspective. These differences are well represented by jurisdictional systems: in most European countries judges apply the law and their role id identify the most appropriate regulation that is case-specific. In Anglo-Saxon culture judges are actively involved in defining new rules, and can only use past legal conflicts as examples to justify their choices. We also suggest that in the European Union it is easier to justify the political intervention on the basis of a moral intervention that is valuable per se. To support this hypothesis I will offer two examples.

The first one is related to the Pigovian taxation in the form of "fat tax" upon fattening foods. The European Union has founded projects at the scope of understanding the acceptance by public opinion if a tax of this kind would be introduced. European Union authorities wanted to know if the average citizen is willing to pay a price for a policy that target only overweight and obese individuals. On the opposite, in the United States, although the adoption a fat-tax adoption is supported by many food policy makers, its application has been very limited. In the Policy Brief of NOPREN – Nutrition and Obesity Policy Research and Evaluation Network – is reported that: *"In January 2010, Governor Paterson proposed a tax of about 18% on sugar-sweetened beverages that was rejected. A similar proposal was introduced the prior year, but it, too, was rejected. This penny-per-ounce tax would have been levied on all non-diet soft drinks, including fruit drinks containing less than 70% fruit juice. In addition to New York, Philadelphia, California and Massachusetts have recently considered implementing or increasing the existing tax on sugar sweetened beverages. None of these proposals succeeded"* (23). This means that in the United States it's difficult to justify a policy that has consequences on people that not directly benefit from the policy itself.

The second example is related to healthcare systems. In Europe the access to healthcare isa right, guaranteed by Governments and legislation, while in the US having a health insurance is considered something that is up to individual responsibility. Private companies compete for the benefits they offer to their employees and healthcare plan is one of these benefits. In the United States free medical assistance is guaranteed only to those individuals living in poverty and who are eligible for Medicaid and Medicare.

In general, the economic rationale for policy interventions is objectively justified by the indirect costs produced by obesity because of human violation of standard economic principles. However public opinion is also very important because of the political votes. An argument that calls for the need of policy intervention is that as long as obesity is defined as an epidemic, it cannot be controlled at the individual level.

2.3 Caveat towards policy evaluation

The field of policy evaluation is grounded in the work of some experts such as Heckman and Blundell and many are the approaches that have found empirical applications. In this paragraph we focus on the work of Manski on the concept of uncertain policy (1). When possible, I provide examples of obesity policy. The ultimate goal is to shed light on the tradeoff between economic analysis and political decision making. Regarding the problem of obesity, policy makers need to understand whether, how and to what extent governments might intervene in order to prevent the growth of overweight and obesity rates. Even when future consequences of a policy are estimated as precisely as possible, there is always a certain ground of uncertainty. The objective of discussing Manki's approach is to shed light on the possible drawbacks related to the practice of policy implementation. Manski develops a typology of incredible analytical practices and, for each, offers concrete examples. The work of Manski sheds light on the tension between

the economic and statistical interpretation of possible policy outcomes (ex-ante) and the decision process that leads to choose the most convenient policy-option.

2.3.1 Conventional certitude

The first group of "uncertain policies" includes research practices that although not credible follow a logical perspective. The *caveat* is related to the so-called "law of decreasing credibility" by virtue of which the credibility of inference decreases with the strength of assumptions maintained. Manski frames this as a dilemma that analysts face as they decide which assumptions to maintain given that stronger assumptions yield conclusions that are more powerful but less credible. The situation gets critical when scientific consensus assumes the value of a *fact* or a *scientific truth*. Policy makers are less disposed towards confidence intervals (or best and worst case scenarios) and in the process of making decisions would prefer, at least in the US context, very precise conclusion and analysis. According to Manski the attitude of policy makers is biased in two ways. The first is a cognitive-psychological bias and it is related to the bounded rationality of policy makers; it is a preference for certitude results than for uncertainty. The second bias is that decisions are taken by an assembly that has different perspectives and ideas that may influence their opinion on a given topic *a priori*. In favor of UK governors and criticizing US approach, Manski points out how the English government has recently asked to perform a sensitivity analysis of the estimates when a policy analysis is performed. Specifically it asked for a systematic Impact Assessment (IA) for legislation submitted to the Parliament. This best practice should be taken into account

also for policy decision and evaluation related to obesity. Manski also cites Friedman's thought who explicitly said to opt for simplicity and fruitfulness as criteria to choose among different hypothesis. *Does the use of criteria such as simplicity to choose one hypothesis among those consistent with the data promote good policy making?* This open question is posed by Manski at the end of his discussion.

Manski thus introduces the concept of *conventional certitude* – similar to the concept of conventional wisdom – to describe predictions that are conventionally accepted as true but that are not necessarily true.

2.3.1.1 Dueling evidence

The second issue is *dueling evidence*. There is dueling evidence when, for example, there are two studies on a same subject with conflicting results. Conclusions are usually different because of different assumptions. Manski provides an example of two studies on cocaine control policy; the first was by the Institute for Defense Analysis (IDA) and the second by the RAND Corporations. Even in the academic literature on obesity there are many controversial issues about the influence of certain variables. For example as recent official data have reported, income is negatively correlated to obesity for certain groups of population while it is positively correlated to other population groups. In this specific case the problem may be related to gender. Women give more importance to their physical appearance and thus allocate a greater part of their budget to preserve their "beauty" and to stay on diet. This may be different for men.

2.3.1.2 Wishful extrapolation

Another common practice in policy evaluation and decision is *wishful extrapolation*. Wishful extrapolation is related to making conclusions on future outcomes or trends through a process of extrapolation on observed and past evidence, as happened with time series analysis. *Wishful* because the inference on future outcomes is based on the fact that we wish that the assumptions that have determined the actual outcomes will not change in the future. For example, thinking about obesity, we may predict future trends on the basis of past growing rates assuming that the forces that have contributed to the current rates will not change in the future.

2.3.1.3Randomized experiments

Manski also criticizes randomized experiments. Extrapolation is based on invariance assumption, but results may be biased because of some problems. For example because of *self-selection*: the population of interest often differs from the population of policy interest. In many experiments, participants are not chosen following a random selection procedure but they voluntarily ask to participate. This is the case with studies for determining the effects of a new medicine. Another problem of randomized experiment is related to long-term run effects of treatments. Randomized experiments have usually short duration and thus it is difficult to evaluate the effect of a medicine in the long-run term. This is also true for medical treatment of obesity. Although drugs for treating obesity (as tetrahydrolipstatin or hydrochloride monohydrate salt) have side effects that

have been already identified, this may be not true for long term effects. Manski points out that many public agencies use results of randomized experiments as a source of recognized credibility and they make large use of "conventional certitude" as scientific basis for introducing new rules or medicines in the market. For a credible policy analysis. In general Manski invites policy makers to treat external and internal validity of an experiment as equivalent, instead of giving more importance to internal validity with respect to external.

2.3.2 Illogical practices

The second group of research practices includes what Manski defines *illogical practices*. He provides two examples for clarifying what he intends with the term "illogical".

2.3.2.1 The interpretation of hypothesis testing

The first one is related to hypothesis testing. When the null hypothesis is not rejected it does not necessarily mean that the null is the correct hypothesis. We can only say that there is no enough evidence to state that the null is incorrect. This is why many statisticians underlines that a good point of departure is using appropriate terms: never say "acceptance" but "not rejection".

2.3.2.2 Genetics versus environmental factors

The second example is related to the heritability of human traits its implication on social policy. Heritability is affected by the interaction of nature with nurture in determining behavioral outcomes. The distinction was firstly made by Galton in *English men of science: nature and nurture* of 1874. Manski does not agree with those scientists that claim that if IQ is heritable then social policy is not effective and it is a waste of public expenditure. This belief is well summarized by the following statement of Herrnstein and Murray (1994): "*cognitive ability is more important than parental SES in determining poverty*". According to Manski, social policies are unrelated to heritability since heritability is uninformative about the potential effect of a policy on a given outcome.

2.3.2.3 An example with obesity

Following their reasoning, I will make an example considering obesity rather than IQ. Suppose that the weight of an individual – expressed in BMI is the result of genetic and environmental factors.

$$BMI_i = \beta_g X_g + \beta_e X_e$$

Suppose also that genetics and environment are uncorrelated. This implies that genetic traits are likely not to be influenced by environmental features, and vice-versa. If obesity is related to some genetic traits, these are likely to appear whatever the environment is. And the other way around: if obesity depends only on environment, the BMI will be influenced independently on the genetic pool. To disentangle the genetic effect from the

environmental one, one should be able to say how much of the variance of the BMI is explained by genetics and how much by the environment. At one extreme suppose the population is composed of clones that face different environment. In this case $\sigma(\beta_g) = 0$and $E(\beta_e) = 1$so the variability depends only on environment. On the opposite extreme suppose that we have a variety of genetic diverse people living in the same environment. In this case we have $\sigma(\beta_e) = 0$and $E(\beta_g) = 1$andthe variation in BMI is explained only by genetics. What is the role for policy analysis? Research to disentangle genetics and environment may found new answers for example studying twins.

2.3.2.4 Media Overreach and an example of the role of social network in obesity research

A final remark is made for media overreach. Manski warrants how mass media may report a news as certain, even when it has not sufficiently documented and empirically demonstrated. For example this happen when journalists start to discuss about research whose results have not been empirically demonstrated in the literature, but aroused to claim for new policies by mass media. Christakis and Fowler's findings about obesity contagiousness (34), for example, attracted a lot of media attention. Their conclusion was that there isa social network effect, in virtue of which an increase in weight was more likely to happen if people in the same social network were overweight. The identification problem in case of peer effect is one of the most discussed in econometric literature. As explained in Manski, (1) three possible effects may lead people in the same social network to behave similarly or to share a condition. There is an endogenous effect if, for

example, my “obesity” is caused by the obesity of someone of my reference group. There is an exogenous effect if individuals in the same social network have a similar weight status because they share the same environment. For example if a new fast food opens in the neighborhood, individuals living there may adjust their eating behaviors at the same time. There is then a correlated effect when individuals becomes friends (or are part of the same reference group) because they have the same preferences or other features in common. For example, overweight individuals like staying together because of their eating habits and because they do not like doing any physical activity. This phenomenon is also known as selection or homophily. The authors have been criticized in the results of their findings. This was an example for showing how a research capable of attract a lot of media attention and that has been somehow treated as certain has been criticized methodologically, thus mining the supposed certitude of the findings.

2.3.3 Final remarks on policy incertitude

After having presented the problem policy analysis, Manski explains what he intends for credible policy analysis. If the objective is informing policy choice, a good researcher should provide a set of conclusions based on different assumptions. There is need to understand what a policy planner with partial knowledge should do to choose among different options. The simplest answer comes from decision theory: the planner should choose the *dominated* policy. Basically if there are two policies to tackle a problem and the first one yields higher welfare than the second, one should opt for the first one. The dominated policy may be chosen, for example, using cost-benefit analysis. The hardest

problem happens when one has to choose between undominated policies. Decision theory suggests that, in this case, there is not a valid approach but a set of rules that may be applied. The first possibility is using Bayesian approach and the subjective expected utility criterion. This approach assumes that beliefs are probabilistic. The second possibility is to use decision theory under ambiguity and the *maximin* and *minimax-regret* criteria. Finally, a different question is related to the actual policy environment within a policy develops. Agents have beliefs and political views have to find a common solution to a given problem. In this case, game theory could a good point of departure for helping policy makers to develop strategies to improve the capacity of choosing (1).

Summing up in this chapter we stimulated a discussion about differences in policy making between United States and Europe, and also – through Manski's analysis –reflect on the general difficulties that may arise in policy decision process. Examples on policy issues related to obesity were also provided.

CHAPTER 3
Public policy and obesity in the United States and the European Union

3.1 Closing the gap: nutrition and agricultural policy and their effect on obesity in Europe and United States

The goal of this chapter is to present concrete examples of public policy aimed at tackling obesity in both the United States and the European Union. We try to group the intervention according to their typology. Developing adequate public policies able to tackle obesity or at least to help people to reduce or contain their weight is a hard challenge because of the complexity of factors involved. Policy makers need to find strategies and methods for reducing at the minimum the risk of unsuccessful outcomes. As policy against smoking as shown, an indicator of a successful policy is if it creates a new social norm in the long run. If, for example, until 10 years ago smoking was socially accepted and related to emancipation from family, nowadays is true the opposite at least in certain socio-economic environments.

In the following paragraphs we list some of the main interventions that have been implemented in Unites States and European Union.

We also briefly present the perspective around the relation between agricultural policy and obesity. In the academic literature – to our knowledge – there have been controversial concerning the role of agricultural policy in tackling obesity. Some have argued that subsidizes to some agricultural commodities have contributed to lower relative prices and increased consumption of fattening foods and thus increased the number of obese individuals. We also try to evaluate if there are differences between Europe and United States.

3.2 Typology of policy measures

Before presenting concrete examples of programs aimed at tackling obesity in EU and US, we have classified the type of policy interventions. Policies can be divided into two broad groups. Some of them operate regardless individual choice and are posed by the legislator, others aim at changing individual behavior – whether implicitly or explicitly – and thus for being effective they require the individual to take action. This classification is based on the role of individual choice but there are other ways of classifying food policies. For example Mazzocchi et al (24) divide them into two broad categories: information measures and market intervention measures. According to the classification of the policy approaches discussed in Chapter 2, we have tried to schematize the typology of policy interventions as follows:

Table 3.1 Typology of policy intervention

Hard paternalism	Soft paternalism	Libertarianism
Legislation (i.e. establishment of nutritional standards or taxes on junk foods or soft drinks)	Social marketing and informational campaign; Education and prevention programs; Community programs aimed at changing built environment	Information on nutritional contents of food products as reported in labels

It has to be said that the border between measures that fall under the category of soft paternalism and those falling under libertarianism may be sometimes unclear. Since libertarianism means "no intervention" it may seem a paradox including it in policy classification measures. There are rules that have to be implemented but that imply for the consumer no more that obtaining objective information. We argue here that the main difference is related to the degree of sophistication around the non-verbal message that accompanies the content of the message itself. For example think about the messages that appears on packages of cigarette. If it only consists in words (for example the content of nicotine) the purpose is only informative and we say that falls under the category of libertarianism. If the use of certain images – think about lung cancer's picture – accompanies the written message, the overall goal is to impress the smoker at the point to induce them to quit or reduce the amount of cigarettes because of the fear of cancer.

Given the great numbers of measures we will select those that have been more discussed in either US or EU. For each of the category listed above I will provide an example. However it has to be said that many initiatives have several communalities and they their features may sometimes overlap.

3.2.1 United States

An useful database on legislation of nutrition policies can be found on the Yale Rudd Center for Food Policy & Obesity. Some regulations are enforced at State level and others at Federal level. This implies that there may be differences across States[5].

Hard Paternalism

With legislation I intend all the legal acts, regulations, bills that take the form of guidelines for building the framework within policy makers, private companies and economic agents take their decision. For example at the end of November 2011, the USDA has approved the applicability of free and reduced price meals of three food programs:

1. National School Lunch Program
2. School Breakfast Program
3. Benefits in the Special Milk Program

Another example are taxes on junk foods or soft drinks can be found in the legislation of New York State. Fat-tax (also called pop-tax) is the most common market measure for tackling obesity rates. The New York State has approved, in January 2011, an act to amend the public health law and the agriculture and market law, in relation to prohibiting the sale or use of artificial trans fats in food service establishments, mobile food service establishments and retail food stores.

[5] See: http://www.yaleruddcenter.org/

Soft paternalism

Social marketing is another effective tool. A definition of social marketing can be found in (25): "*The application of commercial marketing technologies to the analysis, planning, execution, and evaluation of programs designed to influence voluntary behavior of target audiences in order to improve their personal welfare and that of society*."On the website of the Center for Disease and Control Prevention there is a list of social marketing strategies. The website provides some e-courses for improving social marketing strategies or give the possibility of downloading some guidelines. A recent public campaign – that used social marketing tools – is the USDA ChooseMyPlate.gov Campaign that substitutes the former Food Pyramid. What changes it is substantially the communication used and the overall goal is to make things easier by giving people simple and direct information on the nutrients they should eat daily and on the exact proportion of food components. Using images to show what the food proportions are should help consumers to balance their diet. There is evidence that food marketing used by private companies has positive effects on changing behavior, but further research is needed to evaluate the effectiveness of social marketing. A possible downward is that public marketing have more financial constraints than the private sector. If this is the case, private-public partnership may be welcomed as well as initiatives guided by principles of Corporate Social Responsibility.

There are many initiatives that have been recently implemented to fight obesity rates and that focus on education and prevention. Education and prevention are key instruments for targeting children although one of the main difficulties of these programs is their capacity to overcome cultural barriers, to actively involve families as well as school operators. One of the biggest public actions aimed at fighting obesity is the *Let's Move* initiative

launched by Michelle Obama on February 2010. The initiative consists of a series of synergic actions that try to promote the importance of eating local fruit and vegetables but mostly – as evocated by the campaign's name – the importance of physical activity. Concerning the importance of burning calories, *Let's Move* tries to reach disadvantaged people by the involvement of families, schools and communities. Education programs implemented by government focus on the second part of the "obesity equation": calorie expenditure. As Michelle Obama has recently declared this is because it is easier to convince people – especially children – to move more rather than eat less. Marion Nestle criticizes this approach and in a recent article appeared on her blog *Food Policy*[6].

Informational campaigns may be a useful tool to inform people, although they assume that individuals are rational and thus, once informed, they would adjust their habits. This assumption –may work for some individuals but not for others. Just to make an example, in 2009, the New York City Department of Mental Hygiene and Health has launched the "pouring on the pounds campaign" at the scope of informing on the unhealthiness of soft drinks given the high content in sugars. The issue has been debated among nutritional experts. For example some scholars (26) argued that this of information may ultimately lead to a greater social exclusion of those who are actually obese and may be suffered of their stigmatization. This campaign was actually launched in other cities, such as San Francisco where has also been evaluated by the Samuels & Associates for the California Obesity Prevention Programs 2010. Although the recognized limitations of the survey evaluation method, the conclusion was the following: "*overall, few respondents reported drinking regular soda and other sugar-sweetened beverages on a frequent basis. Most respondents across all three data collection methods saw a strong relationship between*

[6]See: http://www.foodpolitics.com/2011/12/lets-move-campaign-gives-up-on-healthy-diets-for-kids/.

consumption of these types of drinks and health outcomes including obesity. While much of our sample recognized that environmental factors influence beverage choices, many respondents expressed reluctance for policies that would restrict sales of certain types of beverages. Most respondents were in favor of taxation of sugar-sweetened beverages but thought it may have limited effectiveness in reducing consumption" (27).

Community programs for tackling obesity are also particularly used in the United States. This is because of the variety of ethnic populations and the necessity of targeting interventions as precisely as possible. For example among the many community-based intervention, in New York City it has been established a task force on the condition of African Americans. Many other programs focus their attention on kids in low-income communities and Hispanic population. These programs have the positive feature of being better targeted than general legislation or informational campaigns. They are usually the result of collaborations between different organizations: universities, medical centers, schools and local organizations. I included these programs in the soft paternalism approach because although they do not provide any compulsory interventions, the overall goal is to indirectly change the prevalence of a certain behavior in local communities and this is made through various techniques. For example the diffusion of green markets in specific areas of cities may positively affect the food choice architecture of citizens living in those areas. They can chose to buy in the local green markets – where food stamps are also accepted – rather in the traditional supermarket. The decision of where and where locate green markets may thus be considered a nudge.

Libertarianism

An example of libertarianism is related to those information that – although has to be enforced by law, have the only scope of informing the consumer without any other scope of changing his or her behavior. For example we can think about the ingredients every food packages as well as the contact of customer service that invites customers to directly contact the company for any observation they need. Another form of libertarianism is to let companies compete one with each other on the information they provide to consumers.

3.2.2 Europe

Although food policy related to obesity is affected by the European Commission (in particular by the DG for Health and Consumers and by the DG Agriculture) nutrition policies are implemented at member State level. In Europe the World Health Organization plays also a crucial role and it is particularly active in coordinating data collection as well as strategies among member states to tackle obesity. For example the WHO set the first standardized, European wide surveillance systems for nutrition policy development: the European Childhood Obesity Surveillance Initiative (COSI).

Hard paternalism

Taxes on high-caloric foods are encouraged by the European Commission, but their application is up to national governments. Denmark was the first country to introduce a fat tax within its borders, taxing foods that are high in satured fax. The amount of the tax is high and it was motivated by the fact that the average life expectancy of Danish

population is behind the average of other Europeans countries. Other measures are expected to be implemented to tax sodas. France is going to introduce a 'fat tax' on sugary soft drinks in a bid to combat childhood obesity. The application of a taxon junk food however requires caution because of the political implication of these measures. A key element to justify the intervention and to help people to accept the measures may be finding for the right communication to use – for example through social marketing techniques and at the same time pointing on the seriousness of the phenomenon as wells as on the social costs in the long-run term.

Soft paternalism

Nutritional labels – including nutritional facts, nutritional claims and health claims – target food safety and food quality standards rather than obesity. However a direct link to obesity epidemic may be found in White Papers of the European Commission on a Strategy for Europe on Nutrition, Overweight and Obesity related health issues (28). The White Paper firstly underlines the role of the EU Platform for EU Platform for Action on Diet, Physical Activity and Health started in 2005 created at the scope of providing a common forum for all the interested actors at European level. The overall goal is to create a partnership between Member States and to offer a common ground to intervene at national and local level in order to harmonize policy actions and measures. The White Paper individuates key areas of intervention and for each offers a concrete policy actions. Guidelines can be summarized as follows.

1. Better informed consumers through nutritional labels and health claims. Health claims must be based on scientific evidence.

2. Making the healthy option available - for example as part of the reform of the CMO (Common Market Organization) for fruit and vegetables, the Commission would have promoted children's consumption of fruit and vegetables in its proposals to allow surplus production to be distributed to educational institutions, and children's holiday centers, the Commission also proposes to increase EU co-financing to 60% for promotion projects aimed at young consumers (children below 18 years of age).
3. Encouraging physical activity trough the reinforcement of the built environment through transportation policies - for example the European Commission also supports sustainable urban transport actions through cohesion policy, CIVITAS and the Intelligent-Energy Europe programme, which is entering a new phase in 2007;walking and cycling projects are considered to be a key part of this and applications from local authorities are encouraged.
4. Establish priority groups and settings given that low-income population and ethnic minorities suffer from higher rates of overweight and obesity; this through promotion of school education programs.
5. Developing the evidence base to support policy making - The Commission has identified the need to know more about the determinants of food choices, and will establish, under the Seventh Framework Programme, major strands of research into consumer behavior; the health impact of food and nutrition; drivers for preventing obesity in target groups such as infants, children and adolescents, and into effective diet interventions.

Developing monitoring systems – see for example the above mentioned WHO initiative European Childhood Obesity Surveillance Initiative (COSI) and also the European Health Interview Survey (EHIS) – operative since 2007 and the European Health Examination Survey (EHES).

The White Paper also recommends that private companies take actions in order to do something although suggestions over strategies remain at a very general level and are similar to those that should be implemented by public authorities. Finally the White Paper recommends strengthening the international cooperation, especially between Europe and United States. Although the recognized importance of social marketing – documented in many EU reports (29), to our knowledge, no concrete action has been taken so far at the European level. The role of social marketing in fighting unhealthy behaviors has been recognized in social campaigns against alcohol consumption (30).

Some efforts have been made at State level for example the WHO reported that "*some countries, such as Norway and Sweden, have introduced statutory regulations that ban this form of advertising. Non-statutory guidelines that impose some limitations exist in Finland and Ireland. Other countries, such as the Netherlands, Portugal and Spain, rely on self-regulation by the advertising and media industries. In France, all television advertising and other forms of marketing processed foods and food or drink containing added fats, sweeteners or salt must be accompanied by a health warning on the principles of dietary education as approved by the National Institute of Health Education. Alternatively, the advertiser must contribute a tax (1.5% of the annual expenditure on the advertisement in question) to the funding of nutritional information and education campaigns.*" (31).

Education programs are mainly organized at State level and the role of the European Union is limited to the provision of guidelines and intervention strategies. A positive educational outcome is reported in (32). The authors exploited a unique natural experiment in the UK – the *Feed me better campaign* conducted by Jamie Oliver with the aim of improving the nutritional standards at school conducted in primary schools of the neighborhood of Greenwich in London. The overall goal was to estimate the effect of improved meals in terms on nutrition upon the effect of school achievements. They evaluate the effect of the reform on educational performance before and after the campaign in primary schools. They found an increase in the proportion of children reaching level 5 by 3% points in Maths, 6% in English and 8% in Science. The authors provided three possible alternative explanations of this large effect: the first is the "Hawthorne effect" in virtue of which schools that were part of the experiment were aware they were part of a pilot project, secondly the selection effect that may have led to self-selection of schools participating in the program and thirdly school policies that may have changed to raise educational achievements. Although further steps could be found to improve nutritional standards in school – and this is particularly true not only in Europe but also in the United States – positive signs seem to come from academic research.

Libertarianism

The examples that can be made about libertarianism are the same as I provided for the US. The competition among firms, however, in Europe is less aggressive than in the United States. This depends on the different role of the public regulation of markets.

3.3 Agricultural policies and obesity

The goal of this paragraph is to briefly discuss the debate around the role of agricultural policy as a contributor to obesity epidemic. In the United States the key issue is related to the effect of corn subsides.

Corn subsides have been criticized because derivatives of corn – such as high-fructose syrup – are present in many foods of large and daily consumption. Basically they argue that agricultural commodities price are lower than they would be without public subsidizes, leading to an increase consumption of "unnecessary" calories. Theseresearches attracted media attention and has been addressed by opinion leaders, see for example the article of Michael Pollan "*The agri(cultural) contradictions of obesity, appeared in The New York Times on October 12th, 2009*[7]. Using Manski's classification, this is a case of "media overreach".

According to other studies, policy support is too low in the US to be considered to have a direct impact on obesity rates. Those who support this position point out as contro-factual evidence that the European Union – where agriculture is highly subsidized - has not experienced similar patterns of obesity and overweight growth. Although obesity is a complex phenomenon with more than one cause, it is likely that – if any – food policies may have a limited impact on obesity trends. For example Altson et al. (2008) provided a detailed analysis of the relation between agricultural policy and obesity and concluded claiming that "*the magnitude of the impact in each case is zero or small. First, the*

[7] See: http://michaelpollan.com/articles-archive/the-way-we-live-now-the-great-yellow-hype/

evidence indicates that farm subsidies have had very modest (and mixed) effects on the total availability and prices of farm commodities that are the most important ingredients in more-fattening foods. Second, such small commodity price impacts would imply very small effects on costs of food at retail, which, even if fully passed on to consumers would mean very small changes in prices faced by consumers. Third, given that food consumption is relatively unresponsive to changes in market prices, the very small food price changes induced by farm subsidies could not have had large effects on food consumption patterns. These findings are reinforced by the consideration of some international data on obesity rates and farm commodity policies" (33).

Although the literature is still controversial on the topic, it would seem that the impact of agricultural policies on obesity rates is really limited. Addressing the debate - and if possible eliminate any doubt –it is important to the extent that nutritional policies are developed within agricultural policies (at least in the US) and their goal is to improve human nutrition and guaranteeing food safety to his consumers.

CHAPTER 4

Conclusions

4.1 Remarks on the role of agricultural policy

We conclude the First Part with some remarks. Some are related to the role of agricultural policy itself and to new research directions, while others are related to the relation between agricultural policy, nutrition policy and obesity. Finally we discuss the main differences and similarities between the American and European agricultural and nutritional policy trying to individuate where and if there is ground for any type of cooperation and of exchange of best practices.

4.1.1Future direction

Although social and political implications of the emerging attention towards environmental protection will be only evaluated in the long-run term, there is room to advance the hypothesis that these new efforts – actively translated into policy actions – may lead to a greater food safety and to healthier eating choices. An interesting aspect is to observe how and if *environmental modernization*may give birth to a new form of

governance for shaping policy intervention. It may be the result of an interaction of different actors and a different way of collaborative management. Specifically some argue that these changes may lead to a new model of decision making and new form of democratic participation with social actors sharing responsibilities. This perspective does not interpret attention for the environment on one side and the economic growth on the other as two antagonist forces.

According (5), there are two possible evolution for ecological modernization. The first one describes ecological services from agriculture as potential commodities and the other sees ecological services as public goods. If these two scenarios are placed on being to reshape policy decision making process, we may suggest a similar way of reasoning concerning the way society is addressing obesity. On one hand there is an increasing role of public policy and an increase number of researchers that try to understand which are the way that may significantly affect obesity rates, on the other side there is the role of the private sector and the increasing importance of the role of Corporate Social Responsibility in defining companies' goals. Companies may work to respond to the different needs of population (such as a greater attention to food quality and safety as well as healthy eating choice). Companies have also a significant know-how of effective marketing strategies.US-EU partnerships should thus be encouraged.

Another future scenario is the *post-productivist transition* characterized by increasing concerns about food and environmental quality, production for niche market, production that satisfies high standards of quality and safety, a return to extensive and diversified production, a growing network of integrated producers and at the same time the introduction of a direct relation between the consumer and the farmer.

Finally the role of *social network* may also play a role in augmenting the awareness of consumers. New technologies offer the possibility of being rapidly informed about pros and cons of actual food choices and also help consumers to deal with the complexity of choices themselves.

4.2. The relation between agricultural policy, nutrition policy and obesity

Although the relation between agricultural policy and obesity did not found a consistent empirical verification, we offer here some arguments of reflection.

Agricultural history has shown that a policy that support only prices and even worse concentrate financial aids only on some selected output (in the US corn, wheat, rice and cotton) may lead to overproduction and to a lack of diversification. A crucial question about the utility of new environmental programs such as the CSP introduced with the Farm Bill of 2002, is to understand if it has contributed to overcome the dependence on corn-soybean production. Implementing diversification means overcoming some barriers. Specifically the strongest identified barriers are a lack of ready markets for anything besides corn and soybeans; low prices for alternative crops; and a government policy that subsidizes only a few commodities (8). Another issue to address that inevitably affects production it is the concentration of producers in input suppliers especially seed producers, biotech companies and pesticides/fertilizers producers. We argue that anti-trust legal measures may help to reduce the power of lobbies, but the way with which further regulations may impact on agricultural production is an hypothesis that should be

further and properly explored. We simply argue here that understanding the complex corporate system of agriculture may be helpful to clarify what are the implications on diets and food habits.

Paying attention to mechanisms behind the new environmental policies is also another important aspect. If applications for grant are based on a volounteer scheme, the risk that larger companies will obtain the greatest majority of available funds because of an increased opportunity to access to the relevant information should be addressed too. Of course an in-depth understanding of the criteria used to allocate funds is also recommendable.

Another important issue for the future is to understand what the impact of nutrition policy on consumer behaviors is.

For example, a key question is to understand how changes in the SNAP Programme in US and Food Stamp programs in Europe will affect the food habits and diets of recipients. This issue requires particularly attention because recipients are low-income citizens that are more likely to be affected by obesity. And of course there is the role of personal responsibility that is how and for what the food stamps will be employed. In some states of the US, for example, food stamps may only be used for certain food-products categories.

Due to the complexity we just described, policies against obesity increasemay follow two directionsto be effective. The first one goes towards an *expansive direction* to the extent that policies makers should privilege synergic intervention and, simultaneously hit the problem from different sides and not just spend money in isolated actions. The second approach goes in the opposite direction. Given the complexity composition of the

population, “one size fits all” policy are less likely to be effective. The risk is to increase the differences among the population instead of reduce them. What would happen, for example, if only educated people respond positively to some public messages?

Effective public policies should also attentively monitor individuals who have lost weight and who were able to maintain their new weight. Why were they effective? What did change in their behavior? Small effective triggers and evidence-based cases could surely be a useful point of departure. It is not only a matter of monitoring and evaluating the efficacy of a given policy, but also a close monitoring of individual behaviors.

4.3 Similarities and differences between US and EU

Agricultural policies in both the US and UE started from the same need: assuring a good standard of living to farmers through sustainment of their incomes and assuring food security within borders. I argue here that actual differences are related to a different “spirit” of the time, the one of World War II. The US agricultural policy was primarily inspired by a sense of internal growth, expansion and trust towards technological progress. United States decided to point on massive production and technology, sustaining the agriculture but at the same time – under the logic of economic growth – becoming the greatest exporter of agricultural products in the world. Coherently with this vision, US agricultural policy has been oriented towards a progressive reduction of tariffs and taxes on trade. European agricultural policy was settled on the same needs

(protecting farmers and assuring food security to its population) but policy making was inspired by different "feelings". Europe was disrupted by the violence of totalitarism and European governors were scared by the ghost of new threats to stability. Europe was in need of building peace and cooperation among countries and stability was the *"condition sine qua non"* this would have been possible. Starting from agriculture, Europe opted for a policy aimed at protecting the sector, helping farmers to survive and raising trade barriers to avoid the risk of dependence. Despite protections, Europe is the greatest world importer of agricultural commodities. In the middle of nineties the signing of GATT agreement led both economies to readjust the tools of their agricultural policies. This change was inspired by a need of encountering the new wave of market liberalization. Both economies, although starting from different points (in term of economic power and degree to agricultural support) faced the need to reduce and change subsidies to farmers, opting for income support rather than price support measures. Another similarity is related to the increasing importance of environmental issues that became an integral part of agricultural policies. This sort of convergence between agricultural policy goals– was strictly related to the need of responding to global challenges – the emerging roles of new economies on one side and the problem of climate change on the other.

In the last ten years the environmental concerns - accompanied by the so called ecological modernization transition – has characterized a new shaping of agricultural financial sources and policy measures in both economies. A big difference is that in the European Union quality assurance schemes are decided by the European Commission and the steps to obtain product certification and grants are standardized, while in the US there is a prevalence of voluntary schemes (despite things are changing). The word

environment has to be intended in a broader meaning. It is not only related to environment itself and climate changes, but also to all the issues surrounding the topic such as animal welfare, reduction of the use of chemicals or promotion od extensive agricultural techniques. This is ultimately translated in an improvement of human nutrition and, maybe, to obesity and overweight. If econometrics results may be lead to fallacies of interpretation, food policy direction is likely to be related to future political adjustments. The political environment will play a key role in shaping new directions and the space for new policies. Although obesity is recognized to be an epidemic by all political parties, it is also possible that the more liberal is the view of a given political party, the less likely the party will favor intervention based on soft or hard paternalism.

The final remark is to understand if there is room for cooperation and exchange of best practices between United States and European Union. Under the assumption that private companies will play a significant role in fighting obesity, a possibility of cooperation is offered by Corporate Social Responsibility, creation of private public platforms between US and EU may be welcomed concerning education and prevention measures. However any form of cooperation should take into consideration (1) the social context and the history within policies develop andalso (2) the political, cultural and economic framework of policy decision making process.

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PART 2

An interdisciplinary perspective on the causes of obesity

Introduction

Through an accurate review of the literature, we propose a Socio-Ecological Model (47) on obesity determinants. We argue that for understanding the problem of obesity, it is helpful to employ interdisciplinary models because they are able to capture the simultaneous influence of several factors. Obesity is the result of lower levels of income and education, genetics, social influences, behavioral determinants and many others variables. Although further evidence is needed, we claim that for developing effective public policies that synergic approaches are more effective than intervention based on isolated measure (see for example Paragraph 1.2). In the model we try to generally explain the factors behind weight adjustments across a lifetime with the inclusion of pre-birth factors, primary socialization (family socio-economic characteristics and cultural norms) and secondary socialization (school and neighborhood environment). For empirically testing the significance of our hypothesis, we use Student's t-test and Pearson's Chi test, exploiting the great variety of information of the National Longitudinal Survey of Adolescent Health (*see Appendix*). Specifically, the paper is structured as follows. The first chapter introduces the concept of obesity epidemic in the United States and Europe and discusses the importance of theory in obesity research. The second chapter presents the socio-ecological model of obesity. The model is integrated with the role of genetics that influence the likelihood of being overweight or obese aside from the socio-economic environment. The third chapter provides empirical evidence

between the model and observed variables using data from The National Longitudinal Study of Adolescent Health. The fourth chapter draws conclusion.

Contents

CHAPTER 1
The obesity epidemic: United States and Europe

1.1 Obesity rates in the United States and Europe

Since the beginning of the Nineties the World Health Organization expressed concerns for the increasing constant increase in obesity rates in the United States and Europe, such that it defined the phenomenon with the term *epidemic* (1). In the United States Obesity has been monitored since eighties. The problem of changing consumer behavior and helping individuals to make healthier food choice has recently become a priority in the public policy agenda in the US and the EU (2). Data reported in Table 1.1 are a synthesis of official statistics released by governments and are updated around every year. In particular, further information is available in the website of the Center for Disease and Control Prevention for the United States and in the press release page of the European Commission for data at the European level[8].

If we look at the Table below, it is clear that the problem of obesity is urgent in both in Europe and United States. Given that variations in obesity rates varies across ethnicities

[8] For the United States, updated information are available at http://www.cdc.gov/obesity/data/adult.html and for the EU http://europa.eu/rapid/pressReleasesAction.do?reference=STAT/11/172&type=HTML

(3), the multicultural environment of the population of the United States can be seen as a large dataset for observing the role of genetics in obesity.

Table 1.1 Obesity epidemic in the United States and European Union

United States	European Union
Prevalence	***Prevalence***
33.8% of adults in the US are obese	Overweight and obese population varies between 36.9% and 56.7% for women and between 51% and 69.3% among men. There is high variability across States
17% (approximately 12.5 million) of children and adolescents are obese – ages 2-19	24% of the children aged 6-9 years old are overweight or obese (based on the 2007 WHO growth reference for children and adolescents)
By state, obesity prevalence, on the basis of self-report, ranged from 21% in Colorado to 34% in Mississippi in 2010. Twelve states had a prevalence of 30% or more.	The lowest shares of obesity in 2008/9 were observed in Romania (8.0 % for women and 7.6 % for men), Italy (9.3 % and 11.3 %), Bulgaria (11.3 % and 11.6 %) and France (12.7 % and 11.7 %).
The South has the highest obesity prevalence (29.4%) followed by the Midwest (28.7%), Northeast (24.9%) and the West (24.1%)	The highest proportions of obese women were recorded in the United Kingdom (23.9 %), Malta (21.1 %), Latvia (20.9 %) and Estonia (20.5 % in 2006), and of men in Malta (24.7 %), the United Kingdom (22.1 %), Hungary (21.4 %) and the Czech Republic (18.4 %).
No state has met the nation's Healthy People 2010 goal to lower obesity prevalence to 15%	Obesity is already responsible for 2–8% of health costs and 10–13% of deaths in different parts of the Region.
In 2008, medical costs associated with obesity were estimated at $147 billion; the medical costs paid by third-party payors for people who are obese were $1,429 higher than those of normal weight	In all Member States available the proportion of overweight men is much higher than for women (differences from 8.5 % in Hungary to 18.2 % in Slovenia)
Non-Hispanic blacks have the highest rates of obesity (44.1%) compared with Mexican Americans (39.3%), all Hispanics (37.9%) and non-Hispanic whites (32.6%).	***Related issues***
Related issues	The share of overweight and obese persons tends to fall with educational level. For women, the pattern is clear in all Member States available: the proportion of women who are obese or overweight falls as the educational level rises. For women the differences between lower and upper education level vary between 12.8 and 36.7 %
Among non-Hispanic black and Mexican-American men, those with higher incomes are more likely to be obese than those with low income	For men, the pattern is again slightly different.
Higher income women are less likely to be obese than low-income women	
There is no significant relationship between obesity and education among men. Among women, however, there is a trend—those with college degrees are less likely to be obese compared with less educated women	

Between 1988–1994 and 2007–2008 the prevalence of obesity increased in adults at all income and education levels	Differences are smaller and the distribution is different: in 8 of the available Member States, the highest share of overweight and obese men is observed for those with the lowest educational level, in six Member States for those with a medium educational level while in 4 countries it is for those with a high educational level.

Sources: Centers for diseases and control prevention (US); European Health Interview Survey (EHIS) and World Health Organization (WHO)

In the European Union, to our knowledge, immigrant population is not systematically included in any of the official datasets that collect information on weight and height. In the European Union differences are mainly observed at theState level. Education is negatively correlated with women obesity in both US and EU. This evidence suggests that the role of education may be further addressed given that women are usually responsible for food shopping of households.

1.2The risk of being obese

Obesity is known to be related to higher health risks because of its correlation with some non-communicable diseases. For example, the OECD (4) reports that severely obese individuals have a risk of developing type 2 diabetes up to sixty times larger than people at the lower end of the normal range of obesity classification of the World Health Organization. Obesity is also associated with higher blood pressure and higher cholesterol level (4). The US National Vital Statistics Report of December 2010reported however that "*the preliminary estimate of life expectancy at birth for the total population in 2008 is 77.8 years. This represents a decrease in life expectancy of 0.1 year relative to*

2007" (5). Although there is little scientific evidence on mortality due to cardiovascular diseases developed because of obesity, the reduction of life expectancy – or at least the slowing down of its increase about obesity – because of obesity, it is one of the most debated issues in the academic literature. Cardiovascular diseases represent the first cause of mortality in US and also in Europe[9].

Further research is surely needed to understand to what extent the role of public policy may be helpful – if not to reduce – at least to prevent the increase of obesity rates and to promote a healthier lifestyle for preventing cardiovascular diseases. Concerning the prevalence of obesity in children, a first positive signal however has been recently observed in New York City in relation to obesity trends in children. Specifically it has been observed that *the number of obese New York City schoolchildren fell by 5.5 percent over five years*[10]. The reasons behind this achievement have not been recognized yet, however the most accredited explanation is the simultaneity of different policies implemented at school levels – such as improvements in school meals and in physical activity.

1.3 Obesity and theory

[9] For the US further information available at: http://www.cdc.gov/nchs/fastats/lcod.htm and for the EU at: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Causes_of_death_statistics

[10] See for example http://www.nytimes.com/schoolbook/2011/12/15/obesity-in-new-york-children-on-the-decline-officials-say

To provide a framework for analyzing obesity we start from the two possible directions from analysis. We can use either an inductive approach or a deductive approach.

Induction starts from the observation of particular aspects of life for drawing general conclusion, while deduction stems from assumptions or general principles and it goes on the other way around: from general to particular. Obesity can be studied under both perspectives.

During the last years, research coming from epidemiological, psychological and social analysis has been largely used for "communicating" with policy makers (6). This could be related to the complexity of the problem of obesity that involves by itself different perspectives and disciplines. However using theory may be helpful for understanding obesity at the light of a more general framework of health education.

For example (6) among the theory within which we can address the role of obesity there are the Health Belief Model, the Trans- theoretical Model and the Theory of Reasoned Action/Theory of Planned Behavior and the Precaution Adoption Process Model. Other models are those focusing on interpersonal theories – that found their maximum exponent in Bandura with his Social Cognitive Theory. These models are part of the wider health education models. There are several ways of defining health education. Griffiths (1972) defined it in the following way: *"health education attempts to close the gap between what is known and which is actually practiced"*. Simonds (1976) defined the aims of health education as: "*bringing about behavioral changes in individuals, groups, and larger populations from behaviors that are presumed to be detrimental to health to behaviors that are conductive to present and future health*".

According to (6) current theories and models can be classified in the following typology:

Table 1.2 Health behavior and health education: theories and models

Theories		
Health Belief Model	The Transteorethical Model/ Stages of Change	Diffusion of innovation
Social Learning Theory	Social support and social networks	Stress and Coping
Theory of Reasoned Action	Community organization	Patient provider interaction
Theory of Planned Behavior	Social Marketing	Ecological Models – Social ecology

The theories listed above are of course not exhaustive, there are many other models that address the behavior of an obese individual, many of them coming from economics. However, we focus here on theories used within Health Education.

1.3.1 The role of theory in explaining obesity behaviors

The role of theory is, firstly, to explain the phenomenon itself individuating what are the mechanisms behind it and secondly – and most importantly – to individuate strategies that make changes possible. The underlying causes for these trends have been investigated in various disciplinary areas, but uncertainty remains because of the complexity of the determinants of food choices and the variety of models aimed at explaining eating behaviors. Theory is also useful because professionals charged with responsibility for health education and health behavior and interventionists and action-oriented. They use their knowledge to design and implement programs to improve health. Using the theory as a basis may be a useful step of departure.

In the second Chapter we present a socio-ecological model of obesity. One of the advantages of using a socio-ecological approach is offered by the possibility of using an interdisciplinary approach that includes variables coming from different fields. Several theories with different grades of sophistication have been tried to explain the behavior of overweight people. Some of them have been recognized to be particularly successfully in explaining the mechanisms behind it. For example, some economists address the technological change in the food system as the main explanation of the population weight increase (7). Cutler et al. (8) argue that expanding the budget set makes people better off and the problem of obesity would be only confined to self-control problems of some individuals. On the opposite, nutritionists and medical researchers stress the role of the increase portion sizes and the imbalance of food accessibility. The increasing numbers of fast food restaurants and the difficulty to access groceries limit the possibility for many individuals to eat healthy (9). The caloric imbalance is positively correlated with the numbers of hours spent watching TV and using computers, especially for children and adolescents (10). If an obesogenic environment surely increases the probability of becoming overweight and obese, still it is unclear why some individuals are more likely to gain weight than others. At the individual level weight is the result of different components affecting individual behavior during lifespan. Obesity is more likely to occur in an obesogenic environment but there are factors that affect the probability of gaining weight at the individual level (as socio-economic status, cultural norms, lifestyle and genetics) that also need to be further investigated.

Theories are useful during the various stages of planning, implementing and evaluating interventions. As reported by (6), according to Lakatos and Musgrave a new theory is

accepted as truly advancing our understanding of phenomenon when some rules of thumbs are used. A new theory is considered acceptable if:

- It explains everything that prior theory explains
- It provides explanations for phenomena that could not be explained by prior theories
- It identifies conditions under which the theory could be falsified
- There should be a body of research testing and supporting it – research that it has been conducted by multiple scientists beyond the original developer or developers.

CHAPTER 2
Obesity through a socio-ecological perspective

2.1 Theory for modeling health behaviors

A theory (or model) us a set of interrelated concepts, definitions and propositions that present a systematic view of events and situations by specifying relations among variables, in order to explain and predict the events or situation (6). Theory is made of concepts – that may evolve in constructs – and variables. Concepts are the building blocks of a theory and can vary in the extent to which they have meaning or can be understood outside the context of a specific theory. When concepts are developed or used outside the context of a specific theory, are called constructs. Variables are the empirical part or operational forms of concepts. Variables are measurable and measure the weight of a certain concept in the theory. There are other important aspects that rotate towards a theory. There are the principles or general guidelines of actions, based on history or precedent research. Finally there are paradigms that are the patterns under which a theory develops. According to the Online Oxford Dictionary, a paradigm is *a world view underlying the theories and methodology of a particular scientific subject*. Paradigms

create boundaries within which the search for answers occurs; they play the role of directing the search for answers. In health education and health behavior the dominant paradigm is the l*ogical positivism* or *logical empiricism* founded by Vienna Circle during the thirties. This paradigm has two central features:

1. An emphasis on the use of induction or sensory experience, feelings and personal judgments as the source of knowledge;
2. The view that deduction is the standard for verification or confirmation of theory, so that theory must be tested through empirical methods and systematic observation of phenomena

Finally it is worth of note Lewin's meta-theory that stipulates the rules to be followed for building a good theory. Key rules include an analysis that starts with the situation as a whole, contemporaneity, a dynamic approach, constructive method, mathematical representation of constructs and variables and a psychological approach that explains both inner experiences and overt actions from the actor's perspective. Health education and health behavior theories are concerned with approaches to solving social problems but although this great desire of "producing a better world", techniques that push people to change their behavior are seen by many as manipulative reducing freedom of better choices and paternalistic. Thus a change in the paradigm has occurred and, nowadays, current theories are based on reducing obstacles to change and promoting informed decision making rather than pushing people on change.

2.2Obesity through a socio-ecological perspective

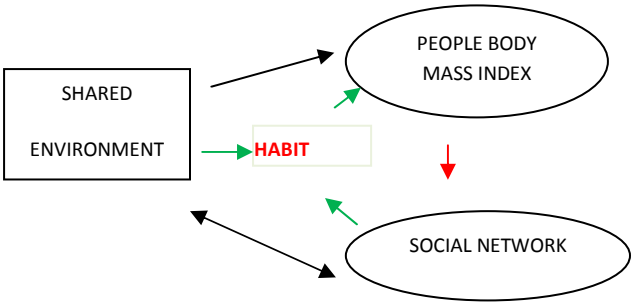
The Social Ecology Model, also called Social Ecological Perspective, is a framework to examine the multiple effects and interrelatedness of social elements in an environment. SEM can provide a theoretical framework to analyze various contexts in multiple types of research and in conflict communication (47). Social ecology is the study of people in an environment and the influences on one another (Hawley, 1950). This model allows for the integration (47) of multiple levels and contexts to establish the big picture in conflict communication, health or physical activity contexts. Two advantages of using ecological models for explaining obesity can be found in two key ideas developed by Glanz and Rimer (6).First behavior is viewed as being affected by and affecting multiple levels of influence:

1. Intrapersonal or individual factors
2. Interpersonal factors
3. Institutional or organizational factors
4. Community factors
5. Public policy factors

The second key ideas relates to the possibility of reciprocal causality between individual and their environments: that is behavior both influences social environment and is influenced by social environment. For example the social network, together with the environment people live in, resembles somehow the concept of “collective consciousness” introduced by Durkheim in early twentieth century, intended as shared

beliefs and moral attitudes which operate as a unifying force within society. The habitus concept (or process) has been widely debated in the academic literature, but for now, it is convenient to consider its elementary meaning: a consolidated behavior repeated over time (11).

Fig. 2.1 The role of habit



A shared environment – from schools to recreation centers – together with other economic variables defines the activities that people living in the same neighborhood can and can't do during their spare time. A shared social network defines members' group behavioral patterns that, with time, take the form of habits. As far as social network plays a role in defining people's identity, the relevance of habits increases as they obey to the group behavioral patterns. Within every group there exist some rules (and/or habits) that function as a sort of "mirror" or "glue" among members. If being part of a social network is valuable, the higher is the respect of the rules, the higher the level of integration. Changing habits would thus be too costly for an individual: it is not only harder per se (as evident in the literature on habits formation and changing) but would also imply disutility in the sense of risking of being emarginated by members of group

and of rising doubts over the integrity of individual identity. This is also in line with the distinction between “optimizers” and “non-optimizers” agents made in the model of Conlisk (12). If the decision making process is costly, it may be optimal for individuals to imitate the behavior of other people (namely the “optimizers” who are willing to pay an extra cost to look for strategy or information to behave autonomously). Coming back to BMI, as far as the social network tightens people to certain habits, it is likely that the social network rather than directly cause obesity – which is the result of several environment, individual and economic factors – may have a role in making difficult to change habits (or slow down the occurrence of a change). In terms of weight, it means that people with a stable social network are less prone to gain or to lose weight than those who have less social ties or/and are experiencing a change in habit (13).

2.3The Model

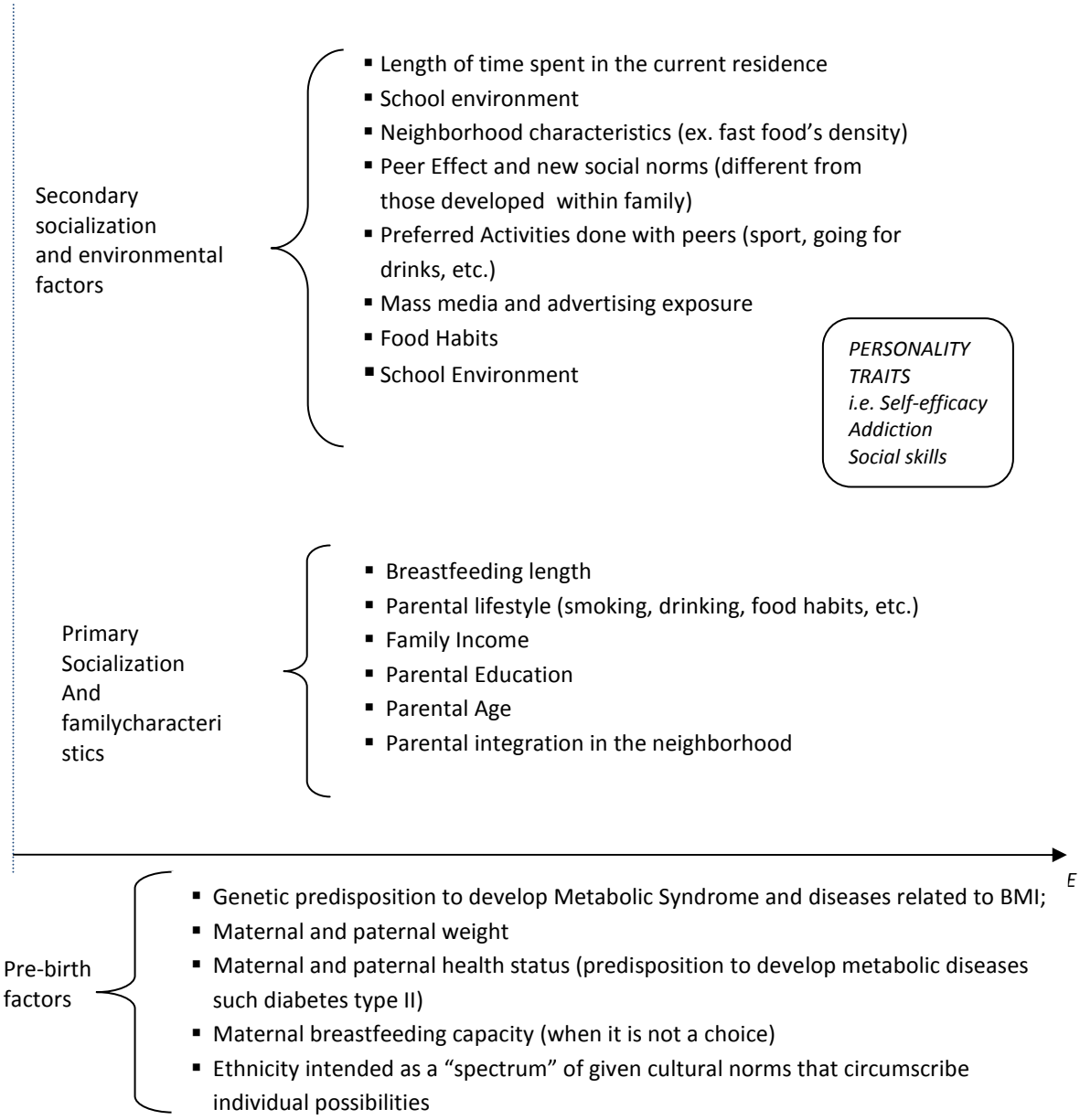
In the model that we present here below the event to be explained – weight adjustments - is the result of a set of behaviors leading to weight adjustments. The model evolves on three levels. The first one includes the effect on weight that occurs atthe genetic level and that act at the pre-birth level. The second level corresponds to the early childhood and to the so-called primary socialization[11]. For example, it includes the role played byfamilyrelationsas well as family socio-demographic variables as parental income

[11] For the distinction see for example: http://www.ehow.com/list_7255943_differences-between-primary-secondary-socialization.html

variations. The third level encompasses all the factors that influence obesity during the secondary socialization as the influence played by school, neighborhood/environment and peers. Different combinations of the variables listed in the model determine an influence of the "personality traits" that act as a reinforcement of the likelihood of weight adjustments.

The model focuses the attention on what happens in children and adolescence but we can assume that it may be valid for adults if we assume that – ruling out special cases and life events – the adult life is the result of previous experiences such as those of childhood and adolescence. The model has to be seen as a dynamic model where even small changes in variables may influence the likelihood of a change his or her weight. The advantage of this model is that it captures the intrinsic interdisciplinary nature on the causes of obesity. Each factor contributes to increase or the probability of being underweight or overweight at any point in time. Given that weight changes over time and it is subject to continuous adjustments we could try to think about this model as a dynamic one, where the influence of each component continuously plays a role in influencing weight adjustments. The complexity of the problem increases as the number of factors influencing individual behavior are summed one to another. This is consistent with the fact that public policies aiming at fighting obesity focus on a synergic approach, trying to face the problem under different points of views.

Fig. 2.2Asocio-ecological model for weight adjustment through a lifetime



In its simplest form, an increase in weight depends on the fact that the calorie intake is systematically higher than calorie expenditure. Calories eaten and calories burnt are the result of several factors that play a role at different levels. As we go up through the level

the proximity to the individuals decreases. It has to be kept in mind that each of the factor listed below, even if treated separately, are strictly related to the environment people live in. Following an evolutionary perspective, it is likely that individuals use different cognitive sources to adapt themselves to certain environment and adjust their behavior according to it. In doing it so, they can behave either as rational agents (and maximize their utility and future well-being) or as irrational agents (heavily discounting their future well-being). The more complex an environment is, the harder is to get adapted to it. This idea recalls the concept of *social Darwinism*, an evolutionary theory developed in 1870. The basic mechanisms of this theory can be explained with this statement: "*There are underlying, and largely irresistible, forces acting in societies which are like the natural forces that operate in animal and plant communities. One can therefore formulate social laws similar to natural ones. These social forces are of such a kind as to produce evolutionary progress through the natural conflicts between social groups. The best-adapted and most successful social groups survive these conflicts, raising the evolutionary level of society generally (the 'survival of the fittest"* (14).

2.4 Measuring obesity

Body Mass Index – BMI – is the ratio between weight (kg) and height (squared meters) and it is the most widely used measure to detect if an individual is underweight, normo-weight or overweight/obese. According to the definition of the World Health

Organization, an individual is considered obese if his BMI is equal or above the value of 30. BMI can also be split into classes as recommended by the American Association of the Study of Obesity NAASO (Tab. n.2.1). The use of BMI has been criticized because it does not take into account of the ratio between the fat mass and muscles with different effects on health risk probabilities (15). Although some alternatives have been proposed such as the Fat Free Mass Index (FFMI) or the waist circumference, BMI classification remains the main recognized standard at both international and national level. Specifically two main evidences led to a rethinking of the current BMI classification. Firstly in some Asians populations, as for example in Japan, the prevalence of obesity is lower than in Europe and the US despite the health risks associated with obesity occur at lower level of BMI. Secondly it has been shown that Polynesians tend on average to be more muscular and have a higher BMI than Euripides but lower body fat levels at the same BMI. In general for Pacific Islanders the probability of the occurrence of obesity-related diseases is observed at higher level of BMI than Europeans, except for diabetes. Some studies have thus suggested different cut-off points tailored for these two groups and stressed the need of further research for developing specific policies for tackling obesity in these sub-groups (for example see 17,18). Following these warnings, another expert consultation was launched by the WHO in 2002. The consultation confirmed the efficacy of BMI since it is highly correlated with fat mass but also asks for the need of further cross-country research and empirical evidences (17). Apart from the correctness of BMI, a greater problem is that in many surveys it is not directly measured but self-reported (or in case of children and adolescents, parent-reported). The validity of self-reported data is controversial in the literature. The positions can be summarized as

follows. Some researchers strongly discourage the employment of self-reported data. Akinbami and Ogden (18) after having compared two parent-reported surveys – The National Health Survey and The National Survey of Children Health – with the National Health and Examination Nutrition Survey where height and weight are directly measured demonstrated that parents systematically over-reported their children BMI. Nawaz et al. (19) have shown that obese women tend to under-report their weight and over-report their height and also that misreporting is influenced by employment and disability status. Some investigators rely on self-reported data on the basis that the difference between actual and reported BMI is small (20) and that the correlation between the two measures is high. For example, Singh at al. (21) calculated the gap between NSCH and NHANES and concluded that there is a fairly close correspondence between the overall BMI and obesity estimates for children 10 – 17 years of age. Finally there is the "something in between" perspective. At the light of the high correlation, equations to correct self-reported data have been suggested. A drawback of using correction methods is that equations should be differentiated by age group and gender, and this may be a complex task.

In the United States there is a significant number of surveys and surveillance systems for monitoring the health status of US population. Most of these surveys are headed to the Center of Disease and Control Prevention that is one on the main component of the Department of Human Health and Service. To our knowledge, the principal surveys reporting information about weight and height among children and adolescents are six. In Tab. 2.2 we described their main characteristics we also specify how height and weight were measured, both in the United States and European Union.

Table 2.1 The International Classification of adult underweight, overweight and obesity according to BMI

Underweight	**<18.50**
Severe thinness	<16.00
Moderate thinness	16.00 - 16.99
Mild thinness	17.00 - 18.49
Normal range	**18.50 - 24.99**
Overweight	**≥25.00**
Pre-obese	25.00 - 29.99
Obese	**≥30.00**
Obese class I	30.00 - 34.99
Obese class II	35.00 - 39.99
Obese class III	≥40.00

Measuring BMI it is not only a matter of how but also of who collects data. In both United States and Europe there are a lot of surveillance systems. To our knowledge in the European Union data are collected by Member States – and specifically by Departments within the National Statistics Centre – while in the United States given also the dimension of the problem, data collection is spread on several agencies, as shown in Table n.2.2 the first standardized European-wide surveillance system has been implemented by the European Regional Office of the World Health Organization; first data were collected between 2007/2008.

Table 2.2 – Databases on obesity in US and Europe

Survey	**Brief description**	**Weight and height**
NHANES National Health and Nutrition Examination Survey	**General goal** Assess the health and nutritional status of adults and children in the United States **Sample and data collection** Representative of US population, all ages Interviews examinations and laboratory tests	Directly measured

	Since 1960s, with surveys focusing on different topics and population	
BRFSS Behavioral Risk Factors Surveillance System	**General goal** Tracking health conditions and risk behaviors in the United States **Sample and data collection** Representative of US population, 18 years and older On-going telephone survey, data are collected monthly Since 1984	Self reported
YBRSS Youth Risk Behavior Surveillance System	**General goal** Monitors priority health-risk behaviors and the prevalence of obesity and asthma among youth and young adults **Sample and data collection** Representative of US students from 9th to 12th grades Interviews Since 1991	Self reported
ADD-HEALTH National Longitudinal Survey of Adolescent Health	**General goal** Combines longitudinal survey data on respondents' social, economic, psychological and physical well-being with contextual data on the family, neighborhood, community, school, friendships, peer groups, and romantic relationships **Sample and data collection** Representative of US students from 7th to 12th grades Interviews Since 1994, Waves I, II, III and IV are available	Self reported in WAVE I, directly measured in the following Waves (II, III and IV)
NHIS National Health Interview Survey	**General goal** Broad range of health topics **Sample and data collection** Representative of all US population, all ages Personal household interview survey Institutionalized in 1957, it is continuous throughout each year	Self-reported (in case of children parent reported)
NSCH National Survey of Children Health	**General goal** Examines the physical and emotional health of children ages 0-17 years of age. Special emphasis is placed on factors that may relate to well-being of children, including medical homes, family interactions, parental health, school and after-school experiences, and safe neighborhoods **Sample and data collection** Representative of US children and adolescents from 0 to 17 years old Telephone interviews since 2003 (other Waves in 2007 and 2011)	Parent reported

Together with data collection, there are other important databases that collect evidence-based programs and policies particularly useful for projects developed at national or community level, as for example did the Cochrane Collaboration or the Guide to

Community Preventive Services[12]. At a broader level, policy guidelines can be found in key governmental documents and initiatives, implemented at the aim of directing future research. In the European Union the key instrument is the White Paper of Nutrition and Policy of 2007 and in the United States the Healthy People 2020 initiatives (22, 23).

[12] More information are available on the website of the projects http://www.cochrane.org/ and http://www.thecommunityguide.org/index.html

CHAPTER 3
Empirical validation of the model through Add Health Survey

3.1 Validating the Model through Add Health Dataset

The goal of this part is to provide basic empirical evidence in relation to the model proposed above. This will be done through an exploration of the significant relations across classes of Body Mass Index on a cohort of adolescents of the US between 6th and 12th grade. Data are taken from the Wave I of The National Longitudinal Survey of Adolescent Health (Add Health) of 1994. In-School, In-home and Parent questionnaires of Wave I have been used in the explorative analysis.The advantage of using Add Health Survey is that includes a broad range of information, from socio-economic anddemographic variables, to physical and health condition, neighborhood characteristics, friendship's and parental relations and attitude towards risk behaviors, food and other types of habits. Further information about the Add Health Survey is

summarized in the Appendix I. An in-depth description is also available on the website of the project[13].

3.2 Calculation of the Body Mass Index and Methodology

BMI Calculation

Height and weight were self-reported in the Add Health Survey. For Wave I have calculated a new variable (BMI) using the formula reported by the US Centre for Disease and Control Prevention. Weight was expressed in pounds and height in inches.

$$BMI = \frac{weight(lb)}{[height(in)^2]} * 703$$

At the light of the discussion about the validity of self-reported data, I have used two estimated equations (one for males and one for females) developed by Hayes et al(24). Original corrections have been applied to correct self-reported values of the Australian National Nutrition Survey conducted in 1995. The formula of the two equations is reported here below; the first one corrects males BMI and the second females BMI.

[13] http://www.cpc.unc.edu/projects/addhealth

$$BMI_c = \frac{(1.022 * srweight + 0.07)}{0.00911 * srheight\ + 0.1375^2} [2]$$

$$BMI_c = \frac{(1.04 * srweight - 0.067)}{(0.00863 * srheight\ + 0.2095)^2} [3]$$

After having calculated the corrected BMI we have binned the variable according to the WHO classification as reported in Table 2.1. We have weighted cases using the Grand Sample Weights. We have then selected the core sample (using variable SMP01). According to the binning the majority of adolescents fall in the normo-weight class (41%) followed by the overweight class and by obese classes. Only 3.4% of the sample resulted to be underweight. First observation suggest that in the observed sample males are generally more likely to be overweight than females (the total proportion male female in the sample is 51.5% and 48.5).

Hypothesis testing

For determining if each component of the model was significantly related to the body mass index, we have used test on two means for unrelated samples. As defined in Mazzocchi (48) "*unrelated samples are those were the sampled units belong to different populations and are randomly extracted*". For example we have tested if average BMI differs between Black and White Americans. The sub-samples of White and Black are unrelated since one randomly extracted individual must belong to one of the two groups.

Suppose that we want to test the equivalence of the Body Mass Index of two groups, G_1 and G_2, against the alternative hypothesis that the BMI of the two groups have a different distribution. Formally the hypothesis system is:

H_0: $BMI_{g_1} = BMI_{g_2}$

H_1: $BMI_{g_1} \neq BMI_{g_2}$

If we assume that the BMI of the two groups is normally distributed, under the null hypothesis, their difference is also normally distributed. If we knew the actual population standard errors we might compute the joint standard error as

$$\sigma_{\mu_1} - \sigma_{\mu_2} = \sqrt{\sigma_1^2}/n_1 + \sigma_2^2/n_2$$

And proceed with the testing the hypothesis using the standard normal distribution. However actual standard errors are unknown, so we need to estimate them from our sample and approximate not to the normal standard distribution but to the Student T distribution.

$$t = (\bar{x}_1 - \bar{x}_2)/s_{\bar{x}}\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$$

The test distribution Student T has a number of degrees of freedom equal to $n_1 + n_2 - 2$.

When one variable presented more than one categories we have instead used cross tabulation, using BMI categories (underweight, normal weight, overweight and obese I, II and III class). In order to determine if the observed frequencies were not casually distributed in the BMI classes, we have used Chi-square test that measures associations of ordinal variables of contingency tables. For example suppose that we want examine the distribution of parent education for each class of the BMI. Suppose also that we want to see if the frequency of children whose parents have at least a high school diploma is higher in the normal weight class than in the obesity class. If this is not the case, the two events (BMI distribution and educational level) are said to be independent. This happens when the probability that two events happen jointly is the product of the probabilities of the two events:

$$Prob\ (X = a, Y = b) = Prob\ (X = a) * Prob\ (X = b)$$

Similarly, when two categorical variables are independent, the joint probability is equal to the product of the probabilities of the individual categorical outcomes. Thus the frequency within the contingency table should be not too different from the expected values:

$$f_{ij}^{*} = \frac{(n_{i0} n_{0j})}{n_{00}} = \frac{(f_{i0} f_{0j})}{f_{00}} = f_{i0} f_{0j}$$

Specifically, n_{ij} are the absolute frequencies, f_{ij} are the relative frequencies and $n_{i0,} n_{0j,} f_{i0} f_{0j}$ are the marginal totals for row i and column j. The distance between the

actual and the expected frequencies is processed into a single value, the chi-square statistic, calculated as follows:

$$\chi^2 = \left[\sum_{i,j}(f_{ij} - f^*_{ij})^2\right] / f^*_{ij}$$

The more distance the actual joint frequencies are from the expected ones, the larger is the Chi-square statistic (48).

3.3. The role of Pre-birth factors

Pre-birth factors include genetics, maternal and paternal weight and health status and maternal breastfeeding capacity and ethnicity, seen as a “spectrum” of given cultural norms that circumscribe individual possibilities.

3.3.1 Evidence from the literature

Genetics

One of the most discussed issues related to obesity is the role of genetics. Genetics plays a role in explaining overweight and obesity because of the individual predisposition to develop Metabolic Syndrome and diseases that accelerate – or decelerate – weight adjustments. For example one of the most studied issues is the study of the prevalence of

obesity in different ethnic population. The hardest problem is to disentangle the role of other socio-economic variables – such as education and income – from the mere role of genetics (25). As we have already discussed in the discussion upon BMI measurement, higher rates of obesity are systematically observed in Pacific and Islander population and have remained stable over time. Although the role of the obesogenic environment has contributed to increase overweight and obese rates, still individual behaviors, different cultural norms and genetics play also important. Individual behavior is linked to the obesogenic environment because it can be seen as the individual answer to an increasing complexity of the surrounding environment. Genetics affect individuals in a way that is neither controllable nor changeable by rational or irrational behaviors. As Wardle et al (26) pointed out "obesogenic environment may either overshadow the observable effect of genetic differences or boost it by providing a permissive substrate for the expression of susceptibility". All the surveys that have tried to disentangle nature and nurture so far relied on samples including twins.

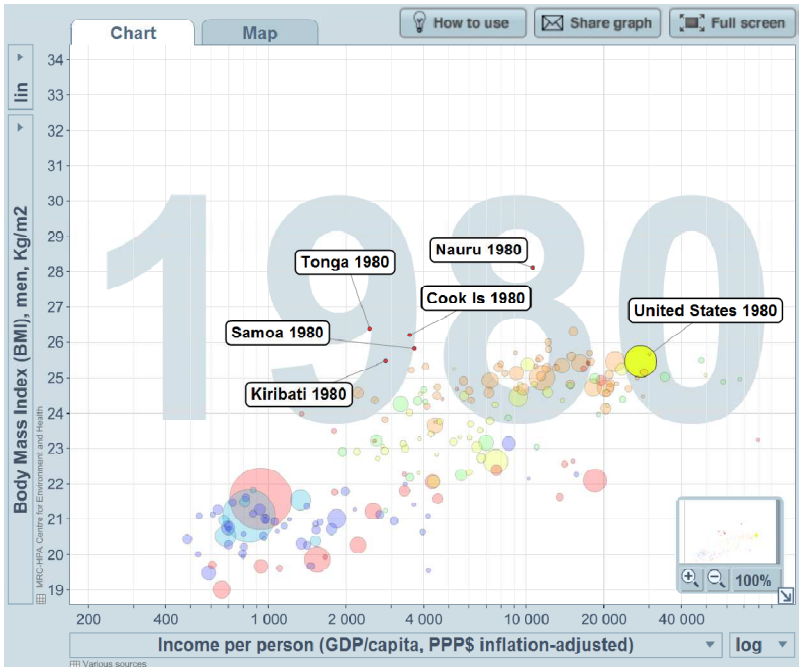
Since genetic variation is lower within the same ethnic group, it is likely that genetics plays a role in explaining – at least partially – the persistence of disparities in obesity and overweight rates among different racial groups. Indigenous populations have greater levels of BMI than Europids with consequent higher incidence of health risks. This fact has been confirmed for indigenous populations living in different part of the world and in both rural and urban areas, although higher rates have been observed for indigenous living in urban areas (27). For example epidemiological data collected by WHO show how obesity rates are higher for Maori of New Zeland or Aborigines in Australia (16).

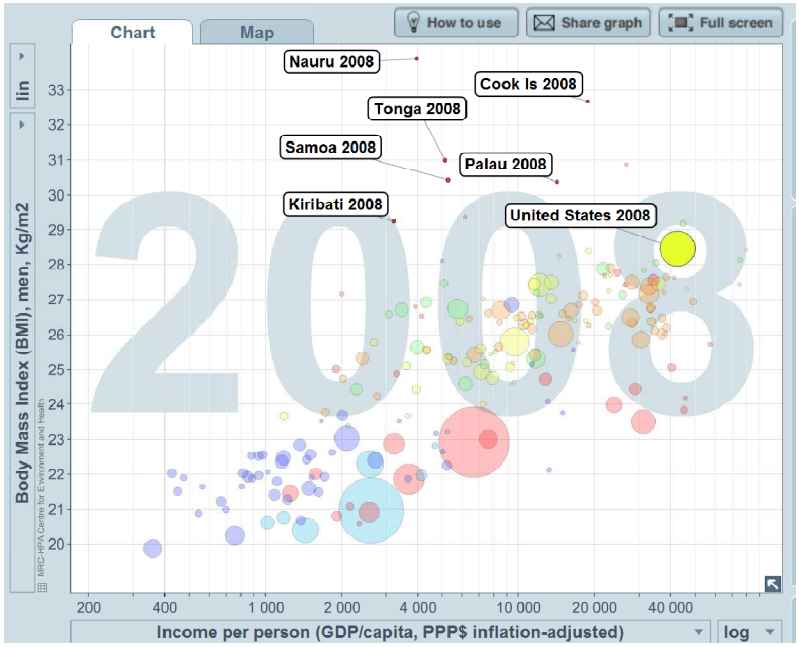
Some indigenous Polynesian islanders presented the highest levels of obesity and overweight, already thirty years ago.

In the United States the Indian Health Service has estimated that 81% of AI/ANs adult population (aged 20 – 74) is at least overweight and 54% is obese and 45% of children (aged 2 – 5 years old) are overweight of whom 25% are obese4. This evidence would suggest that indigenous populations are subjected to higher health risks than the general population and also than other ethnic minorities. There is surely a need of further research to disentangle the environmental from the genetic factors leading to a higher incidence of obesity for this population despite genetics seems to play an important role. See the study on Native Hawaiians and Samoans (27). In the Tables below I compare BMI rates and income worldwide in 1980 and in 2008. Tables were built using the system developed by Hans Rosling[14].

[14] Data elaboration from http://www.gapminder.org/

Figure 3.1 BMI rates and Income per person – 1980 and 2008





As a sign of the recognized importance played by genetics, one of the four indicators of the Healthy People Goal 2020 – a US governmental funded programme aimed at

improving the health of Americans through prevention – is to reduce disparities among ethnic groups (23).

Maternal and paternal weight and health status

There is large empirical evidence that shows how maternal and paternal health and weight is related to childhood obesity. For example a recent study conducted in Canada found that gender differences in socialization may explain why at 7 years of age, girls' bodyweight is influenced by having even one overweight/obese parent (mother or father), while boys' bodyweight appears to be influenced only by father's overweight/obesity when only one parent is overweight/obese (28). Medical literature has shown evidence on a link between weight at birth and a higher probability of developing the metabolic syndrome (MS), Diabetes Mellitus Type 2 and hypertension later in life (see for example 4). Other positive correlations between parental and adolescents health status are observed for mother and father's obesity and for mother diabetes. Overweight and obese individuals are more likely to have obese parents and a mother with diabetes than normal weight people. This evidence is also confirmed and well acknowledged in the literature of obesity.

3.3.2 Evidence from Add Health Survey

Genetics

We assume here that ethnicity is a proxy for genetics. However considering ethnicity as a source of genetics is a discussed topic in the literature because of the strict bond between minorities, income and education levels. It is hard to disentangle the role of genetics and the role of the environment. For a detailed discussion see Part III.

In Wave-I of Add Health Survey, three questions have been used to ask the origin of respondents. The first directly asks *What is your race?*Answers include five options: White, Black or African American, American Indian or Native American, Asian and Other.The average BMI is systematically higher for respondents who marked the following options with respect to those who did not mark them: Black American (27.50) and American Indian (28.50). BMI is systematically lower for White American (26.37) and for Asian (25.30). The null hypothesis of equal means is strongly rejected (the p-value is 0.000) at both 5% and 1% significance levels.

The second question asks respondents: *Which one category best describes your racial background?*A similar pattern is observed for this question too. The majority of Black Americans hat is at least overweight is 61.9%and for American Indian we reach the 83.3% (with a pick of 13.8 of individuals falling in obese class III).The Pearson Chi-square test was significant at the 99% - confirming that the frequency distribution was not "casual".

The third question asks to the interviewer to check for the validity of the precedent answer: "*Please code the race of the respondent from your own observation alone*". Although crosstabs revealed similar patterns, the highest number of non-answers did not allow making proper conclusions upon the significance of the observed frequencies.

For Hispanic population there is a separate classification. Respondents who identified themselves as Hispanic have an average higher BMI than those who did not (27.13).

Maternal and paternal weight and health status

In the Parent Questionnaire some questions were related to parental health status. One of the limits of this investigation is that we do not know how the health status of the parents was before the child was born. However we assume that no significantly variations have occurred. Interviewed parents were asked to answer the following questions on a Likert scale from 1 (excellent) to 5 (poor): *How is your general physical health? How is your current (spouse/ partner)'s general health?* Interestingly we can observe a trend: the lower the health status level, the higher the percentage of overweight or obese adolescents. This pattern is confirmed for the second question (the one about partner's health status). For example, considering those who answered "poor" the trend is 17.3%, 10.3% and 7.1% for respectively obese I, II and III class in the first question and 13.9%, 7.4% and 7.4% in the second question. Again Chi-square test was significant at the 99% confidence level.

Parents were also asked if they have diabetes. Test on means reveal that BMI is significantly higher for adolescent with diabetic mom (29.54 versus 26.42) and also with a diabetic dad (28.10 versus 26.40). Parents were also asked if they were obese. Similar pattern are observed and are even more pronounced: BMI of adolescent with an obese mom is higher than for those without (29.2 versus 25.9) and the same is true for dad (29.8 versus 26.25). We conclude that a poor paternal and maternal health status increases the

likelihood of being overweight or obese of their children. Maternal health status seems to count more than paternal.

3.4Primary Socialization and Family Characteristics

In this section we will discuss the role of the following factors: breastfeeding length, parental lifestyle, family income, parental education and age and parental integration in the neighborhood.

3.4.1 Evidence from the literature

Breastfeeding length

It has been shown that breastfeeding works as a protective factor against the possibility of becoming obese later on in life (29).There is a strong link between the length of breastfeeding and the propensity of being overweight in childhood and later on in life. The explanation is that infants who had been breastfed are more likely to introduce and to accept new foods in their future diet, because they were already used to be fed by maternal milk which contains flavors of different foods. For a detailed discussion about the role of breastfeeding see Part III.

Parental lifestyle (smoking and drinking)

Parental lifestyle may impact on children obesity because of the transmission of habits. For example children of parents who are smokers have been recognized to have a higher probability of become overweight and obese than children of non-smokers parents. Same patterns are observed for children of parents who habitually drink alcohol (30).

Family Income

Income and education strongly limit the possibility for individuals not only to make healthier choices but also to buy healthier foods. There is large evidence in the literature showing how obesity rates are higher for low income individuals and this has been confirmed by both national statistics and academic literature. For a detailed discussion about the role played by income and education see Part III.

Parental Education and age and family structure/habits

Another important variable related to children overweight and obesity is parental education (25). Education is important to the extent that parents may be informed about their food choices as well as their capacity to adjust their behavior after having received messages from health campaigns. For a detailed discussion see Part III.

Parental integration in the neighborhood

Parental integration in the neighborhood as well as social norms play an important role in shaping children habits – food habits included – as well as their predisposition of being overweight or obese.According to (31)family SES and neighborhood SES predicted negative psychological characteristics and experiences such as hostility and

discrimination. Social marginalization has already been explored in Add Health dataset and similar results have been confirmed by clinical academic literature (32).

3.4.2 Evidence from the Add Health Survey

Breastfeeding length

When asked for how long was {NAME} breastfed? Answers were grouped as follows: less than three months, between three and six months, between six and nine, between nine and twelve, between twelve and twenty-four, more than twenty four and (he/she) was not breastfed. Overall 44% of respondents have been breastfed, while 56% were not. For simplicity we have binned the variable into two categories and tested if the average BMI was significantly different. There is a small difference in the average BMI 99% confidence interval, suggesting that individuals who have been breastfed are more likely to have a higher weight than those who are not (26.13 against 26.92).

Parental lifestyle (smoking and drinking)

Two questions investigated if in the household there were smokers: *Are there any cigarette smokers in your household? Do you smoke?* We again observe slightly differences between the average BMI of those who answered yes which is slightly higher, for both questions. Respectively we observe an average BMI of 27.0 versus 26.18 for the first question and of 27.08 versus 26.86 for the second.

Concerning alcohol consumption a question asked: *How often do you drink alcohol?* Except for obese class I – where a higher frequency of alcohol consumption is observed,

it is difficult to individuate a systematic trend in our sample and the frequency distribution was not significant.

Family Income and parental education

The In-Parent questionnaire included a specific question about income. Specifically it asked: *"About how much total income, before taxes did your family receives in 1994? Include your own income, the income of everyone else in your household, and income from welfare benefits, dividends, and all other sources"*. A negative correlation is observed ($\rho = -0.058$) significant at the 0.01 level. This means that the higher the BMI, the lower the income.

Parental Education and age and family structure/habits

Again in the parent questionnaire, two questions investigated parental education. The first asked *How far did you go in school?* And the second *How far did your current (spouse/ partner) go in school?*Answers included a high number of options: 8th grade or less, 2 more than 8th grade, but did not graduate from high school, went to a business, trade, or vocational school instead of high school, high school graduate, completed a GED, went to a business, trade or vocational school after high school, went to college, but did not graduate, graduated from a college or university, professional training beyond a 4-year college or university, never went to school. Chi-square was significant at the 0.005 level. Although many were the categories employed, we observe a linear inverse trend in virtue of which wherever low educated parents are observed there is a higher concentration of obese or overweight people. For example if we take the lowest educational category (8^{th}

grade or less) normal weight are38.4% while overweight, obese class I,II and III are respectively 33.1%, 13.9%, 7.3% and 4.9% for the first question. Similar pattern are observed for the spouse education level. On the opposite if we take the highest level (graduated from college or university) we have 43.8% of normal weight followed by 32.9%, 12%, 4.4% and 2.6% for overweight and obese I,II and III class. Again a similar pattern is observed for interviewer's spouse.For a better understanding of the family environment, we have analyzed the link between BMI and answers to the following questions of the In-Home questionnaire:

"Do your parents let make you your own decision about: the time you must be home on weekend nights? The people you hang around with? How much television you watch? Which television programs you watch? What time you go to bed on week nights? What you eat?"

We always observe a significant difference in average BMI between individuals who answered yes and those who answered no. The situation can be summarized by the following Table.

Table 3.1 – Parental Relations and average BMI

	Average BMI yes	Average BMI no	Confidence Interval
The time you must be home on weekend nights?	27.19	26.32	99%
The people you hang around with?	26.59	26.71	99%
How much television you watch?	26.01	26.74	99%
Which television programs you watch?	26.74	26.14	95%
What time you go to bed on week nights?	26.82	26.21	99%
What you eat	26.77	25.88	99%

This result suggest that adolescent with a higher degree of freedom (or who have less attention from parents) are more likely to have a higher BMI than those who are more controlled by parents.

Parental integration in the neighborhood

We have then explored if the community's participation of parents with overweight and obese children is different from parents of normal weight individuals. These questions also give us a grasp of how respondent's families are well integrated in the neighborhood. The questions were the following: "*Please tell me whether each of the following statements is true with regard to your present neighborhood.* Answer to the statement was given using a dummy response. In the Table below we report significant difference in means as we did before.

Table 3.2 – Parental integration in the neighborhood and average BMI

	Average BMI yes	Average BMI no	Confidence Interval
Your household lives here because this neighborhood is close to a place where you (or your spouse or partner) used to work	26.27	26.65	95%
You moved to this neighborhood because you had outgrown your previous housing	26.31	26.70	95%
You live here because there is less crime in this neighborhood than there is in other neighborhoods	26.41	26.80	95%
You (or your spouse or partners) were born in this neighborhood.	27.02	26.40	99%

At a first glance it would seem that those who are more likely to have a higher BMI, live in their neighborhood more by "chance". All of the answer would however suggest how income plays a significant role. Having a higher income allows individuals to have more

possibilities of making better choices when it comes to decide where to live. And we argue that this is particularly true in the United States. This evidence is strengthened by the last questions suggesting that individuals with a higher BMI have less opportunity to take advantage of mobility.

3.4 Secondary socialization and environmental factors

The secondary socialization level tests the influence of the following factors: the length of time spent in the current residence, the school environment, neighborhood characteristics, the role of peer effect and social norms (different from those developed within family), Preferred Activities done with peers (sport, going for drinks, etc.), mass media, advertising exposure and hours spent in front of the computer and the general school environment.

3.4.1 Evidence from the literature

Length of times in the current residence

There is a relation between obesity and mobility because of the change of habits is related to a change in the environment and weight adjustments are thus more likely to occur. People are more likely to change their habits when they also change the environment (33). Nevertheless the relation between obesity and mobility should be supported by more evidence, for example it would be useful to characterize who are those who moved

in the last five years and why did they move: income disparities or family adjustments could be a reason why people have to change home (and are likely to be related to food habits too).

School Environment and performance

The relation between school performance and nutrition is a current topic of study but still it is not clear why these differences exist. Some argue is because obese students skip more days at school and thus would depend by their family characteristics (34). Others address the role of healthy nutrition as a key factor in developing adequate learning skills (35). Even if controversial, the issue is however important to the extent that these differences may have consequences on the future human capital, especially given the significant rise in children obesity. Some questions addressed how the students perceive their school environment. When asked their agreement that teachers treat students fairly, overweight and obese were more likely to disagree than normal weight. The level of disagreement is systematically higher for those who are overweight (and up) respect to normal-weight individuals. This trend is confirmed by both In-School and In-Home questionnaires, despite is more pronounced for the In-Home questionnaire probably because students at home feel more comfortable in telling the truth than when are at school. The role played by the academic environment in influencing scholastic performance is one classical topic of the academic literature and this evidence could be further explored.

Neighborhood characteristics

The role of the built environment has been recognized to be important in affecting BMI. For example the lack of sidewalks, parks or recreation centers limit the individual possibility of walking or doing sports (36). For a detailed description on the role of built environment see Part III.

Peer Effect and social norms (different from those developed within family)

A recent topic recently investigated in obesity literature is the role played by peers. If my friends are overweight and obese, which is the probability that I will become obese too?To explain the causal relation, usually three effects are used. As in Manski (37) these three effects are the endogenous, the exogenous and the correlated effect. We observe an endogenous effect if individual weight adjustments are caused by peers' behavior. An exogenous effect (also known as environmental or contextual) is more likely to explain the causality if individual weight adjustments are influenced not directly by peers' behavior but by peers' characteristics. For example, confounding factors may be the socio-economic status of families or the sharing of a common environment. Finally there is a correlate effect if people behavior and the choice of friends with who to hang out is led by a self-selection and, for example, the choice of friends depends on some unobservable preferences, such as taste or habits. To understand if a peers' effect exists is as important as challenging. It is important because if an endogenous effect exists there is also a social multiplier of a certain behavior that means a better allocation of financial resources when coming to policies aimed at tackling obesity. Suppose, for example, that an intervention targets a limited group of people. Under the assumption of endogenous effect, a positive policy response can provide benefits to people outside the treatment but

connected to the experimental group.However it is challenging because – unless research is properly designed – it is hard to overcome the reflection problem (econometrically) and distinguishes who influenced whom in social interactions of human behavior. There still not enough evidence for better explaining which the prevailing effect is. Finally under the assumption that obese are more likely to avoid direct relations with their peers, they may rely more on the potential of the virtual worlds to build a social identity that give them more confidence. This could also lead to a vicious circle since the number of daily hours spent in front of a screen is negatively related to the number of calories burnt.

Foodhabits and mass media exposure

It is straightforward that food habits influence diets and thus increase the possibility of being overweight and obese. Media exposure is also a crucial factor. Several studies show how junk food advertising increase the likelihood of consuming high-caloric food and ultimately of being overweight (38). This is also why there are some public policy makers that have suggested imposing strict rule on advertising targeting children.

3.4.2 Evidence from the Add Health Survey

Length of times in the current residence

Respondents were asked to indicate the year they moved in the current residence. On the basis of the answer and to their age, I have grouped the age at which respondents moved in the current residence. Results would suggestthat individuals who have been lived for a long time in the same neighborhood have, on average, a higher BMI. For example, 32.4% of pre-obese teen agers have never changed their residence since birth, while27.4%

changed their residence more recently; 3.2% of obese class II have never moved and 1.8 did it recently.However this trend is unclear for other classes and we suggest thatfurther analysis is needed for understanding the relation between weight and a change of the environment (and presumably of habits).

School Environment

Is overweight and obese teenager's school performance as good (or as bad) as normal weight people? When crossing BMI with data on school grades, evidence suggests that the school performance is slightly inferior for overweight and obese subjects. In the In-School questionnaire individuals had to answer to the question: *"At the most recent grading period, what was your grade in each of the following subjects (English, Mathematics, History/Social Studies and Science?"*

Concerning English class, overweight and obese individual are more likely to obtain C and D score than normal weight do. For example the average BMI of teenagers scoring A is 25.68 and the average BMI of teens scoring D or lower is 27.08. This difference is significant at the 99% level. Same situation is observed for Math (25.75 versus 27.29), History (25.88 versus 27.67) and Science (26.01 versus 27.26). We argue that there is a sort of linear inverse trend: the higher the weight the lower the school performance. However school performance may be also related to parental education and income.

Neighborhood characteristics

In the In-Home questionnaire a battery of questions investigate the relation between the adolescent and the people living in the same neighborhood. Answers were dummy

(true/false and yes/no). We tested the difference in the average BMI and the questions that resulted to have a different BMI distribution were *"Do you usually feel safe in your neighborhood?"* and "*On the whole, how happy are you with living in your neighborhood?*" For the first question, the average BMI of those who answered yes was 26.57 and the average BMI of those who answered no was 27.27. These means are difference at the 0.001 confidence level. For the second question, normal weight that answered "not at all" was 36.7% and those who answered "very much" were 41.3%. The correspondent percentages observed for pre-obese were 38.4% (very much) and for obese class III 3.4% (not at all). Concerning happiness, unhappy adolescents have a higher BMI than their happier peers (26.50 against 27.49). This difference was significant at the 0.05 level.

Peer Effect/Relation with friends (different from those developed within family)

Social marginalization may be linked to obesity and overweight. Specifically here we observe whether overweight and obese people are more or less sociable than their normal weight peers and the differences in their "socialization" skills. Overweight and obese people are usually less sociable than their normal weight peers, are more easily marginalized and derided. Although many efforts are taking place against the so called "weight stigma" (39), overweight and obese individuals are still more likely to suffer of social marginalization.

In the In-Home questionnaire respondents were asked to list some up to five of their friends together with some other features characterizing their friendship. The great majority of respondents indicated only one friend of each category. Even though, when

relative frequencies were crossed with BMI classes some interesting observations can be made. In the following Table we summarize the result founded for female and male friend. Results were statistically significant at the 0.000 level.

Table 3.3 Adolescent and friends

MALE FRIEND	Average BMI yes	Average BMI no	Confidence Interval
Did you go to {NAME}'s house during the past seven days?	26.87	26.44	90%
Did you talk to {NAME} on the telephone during the past seven days?	26.45	27.12	99%
FEMALE FRIEND			
Does {NAME} go to school?	26.46	27.89	95%
Did you meet {NAME} after school to hang out or go somewhere during the past seven days?	26.38	26.76	95%
Did you spend time with {NAME} during the past weekend?	26.40	26.75	95%

Concerning friendship with peers we observe that overweight and obese people are likely to be less sociable than their normal weight friends, whether they are male or female. Indeed for all the answers pointing out towards this direction, we always observe a slightly higher BMI. However we actually observe only very small differences mainly decimal. To reduce the effect of means, further analysis is surely needed.

Foodhabits and mass media exposure

We have then analyzed BMI mean differences controlling for different food habits. Respondents were asked to mark a series of food items to indicate their preference for breakfast. Differences are reported in the following Table. All values were statistically significant at the 0.000 level.

Table 3.4 BMI and food habits

What do you usually have for breakfast on a weekday morning?	Average BMI Marked	Average BMI Not marked	Confidence Interval
Milk	26.26	27.17	99%
Cereal	26.14	27.17	99%
Fruit juice	26.26	26.83	99%
Eggs	27.11	26.54	99%
Meat	27.27	26.56	99%
Bread, toast or rolls	26.36	26.80	99%
Nothing	26.74	26.80	99%

From the Table above it emerges that the non-consumption of milk, cereal andfruit juice is related to an average higher BMI, while the consumption of eggs, meat, bread or the habit of skipping breakfast is associated to a higher BMI. This last evidence is coherent with some other findings in the academic literature (40).

3.4 Personality traits and other behavioral factors

In this paragraph we finally discuss the relation between obesity traits and other personality traits which we assume are the result from the complex interaction between pre-birth factors, primary and secondary socialization.

3.4.1 Evidence from the literature

Self-perception

Self-perception is a topic that has been largely studied in cognitive psychology and in studies on personality. An exhaustive definition, that summarizes the work made by Skinner, Mead and Ryle between the thirties and sixties, can be found in (41). It is defined as follows: "*Self-perception, an individual's ability to respond differentially to his own behavior and its controlling variables, is a product of social interaction. Verbal statements that are self-descriptive are among the most common responses comprising self-perception, and the techniques employed by the community to teach its members to make such statements would not seem to differ fundamentally from the methods used to teach interpersonal perception in general*".

Self-perception is thus a construct resulting from an inner self-perception and from the connotation of messages from the community individuals live in. In the academic literature the relation between self-perception and obesity has been largely studied. For example it has been shown how an incorrect self-perception is more likely to exist for White women. Also both the correct and incorrect perception of overweight was more common in normal weight and overweight white women compared with black women. This is a sign of how cultural norms play a role in determining self-perception. For a detailed analysis on cultural norms see Part III. In this model we consider cultural norms as a pre-existing factor (42). It is well acknowledged that in some countries – as in India, Africa or in the Middle East – being overweight is still associated to wealth and prosperity while being normal weight (or thin) is negatively perceived. From our observations, this cultural trait seems to persist even when individuals are not in the environment from where this norm comes from.

Addiction

Food addiction is a topic that has been also studied in the literature. Most findings come from neuroscience. An interesting aspect is the interrelation between food addiction, drug addiction and obesity. There is a sort of predisposition of developing addicted behaviors, partly driven by genetics partly by the environment and motivational inputs. According to the authors, obesity and addiction are special cases of the consequences of ingestive behavior gone awry. Each develops in some but not all individuals, and each is subject to genetic predispositions and the availability of a powerful reinforce. In each case, there appear to be periods of developmental vulnerability (43).

Self-Efficacy

Self-efficacy can be defined as the individual's belief in his or her ability to perform and succeed in challenging situations (44). The psychological literature on obesity and self-efficacy has shown that obese people have generally less self-efficacy respect to their normal weight peers. However it is not clear yet which is the role of self-efficacy in preventing people from sticking to their. There is evidence in the literature that a lack of self-efficacy can impede the success of weight loss programs (45).

The problem of self-efficacy is that varies during a lifetime. Individuals may feel more confident is some periods or in some circumstances; while in others they may experience a lack of self-confidence.

Risk-taking

In general risky behaviors are related to individual health. The more an individual is risk-adverse, the less likely he or she will engage in risky behaviors. For example there is evidence that overweight and obesity were significantly associated with substance use among girls only: Frequent smoking and drinking were associated with overweight and obesity among younger girls, whereas these behaviors were associated with obesity among older girls. Frequent smoking and cannabis use were associated with overweight among younger girls only. Relationships between violent behavior and overweight/obesity were mainly observed among boys: Younger obese boys were more likely to be victims of bullying, whereas older obese boys were more likely to carry weapons compared to boys of normal weight (46).

3.4.1 Evidence from Add Health Survey

Self-perception

The aim of this paragraph is to understand how obese teen agers perceive themselves in term of general health and weight. How aware are about their health status according to their BMI? In the In-home questionnaire some questions addressed this issue. Respondents were asked how they perceive themselves in terms of weight, how is their general health and if they like themselves the way they are. Among those who rated their health status as “excellent” results indicate a good level of awareness: the higher the health status, the lower the percentage. For example 45.5% of normal height individuals rated their health status as excellent while only 1.5% of severe obese (class III) did it (which however is a percentage). Pre-obese teens who answered excellent were 32.3%. It

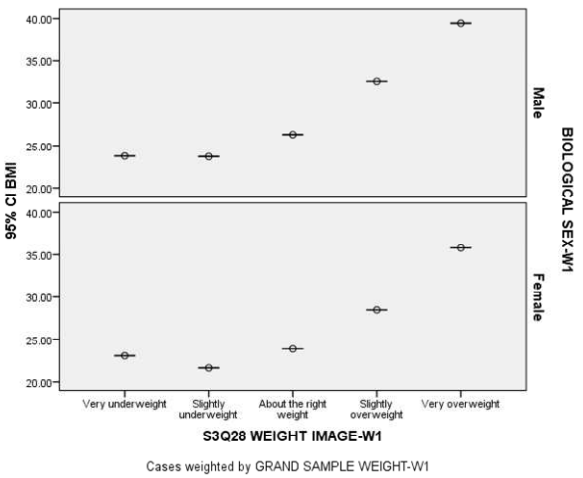
seems that, instead of giving “negative” answers such as fair or poor, obese individuals are more likely to answer “good”. Among those who rated their health status good, the observed percentages are the following: normal weight individuals were 44.5%, overweight (pre-obese) individuals 32.6%, obese class I 11.9%, obese class II 5.4% and obese class III 2.5%. Pearson Chi-square test was significant at the 0.000 level. Concerning the weight image similar results emerged. There is an average correct evaluation by individuals. Again the majority of obese individuals instead of rating themselves as objectively overweight, they give the “less bad” option that is “slightly overweight”. Specifically 33% of overweight individuals rated themselves as slightly overweight, 48% obese I class, 57.8 obese II class and 56.4 obese III class. Results and proportions were significant at the 0.000 level. It would be interesting to understand if their answers are led by a real self-perception or by the shyness of expressing their real perceptions. Finally concerning the degree individuals like themselves the way they are again we do not observe any particular trend. The majority in all classes of weight said that they like themselves (whether they strongly agree or strongly disagree). The fact that weight image can be considered a cultural norm is confirmed if we observe the error bars reported in Figure 3.1. In the Add-health sample there is a strong relation between weight perception and ethnicity controlling for BMI.There is a discrepancy between actual weight and weight perception that strongly varies with ethnicity. For Hispanic population we observe a misperception for all categories and particularly for those who perceive themselves as underweight and very overweight. The same pattern is observed for Black Americans with a peak of incongruence for very overweight individuals. American Indians also perceive themselves as more overweight than individuals with other

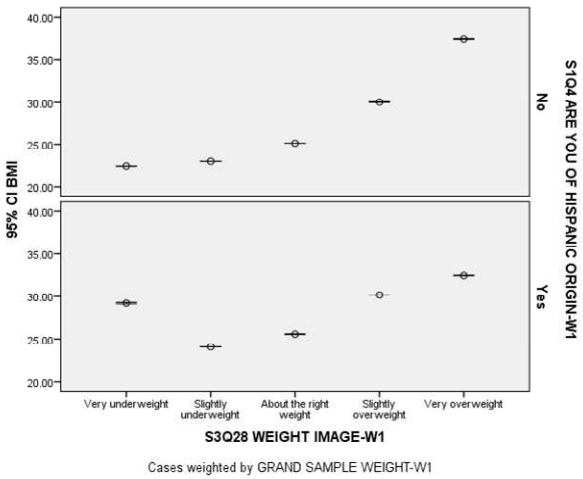
backgrounds and this is particularly true for those who perceive themselves as very underweight when they are actually normal weight. Finally for Asian population the other way around is valid: although they have an average lower BMI than other ethnicities, their self-evaluation systematically undervalues their actual weight.

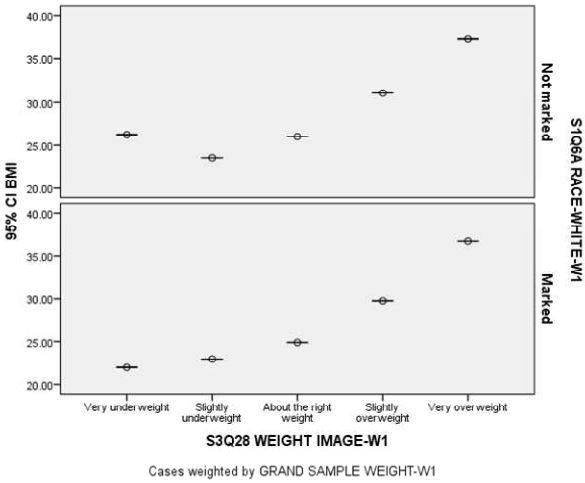
Addiction

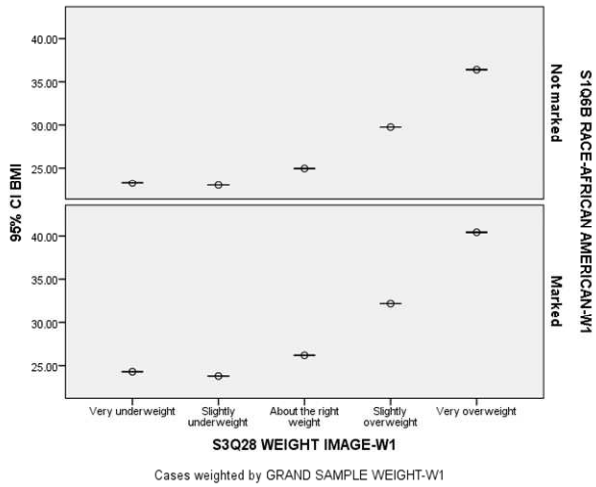
In the Add Health sample we used smoking and drinking as proxies for addictive behaviors. Respondents were asked if they have ever smoked a cigarette. Although this question it does not imply an addiction to cigarettes, test on means - significant at the 99% - reveals that individuals that have already tried to smoke have a BMI of almost one point higher than those who have not - 26.91 for individuals that tried at least once, and 26.28 for those who never tried. Respondents were also asked if they have you had a drink of beer, wine, or liquor—not just a sip or a taste of someone else's drink—more than 2 or 3 times in their life. A specular result emerged: those who have already tried have a BMI higher than those who have not almost one point (26.91 versus 26.28). This difference was significant at the 99%.

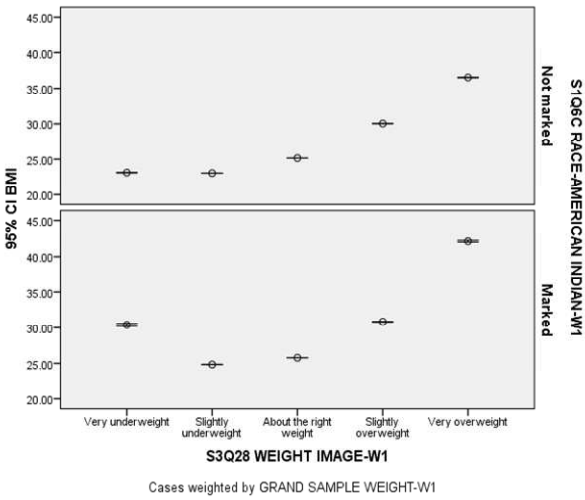
Figure 3.1. BMI, sex, ethnicity and self-perception

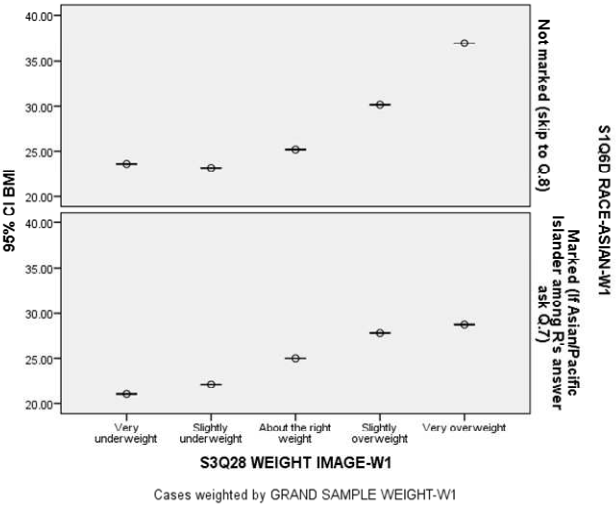












Self-Efficacy

We have identified two questions that can be considered proxies for self-efficacy. The first one asked respondents: *"how sure are you that you could resist sexual intercourse if your partner did not want to use some form of birth control?"* and the second "*I feel like I am doing everything just right*".Concerning the first question we have used the Explore command. We observe a trend that suggests that the higher weight, the higher the level of uncertainty. For example, the observed percentage of those who answered sure were 37.9 for normal weight individuals, 35.2% of pre-obese, 15.6% obese class I, 6.3% obese class II and 4.15 obese class III. Similar situation is observed for those who answered "very unsure". Normo weight was 24.1% and pre-obese 39.6%. Chi-square test was significant with a 99% confidence level.

A similar pattern is observed for the second questions. Individuals who think they are not doing right enough have, on average, a higher BMI than those who believe they do. For example observed percentages among those who answered strongly agree are the following: normal weight 43.9%, pre-obese 29.4%, obese class I 14.3%, obese class II 6.3%, obese class III 2.9%.

Risk-taking

Finally we analyze the relation between risky behaviors and obesity. To measure risk propensity we have selected the following five questions from the General Health Section of the questionnaire: (1) how often do you wear a helmet when you ride a bicycle? (2) During the past 12 months, how often did you ride a motorcycle?(3) When you rode a motorcycle during the past 12 months, how often did you wear a helmet?(4) How often do you wear a seatbelt when you are riding in or driving a car?(5) During the past 30

days, how often did you drive a car or othervehicle when you had been drinking alcohol? Using the explore command we have evaluated the differences in average BMI across categories. A significant pattern is present for only the frequency with which respondents are used to wear a helmet. Teens who always answer a helmet when riding a helmet is the following: normo weight 39.8%, pre-obese 32.9%, obese class I 15.2%, obese class II 6% and obese class III 3.9. Teens that always wear a helmet when riding a bicycle were 41.8% normal weight, 32% pre-obese, 13.9 obese I, 5.6 obese II and 3.3 obese III.

Although we are not able to evaluate if respondents tried to give the most desirable answers for some questions, these patterns suggest a clear trend: the higher the weight the more the likelihood of engaging in risky behaviors.

CHAPTER 4
Conclusions, Limits and Further Research

4.1. Conclusion

According to our analysis all the variables resulted to have significant relations with BMI as postulated in the model. These findings would thus confirm that obesity is a complex phenomenon that needs to be studied under different perspectives. In Figure 4.1 we summarize all the variables included in the model. Given the complexity of the factors involved we claim here that fighting obesity in a systematic manner, without using any paternalistic approach in public policy design, may be seriously hard. Looking for the "magic" ingredient to fight obesity and that can change individuals behavior may be challenged. Most likely obesity will keep affecting disadvantaged people and the scissors between healthy and non-healthy individuals will increase instead of decreasing. It has to be said – however – that the most effective public intervention conducted so far opted for a synergic approach. They fight obesity from different point of views and this happens all at once. We argue here that solving obesity it will not be the result of efficient intervention aimed at changing behaviors but from technology development. It is of course desirable that individual all over the world will make informed choices, but more

radical solutions are more likely to come from medical and technological environment. Research should focus on genetics and metabolism research (which is actually happening nowadays) as well as on food product development. For example there are a lot of products that – although maintain the original flavor – have a reduced amount of calories. A risk of this approach should be employing all natural ingredients, avoiding the use of chemicals that may harmful for human health.

4.2. Limits and further research

We conclude listing some limits of our research. Firstly the model should be tested more accurately and using more sophisticated techniques able to capture causality between BMI and the variables in the model as well as their interactions. This limit is well summarized by Weinstein (2007). that criticizes the tendency of testing models (especially in health behavior science) using only correlation techniques. A second limit of this work is related to the fact that the model should be tested not only on a cohort of adolescents but also of adults.

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APPENDIX

The Add Health survey in brief

The National Longitudinal Survey of Adolescent Health (Add Health) is a national survey conducted by the UNC Carolina Population Center, representative of the US adolescents between 7th and 12th grade (aged from 12-13 to 18-19 years). It includes a broad range of information: from social, economic, physical well-being data to contextual, neighborhood, friendship, peer groups and propensity to undertake risk behaviors. The data used in this research are taken from Wave I and the Wave II which cover a two-year period, from 1994 to 1996. Specifically, among the public-use dataset we have selected In-school Questionnaires, Wave I and II in home interviews, Wave I parent questionnaire, contextual data and in-school network data. The picture[15] below summarizes the sampling structure. The In-school questionnaires and the In-home questionnaires of the following waves are based on this core sample. The primary sampling frame for Add Health has been collected by Quality Education Data. Eighty high schoolswere selected through a stratified procedure and are representative of US school with respect of region of country, urbanicity, size, type and ethnicity. Feeder schools are those who included a seventh grade and sent at least five graduates from that high school.

In school questionnaires were self-administrated and submitted to 90.000 high school students.

[15] Adapted from http://www.cpc.unc.edu/projects/addhealth/design/wave1

In-home samples included students who participated and complete the in in-school questionnaire, plus those who didn't complete it but were eligible. A total core sample of 12.105 students was selected. In-home sample includes four special oversamples: ethnic sample, saturation, disabled and genetic. The first one includes the following units: 1,038 blacks from well-educated families (with a parent with a college degree), 334 Chinese, 450 Cuban, 437 Puerto Rican. In addition, the main sample contains more than 1,500 Mexican-Americans and significant numbers of Nicaraguans, Japanese, South Koreans, Filipinos, and Vietnamese. Both Wave I and Wave II In-home questionnaire include sections related social and demographic characteristics of respondents (of interest both as data and as selection criteria for in-home special samples), education and occupation of parents, household structure, risk behaviors, expectations for the future, self-esteem, health status, friendships, school-year extracurricular activities. Wave II in-home questionnaire adds sections on sun exposure and on nutrition habits. Obviously, questions on attribute that do not change (as ethnicity) were not repeated, as well as questions relative to physical limitations since disabled sample was not included in Wave II. Plus, weight and height were self-reported in Wave I, while directly measured in Wave II.

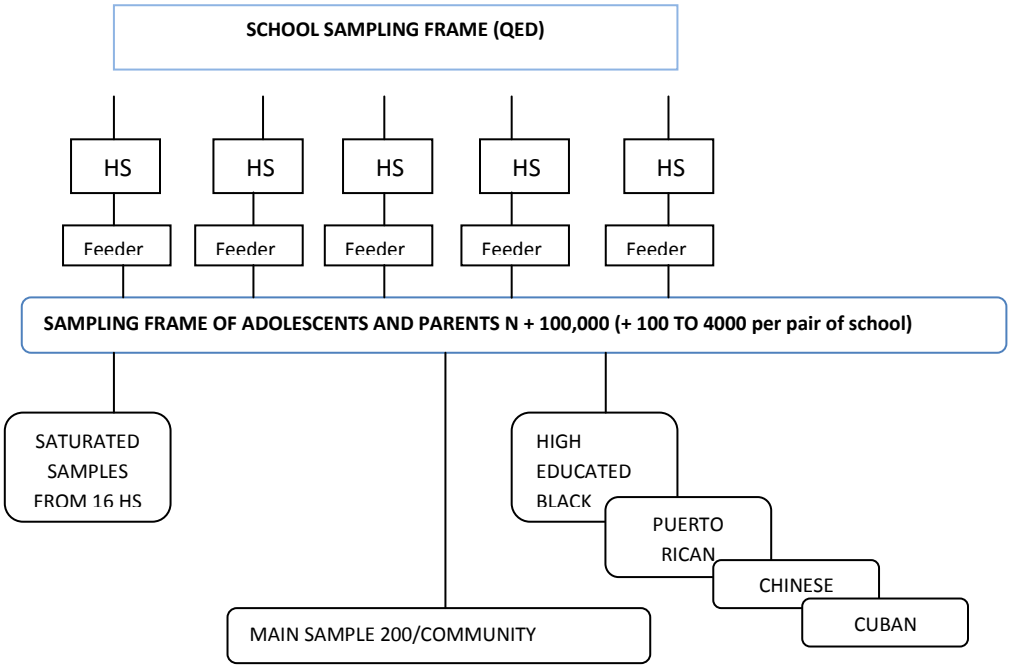
Parent questionnaire is a 40 minutes interview for one parent of the adolescent. It is a self-administrated and paper-pencil survey that includes questions on socio-demographics, attitudes and behaviors. Wherever possible, the mother is the desired respondent. According to some researchers mothers are generally more familiar with the schooling, health status and health behavior of their children. The structure of women labor force however has changed since Wave I. Recent surveys, for example, show

evidence that a reduction in the amount of time that mothers spent with their children is related to the spread-out of childhood obesity5.

Parent questionnaire consists of four sections: core questions (A), current spouse or partner (B), Child Specific questions (C) and twin (D).

The aim of this section is to observe whether there are significant differences between parental answers' distribution and the BMI of the adolescent.

Figure 1Sampling Procedure of Add Health



Statistical analysis (summary)

Group Statistics

S1Q6A RACE-WHITE-W1	N	Mean	Std. Deviation	Std. Error Mean

BMI	Marked	4162	26.3781	5.84191	.09055
	Not marked	1704	27.3062	6.47519	.15686

Group Statistics

	S1Q6B RACE-AFRICAN AMERICAN-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Marked	1136	27.5429	6.30487	.18706
	Not marked	4730	26.4327	5.96395	.08672

Group Statistics

	S1Q6C RACE-AMERICAN INDIAN-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Marked	215	28.5099	7.91017	.53947
	Not marked	5651	26.5768	5.95391	.07920

Group Statistics

	S1Q6D RACE-ASIAN-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Marked (If Asian/Pacific Islander among R's answer ask Q.7)	260	25.3036	5.25852	.32612
	Not marked (skip to Q.8)	5606	26.7100	6.07415	.08113

Group Statistics

	S1Q6E RACE-OTHER-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Marked	396	27.1406	6.03601	.30332
	Not marked	5470	26.6120	6.04664	.08176

BMI (Binned) * A9 RACE, OBSERVATION OF INTERVIEWER-PQ Crosstabulation

			A9 RACE, OBSERVATION OF INTERVIEWER-PQ				Total
			White	Black/African American	American Indian/Native American	Asian/Pacific Islander	
BMI (Binned)	sever thinness UW	Count	9_{a}	$4_{a, b}$	$1_{a, b}$	3_{b}	17
		% within A9 RACE, OBSERVATION OF INTERVIEWER-PQ	.2%	.5%	1.3%	1.8%	.3%
	moderate thinness UW	Count	34_{a}	7_{a}	0_{a}	2_{a}	43
		% within A9 RACE, OBSERVATION OF INTERVIEWER-PQ	.9%	.8%	.0%	1.2%	.9%
	mild thinnes UW	Count	84_{a}	14_{a}	0_{a}	5_{a}	103
		% within A9 RACE, OBSERVATION OF INTERVIEWER-PQ	2.2%	1.6%	.0%	3.0%	2.1%
	normal weight	Count	1651_{a}	305_{b}	$28_{a, b}$	86_{a}	2070
		% within A9 RACE, OBSERVATION OF INTERVIEWER-PQ	**43.0%**	**35.2%**	**35.0%**	**51.5%**	**41.8%**
	pre-obese	Count	$1231_{a, b}$	309_{b}	$23_{a, b}$	39_{a}	1602
		% within A9 RACE, OBSERVATION OF INTERVIEWER-PQ	**32.0%**	**35.7%**	**28.7%**	**23.4%**	**32.3%**
	obese class I	Count	498_{a}	130_{a}	13_{a}	24_{a}	665
		% within A9 RACE, OBSERVATION OF INTERVIEWER-PQ	**13.0%**	**15.0%**	**16.3%**	**14.4%**	**13.4%**
	obese	Count	229_{a}	59_{a}	4_{a}	6_{a}	298

	class II	% within A9 RACE, OBSERVATION OF INTERVIEWER-PQ	**6.0%**	**6.8%**	**5.0%**	**3.6%**	**6.0%**
	obese class III	Count	107_a	38_a	11_b	2_a	158
		% within A9 RACE, OBSERVATION OF INTERVIEWER-PQ	**2.8%**	**4.4%**	**13.8%**	**1.2%**	**3.2%**
Total		Count	3843	866	80	167	4956
		% within A9 RACE, OBSERVATION OF INTERVIEWER-PQ	100.0%	100.0%	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	82.217[a]	21	.000
Likelihood Ratio	67.082	21	.000
Linear-by-Linear Association	.795	1	.373
N of Valid Cases	4956		

a. 9 cells (28.1%) have expected count less than 5. The minimum expected count is .27.

BMI (Binned) * A8B RACE, CHOOSE ONE ANSWER-PQ Crosstabulation

			A8B RACE, CHOOSE ONE ANSWER-PQ					
			White	Black/African American	American Indian/Native American	Asian/Pacific Islander	Other	Total
BMI (Binned)	moderate thinness UW	Count	1_a	0_a	0_a	0_a	1_a	2
		% within A8B RACE, CHOOSE ONE ANSWER-PQ	1.5%	.0%	.0%	.0%	10.0%	1.7%
	mild thinnes UW	Count	1_a	0_a	0_a	0_a	1_a	2
		% within A8B RACE, CHOOSE ONE ANSWER-PQ	1.5%	.0%	.0%	.0%	10.0%	1.7%
	normal weight	Count	27_a	4_a	6_a	1_a	3_a	41
		% within A8B RACE, CHOOSE ONE ANSWER-PQ	40.3%	18.2%	35.3%	25.0%	30.0%	34.2%
	pre-obese	Count	20_a	12_a	4_a	1_a	3_a	40
		% within A8B RACE, CHOOSE ONE ANSWER-PQ	29.9%	54.5%	23.5%	25.0%	30.0%	33.3%
	obese class I	Count	11_a	4_a	5_a	1_a	0_a	21
		% within A8B RACE, CHOOSE ONE ANSWER-PQ	16.4%	18.2%	29.4%	25.0%	.0%	17.5%
	obese	Count	4_a	2_a	2_a	1_a	0_a	9

	class II	% within A8B RACE, CHOOSE ONE ANSWER-PQ	6.0%	9.1%	11.8%	25.0%	.0%	7.5%
	obese class III	Count	3_a	0_a	0_a	0_a	2_a	5
		% within A8B RACE, CHOOSE ONE ANSWER-PQ	4.5%	.0%	.0%	.0%	20.0%	4.2%
Total		Count	67	22	17	4	10	120
		% within A8B RACE, CHOOSE ONE ANSWER-PQ	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Group Statistics

	S1Q4 ARE YOU OF HISPANIC ORIGIN-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Yes	698	27.1393	5.96231	.22568
	No	5164	26.5768	6.04506	.08412

BMI (Binned) * A58 GENERAL PHYSICAL HEALTH-PQ Crosstabulation

			A58 GENERAL PHYSICAL HEALTH-PQ					
			Excellent	Very good	Good	Fair	Poor	Total
BMI (Binned)	sever thinness UW	Count	4_a	7_a	2_a	3_a	0_a	16
		% within A58 GENERAL PHYSICAL HEALTH-PQ	.4%	.4%	.1%	.6%	.0%	.3%
	moderate thinness UW	Count	12_a	14_a	13_a	4_a	1_a	44
		% within A58 GENERAL PHYSICAL HEALTH-PQ	1.1%	.8%	.9%	.7%	.6%	.9%
	mild thinnes UW	Count	23_a	52_a	29_a	5_a	1_a	110
		% within A58 GENERAL PHYSICAL HEALTH-PQ	2.1%	2.9%	1.9%	.9%	.6%	2.2%
	normal weight	Count	527_a	$771_{a, b}$	$583_{b, c}$	189_c	$52_{b, c}$	2122
		% within A58 GENERAL PHYSICAL HEALTH-PQ	47.0%	43.3%	38.9%	35.4%	33.3%	41.7%
	pre-obese	Count	350_a	577_a	500_a	174_a	48_a	1649
		% within A58 GENERAL PHYSICAL HEALTH-PQ	31.2%	32.4%	33.3%	32.6%	30.8%	32.4%
	obese class I	Count	125_a	$223_{a, b}$	$219_{a, b}$	87_b	$27_{a, b}$	681
		% within A58 GENERAL PHYSICAL HEALTH-PQ	11.2%	12.5%	14.6%	16.3%	17.3%	13.4%
	obese class II	Count	$54_{a, b}$	88_b	114_c	$38_{a, b, c}$	$16_{a, c}$	310
		% within A58 GENERAL PHYSICAL HEALTH-PQ	4.8%	4.9%	7.6%	7.1%	10.3%	6.1%
	obese class III	Count	26_a	50_a	40_a	34_b	11_b	161
		% within A58 GENERAL PHYSICAL HEALTH-PQ	2.3%	2.8%	2.7%	6.4%	7.1%	3.2%
Total		Count	1121	1782	1500	534	156	5093
		% within A58 GENERAL PHYSICAL HEALTH-PQ	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

BMI (Binned) * B21 GENERAL HEALTH OF PARTNER-PQ Crosstabulation

			B21 GENERAL HEALTH OF PARTNER-PQ					
			Excellent	Very good	Good	Fair	Poor	Total
BMI	sever thinness UW	Count	$1_{a, b}$	$6_{a, b}$	2_b	$1_{a, b}$	2_a	12

(Binned)		% within B21 GENERAL HEALTH OF PARTNER-PQ	.1%	.5%	.2%	.3%	1.6%	.3%
	moderate thinness UW	Count	9_{a}	18_{a}	6_{a}	2_{a}	2_{a}	37
		% within B21 GENERAL HEALTH OF PARTNER-PQ	1.2%	1.4%	.5%	.5%	1.6%	1.0%
	mild thinnes UW	Count	21_{a}	41_{a}	23_{a}	6_{a}	1_{a}	92
		% within B21 GENERAL HEALTH OF PARTNER-PQ	2.8%	3.1%	1.9%	1.6%	.8%	2.4%
	normal weight	Count	334_{a}	591_{a}	$497_{a, b}$	$156_{a, b}$	36_{b}	1614
		% within B21 GENERAL HEALTH OF PARTNER-PQ	44.8%	44.6%	40.9%	40.4%	29.5%	42.6%
	pre-obese	Count	249_{a}	410_{a}	378_{a}	120_{a}	46_{a}	1203
		% within B21 GENERAL HEALTH OF PARTNER-PQ	33.4%	30.9%	31.1%	31.1%	37.7%	31.7%
	obese class I	Count	76_{a}	$162_{a, b}$	180_{b}	64_{b}	$17_{a, b}$	499
		% within B21 GENERAL HEALTH OF PARTNER-PQ	10.2%	12.2%	14.8%	16.6%	13.9%	13.2%
	obese class II	Count	41_{a}	73_{a}	83_{a}	22_{a}	9_{a}	228
		% within B21 GENERAL HEALTH OF PARTNER-PQ	5.5%	5.5%	6.8%	5.7%	7.4%	6.0%
	obese class III	Count	$14_{a, b}$	24_{b}	$46_{a, c}$	$15_{a, b, c}$	9_{c}	108
		% within B21 GENERAL HEALTH OF PARTNER-PQ	1.9%	1.8%	3.8%	3.9%	7.4%	2.8%
Total		Count	745	1325	1215	386	122	3793
		% within B21 GENERAL HEALTH OF PARTNER-PQ	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Group Statistics

	C49F_2 HEALTH PROB/DIABETES/BIO MOM-PQ	N	Mean	Std. Deviation	Std. Error Mean
BMI	Yes	195	29.5487	7.09485	.50807
	No	4780	26.4216	5.94244	.08595

Group Statistics

	C49F_3 HEALTH PROB/DIABETES/BIO DAD-PQ	N	Mean	Std. Deviation	Std. Error Mean
BMI	Yes	254	28.1011	7.54839	.47363
	No	4461	26.4022	5.89746	.08830

Group Statistics

	C49A_2 HEALTH PROB/OBESITY/BIO MOM-PQ	N	Mean	Std. Deviation	Std. Error Mean
BMI	Yes	927	29.2205	7.38122	.24243
	No	4112	25.9659	5.51954	.08607

Group Statistics

	C49A_3 HEALTH PROB/OBESITY/BIO DAD-PQ	N	Mean	Std. Deviation	Std. Error Mean

BMI	Yes	491	29.0890	7.40719	.33428
	No	4405	26.2555	5.77766	.08705

Group Statistics

	C20 LENGTH OF TIME BREASTFEEDING-PQ	N	Mean	Std. Deviation	Std. Error Mean
BMI	>= 7	2717	26.9251	6.33498	.12153
	< 7	2278	26.1305	5.66014	.11859

Group Statistics

	A63 CIGARETTE SMOKERS IN HOUSEHOLD-PQ	N	Mean	Std. Deviation	Std. Error Mean
BMI	No (skip to Section B)	2748	26.1875	5.83487	.11131
	Yes (go to A64)	2341	27.0012	6.18961	.12793

Group Statistics

	A64 DOES RESPONDENT SMOKE-PQ	N	Mean	Std. Deviation	Std. Error Mean
BMI	No	829	26.8673	6.01305	.20884
	Yes	1514	27.0826	6.28411	.16150

BMI (Binned) * A61 HOW OFTEN DRINK ALCOHOL-PQ Crosstabulation

			A61 HOW OFTEN DRINK ALCOHOL-PQ						
			Never	Once a month or less	Two or three days a month	Once or twice a week	3-5 days a week	Nearly everyday	Total
BMI (Binned)	sever thinness UW	Count	10_a	3_a	1_a	3_a	0_a	0_a	17
		% within A61 HOW OFTEN DRINK ALCOHOL-PQ	.5%	.2%	.2%	.6%	.0%	.0%	.3%
	moderate thinness UW	Count	16_a	15_a	5_a	5_a	2_a	1_a	44
		% within A61 HOW OFTEN DRINK ALCOHOL-PQ	.7%	.9%	1.0%	1.0%	1.7%	1.3%	.9%
	mild thinnes UW	Count	43_a	34_a	16_a	11_a	3_a	2_a	109
		% within A61 HOW OFTEN DRINK ALCOHOL-PQ	2.0%	2.1%	3.1%	2.1%	2.5%	2.5%	2.1%
	normal weight	Count	868_a	$690_{a, b}$	$215_{a, b}$	244_b	64_b	$36_{a, b}$	2117
		% within A61 HOW OFTEN DRINK ALCOHOL-PQ	39.5%	41.7%	41.7%	47.0%	53.3%	45.6%	41.6%
	pre-obese	Count	697_a	556_a	183_a	151_a	33_a	24_a	1644
		% within A61 HOW OFTEN DRINK ALCOHOL-PQ	31.7%	33.6%	35.5%	29.1%	27.5%	30.4%	32.3%
	obese class I	Count	326_a	212_a	61_a	58_a	12_a	12_a	681
		% within A61 HOW OFTEN DRINK ALCOHOL-PQ	14.8%	12.8%	11.8%	11.2%	10.0%	15.2%	13.4%
	obese	Count	155_a	94_a	24_a	30_a	4_a	3_a	310

	class II	% within A61 HOW OFTEN DRINK ALCOHOL-PQ	7.1%	5.7%	4.7%	5.8%	3.3%	3.8%	6.1%
	obese class III	Count	82[a]	49[a]	11[a]	17[a]	2[a]	1[a]	162
		% within A61 HOW OFTEN DRINK ALCOHOL-PQ	3.7%	3.0%	2.1%	3.3%	1.7%	1.3%	3.2%
Total		Count	2197	1653	516	519	120	79	5084
		% within A61 HOW OFTEN DRINK ALCOHOL-PQ	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Correlations

		BMI	A55 TOTAL HOUSEHOLD INCOME-PQ
BMI	Pearson Correlation	1	-.059**
	Sig. (1-tailed)		.000
	N	5878	4459
A55 TOTAL HOUSEHOLD INCOME-PQ	Pearson Correlation	-.059**	1
	Sig. (1-tailed)	.000	
	N	4459	4605

**. Correlation is significant at the 0.01 level (1-tailed).

BMI (Binned) * S14Q1 RES MOM-EDUCATION LEVEL-W1 Crosstabulation

			S14Q1 RES MOM-EDUCATION LEVEL-W1												
			8th grade or less	>8th grade/didn't graduate high school	Business/trade/voc. school instead high school	High school graduate	GED	Business/trade/voc. school after high school	College/didn't graduate	Graduated from college/university	Prof training beyond 4-year college/university	She never went to school	Went to school/Resp doesn't know level	Resp doesn't know if she went to school	Total
BMI (Binned)	severthinnessUW	Count	1[a]	0[a]	0[a]	6[a]	0[a]	2[a]	1[a]	7[a]	0[a]	0[a]	2[a]	0[a]	19
		% within S14Q1 RES MOM-EDUCATION LEVEL-W1	.4%	.0%	.0%	.4%	.0%	.5%	.1%	.7%	.0%	.0%	1.2%	.0%	.3%
	mo	Count	0[a]	5[a]	0[a]	18[a]	4[a]	3[a]	2[a]	11[a]	1[a]	0[a]	0[a]	0[a]	44

	derate thinness UW	% within S14Q1 RES MOM-EDUCATION LEVEL-W1	.0%	.9%	.0%	1.1%	1.9%	.8%	.3%	1.0%	.2%	.0%	.0%	.0%	.8%
	mild thinness UW	Count	5$_{a}$	9$_{a}$	2$_{a}$	31$_{a}$	1$_{a}$	6$_{a}$	18$_{a}$	28$_{a}$	7$_{a}$	0$_{a}$	3$_{a}$	0$_{a}$	110
		% within S14Q1 RES MOM-EDUCATION LEVEL-W1	2.0%	1.7%	5.0%	1.8%	.5%	1.6%	2.6%	2.7%	1.6%	.0%	1.9%	.0%	2.0%
	normal weight	Count	94$_{a}$	205$_{a}$	19$_{a}$	699$_{a}$	95$_{a}$	163$_{a}$	287$_{a}$	462$_{a}$	183$_{a}$	1$_{a}$	70$_{a}$	7$_{a}$	2285
		% within S14Q1 RES MOM-EDUCATION LEVEL-W1	38.4%	37.8%	47.5%	40.9%	46.1%	42.3%	41.4%	43.8%	42.3%	14.3%	43.5%	18.9%	41.4%
	pre-obese	Count	81$_{a, b}$	158$_{b}$	8$_{a, b}$	559$_{a, b}$	54$_{b}$	123$_{a, b}$	226$_{a, b}$	347$_{a, b}$	153$_{a, b}$	2$_{a, b}$	49$_{a, b}$	21$_{a}$	1781
		% within S14Q1 RES MOM-EDUCATION LEVEL-W1	33.1%	29.2%	20.0%	32.7%	26.2%	31.9%	32.6%	32.9%	35.3%	28.6%	30.4%	56.8%	32.3%
	obese class I	Count	34$_{a, b, c, d, e, f, g, h}$	87$_{a, b, c, d, e, f, g, h}$	6$_{a, b, c, d, e, f, g, h}$	230$_{a, b, c, d, e, f, g, h}$	25$_{e, f, g, h}$	51$_{a, b, c, d, e, f, g, h}$	103$_{a, b, c, d, e, f, g, h}$	127$_{c, d, g, h}$	56$_{b, d, f, h}$	4$_{a}$	25$_{a, b, c, d, e, f, g, h}$	5$_{a, b, c, d, e, f, g, h}$	753
		% within S14Q1 RES MOM-EDUCATION LEVEL-W1	13.9%	16.1%	15.0%	13.5%	12.1%	13.2%	14.9%	12.0%	12.9%	57.1%	15.5%	13.5%	13.7%
	obese	Count	18$_{a, b}$	47$_{b}$	2$_{a, b}$	118$_{a, b}$	18$_{a, b}$	19$_{a, b}$	34$_{a, b}$	46$_{a}$	22$_{a, b}$	0$_{a, b}$	7$_{a, b}$	2$_{a, b}$	333

	class II	% within S14Q1 RES MOM-EDUCATION LEVEL-W1	7.3%	8.7%	5.0%	6.9%	8.7%	4.9%	4.9%	4.4%	5.1%	.0%	4.3%	5.4%	6.0%
	obese class III	Count	12[a]	31[a]	3[a]	48[a]	9[a]	18[a]	22[a]	27[a]	11[a]	0[a]	5[a]	2[a]	188
		% within S14Q1 RES MOM-EDUCATION LEVEL-W1	4.9%	5.7%	7.5%	2.8%	4.4%	4.7%	3.2%	2.6%	2.5%	.0%	3.1%	5.4%	3.4%
Total		Count	245	542	40	1709	206	385	693	1055	433	7	161	37	5513
		% within S14Q1 RES MOM-EDUCATION LEVEL-W1	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

BMI (Binned) * S15Q1 RES DAD-EDUCATION LEVEL-W1 Crosstabulation

			S15Q1 RES DAD-EDUCATION LEVEL-W1												
			8th grade or less	>8th grade/didn't graduate high school	Business/ trade/voc. school instead high school	High school graduate	GED	Business/ trade/voc. school after high school	College/didn't graduate	Graduated from college/ university	Prof training beyond 4-year college/univ	Henever went to school	Went to school/Resp doesn't know level	Resp doesn't know if he went to school	Total
BMI (Binned)	severthinness UW	Count	0[a]	0[a]	0[a]	6[a]	0[a]	0[a]	2[a]	4[a]	1[a]	0[a]	1[a]	0[a]	14
		% within S15Q1 RES DAD-EDUCATION LEVEL-W1	.0%	.0%	.0%	.5%	.0%	.0%	.4%	.5%	.2%	.0%	.7%	.0%	.3%

moderate thinness UW	Count	0[a]	2[a]	1[a]	10[a]	3[a]	2[a]	2[a]	8[a]	5[a]	0[a]	1[a]	1[a]	35
	% within S15Q1 RESDAD-EDUCATION LEVEL-W1	.0%	.6%	3.8%	.8%	2.5%	.8%	.4%	1.0%	1.0%	.0%	.7%	2.2%	.8%
mild thinness UW	Count	5[a]	8[a]	2[a]	27[a]	5[a]	8[a]	11[a]	23[a]	7[a]	0[a]	3[a]	0[a]	99
	% within S15Q1 RESDAD-EDUCATION LEVEL-W1	2.3%	2.2%	7.7%	2.2%	4.1%	3.3%	2.3%	2.8%	1.4%	.0%	2.1%	.0%	2.4%
normal weight	Count	74[a]	137[a, b]	5[a, b]	489[a, b]	42[a, b]	108[a, b]	202[a, b]	389[b]	236[b]	3[a, b]	60[a, b]	16[a, b]	1761
	% within S15Q1 RESDAD-EDUCATION LEVEL-W1	34.6%	38.5%	19.2%	40.2%	34.4%	44.8%	42.3%	47.5%	48.9%	42.9%	42.9%	35.6%	42.5%
pre-obese	Count	74[a]	109[a]	8[a]	386[a]	36[a]	73[a]	162[a]	241[a]	156[a]	1[a]	42[a]	20[a]	1308
	% within S15Q1 RESDAD-EDUCATION LEVEL-W1	34.6%	30.6%	30.8%	31.8%	29.5%	30.3%	33.9%	29.4%	32.3%	14.3%	30.0%	44.4%	31.5%
obese class I	Count	32[a]	49[a]	6[a]	175[a]	19[a]	30[a]	61[a]	95[a]	52[a]	3[a]	22[a]	2[a]	546
	% within S15Q1 RESDAD-EDUCATION LEVEL-W1	15.0%	13.8%	23.1%	14.4%	15.6%	12.4%	12.8%	11.6%	10.8%	42.9%	15.7%	4.4%	13.2%
obese	Count	17[a]	30[a]	4[a]	82[a]	13[a]	16[a]	25[a]	37[a]	18[a]	0[a]	7[a]	3[a]	252

	class II	% within S15Q1 RESDAD-EDUCATION LEVEL-W1	7.9%	8.4%	15.4%	6.7%	10.7%	6.6%	5.2%	4.5%	3.7%	.0%	5.0%	6.7%	6.1%
	obese class III	Count	12[a]	21[a]	0[a]	40[a]	4[a]	4[a]	13[a]	22[a]	8[a]	0[a]	4[a]	3[a]	131
		% within S15Q1 RESDAD-EDUCATION LEVEL-W1	5.6%	5.9%	.0%	3.3%	3.3%	1.7%	2.7%	2.7%	1.7%	.0%	2.9%	6.7%	3.2%
Total		Count	214	356	26	1215	122	241	478	819	483	7	140	45	4146
		% within S15Q1 RESDAD-EDUCATION LEVEL-W1	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Group Statistics

	S16Q1 MAKE OWN DECISION-WKEND CURFEW-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	No	3813	26.3219	5.83732	.09453
	Yes	1936	27.1916	6.39667	.14538

Group Statistics

	S16Q2 MAKE OWN DECISION-FRIEND-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	No	837	26.7135	5.81520	.20100
	Yes	4918	26.5902	6.06568	.08649

Group Statistics

	S16Q3 MAKE OWN DECISION-CLOTHING-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	No	515	26.4458	5.82180	.25654
	Yes	5242	26.6307	6.06277	.08374

Group Statistics

	S16Q4 MAKE OWN DECISION-AMOUNT OF TV-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	No	998	26.0167	5.84486	.18502
	Yes	4759	26.7418	6.07616	.08808

Group Statistics

	S16Q5 MAKE OWN DECISION-TV PROGRAMS-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	No	1291	26.1484	5.88841	.16388
	Yes	4465	26.7483	6.08004	.09099

Group Statistics

	S16Q6 MAKE OWN DECISION-WEEKDAY BED-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	No	1967	26.2113	5.94843	.13412
	Yes	3789	26.8251	6.07946	.09876

Group Statistics

	S16Q7 MAKE OWN DECISION-DIET-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	No	1035	25.8830	5.71509	.17764
	Yes	4723	26.7779	6.10235	.08879

Group Statistics

	A28A NEIGHBORHOOD, NEAR PAST JOB-PQ	N	Mean	Std. Deviation	Std. Error Mean
BMI	No	3826	26.6525	6.09676	.09857
	Yes	1216	26.2769	5.77247	.16554

Group Statistics

	A28B NEIGHBORHOOD, NEAR CURRENT JOB-PQ	N	Mean	Std. Deviation	Std. Error Mean
BMI	No	3117	26.6010	6.12811	.10976
	Yes	1926	26.5072	5.84894	.13328

Group Statistics

	A28C NEIGHBORHOOD, OUTGROWN OLD HOME-PQ	N	Mean	Std. Deviation	Std. Error Mean
BMI	No	3204	26.7083	6.12018	.10812
	Yes	1831	26.3129	5.84963	.13670

Group Statistics

	A28D NEIGHBORHOOD, AFFORDABLE -PQ	N	Mean	Std. Deviation	Std. Error Mean
BMI	No	2569	26.4999	5.82123	.11485
	Yes	2455	26.6180	6.21363	.12541

Group Statistics

	A28E NEIGHBORHOOD, LESS CRIME-PQ	N	Mean	Std. Deviation	Std. Error Mean
BMI	No	1970	26.8067	6.20530	.13981
	Yes	3049	26.4149	5.90806	.10700

Group Statistics

	A28F NEIGHBORHOOD, LESS DRUG USE-PQ	N	Mean	Std. Deviation	Std. Error Mean
BMI	No	2179	26.6931	6.17278	.13224
	Yes	2803	26.4364	5.88612	.11118

Group Statistics

	A28G NEIGHBORHOOD, NEAR FRIENDS-PQ	N	Mean	Std. Deviation	Std. Error Mean
BMI	No	2814	26.4469	5.90562	.11133
	Yes	2235	26.7197	6.15515	.13020

Group Statistics

	A28H NEIGHBORHOOD, BETTER SCHOOLS-PQ	N	Mean	Std. Deviation	Std. Error Mean
BMI	No	2608	26.6168	6.12104	.11986
	Yes	2409	26.4769	5.88895	.11998

Group Statistics

	A28I NEIGHBORHOOD, CHILDREN SAME AGE-PQ	N	Mean	Std. Deviation	Std. Error Mean
BMI	No	3566	26.6482	6.04502	.10123
	Yes	1463	26.3577	5.95984	.15582

Group Statistics

	A28J NEIGHBORHOOD, BORN HERE-PQ	N	Mean	Std. Deviation	Std. Error Mean
BMI	No	4077	26.4088	5.82650	.09125
	Yes	963	27.2458	6.76041	.21785

BMI (Binned) * S1Q3 AGE MOVED TO CURRENT RESIDENCE-W1 Crosstabulation

			S1Q3 AGE MOVED TO CURRENT RESIDENCE-W1																			Total
			Since birth/under 1y/o when moved	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19 years old and older	
BMI (Binned)	severthinnessUW	Count	0a	0a,b	1a,b	0a,b	0a,b	0a,b	3b	1a,b	1a,b	2a,b	1a,b	0a,b	6b	3a,b	1a,b	0a,b	0a,b	1a,b	0a,b	0a,b	20
		% within S1Q3 AGE MOVED TO CURRENT RESIDENCE-W1	.0%	.0%	.7%	.0%	.0%	.0%	1.6%	.4%	.4%	.9%	.3%	.0%	1.2%	.6%	.2%	.0%	.0%	.5%	.0%	.0%	.3%
	moderatethinnessUW	Count	7a,b	2a,b	1a,b	4a,b	1a,b	1a,b	2a,b	3a,b	1a,b	2a,b	3a,b	4a,b	7a,b	3a,b	2a,b	0b	1a,b	0b	0a,b	1a	45
		% within S1Q3 AGE MOVED TO CURRENT RESIDENCE-W1	.6%	1.6%	.7%	2.8%	.8%	.5%	1.1%	1.3%	.4%	.9%	.9%	1.1%	1.4%	.6%	.5%	.0%	.4%	.0%	.0%	8.3%	.8%
	mild	Count	26a	1a	1a	5a	2a	3a	6a	4a	3a	6a	7a	12a	16a	8a	4a	8a	4a	3a	1a	0a	120

thinnesUW	% within S1Q3AGE MOVED TO CURRENT RESIDENCE-W1	2.2%	.8%	.7%	3.5%	1.7%	1.5%	3.2%	1.8%	1.3%	2.7%	2.2%	3.3%	3.3%	1.6%	1.0%	2.1%	1.4%	1.6%	.9%	.0%	2.1%
normalweight	Count	484 a, b	53 a, b	64 a, b	53 a, b	53 a, b	99 b	86 a, b	111 a, b	107 a, b	92 a, b	133 a, b	163 a, b	217 a, b	187 a, b	160 a, b	146 a, b	101 a, b	61 a	39 a, b	2 a, b	2411
	% within S1Q3AGE MOVED TO CURRENT RESIDENCE-W1	40.8%	42.4%	42.7%	37.1%	44.9%	50.8%	45.3%	49.1%	45.7%	42.0%	41.6%	44.8%	44.1%	38.5%	38.5%	38.0%	35.7%	32.3%	35.5%	16.7%	41.3%
pre-obese	Count	385 a	43 a	45 a	52 a	34 a	46 a	58 a	62 a	82 a	72 a	108 a	113 a	144 a	175 a	142 a	136 a	96 a	66 a	30 a	2 a	1891
	% within S1Q3AGE MOVED TO CURRENT RESIDENCE-W1	32.4%	34.4%	30.0%	36.4%	28.8%	23.6%	30.5%	27.4%	35.0%	32.9%	33.8%	31.0%	29.3%	36.0%	34.1%	35.4%	33.9%	34.9%	27.3%	16.7%	32.4%
obese class I	Count	168 a	11 a	20 a	14 a	16 a	24 a	22 a	27 a	28 a	31 a	43 a	43 a	64 a	77 a	56 a	50 a	46 a	32 a	27 a	5 a	804
	% within S1Q3AGE MOVED TO CURRENT RESIDENCE-W1	14.2%	8.8%	13.3%	9.8%	13.6%	12.3%	11.6%	11.9%	12.0%	14.2%	13.4%	11.8%	13.0%	15.8%	13.5%	13.0%	16.3%	16.9%	24.5%	41.7%	13.8%
obese	Count	79 a	5 a	10 a	8 a	8 a	14 a	10 a	13 a	5 a	11 a	11 a	21 a	23 a	20 a	33 a	35 a	20 a	17 a	11 a	2 a	356

class II	% within S1Q3 AGE MOVED TO CURRENT RESIDENCE-W1	6.7%	4.0%	6.7%	5.6%	6.8%	7.2%	5.3%	5.8%	2.1%	5.0%	3.4%	5.8%	4.7%	4.1%	7.9%	9.1%	7.1%	9.0%	10.0%	16.7%	6.1%
obese class III	Count	38[a]	10[a]	8[a]	7[a]	4[a]	8[a]	3[a]	5[a]	7[a]	3[a]	14[a]	8[a]	15[a]	13[a]	18[a]	9[a]	15[a]	9[a]	2[a]	0[a]	196
	% within S1Q3 AGE MOVED TO CURRENT RESIDENCE-W1	3.2%	8.0%	5.3%	4.9%	3.4%	4.1%	1.6%	2.2%	3.0%	1.4%	4.4%	2.2%	3.0%	2.7%	4.3%	2.3%	5.3%	4.8%	1.8%	.0%	3.4%
Total	Count	1187	125	150	143	118	195	190	226	234	219	320	364	492	486	416	384	283	189	110	12	5843
	% within S1Q3 AGE MOVED TO CURRENT RESIDENCE-W1	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Each subscript letter denotes a subset of S1Q3 AGE MOVED TO CURRENT RESIDENCE-W1 categories whose column proportions do not differ significantly from each other at the .05 level.

Group Statistics

	S5Q11 MOST RECENT GRADE-ENGLISH-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	A	1557	25.6868	5.50653	.13955
	D or lower	592	27.0878	6.22974	.25604

Group Statistics

	S5Q12 MOST RECENT GRADE-MATH-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	A	1443	25.7536	5.65990	.14900
	D or lower	844	27.2934	6.26646	.21570

Group Statistics

	S5Q13 MOST RECENT GRADE-HISTORY	N	Mean	Std. Deviation	Std. Error Mean
BMI	A	1763	25.8853	5.58539	.13302

Group Statistics

	S5Q13 MOST RECENT GRADE-HISTORY	N	Mean	Std. Deviation	Std. Error Mean
BMI	A	1763	25.8853	5.58539	.13302
	D or lower	596	27.6707	6.83670	.28004

Group Statistics

	S5Q14 MOST RECENT GRADE-SCIENCE-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	A	1616	26.0116	5.67637	.14120
	D or lower	610	27.2608	6.55923	.26558

Group Statistics

	S36Q1 KNOW MOST PEOPLE IN NBORHOOD-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	True	4287	26.6269	6.09857	.09314
	False	1574	26.6940	5.88730	.14839

Group Statistics

	S36Q2 PAST MO-STOP & TALK TO NEIGHBOR-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	True	4623	26.6753	6.09687	.08967
	False	1237	26.5205	5.83687	.16596

Group Statistics

	S36Q3 NEIGHBORS LOOK OUT FOR EA OTHER-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	True	4253	26.6143	6.07073	.09309
	False	1507	26.8349	6.01576	.15497

Group Statistics

	S36Q4 USE REC CTR IN NBORHOOD-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Yes	1165	26.6798	6.03367	.17677
	No	4688	26.6304	6.04254	.08825

Group Statistics

	S36Q5 FEEL SAFE IN NBORHOOD-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Yes	5266	26.5724	5.98477	.08247
	No	592	27.2718	6.53281	.26850

BMI (Binned) * S36Q6 HOW HAPPY LIVING IN NBORHOOD-W1 Crosstabulation

			S36Q6 HOW HAPPY LIVING IN NBORHOOD-W1					
			Not at all	Very little	Somewhat	Quite a bit	Very much	Total
BMI (Binned)	sever thinness UW	Count	0_a	1_a	5_a	5_a	9_a	20
		% within S36Q6 HOW HAPPY LIVING IN NBORHOOD-W1	.0%	.3%	.4%	.2%	.5%	.3%
	moderate thinness UW	Count	1_a	3_a	5_a	16_a	20_a	45
		% within S36Q6 HOW HAPPY LIVING IN NBORHOOD-W1	.6%	.9%	.4%	.8%	1.0%	.8%
	mild thinnes UW	Count	3_a	1_a	17_a	44_a	55_a	120
		% within S36Q6 HOW HAPPY LIVING IN NBORHOOD-W1	1.7%	.3%	1.4%	2.1%	2.8%	2.0%
	normal	Count	65_a	133_a	508_a	888_a	829_a	2423

	weight	% within S36Q6 HOW HAPPY LIVING IN NBORHOOD-W1	36.7%	40.1%	40.9%	41.8%	41.7%	41.3%
	pre-obese	Count	68[a]	99[a]	423[a]	672[a]	634[a]	1896
		% within S36Q6 HOW HAPPY LIVING IN NBORHOOD-W1	38.4%	29.8%	34.1%	31.7%	31.9%	32.3%
	obese class I	Count	21[a]	57[a]	165[a]	285[a]	277[a]	805
		% within S36Q6 HOW HAPPY LIVING IN NBORHOOD-W1	11.9%	17.2%	13.3%	13.4%	13.9%	13.7%
	obese class II	Count	9[a]	22[a]	76[a]	145[a]	104[a]	356
		% within S36Q6 HOW HAPPY LIVING IN NBORHOOD-W1	5.1%	6.6%	6.1%	6.8%	5.2%	6.1%
	obese class III	Count	10[a]	16[a]	43[a]	68[a]	60[a]	197
		% within S36Q6 HOW HAPPY LIVING IN NBORHOOD-W1	5.6%	4.8%	3.5%	3.2%	3.0%	3.4%
Total		Count	177	332	1242	2123	1988	5862
		% within S36Q6 HOW HAPPY LIVING IN NBORHOOD-W1	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

BMI (Binned) * S36Q7 HAPPY/UNHAPPY TO MOVE-W1 Crosstabulation

			S36Q7 HAPPY/UNHAPPY TO MOVE-W1					
			Very unhappy	A little happy	Wouldn't make any difference	A little happy	Very happy	Total
BMI (Binned)	sever thinness UW	Count	6[a]	9[a]	2[a]	1[a]	2[a]	20
		% within S36Q7 HAPPY/UNHAPPY TO MOVE-W1	.4%	.5%	.1%	.2%	.4%	.3%
	moderate thinness UW	Count	14[a]	14[a]	8[a]	6[a]	3[a]	45
		% within S36Q7 HAPPY/UNHAPPY TO MOVE-W1	1.0%	.9%	.5%	1.0%	.7%	.8%
	mild thinnes UW	Count	39[a]	35[a]	28[a]	13[a]	4[a]	119
		% within S36Q7 HAPPY/UNHAPPY TO MOVE-W1	2.7%	2.1%	1.6%	2.2%	.9%	2.0%
	normal weight	Count	611[a]	684[a]	674[a]	249[a]	200[a]	2418
		% within S36Q7 HAPPY/UNHAPPY TO MOVE-W1	41.7%	41.7%	39.6%	43.1%	43.4%	41.4%
	pre-obese	Count	474[a]	529[a]	569[a]	175[a]	141[a]	1888
		% within S36Q7 HAPPY/UNHAPPY TO MOVE-W1	32.3%	32.3%	33.4%	30.3%	30.6%	32.3%
	obese class I	Count	189[a]	219[a]	257[a]	77[a]	62[a]	804
		% within S36Q7 HAPPY/UNHAPPY TO MOVE-W1	12.9%	13.4%	15.1%	13.3%	13.4%	13.8%
	obese class II	Count	84[a]	101[a]	103[a]	36[a]	31[a]	355
		% within S36Q7 HAPPY/UNHAPPY TO MOVE-W1	5.7%	6.2%	6.1%	6.2%	6.7%	6.1%
	obese class III	Count	49[a]	48[a]	61[a]	21[a]	18[a]	197
		% within S36Q7 HAPPY/UNHAPPY TO MOVE-W1	3.3%	2.9%	3.6%	3.6%	3.9%	3.4%
Total		Count	1466	1639	1702	578	461	5846

	% within S36Q7 HAPPY/UNHAPPY TO MOVE-W1	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Group Statistics

	A20 HAPPY-PQ	N	Mean	Std. Deviation	Std. Error Mean
BMI	Yes	4891	26.5273	5.97833	.08548
	No	189	27.4922	6.62096	.48160

Group Statistics

	S20Q6A MALE FRIEND 1-FRIENDS HOUSE-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Yes	2604	26.8779	5.91451	.11590
	No	2829	26.4494	6.14500	.11553

Group Statistics

	S20Q7A MALE FRIEND1-MEET AFTER SCHOOL-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Yes	2900	26.5456	5.76949	.10714
	No	2530	26.7733	6.31635	.12558

Group Statistics

	S20Q8A MALE FRIEND1-TIME LAST WEEKEND-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Yes	2895	26.5932	5.78855	.10758
	No	2536	26.7281	6.31417	.12538

Group Statistics

	S20Q9A MALE FRIEND1-TALK ABOUT A PROB-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Yes	2737	26.5830	5.66053	.10820
	No	2695	26.7309	6.39931	.12327

Group Statistics

	S20Q10A MALE FRIEND1-TALK ON PHONE-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Yes	3837	26.4580	5.75256	.09287
	No	1596	27.1277	6.65530	.16659

Group Statistics

	S20Q1A FEMALE FRIEND1-SCHOOL-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Yes	4828	26.4611	5.91607	.08514
	No (skip to Q.6)	408	27.8924	6.59925	.32671

Group Statistics

	S20Q6A FEMALE FRIEND 1-FRIENDS HOUSE-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Yes	2525	26.4418	5.63003	.11204
	No	2714	26.6891	6.29346	.12080

Group Statistics

	S20Q2A FEMALE FRIEND1-GRADE-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	>= 10	2477	27.1800	5.89691	.11848
	< 10	2351	25.6870	5.83201	.12028

Group Statistics

	S20Q7A FEMALE FRIEND1-MEET AFTER SCHL-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Yes	2798	26.3871	5.72751	.10828
	No	2439	26.7681	6.24292	.12641

Group Statistics

	S20Q8A FEMALE FRIEND1-TIME LAST WKEND-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Yes	2780	26.4059	5.68247	.10777
	No	2460	26.7538	6.30197	.12706

Group Statistics

	S20Q9A FEMALE FRIEND1-DISCUSS A PROB-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Yes	3169	26.4518	5.70249	.10130
	No	2070	26.7518	6.38648	.14037

Group Statistics

	S20Q10A FEMALE FRIEND1-TALK ON PHONE-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Yes	4033	26.4950	5.89129	.09277
	No	1207	26.8175	6.27688	.18067

Group Statistics

	S3Q23A HAVE FOR BREAKFAST-MILK-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Marked	3407	26.2654	5.77249	.09890
	Not marked	2471	27.1629	6.36513	.12805

Group Statistics

	S3Q23B HAVE FOR BREAKFAST-COFFEE/TEA-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Marked	398	26.2969	6.17984	.30977
	Not marked	5480	26.6678	6.03431	.08151

Group Statistics

	S3Q23C HAVE FOR BREAKFAST-CEREAL-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Marked	3045	26.1433	5.77358	.10463
	Not marked	2833	27.1795	6.27956	.11798

Group Statistics

	S3Q23D HAVE FOR BREAKFAST-FRUIT/JUICE-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Marked	2017	26.2697	5.76079	.12827
	Not marked	3861	26.8376	6.17925	.09945

Group Statistics

	S3Q23E HAVE FOR BREAKFAST-EGGS-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Marked	990	27.1142	6.45374	.20511
	Not marked	4888	26.5472	5.95429	.08517

Group Statistics

	S3Q23F HAVE FOR BREAKFAST-MEAT-W1	N	Mean	Std. Deviation	Std. Error Mean

BMI	Marked	663	27.2705	6.51854	.25316
	Not marked	5215	26.5629	5.97744	.08277

Group Statistics

	S3Q23G HAVE FOR BREAKFAST-SNACK FOODS-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Marked	391	26.1524	5.91633	.29920
	Not marked	5487	26.6776	6.05250	.08171

Group Statistics

	S3Q23H HAVE FOR BREAKFAST-BREAD/TOAST-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Marked	2140	26.3665	5.99273	.12954
	Not marked	3738	26.8008	6.06901	.09927

Group Statistics

	S3Q23I HAVE FOR BREAKFAST-OTHER-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Marked	720	26.2122	5.75124	.21434
	Not marked	5158	26.7028	6.08237	.08469

Group Statistics

	S3Q23J HAVE FOR BREAKFAST-NOTHING-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Marked	1158	27.7463	6.45447	.18967
	Not marked	4720	26.3719	5.90885	.08601

BMI (Binned) * S3Q1 GENERAL HEALTH-W1 Crosstabulation

			S3Q1 GENERAL HEALTH-W1					
			Excellent	Very good	Good	Fair	Poor	Total
BMI (Binned)	sever thinness UW	Count	4_{a}	8_{a}	7_{a}	1_{a}	0_{a}	20
		% within S3Q1 GENERAL HEALTH-W1	.2%	.3%	.5%	.3%	.0%	.3%
	moderate thinness UW	Count	16_{a}	18_{a}	10_{a}	1_{a}	0_{a}	45
		% within S3Q1 GENERAL HEALTH-W1	1.0%	.8%	.7%	.3%	.0%	.8%
	mild thinnes UW	Count	45_{a}	48_{a}	22_{a}	6_{a}	0_{a}	121
		% within S3Q1 GENERAL HEALTH-W1	2.7%	2.0%	1.5%	1.6%	.0%	2.1%
	normal weight	Count	753_{a}	1064_{a}	519_{b}	87_{c}	$5_{a, b, c}$	2428
		% within S3Q1 GENERAL HEALTH-W1	45.5%	44.5%	36.2%	23.1%	20.8%	41.3%
	pre-obese	Count	535_{a}	778_{a}	458_{a}	123_{a}	6_{a}	1900
		% within S3Q1 GENERAL HEALTH-W1	32.3%	32.6%	32.0%	32.7%	25.0%	32.3%
	obese class I	Count	$212_{a, b}$	285_{b}	236_{c}	$68_{a, c}$	8_{c}	809
		% within S3Q1 GENERAL HEALTH-W1	12.8%	11.9%	16.5%	18.1%	33.3%	13.8%
	obese class II	Count	65_{a}	130_{a}	111_{b}	49_{c}	$2_{a, b, c}$	357
		% within S3Q1 GENERAL HEALTH-W1	3.9%	5.4%	7.8%	13.0%	8.3%	6.1%
	obese class III	Count	25_{a}	59_{a}	69_{b}	41_{c}	$3_{b, c}$	197
		% within S3Q1 GENERAL HEALTH-W1	1.5%	2.5%	4.8%	10.9%	12.5%	3.4%
Total		Count	1655	2390	1432	376	24	5877
		% within S3Q1 GENERAL HEALTH-W1	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

BMI (Binned) * S3Q28 WEIGHT IMAGE-W1 Crosstabulation

			S3Q28 WEIGHT IMAGE-W1					
			Very underweight	Slightly underweight	About the right weight	Slightly overweight	Very overweight	Total
BMI (Binned)	sever thinness UW	Count	3_{a}	12_{a}	5_{b}	0_{b}	$0_{a, b}$	20
		% within S3Q28 WEIGHT IMAGE-W1	2.5%	1.4%	.2%	.0%	.0%	.3%
	moderate thinness UW	Count	5_{a}	$17_{a, b}$	21_{c}	2_{c}	$0_{b, c}$	45
		% within S3Q28 WEIGHT IMAGE-W1	4.2%	2.0%	.7%	.1%	.0%	.8%
	mild thinnes UW	Count	13_{a}	55_{a}	52_{b}	1_{c}	$0_{b, c}$	121
		% within S3Q28 WEIGHT IMAGE-W1	11.0%	6.6%	1.7%	.1%	.0%	2.1%
	normal weight	Count	$63_{a, b}$	481_{b}	1579_{a}	291_{c}	14_{d}	2428
		% within S3Q28 WEIGHT IMAGE-W1	53.4%	57.3%	51.0%	17.9%	7.0%	41.3%
	pre-obese	Count	$18_{a, b}$	227_{b}	1001_{c}	621_{d}	32_{a}	1899
		% within S3Q28 WEIGHT IMAGE-W1	15.3%	27.1%	32.3%	38.3%	16.1%	32.3%
	obese class I	Count	$5_{a, b}$	37_{b}	339_{a}	388_{c}	40_{c}	809
		% within S3Q28 WEIGHT IMAGE-W1	4.2%	4.4%	10.9%	23.9%	20.1%	13.8%
	obese class II	Count	$4_{a, b}$	8_{b}	85_{a}	206_{c}	54_{d}	357
		% within S3Q28 WEIGHT IMAGE-W1	3.4%	1.0%	2.7%	12.7%	27.1%	6.1%
	obese class III	Count	7_{a}	2_{b}	14_{b}	114_{a}	59_{c}	196
		% within S3Q28 WEIGHT IMAGE-W1	5.9%	.2%	.5%	7.0%	29.6%	3.3%
Total		Count	118	839	3096	1623	199	5875
		% within S3Q28 WEIGHT IMAGE-W1	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

BMI (Binned) * 62.m LIKES SELF Crosstabulation

			62.m LIKES SELF					
			Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Total
BMI (Binned)	sever thinness UW	Count	7_{a}	2_{a}	2_{a}	0_{a}	1_{a}	12
		% within 62.m LIKES SELF	.6%	.2%	.3%	.0%	.7%	.3%
	moderate thinness UW	Count	7_{a}	11_{a}	4_{a}	1_{a}	1_{a}	24
		% within 62.m LIKES SELF	.6%	.8%	.6%	.2%	.7%	.6%
	mild thinnes UW	Count	28_{a}	34_{a}	13_{a}	4_{a}	2_{a}	81
		% within 62.m LIKES SELF	2.3%	2.6%	1.9%	1.0%	1.3%	2.1%
	normal weight	Count	554_{a}	$546_{a, b}$	$275_{a, b}$	146_{b}	$50_{a, b}$	1571
		% within 62.m LIKES SELF	44.8%	41.6%	39.4%	36.1%	33.3%	41.3%
	pre-obese	Count	381_{a}	425_{a}	242_{a}	136_{a}	50_{a}	1234

		% within 62.m LIKES SELF	30.8%	32.4%	34.7%	33.7%	33.3%	32.5%
	obese class I	Count	171_{a}	185_{a}	88_{a}	62_{a}	25_{a}	531
		% within 62.m LIKES SELF	13.8%	14.1%	12.6%	15.3%	16.7%	14.0%
	obese class II	Count	58_{a}	$74_{a, b}$	$49_{a, b}$	37_{b}	$11_{a, b}$	229
		% within 62.m LIKES SELF	4.7%	5.6%	7.0%	9.2%	7.3%	6.0%
	obese class III	Count	31_{a}	$35_{a, b}$	$25_{a, b}$	$18_{a, b}$	10_{b}	119
		% within 62.m LIKES SELF	2.5%	2.7%	3.6%	4.5%	6.7%	3.1%
Total		Count	1237	1312	698	404	150	3801
		% within 62.m LIKES SELF	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Group Statistics

	S28Q1 EVER SMOKED A CIGARETTE-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Yes	3334	26.9189	6.00712	.10404
	No (skip to Q.9)	2505	26.2694	6.08828	.12164

Group Statistics

	S280Q12 DRINK ALCOHOL > 2-3 TIMES-W1	N	Mean	Std. Deviation	Std. Error Mean
BMI	Yes	3298	26.9179	5.97699	.10408
	No (skip to Q.29)	2536	26.2810	6.13053	.12174

BMI (Binned) * S9Q3 RESIST SEX IF NO BIRTH CONTROL-W1 Crosstabulation

			S9Q3 RESIST SEX IF NO BIRTH CONTROL-W1						
			Very sure	Moderately sure	Neither sure nor unsure	Moderately unsure	Very unsure	I never want to use birth control	Total
BMI (Binned)	sever thinness UW	Count	1_{a}	$0_{a, b}$	$0_{a, b}$	$1_{a, b}$	2_{b}	$0_{a, b}$	4
		% within S9Q3 RESIST SEX IF NO BIRTH CONTROL-W1	.0%	.0%	.0%	.6%	.9%	.0%	.1%
	moderate thinness UW	Count	5_{a}	1_{a}	1_{a}	2_{a}	2_{a}	1_{a}	12
		% within S9Q3 RESIST SEX IF NO BIRTH CONTROL-W1	.2%	.1%	.2%	1.1%	.9%	2.1%	.3%
	mild thinnes UW	Count	28_{a}	8_{a}	7_{a}	6_{a}	4_{a}	0_{a}	53
		% within S9Q3 RESIST SEX IF NO BIRTH CONTROL-W1	1.2%	1.1%	1.2%	3.4%	1.9%	.0%	1.3%
	normal weight	Count	882_{a}	265_{a}	202_{a}	$63_{a, b}$	51_{b}	$13_{a, b}$	1476
		% within S9Q3 RESIST SEX IF NO BIRTH CONTROL-W1	38.3%	37.9%	35.6%	35.6%	24.1%	27.7%	36.9%
	pre-obese	Count	797_{a}	246_{a}	194_{a}	55_{a}	84_{a}	20_{a}	1396
		% within S9Q3 RESIST SEX IF NO BIRTH CONTROL-W1	34.6%	35.2%	34.2%	31.1%	39.6%	42.6%	34.9%
	obese	Count	349_{a}	109_{a}	95_{a}	27_{a}	42_{a}	10_{a}	632

	class I	% within S9Q3 RESIST SEX IF NO BIRTH CONTROL-W1	15.2%	15.6%	16.7%	15.3%	19.8%	21.3%	15.8%
	obese class II	Count	146_a	44_a	45_a	11_a	21_a	1_a	268
		% within S9Q3 RESIST SEX IF NO BIRTH CONTROL-W1	6.3%	6.3%	7.9%	6.2%	9.9%	2.1%	6.7%
	obese class III	Count	94_a	26_a	24_a	12_a	6_a	2_a	164
		% within S9Q3 RESIST SEX IF NO BIRTH CONTROL-W1	4.1%	3.7%	4.2%	6.8%	2.8%	4.3%	4.1%
Total		Count	2302	699	568	177	212	47	4005
		% within S9Q3 RESIST SEX IF NO BIRTH CONTROL-W1	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

BMI (Binned) * 62.n DOING EVERYTHNG RIGHT Crosstabulation

			62.n DOING EVERYTHNG RIGHT					
			Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Total
BMI (Binned)	sever thinness UW	Count	2_a	5_a	4_a	0_a	1_a	12
		% within 62.n DOING EVERYTHNG RIGHT	.4%	.4%	.3%	.0%	.5%	.3%
	moderate thinness UW	Count	4_a	6_a	11_a	2_a	1_a	24
		% within 62.n DOING EVERYTHNG RIGHT	.9%	.5%	.8%	.3%	.5%	.6%
	mild thinnes UW	Count	8_a	32_a	25_a	12_a	3_a	80
		% within 62.n DOING EVERYTHNG RIGHT	1.8%	2.7%	1.9%	1.9%	1.6%	2.1%
	normal weight	Count	196_a	505_a	546_a	261_a	68_a	1576
		% within 62.n DOING EVERYTHNG RIGHT	43.9%	43.3%	40.8%	40.4%	36.2%	41.6%
	pre-obese	Count	131_a	369_a	443_a	222_a	58_a	1223
		% within 62.n DOING EVERYTHNG RIGHT	29.4%	31.6%	33.1%	34.4%	30.9%	32.3%
	obese class I	Count	64_a	150_a	178_a	97_a	37_a	526
		% within 62.n DOING EVERYTHNG RIGHT	14.3%	12.9%	13.3%	15.0%	19.7%	13.9%
	obese class II	Count	28_a	65_a	87_a	34_a	13_a	227
		% within 62.n DOING EVERYTHNG RIGHT	6.3%	5.6%	6.5%	5.3%	6.9%	6.0%
	obese class III	Count	13_a	34_a	45_a	18_a	7_a	117
		% within 62.n DOING EVERYTHNG RIGHT	2.9%	2.9%	3.4%	2.8%	3.7%	3.1%
Total		Count	446	1166	1339	646	188	3785
		% within 62.n DOING EVERYTHNG RIGHT	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

BMI (Binned) * S3Q39 WEAR HELMET WHILE CYCLING-W1 Crosstabulation

			S3Q39 WEAR HELMET WHILE CYCLING-W1						
			Never	Rarely	Sometimes	Most of the time	Always	Never rides a bicycle	Total
BMI	sever	Count	10_a	0_a	0_a	0_a	3_a	7_a	20

(Binned)	thinness UW	% within S3Q39 WEAR HELMET WHILE CYCLING-W1	.3%	.0%	.0%	.0%	1.5%	.4%	.3%
	moderate thinness UW	Count	25_{a}	6_{b}	$2_{a, b}$	$2_{a, b}$	$3_{a, b}$	7_{a}	45
		% within S3Q39 WEAR HELMET WHILE CYCLING-W1	.7%	2.8%	1.3%	1.4%	1.5%	.4%	.8%
	mild thinness UW	Count	$67_{a, b}$	$6_{a, b, c}$	$5_{a, b, c}$	9_{c}	$10_{b, c}$	24_{a}	121
		% within S3Q39 WEAR HELMET WHILE CYCLING-W1	2.0%	2.8%	3.2%	6.4%	4.9%	1.4%	2.1%
	normal weight	Count	1404_{a}	103_{a}	75_{a}	69_{a}	92_{a}	686_{a}	2429
		% within S3Q39 WEAR HELMET WHILE CYCLING-W1	40.9%	47.5%	48.4%	48.9%	44.7%	39.8%	41.3%
	pre-obese	Count	1120_{a}	61_{a}	39_{a}	42_{a}	70_{a}	568_{a}	1900
		% within S3Q39 WEAR HELMET WHILE CYCLING-W1	32.6%	28.1%	25.2%	29.8%	34.0%	32.9%	32.3%
	obese class I	Count	469_{a}	30_{a}	20_{a}	9_{a}	19_{a}	262_{a}	809
		% within S3Q39 WEAR HELMET WHILE CYCLING-W1	13.7%	13.8%	12.9%	6.4%	9.2%	15.2%	13.8%
	obese class II	Count	228_{a}	5_{a}	7_{a}	8_{a}	5_{a}	104_{a}	357
		% within S3Q39 WEAR HELMET WHILE CYCLING-W1	6.6%	2.3%	4.5%	5.7%	2.4%	6.0%	6.1%
	obese class III	Count	111_{a}	6_{a}	7_{a}	2_{a}	4_{a}	67_{a}	197
		% within S3Q39 WEAR HELMET WHILE CYCLING-W1	3.2%	2.8%	4.5%	1.4%	1.9%	3.9%	3.4%
Total		Count	3434	217	155	141	206	1725	5878
		% within S3Q39 WEAR HELMET WHILE CYCLING-W1	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

BMI (Binned) * S3Q40 FREQ-RIDE A MOTORCYCLE-W1 Crosstabulation

			S3Q40 FREQ-RIDE A MOTORCYCLE-W1					
			Never (skip to Q.42)	Once or twice	About once a month	About once a week	Almost every day	Total
BMI (Binned)	sever thinness UW	Count	18_{a}	1_{a}	0_{a}	1_{a}	0_{a}	20
		% within S3Q40 FREQ-RIDE A MOTORCYCLE-W1	.4%	.1%	.0%	.6%	.0%	.3%
	moderate thinness UW	Count	$36_{a, b}$	2_{b}	$2_{a, b}$	$1_{a, b}$	4_{a}	45
		% within S3Q40 FREQ-RIDE A MOTORCYCLE-W1	.8%	.3%	1.0%	.6%	2.6%	.8%
	mild thinness UW	Count	101_{a}	12_{a}	4_{a}	3_{a}	1_{a}	121
		% within S3Q40 FREQ-RIDE A MOTORCYCLE-W1	2.2%	1.6%	1.9%	1.9%	.6%	2.1%
	normal	Count	1915_{a}	311_{a}	77_{a}	65_{a}	61_{a}	2429

	weight	% within S3Q40 FREQ-RIDE A MOTORCYCLE-W1	41.5%	41.7%	36.7%	41.9%	39.1%	41.3%
	pre-obese	Count	1495_a	234_a	73_a	49_a	49_a	1900
		% within S3Q40 FREQ-RIDE A MOTORCYCLE-W1	32.4%	31.4%	34.8%	31.6%	31.4%	32.3%
	obese class I	Count	624_a	108_a	33_a	20_a	24_a	809
		% within S3Q40 FREQ-RIDE A MOTORCYCLE-W1	13.5%	14.5%	15.7%	12.9%	15.4%	13.8%
	obese class II	Count	275_a	50_a	12_a	11_a	9_a	357
		% within S3Q40 FREQ-RIDE A MOTORCYCLE-W1	6.0%	6.7%	5.7%	7.1%	5.8%	6.1%
	obese class III	Count	147_a	28_a	9_a	5_a	8_a	197
		% within S3Q40 FREQ-RIDE A MOTORCYCLE-W1	3.2%	3.8%	4.3%	3.2%	5.1%	3.4%
Total		Count	4611	746	210	155	156	5878
		% within S3Q40 FREQ-RIDE A MOTORCYCLE-W1	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

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BMI (Binned) * S3Q41 FREQ-WEAR MOTORCYCLE HELMET-W1 Crosstabulation

			S3Q41 FREQ-WEAR MOTORCYCLE HELMET-W1					
			Never	Rarely	Sometimes	Most of the time	Always	Total
BMI (Binned)	sever thinness UW	Count	0_a	0_a	0_a	0_a	2_a	2
		% within S3Q41 FREQ-WEAR MOTORCYCLE HELMET-W1	.0%	.0%	.0%	.0%	.3%	.2%
	moderate thinness UW	Count	2_a	1_a	1_a	0_a	5_a	9
		% within S3Q41 FREQ-WEAR MOTORCYCLE HELMET-W1	.5%	1.3%	1.4%	.0%	.8%	.7%
	mild thinnes UW	Count	5_a	5_b	$1_{a,\,b}$	$1_{a,\,b}$	8_a	20
		% within S3Q41 FREQ-WEAR MOTORCYCLE HELMET-W1	1.3%	6.7%	1.4%	1.2%	1.2%	1.6%
	normal weight	Count	134_a	$29_{a,\,b}$	$31_{a,\,b}$	$37_{a,\,b}$	283_b	514
		% within S3Q41 FREQ-WEAR MOTORCYCLE HELMET-W1	34.1%	38.7%	44.3%	44.0%	43.9%	40.6%
	pre-obese	Count	135_a	18_a	20_a	25_a	207_a	405
		% within S3Q41 FREQ-WEAR MOTORCYCLE HELMET-W1	34.4%	24.0%	28.6%	29.8%	32.1%	32.0%
	obese class I	Count	57_a	12_a	9_a	18_a	89_a	185
		% within S3Q41 FREQ-WEAR MOTORCYCLE HELMET-W1	14.5%	16.0%	12.9%	21.4%	13.8%	14.6%
	obese class II	Count	37_a	$8_{a,\,b}$	$7_{a,\,b}$	$2_{a,\,b}$	28_b	82
		% within S3Q41 FREQ-WEAR MOTORCYCLE HELMET-W1	9.4%	10.7%	10.0%	2.4%	4.3%	6.5%
	obese class III	Count	23_a	2_a	1_a	1_a	23_a	50
		% within S3Q41 FREQ-WEAR MOTORCYCLE HELMET-W1	5.9%	2.7%	1.4%	1.2%	3.6%	3.9%
Total		Count	393	75	70	84	645	1267

		% within S3Q41 FREQ-WEAR MOTORCYCLE HELMET-W1	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

BMI (Binned) * S3Q42 FREQ-WEAR SEAT BELT IN CAR-W1 Crosstabulation

			S3Q42 FREQ-WEAR SEAT BELT IN CAR-W1					
			Never	Rarely	Sometimes	Most of the time	Always	Total
BMI (Binned)	sever thinness UW	Count	1_a	3_a	1_a	4_a	11_a	20
		% within S3Q42 FREQ-WEAR SEAT BELT IN CAR-W1	.3%	.7%	.1%	.3%	.4%	.3%
	moderate thinness UW	Count	1_a	2_a	7_a	6_a	29_a	45
		% within S3Q42 FREQ-WEAR SEAT BELT IN CAR-W1	.3%	.5%	.9%	.5%	1.0%	.8%
	mild thinnes UW	Count	7_a	7_a	15_a	25_a	67_a	121
		% within S3Q42 FREQ-WEAR SEAT BELT IN CAR-W1	2.3%	1.6%	1.8%	2.0%	2.2%	2.1%
	normal weight	Count	102_a	$173_{a, b}$	$321_{a, b}$	562_b	1271_b	2429
		% within S3Q42 FREQ-WEAR SEAT BELT IN CAR-W1	33.3%	39.6%	39.2%	44.1%	41.8%	41.3%
	pre-obese	Count	113_a	145_a	270_a	399_a	973_a	1900
		% within S3Q42 FREQ-WEAR SEAT BELT IN CAR-W1	36.9%	33.2%	33.0%	31.3%	32.0%	32.3%
	obese class I	Count	49_a	64_a	109_a	163_a	424_a	809
		% within S3Q42 FREQ-WEAR SEAT BELT IN CAR-W1	16.0%	14.6%	13.3%	12.8%	13.9%	13.8%
	obese class II	Count	16_a	30_a	64_a	78_a	169_a	357
		% within S3Q42 FREQ-WEAR SEAT BELT IN CAR-W1	5.2%	6.9%	7.8%	6.1%	5.6%	6.1%
	obese class III	Count	17_a	13_a	31_a	37_a	99_a	197
		% within S3Q42 FREQ-WEAR SEAT BELT IN CAR-W1	5.6%	3.0%	3.8%	2.9%	3.3%	3.4%
Total		Count	306	437	818	1274	3043	5878
		% within S3Q42 FREQ-WEAR SEAT BELT IN CAR-W1	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

BMI (Binned) * S3Q43 FREQ-DRINK ALCOHOL AND DRIVE-W1 Crosstabulation

			S3Q43 FREQ-DRINK ALCOHOL AND DRIVE-W1					
			Never	1 time	2 or 3 times	4 or 5 times	6 or more times	Total
BMI (Binned)	sever thinness UW	Count	19_a	1_a	0_a	0_a	0_a	20
		% within S3Q43 FREQ-DRINK ALCOHOL AND DRIVE-W1	.3%	.9%	.0%	.0%	.0%	.3%

	moderate thinness UW	Count	44[a]	0[a]	1[a]	0[a]	0[a]	45
		% within S3Q43 FREQ-DRINK ALCOHOL AND DRIVE-W1	.8%	.0%	1.4%	.0%	.0%	.8%
	mild thinnes UW	Count	120[a]	1[a]	0[a]	0[a]	0[a]	121
		% within S3Q43 FREQ-DRINK ALCOHOL AND DRIVE-W1	2.1%	.9%	.0%	.0%	.0%	2.1%
	normal weight	Count	2352[a]	41[a]	24[a]	5[a]	7[a]	2429
		% within S3Q43 FREQ-DRINK ALCOHOL AND DRIVE-W1	41.5%	37.6%	34.8%	31.3%	36.8%	41.3%
	pre-obese	Count	1827[a]	38[a]	24[a]	5[a]	4[a]	1898
		% within S3Q43 FREQ-DRINK ALCOHOL AND DRIVE-W1	32.3%	34.9%	34.8%	31.3%	21.1%	32.3%
	obese class I	Count	778[a]	16[a]	9[a]	4[a]	2[a]	809
		% within S3Q43 FREQ-DRINK ALCOHOL AND DRIVE-W1	13.7%	14.7%	13.0%	25.0%	10.5%	13.8%
	obese class II	Count	334[a]	12[a]	6[a]	1[a]	4[a]	357
		% within S3Q43 FREQ-DRINK ALCOHOL AND DRIVE-W1	5.9%	11.0%	8.7%	6.3%	21.1%	6.1%
	obese class III	Count	188[a, b]	0[b]	5[a]	1[a, b]	2[a]	196
		% within S3Q43 FREQ-DRINK ALCOHOL AND DRIVE-W1	3.3%	.0%	7.2%	6.3%	10.5%	3.3%
Total		Count	5662	109	69	16	19	5875
		% within S3Q43 FREQ-DRINK ALCOHOL AND DRIVE-W1	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

PART 3

An empirical analysis of childhood obesity: the role of cultural norms, built environment and socio-economic status

Introduction

The goal of the third part is to examine how socio-economic status, cultural norms and other behavioral factors affect overweight and obesity in children. We model obesity as the result of genetics, environment and cultural norms. For each of these three components we have chosen proxy variables and to estimate their effect on overweight and obesity rates we use probit. The paper is organized as follows. The first Chapter sheds light upon the most recent trends in childhood obesity in the United States and briefly discussessome public programs that address the obesity spread-out. Chaptertwo proposes a simple model on childhood obesitydiscussesrecent evidence on the factors that increase the probability of being obese in children and presents the research hypothesis. The third Chapter describes the National Survey of Children Health and the fourth presents the results of probit models of this analysis. The fifth Chapter draws conclusion and advances hypothesis for future research.

Contents

CHAPTER 1
Childhood obesity in the United States

1.1 Key statistics on obesity rates and its costs

Tackling childhood obesity is currently one of the main goals of the public health system of the United States. According to the Centre for Disease and Control Prevention of the United States approximately 17% (or 12.5 million) of children and adolescents aged 2-19 years are obese and since 1980 obesity prevalence among children and adolescents has almost tripled. Overweight and obese rates differ among ethnic disparities. For example, in 2007-2008, Hispanic boys, aged 2 to 19 years, were significantly more likely to be obese than non-Hispanic white boys, and non-Hispanic black girls were significantly more likely to be obese than non-Hispanic white girls (Centers for Diseases Control and Prevention, CDC). Obesity is not a public concern confined to United States and increasing rates have been observed in all the OECD countries as well as in many transitional economies, as for example China and Mexico (1). The International Association of the Study of Obesity (IASO) and, particularly, the International obesity

Task Force (IOTF) estimated that up to 200 million schools aged children are either overweight or obese, of those 40-50 million are classified as obese[16].

Obesity has become a public concern because of the increasing costs on the healthcare system, especially for individuals eligible for Medicaid and Medicare. Bhattacharya and Bundor estimated that, in the United States, increasing healthcare costs of obesity are paid in the form of lower wages of obese workers in case of employer-sponsored health insurance(2). Obesity is known to be related to a higher health risks because of diabetes, for example it has been shown that body weight regulates cholesterol metabolism in type 2 diabetes such that, with increasing insulin resistance, cholesterol absorption is lowered and cholesterol synthesis increased (3).As we have already seen in Part 2, the US National Vital Statistics Report released in December 2010 also reported that *"the preliminary estimate of life expectancy at birth for the total population in 2008 is 77.8% years. This represents a decrease in life expectancy of 0.1 year relative to 2007"*(4). Diseases of heart, malignant neoplasm, chronic and lower respiratory disease and cerebrovascular diseases are listed as the four main causes of death among US population. The relation between body weight and mortality risk associated with cardiovascular disease is however controversial. A recent Canadian study, for example, showed that underweight and severe obesity[17] are associated with a higher risk of mortality. This association was not verified for severely overweight and obese (5). Another great concern is related to childhood obesity. Unhealthy food habits develop in infancy and childhood has been recognized to be one of the leading causes of adult obesity and diet-related diseases (6). This is translated into higher social costs for health

[16] International Obesity Task Force, Obesity & Research

[17] See Who Classification http://apps.who.int/bmi/index.jsp?introPage=intro_3.html or Tab3 2.1 of Part 2.

systems and into monetary, personal and interpersonal costs for individuals. There is large empirical evidence - coming from both national and international reports and academic research – showing that ethnic minorities are more exposed to obesity and overweight. In the United States, the highest incidence has been observed for Native Americans. In 2007 the US Department of Human and Health Service published a Report with the aim of investigating all factors that may be related to the higher incidence of obesity in American Indians and Asian Natives(henceforth AI/ANs) through a review of all surveys and interventions conducted so far (7). The report concludes with some remarks about directions for future research. The problem of childhood obesity has become one of the priorities of the policy agenda in the United States especially with the launch of the campaign *Let's Move* by Michelle Obama in February 2010 (for further details see Part II). Lowering the risk of being obese since childhood it is of key importance because played by prevention.

1.2 Measuring obesity in the US: the National Survey for Children Health

The National Survey for Children Health started in 2003 and, since then, has been carried out every four years (in 2007 and 2011). The survey was designed to produce national and state-specific prevalence estimates for a variety of physical, emotional, and behavioral health indicators and measures of children's experiences with the health care system. Its principal sponsor is the Maternal and Child Health Bureau, a branch of Health

Resources and Services Administration (HRSA) that is headed to the Human and Health Department. The Maternal and Child Health Bureau (MCHB) has been charged with the primary responsibility of promoting and improving the health of the nation's mothers and children. The mission of the Maternal and Child Health Bureau is to assure the continued improvement in the health, safety, and well-being of all America's women, infants, children, adolescents, and their families (10, 23). The Bureau also seeks to ensure that *"there is equal access for all to quality health care in a supportive, culturally competent, family and community setting"* (23, 24).

Additional financial and logistical support to the NSCH has been given by the Centre for Disease and Control Prevention and, specifically, by the National Center for Infectious Diseases and by the National Center for Health Statistics, the latter in charge of doing the survey.

The survey was also designed to achieve (or contribute to achieve) the following goals:

- To characterize children's health status, understand their families and communities, and identify the challenges they face in navigating the health care system.
- To help Federal and State Title V programs[18] to find the data invaluable for planning and evaluating programs.
- Help researchers and public policy analysts at State and Federal levels to use these data to assess issues such as the prevalence of uninsured children, the

[18] The Title V Maternal and Child Health Program is the Nation's oldest Federal-State partnership. See also http://mchb.hrsa.gov/programs/titlevgrants/index.html for further information about the Program.

relationship of family health to children's health, and the impact of state programs on children's health and well-being.

- Provide baseline estimates for several MCHB companion objectives for Healthy People 2010 (and 2020).

Prevention plays a fundamental role in the healthcare system of the United States especially for those ranges of population that can't afford to pay a private insurance but are not enough poor to have the right to be integrated in Medicaid or Medicare. The problem is even more serious as the number of household components increases.

1.2.1Sample and Questionnaire

The sampling of the NSCH is based on the National Immunization Survey that is a broader scope survey with the aim of monitoring the health status of the population. A random-digit-dial sample of households with at least one child less than 18 years of age was selected from each of the 50 States and the District of Columbia. Interviews were conducted using Computer Assistance Telephone Interviewing (CATI) system. The respondent was the adult in a household who was most knowledgeable about the sampled child's health and health care. In over 95% of households, the respondent was the child's mother/female guardian or father/male guardian. So a potential bias for the results is due to the fact that the answers were parent reported. In 2003, 102,353 interviews were performed. Of these, 101,306 were cases that completed the entire interview and 1,047 were partially completed. The weighted overall response rate was 55.3%. The interview

completion rate, a measure of the proportion of completed interviews among known households with children, was 68.8%. The screener completion rate, which measures the proportion of known households where a resident reported whether or not a child lived in the household, was 87.8%. The resolution rate, indicating the proportion of telephone numbers that could be positively identified as residential or nonresidential, was 91.6%. State response rates ranged from 49.6% in New Jersey to 64.4% in South Dakota, with 32 states achieving overall response rates above 55%.The 2003 survey has been designed with the scope of investigating the health of children in eleven domains. The questionnaire was accordingly structured into these sections: age eligibility screening and demographic characteristics; health and functional status; health insurance coverage; health care access and utilization; medical home; early childhood (0-5 years); middle childhood and adolescence (6-17 years); family functioning; parental health; neighborhood characteristics; additional demographic characteristics. Particularly interesting is the concept of medical home.It is defined by the American Academy of Pediatrics as a primary care that is: accessible, continuous, comprehensive, family centered, coordinated, compassionate, and culturally effective (10). The survey also included a series of indicators related to the topics previously listed.

1.2.2 Childhood obesity: a review of findings of the National Survey of Children Health

In this paragraph we briefly review some findings from the literature that use National Survey of Children Health surveys. These references can be downloaded from the website of the project http://childhealthdata.org/learn/NSCH. The definition of Childhood Obesity is provided by the Centre for Disease and Control prevention: "*For children and teens, BMI ranges above a normal weight have different labels (overweight and obese). Additionally, BMI ranges for children and teens are defined so that they take into account normal differences in body fat between boys and girls and differences in body fat at various ages. For more information about BMI for children and teens (also called BMI-for-age)*".

Most of the papers associate overweight and obesity to disparities as racial, socio-economic andgeographic. For example Singh et al. (11) found that race/ethnicity, SES, non-metropolitan residence, and behavioral factors are independently related to childhood and adolescent obesity. Some authors(12, 13, 14) have also observed significant regional disparities across States and warrants that prevention efforts targeting individual risk factors – as well as contextual social and environmental factors – may reduce geographic disparities in childhood and adolescent obesity. Singh at al. (15)also found that the odds of a child's being obese or overweight were 20-60% higher among children in neighborhoods with the most unfavorable social conditions such as unsafe surroundings, poor housing, no access to sidewalks, parks and recreation centers. Bethell and al. have explored the relationship between childhood obesity and school type, National School Lunch Programme (NSLP) and School Breakfast Programme (SBP) eligibility, membership in sports clubs and other socio-demographic characteristics as well as other

household factors. Results show that a child who attends public school and is eligible for the NSLP or SBP has a 4.5% higher probability of being overweight (14, 16).

Some researchers studied associations between media use and health and found how TV/Video use is associated with a broader range of negative physical and socio-emotional health attributes than computer use (17). Sisson et al. (18) examined screen-based leisure time sedentary behavior and physical activity. Boys and girls who engage in low physical activity and high leisure time sedentary behavior are two times more likely to be overweight. Some of them also investigate the relation between overweight children and other psychological disorders such as ADHD - Attention-Deficit/Hyperactivity Disorder (19). Similar studies try to relate overweight and obesity rates to other chronic conditions (for example hearing, vision or learning disabilities such as autism). Results show that the prevalence of obesity for children 10 – 17 years old without a chronic condition was 12.2%; the prevalence for children with asthma was 19.7%, with hearing or vision problems was 18.4%, with learning 19.3%, with autism 23.4%, with AHDH was 18.9%. These results would show that if a chronic condition exists, overweight and obesity rates are higher than when it is not present. A similar study found that the prevalence of obesity was higher in children with autism - 30.4% against 23.6% (20).

Other analysis studied the relation between breastfeeding, socio-economic variables and legislation on breastfeeding across States in the US. Results showed that breastfeeding rate does not vary across different socio-economic groups but it does vary according to legislation supporting breastfeeding. Results indicated that the adjusted odds of being breastfed were from 2.15 to 5.15 times higherin southern than in Oregon (the reference

State) with a legislation on breastfeeding passed between 1999 and 2003. Also children in states without breastfeeding legislation have higher odds of not being breastfed (21).

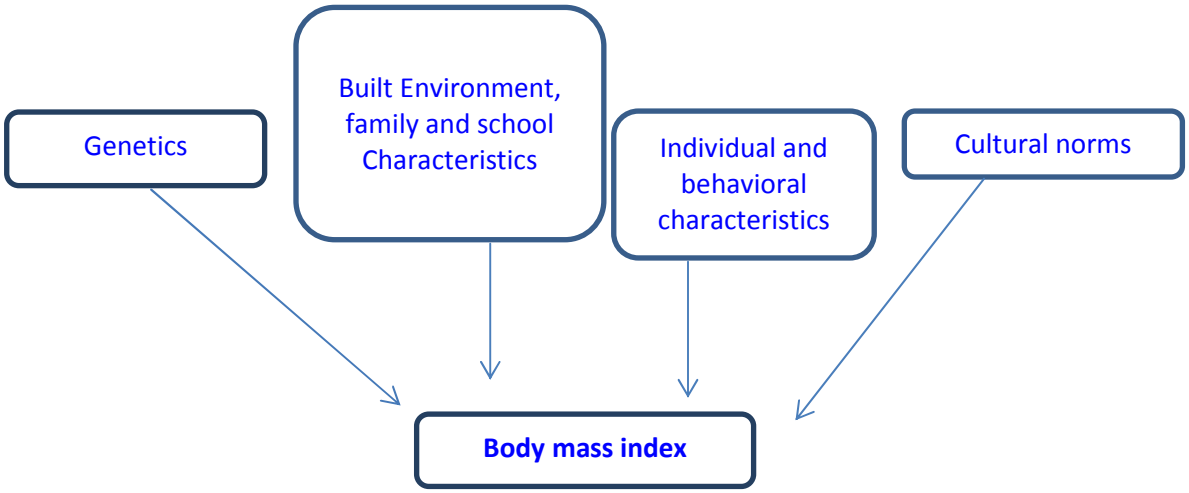
Finally other surveys have used the NSCH for estimating the relation between parent-reported BMI and its actual level. According to Akibami et al. (22), compared to measured data, parent reported data overestimate childhood overweight among younger children, but underestimated overweight among older children.

CHAPTER 2
A simple model on childhood obesity

2.1 A theory on obesity and research hypothesis

In a very simple form, we model childhood obesity as the result of four elements: (1) genetics, (2) built environment, family and school characteristics (3) individual and behavioral characteristics and (4) cultural norms.

Fig. 2.1 A simple model explaining childhood obesity



Formally the model can be represented with an equation form:

$$BMI = \alpha_0 + \beta_g X_g + \beta_e X_e + \beta_i X_i + \beta_{cn} X_{cn}$$

Each explanatory variable is a vector of relevant variables. *Genetics* include the thrifty gene and those entire known and unknown genetics variable that act on body fat storage accelerating or decelerating the individual metabolism. As we have seen in Part II, thrifty genes are a "heritage" from our ancestors and their role is to store fat calories in food shortage periods. *Environment* includes all the variables related to the built environment and to the variables related to the socio-economic status of the family of the children ("the family environment"). Built environment is strictly related to the urban design of the neighborhood. A healthy built environment, for example, includes park, walking paths, sidewalks or recreational areas that can favor physical activity and help people to gather together. The socio-economic variables are related to family but also to school environment. The choice of the school a child will attend is driven by family's income and education and it is thus not random, assuming that there is a minimum variety of choices. *Individual and behavioral characteristics* play also an important role, such as behaviors and attitudes towards eating habits. In this group, as we explain later in the paper, we also want to stress the role of psychological variables in explaining eating behaviors as well as other variables such as gender or ethnicity. The fourth component of the model is the system of *cultural norms*. The American Institute for Research (AIR) defines cultural norms as *behavioral patterns that are typical of specific groups. Such behaviors are learned from parents, teachers, peers, and many others whose values, attitudes, beliefs, and behaviors take place in the context of their own organizational*

*culture (*American Institute of Research). The Encyclopedia of Public Health defines cultural norms as follows: "*Passed from one generation to the next, cultural norms are the shared, sanctioned, and integrated systems of beliefs and practices that characterize a cultural group. These norms foster reliable guides for daily living and contribute to the health and well-being of the group. As prescriptions for correct and moral behavior, cultural norms lend meaning and coherence to life, as well as the means to achieve a sense of integrity, safety and belonging. Thus, normative beliefs, together with related values and rituals, confer a sense of order and control upon aspects of life that might otherwise appear chaotic or unpredictable"* (Encyclopedia of Public Health). Cultural norms are strictly related to children health. Indeed some cultural norms contribute to develop healthy habits as eating regularly fruit and vegetables, while others may have a negative impact on health as, for example, spending time with friends close to fast foods restaurant (thus increasing the chance of eating unhealthy food) or not practicing any sport. Understanding the process through which cultural norms develop is crucial to understand how they can be addressed. A drawback of this analysis is that it considers cultural norms as independent from the built and family environment when they may actually be correlated with it.

2.1.1 Obesity as a calorie imbalance

In its elementary meaning the body mass index can be represented as a function of the difference of calorie intake and calorie expenditure. A steady state is reached when the amount of calorie intake equals the amount of calorie burnt. It is straightforward that an

increase in weight depends on the fact that the calorie intake is systematically higher than calorie expenditure.

$$BMI_i = f(C_i - C_o)$$

Calorie intake is related to the all the explanatory vectors listed above. Taste– to the extent that flavors of food may induce to eat more or less – is influenced by the capacity of an individual of feeling sweet or bitter flavors and there is large evidence that is genetically affected (8,9). Eating habits are related to environment: food eaten depends on family's choice and budget constraint and also by the offer and proximity of the food stores in the neighborhood. Finally eating habits are a result of cultural norms. For example some religion may affect the likelihood of eating certain type of meat. Also cultural norms developed within the group of friend may affect the eating habits. Teenagers may preferspending time together doing some sports rather than eating at a fast-food. Calorie expenditure is related to genetics because our metabolism functioning depends on automatic process headed to the individual genetics (9). It is related to the environment because the possibility of doing physical activity depends on family financial resources – *can people afford to practice a certain sport?* – and also by the presence of parks, sidewalks, and recreational centers in the neighborhood. Finally calorie expenditure is related to culture norms.For example suppose that some individuals give a great value to sports or to be part of a team. People who value sport by itself are more likely to have a higher predisposition towards physical activity than those who don't.

The role of genetics is usually studied comparing behaviors of twins or using biological sample. Given that in the National Health Survey we do not have any information or

proxy for genetics, our research goals are tailored for addressing the role of built and family environment and the role of cultural norms.

2.2 Model formalization: Ordered Probit

In this paragraph I will describe the initial work I have done with the data. The first step was to reduce the questionnaire's length taking out the questions beyond the scope of the analysis. Each observation has been weighted in order to allow the sample to be representative of the US population. Given the complex sample design of the survey, data where analyzed with STATA 12necessary to estimate the marginal effects of the probit model. Using software that allow analyzing complex sample design is recommended to avoid a too low estimation of standard errors (10).

We have framed our analysis using a discrete choice model and, specifically, I opted for a probit. The choice between a probit or a logit models depends on the type of dependent variable. If we can reasonably assume that the dependent variable is a proxy for the true underlying variable which is normally distributed, then the probit model should be chosen. Otherwise if the dependent variable is considered to be a truly qualitative and binomial character, then logit modeling should be preferred (24). Green also says that "*it is difficult to justify the choice of one distribution over the other on theoretical grounds (…) in most applications it seems not to make too much difference"*. The body mass index is a continuous variable and it has been shown to be normally distributed across the

population despite its distribution has been shifted toward right in recent years (25, 26). Parent-reported BMI is a good proxy of the real BMI (22).

From the theory analyzed above we know that the BMI category of individual *i* is the result of *k* explanatory variables. The matrix of all values is summarized for simplicity by the value Z_i. In the underlying and unobservable model of BMI we include genetics, environmental and individual features and cultural norms.

$$BMI_i = \sum_{k=1}^{K} \beta_k X_{ik} + \varepsilon_i = Z_i + \varepsilon_i$$

In our dataset there is no useful information about the influence of genetics and thus we explore the influence of individual and behavioral characteristics, environmental factors and cultural norms. We assume that our population is, on average, generically stable. We also include some questions investigating behavioral patterns related to obesity. Each β_k is the coefficient associated to the k^{th} variable. Probit models are applied when the dependent variable is categorical. In case of BMI for example, instead of observing raw values, using categories associated with weight status (hence with health status) is more useful to observe the effect of specific factors. At this purpose BMI was split in four categories: underweight, healthy weight, overweight and obese. Since we focus on obesity, underweight individuals have been ruled out from the analysis (4.1% of the overall sample falls below the 5th percentile). The categorization has been based on the percentile distribution threshold given by the CDC. Going from healthy weight to obese the formalization is the following:

$$Y_i = 1 \quad if\ D_i \leq \delta_1$$

$Y_i = 2 \quad if\ \delta_1 \leq D_i \leq\ \delta_2$

$Y_i = 3 \quad if\ D_i \geq\ \delta_2$

In particular $\delta_1$is the 85^{th} percentile of the distribution and δ_2 is the 95^{th} percentile. The exact value of the threshold is unknown and it is estimated along with the coefficients. The probability of individual i of being normal-weight, overweight or obese can be summarized as follows:

$\Pr(Y_i = 1) = \Pr(\ Z_i + \ \varepsilon_i \ \leq \delta_1) = \Pr\ (\varepsilon_i \leq \ \delta_1 - \ Z_i)$

$\Pr(Y_i = 2) = \Pr(\delta_1 \leq \ Z_i + \ \varepsilon_i \leq \ \delta_2) = \Pr(\delta_1 - \ Z_i) \leq \varepsilon_i \leq \Pr(\delta_2 - \ Z_i)$

$\Pr(Y_i = 3) = \Pr(\ Z_i + \ \varepsilon_i \geq \delta_2) = \Pr\ (\varepsilon_i \ \geq \ \delta_2 - \ Z_i)$

In the following Chapter I will show how I have calculated the BMI empirically.

We are thus assuming that BMI has a probit distribution with three outcomes and each observation can be considered as a single draw from it. The likelihood of observing the sample is:

$L = [\Pr(Y_i = 1)]^{N_1}[\Pr(Y_i = 2)]^{N_2}[\Pr(Y_i = 3)]^{N_3}$

$= [F(\delta_1 - Z_i)]^{N_1}[F(\delta_2 - Z_i) - F(\delta_1 - Z_i)]^{N_2}[1 - F(\delta_2 - Z_i)]^{N_3}$

N is the total sample N_1 falls in the normal weight range, N_2 in the overweight range and N_3 in the obese class.

$F(x) = \Pr(\varepsilon_i < x)$ is the cumulative probability distribution of the error terms. To estimate the coefficients and thresholds we need to maximize the likelihood of observing

the sample and for doing so we have to assume an error distribution. As explained before, we use probit models and we thus assume that error distribution in our sample is normally distributed.

We assume that in our model the amount of unobservable factors related to weight shifts has a normal distribution. Since I do not explicitly include proxies for genetics, the assumption is that we are dealing with a genetically stable population. Basically we are assuming that the genetic pool has a symmetric distribution and its expected value is a combination of genes that is the prevalent phenotype. Under the error normality distribution we estimated $\hat{\beta}_k$ and we obtain an estimated value for each observation that is

$$\hat{Z}_i = \sum_{k=1}^{K} \hat{\beta}_k X_{i,k}$$

We then calculate, for each individual, the estimated probabilities$\hat{p}_{i,1}, \hat{p}_{i,2}, \hat{p}_{i,3}$. This allows us to have a first grasp of how the explanatory variables affect the estimated probability of being in one of the three categories (healthy weight, overweight or obese). The intercept is absorbed in the first cutoff points.

The cumulative distribution of a standard normal variable X is:

$$\Pr(X < x) = \phi(x) = \int_0^x \left(\frac{1}{2}\pi\right) \exp\left(-X^2/2\right) dX$$

So under the assumption that errors are normally distributed we get

$$\Pr(Y_i = 1) = \phi(\delta_1 - Z_i)$$

$$\Pr(Y_i = 2) = \phi(\delta_2 - Z_i) - \phi(\delta_1 - Z_i)$$

$$\Pr(Y_i = 3) = 1 - \phi(\delta_2 - Z_i)$$

The estimates of $\hat{\beta}_k$ are obtained using the maximum likelihood estimation using the normal function $\phi(.)$ instead of $F(.)$. Note that at this point the values of coefficients are informative not for their magnitude, but for the direction.

2.2.1 Marginal Effect for continuous variables

Given the discrete nature of the dependent variable we can't use the classical regression interpretation to observe how the dependent is affected given a unit increase of the explanatory variable. However we are interested in see how the probabilities of the various outcomes would change when the value of one of the explanatory variables changes. For example suppose that we want to study how the lengths of breastfeeding or the number of hours spent in front of the TV affect the likelihood of being normal weight, overweight or obese. The marginal effects on the three probabilities for person *i* of a small change in X_{ik} (the value of the k^{th} variable for the person *i*) under a normal distribution are:

$$\frac{\partial \Pr(Y_i = 1)}{\partial X_{ik}} = \frac{\delta}{\delta Z_i}[\phi(\delta_1 - Z_i)]\frac{\partial Z_i}{\partial X_{ik}} = -\phi'(\delta_1 - Z_i)\beta_k$$

$$\frac{\partial \Pr(Y_i = 2)}{\partial X_{ik}} = \frac{\delta}{\delta Z_i}[\phi(\delta_2 - Z_i) - \phi(\delta_1 - Z_i)]\frac{\partial Z_i}{\partial X_{ik}} = [\phi'(\delta_2 - Z_i) - \phi'(\delta_1 - Z_i)]\beta_k$$

$$\frac{\partial \Pr(Y_i = 3)}{\partial X_{ik}} = \frac{\delta}{\delta Z_i}[1 - \phi(\delta_2 - Z_i)]\frac{\partial Z_i}{\partial X_{ik}} = \phi'(\delta_2 - Z_i)\beta_k$$

In particular $\phi'(x) = d\phi/dx$ is the probability density function of the normal distribution. Thus the marginal effects can be obtained by calculating the PDF at the relevant points and multiplying by the associated coefficient. Note that if $\beta_k > 0$ and the value of the k^{th} variable increases, the probability for the individual i of falling in the first class decreases because the derivative of $\Pr(Y_i = 1)$ has the opposite sign toβ_k. Similarly the probability of falling in the third group $\Pr(Y_i = 3)$ increases. It is not clear what conclusion can be drawn for the probability of falling in the second group. Basically we only can infer what happens to the extremes but we can't make inference of what happen in the middle class from the sign of the coefficient. However given the scope of our analysis this limitation is not severe because we are interested in observing what happens to the extremes (normal weight and obese).

2.2.2 Marginal Effect for dummy variables

With dummy explanatory variables things are slightly different. When we are dealing with binary variables we are interested in determining how the probabilities of falling in each class vary when $x_{ik} = 1$ or $x_{ik} = 0$ for each k. Suppose we want to know which is the probability of an individual i of being normo weight, overweight or obese and how this probability would change if he were to live in a metropolitan area ($x_{ik} = 1$) rather than in a rural area ($x_{ik} = 0$).

We are thus interested in evaluating Z_i under the assumption that $x_{ik} = 1$(that is ${Z^1}_i$) and calculate the three probabilities using the equations above. Then, under the assumption of ceteris paribus conditions – that is maintaining the values of other explanatory variables unchanged – we evaluate Z_i as if $x_{ik} = 1$ and get${Z^0}_i$. And recompute the three probabilities. Note that ${Z^1}_i = {Z^0}_i + \beta_k$. The difference between the two probabilities is the effect of a person moving from living in a rural area ($x_{ik} = 0$) to an urban area.

Parallel slope assumption

A critical assumption is that the slope coefficientsβ_k do not vary according to the body mass index. The assumption can be tested by estimating a multinomial logit model that allows the slope coefficients to be different between the outcomes. To verify the parallel slope assumption and "be sure" we are using the correct model we have to compute L_1 from the ordered logit model and L_2 for the multinomial logit model, compute $2(L_2 - L_1)$ and compare this value with $\chi^2(K(M-2))$ where M is the number of outcomes of a given explanatory variable. The test is however only suggestive: a very large chi-square value would provide grounds for concerns while a moderate value would not (see STATA, 1999 pag 48). Using a probit model we are basically assuming that, for example, a given number of hours spent in front of the TV have a similar effect whether the child is normo-weight, overweight or obese. A drawback of the analysis presented in the following paragraphs is that we do not control for the appropriateness of the ordered probit.

2.3Research Hypotheses

The first hypothesis is that the built environment and cultural norms have a significant effect in affecting the probability of being overweight and obese. If this is the case, the contribution of this paper consists in providing further empirical evidence to the current status of art over obesity research. We also argue that tackling obesity through *indirectly* (that is addressing the built environment and cultural norms) is more effective than focusing the attention and efforts only on direct behavioral changes. The built and family environments can be interpreted in terms of distance with respect to the individual. If people are used to live in a certain built environment they have a lower capability of comparing it with other built environments of other territories. Variance in the types of family, education and income of a given neighborhood is instead higher and individuals are likely to perceive it. Although people sharing a same environment would have income and education distances within a certain threshold, they are more likely to see the differences because of status symbols (houses, cars, etc).Individuals are aware of their monthly income and of what they can or can't afford in terms of consumption, but they are not necessarily aware of how the built environment affects their lives. This different perception may negatively impact the likelihood of being obese in a more indirect (but also less frustrating) way. It is straightforward that equipped neighborhoods – that are more sport-friendly – are more likely to have lower obesity rates. For example suppose that a person does not have any choice but to drive to go to the recreational center where he or she use to spend Sundays afternoon. This depends by the absence of sidewalks.

How this person would react if she were to know that she could walk and burn a 200 of calories at zero cost (except for time) and saving gasoline? On the other side an individual who have budget constraints and know that he somehow has to opt for more dense-caloric food instead of healthier food is more likely to be aware of how this choice will impact his and his family‘s weight. This is true under the assumption that he is informed about the caloric content of what he or she is buying. Basically the built environment limits the individual freedom but people are not aware of it. Budget constraints limit it as well but individuals are more likely to know what food basket they can afford and what no. Given the differences in the built environment between United States and Europe we argue that, at least for this aspect, these to realities are not comparable.

CHAPTER 3
Empirical description of the model

3.1 A Descriptive representation of the model

The third Chapter describes the variables included in the model specifying how the BMI – the explained variable – has been classified in the survey.

Once that data were collected, some variables have been recoded to protect respondent confidentiality. We divided independent variables into three groups. The first includes proxies for family characteristics and the built environment. On one hand there are environmental variables that are "closer" to the individual and whose combination is individual-specific (the socio-economic status, the family structure and the school environment). On the other there are factors linked to the so called built environment. For measuring the role of the built environment we used variables measuring the safety perception and the social characteristics of the neighborhood. Our dataset did not include information about physical characteristics of the neighborhood. The role of built environment in shaping behavior is quite a novel issue (at least in studying obesity and health) and standardized measures were not used in this survey.

The second group (individual and behavioral characteristics) includes a broader range on information from individual to psychological characteristics. The peculiarity of this group is that all the variables are intrinsically informative about the individual.

The third group includes a group of variables proxies for cultural norms.

Table n.3.1A qualitative description of the model

<table>
<tr><th colspan="4">Dependent Variable(s)</th></tr>
<tr><td colspan="4">Derived. BMI for age classification for sample child (NSCH): underweight, normal weight, at risk of overweight and overweight.

BMI distribution (Binned calculated on z-percentiles using the tool for school): underweight, healthy weight, overweight and obese.

Indicator 1.4: What is the weight status of children/youth ages 10-17 based on Body Mass Index for age (BMI-for-age)? (derived) - underweight, normal weight, at risk of overweight and overweight.</td></tr>
<tr><th colspan="4">Explanatory variables</th></tr>
<tr><th colspan="2">Enviroment</th><th rowspan="2">Other Variables behavioral patterns and psychological factors</th><th rowspan="2">Cultural Norms</th></tr>
<tr><th>SES, Family and School Environment</th><th>Built environment</th></tr>
<tr><td><u>Income</u>

Derived. Poverty level of this household based on DHHS guidelines
Derived. Poverty level of this household based on DHHS guidelines (Binned)

Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare?

Does [S.C.] have any kind of health care coverage, including</td><td>State

Metropolitan Statistical Area

During the past 12 months, did [he/she] participate in any clubs or organizations after school or on weekends, such as Scouts, a religious group, or [Boy/Girl]'s Club?</td><td>Gender

Primary language spoken at home

Has a doctor or health professional ever told you that [S.C.] has depression or anxiety problems

In general, how would you describe [S.C.]'s health? Would you say [his/her] health is excellent, very good, good, fair, or poor?</td><td>Indicator 1.3: Was (child's name) ever breastfed or fed breast milk? (S6Q59 -- ages 0-5 only)

During the past week, on</td></tr>
</table>

health insurance, prepaid plans such as HMOs, or government plans such as Medicaid Indicator 3.1: Does (child's name) have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicaid? (S3Q01) <u>*Family and School Environment*</u> Highest level of education in the household Family structure type What kind of school is [S.C.] currently enrolled in? Is it a public school, private school, or home school? On an average school day, about how many hours does [S.C.] use a computer for purposes other than schoolwork? Indicator 1.5: During the past week, on how many days did (child's name) exercise or participate in physical activity for at least 20 minutes that made him/her sweat and breathe hard? Indicator 6.10: On an average school day, about how many hours does (child's name) usually watch TV, watch videos, or play video games? (S7Q28 -- ages 6-17 only)	During the past 12 months, has [S.C.] been involved in any type of community service or volunteer work at school, church, or in the community? "There are people in this neighborhood who might be a bad influence on my [child/children "There are people I can count on in this neighborhood." We watch out for each other's children in this neighborhood." "If my child were outside playing and got hurt or scared, there are adults nearby who I trust to help my child How many times has [S.C.] ever moved to a new address? Indicator 7.1: How many children/youth (ages 0-17) live in supportive neighborhoods? (derived)	Overall, do you think that [S.C.] has difficulties with one or more of the following areas: emotions, concentration, behavior, or being able to get along with other people? [He/She] bullies, or is cruel or mean to others. [He/She] is disobedient [He/She] tries to resolve conflicts with classmates, family, or friends [He/She] feels worthless or inferior He/She] is unhappy, sad, or depressed [He/She] is withdrawn, and does not get involved with others How often does [he/she] wear a helmet when riding a bike, scooter, skateboard, roller skates, or rollerblades? Would you say never, sometimes, usually or always?	how many days did all the family members who live in this household eat a meal together? About how often does [S.C.] attend a religious service? We watch out for each other's children in this neighborhood.

	How often do you feel [S.C.] is safe in your community or neighborhood? "People in this neighborhood help each other out." Would you say that you definitely agree, somewhat agree, somewhat disagree, or definitely disagree with this statement?		

3.2 Calculation of the BMI (dependent variable)

Body mass index is the most widely used measure to classify an individual as underweight, normal weight, overweight or obese. It is defined as the ratio between weight (in kg) and squared height (in meters). Standard classification expresses the weight in kilograms and height in squared meters but there are formulas to adjust the equation in accordance to the unit of measurement used. The National Survey of Children Health includes parent-reported height and weight. Respondents were permitted to report the child's height in either feet and inches or in centimeters, but in order to avoid confusion, a new variable was built so that all heights were expressed in inches. An identical situation happened with weight. Respondents were allowed to report it either in

kilograms and pounds and a new variable with the latter unit of measurement was recoded. In order to protect confidentiality of children, very short and very tall heights as well as very high and very low weights were suppressed. Extreme values were identified within each single-year age group and were recoded to less extreme values (10). So there was no need to look for outliers in the distribution. A variable of BMI classification was included in the original questionnaire. It includes for classes: underweight (BMI-for-age is in the 5^{th} percentile or lower), at risk for overweight (BMI-for-age is comprised between the 85^{th} and 95^{th} percentiles), overweight (BMI-for-age is in the 95^{th} percentile or greater). Percentiles were determined using the growth charts of the National Centre for Disease and Control Prevention. For example, the 95^{th} percentile means that compared to children of the same gender and age, 95% have a lower BMI. Since we are interested in children that also are classified as normal weight we have recalculated the body mass index using the following formula:

$$\text{BMI} = [\text{weight in pounds} \div (\text{height in inches x height in inches})] \text{ x } 703$$

We have thus built a new variable, BMI parent reported. For calculating the BMI and determine if a child was normo-weight, overweight or obese we have used the Children's BMI Tool for Schools provided by the Centre for Disease and Prevention Control. To use this tool we needed to determine the exact date of birth of each child. Dates of birth and of interview were not reported and the only useful information is that interviews were conducted between January 29^{th}, 2003 and July 1^{st} 2004. We also know how old the children were at the time of interviewing.

I have thus calculated the approximated age of children as if all of the interviews were conducted on October 15th 2003 – which falls exactly in the middle between the first and the last days of the survey – and as if all children were born on October 15th. The year of birth was simply obtained by subtracting children age to 2003. The robustness of our assumption is shown by the quasi-perfect correspondence between the parent-reported BMI and the BMI calculated from the growth charts[19].

After having calculated the percentiles, I have then binned the variable according to CDC recommendations. Underweight teens and children are below the 5thpercentile of the distribution, healthy weight children are above the 5th percentile and below the 85th percentile, overweight are between 85th and 95th, and obese are equal or greater the 95th percentile. Usually the dependent variable in discrete choice model is a latent variable whose real value can't be directly observed but only measured through the construction of an index. So the resulting index can be considered as a proxy for some real and unknown value of the population. In our model we have basically built this index starting from parent-reported weight and height status of their child. We can thus express this formally:

$$BMI^*_i = \left(\frac{W_i}{H_i^2}\right) * 703$$

[19] There is an alternative procedure – which is also the most used – for calculating the Body Mass Index and the percentiles. The website of the Centre for Disease and Prevention Control provides a Program SAS file with the detailed procedure to calculate BMI percentile. Methodology is also downloadable.
http://www.cdc.gov/nccdphp/dnpao/growthcharts/resources/sas.htm

Weight is reported in pounds and height in inches. Data were then adjusted using the CDC growth charts that account for the year of birth. According to BMI estimated value, we have defined three categories:

$BMI_i = 1$ If an individual is normo-weight

$BMI_i = 2$ If an individual is overweight

$BMI_i = 3$ If an individual is obese

The frequency distribution of our sample (using weighted cases) is the following:

Table 3.2 – Frequency distribution of the BMI in the sample

BMI distribution (Binned)	Percent	Valid Percent	Cumulative Percent
Healthy Weight	56.5	56.5	56.5
Overweight	17.3	17.3	73.8
Obese	26.2	26.2	100.0
Total	100.0	100.0	

According to parent reported BMI more than a half of sampled children is healthy weight, one quarter is obese and less than one fifth is overweight.

3.3 Obesity determinants

3.3.1 Environmental factors – the socio-economic factors, family and school (independent variables)

Income

In the original questionnaire raw values of income were not reported but replaced by a ordinal variable that indicates the household poverty status. When respondents did not provide a specific dollar amount for household income, interviewers were trained to go through a series of questions asking respondents whether the household income was below, exactly at, or above some threshold amounts. Once an income-to-household-size measure was computed, it was compared with DHHS Federal Poverty Guidelines. Eight categories were identified and each of them was a percentage of the poverty line value. Thresholds are collected at State level and take into account the number of household components. This category indicated if a family income is, respectively, a percentage of 100, 133, 150, 185, 200, 300 and 400 with respect to poverty line in a given year. Basically the more a family income is below the Federal Poverty Level, the poorer the family is. We have further simplified the classification and binned the variable into four groups. The first one includes family with an income less than 133% of the FPL; the second includes family with an income included between 133% and 185% of the FPL, the third between 185% and 300% and the fourth above 300%. In our weighted sample and with the exclusion of underweight individuals the observed distribution was reported in Table 3.2. We have crossed the poverty level with weight status and it is clear that the incidence of overweight and obese individuals is higher as the income decreases. Chi-square test is significant at the 99% confidence level.

To have a better insight of the categories that differ one from the other we have used a z-proportion test. Each subscript letter denotes a subset of the Poverty Federal Level categories whose column proportions do not differ significantly from each other at the .05 level.

*Table 3.2 BMI distribution (Binned) * Derived Poverty level of this household based on DHHS guidelines (Binned) Cross tabulation*

		Derived Poverty level of this household based on DHHS guidelines (Binned)				
		1	2	3	4	Total
BMI distribution (Binned)	Healthy Weight	48.3%	46.9%	53.6%	62.7%	56.3%
	Overweight	18.0%	19.3%	18.0%	16.6%	17.4%
	Obese	33.7%	33.7%	28.5%	20.7%	26.3%
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Several proxies can also be used for income. A proxy for the socio-economic status of the family is for example the health insurance coverage. Respondents were asked if they had one and, when their answer was positive, if they were covered by Medicaid. We could assume that those who are eligible to Medicaid are those living in poverty while those who are not covered at all are something in between: they can't afford health insurance but at the same time are not enough poor to apply for Medicaid. Other proxies can be the kind of school where the child is enrolled (public or private), whether any member of the household was a recipient of the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Program. Another proxy for the poverty level of the family was the question: "*Was anyone in the household employed at least 50 weeks out of the past 52 weeks?"* Asking a question in an indirect way may help to provide the true answer: it might be easier to say no than to say yes. Finally the following questions may be considered proxies for the economic status of the respondent: *"At any time during the past 12 months, even for one month, did anyone in this household receive any cash assistance from a state or county welfare program? During the past 12 months, did*

[[S.C.]/ any child in the household] receive food stamps?During the past 12 months, did [[S.C.]/ any child in the household] receive free or reduced-cost breakfasts or lunches at school? Does anyone who lives in the household currently receive benefits from the women, infants, and children (WIC) program?"

Family and School Environment

Another aspect that has been investigated in relation to childhood obesity is the family structure. There is some evidence, for example, that family cohesion is inversely related to obesity (27). The 2003 National Survey of Children Health includes a variable on family structure. It accounts for the following information about child family's composition: two parent household which includes both a biological or adoptive mother and father, two parent household with a both mother and father that includes at least one-step parent, one parent household with a biological step, foster or adoptive mother and no father, all other family structure. To protect confidentiality but at the same time to know the frequency with which a child see biological mother or father if parents were separated or divorced, one of the question was formulated as follows: *"during the past 12 months, how often has [S.C.] seen [his/her] biological mother or biological father?"* Another aspect related to obesity is parental education. As true for income, a lower educational level means less information and thus less opportunities for buying healthy food. This relation has been recently investigated by Lajunen et al. (27). They found that, for families living in the same neighborhood, the share sharing a common environment did not affect variation of adolescent BMI in high-educated families but did so in families with limited parental education (27).

There is also epidemiological evidence related to how school performance is lower for overweight and obese children. The causality direction in this case is likely to be reversed: being obese is a condition that may impact on school performance due to the influence it has on nutrients that may have an impact over obesity(28). In our model the only information about school is if the child attends a public or a private school (*What kind of school is [S.C.] currently enrolled in? Is it a public school, private school, or home school?*). No information about school performance has been collected. Another important issue that has been largely addressed in the literature is related to children time-use with particular attention on the amount of time spent in front of the television and the amount of physical activity. In fact one of the acknowledged causes of children overweight is the reduction of calorie expenditure due to a greater amount of time spent in front of the TV or in playing videogames and also to a decrease in time of physical activities. This large evidence comes first from epidemiological research despite the fact that there are difficulties in capturing this effect more systematically (29). Some videogame companies have smartly introduced a "something in between" option exploiting the opportunities offered by technological and virtual reality. The effects (and widespread) of these technologies has not been explored yet, even if it may be interesting to understand if these technologies play a role in children weight adjustments. Although our goals are far from being exhaustive, I account for time-use variables in my model. Specifically I include the following questions: *"On an average school day, about how many hours does [S.C.] use a computer for purposes other than schoolwork? On an average school day, about how many hours does [S.C.] usually watch TV, watch videos, or play video games? During the past month, did your egularly exercise or play sports*

hard enough to make you breathe hard, make your heart beat fast, or make you sweat for 20 minutes or more?; Indicator 1.5: During the past week, on how many days did (child's name) exercise or participate in physical activity for at least 20 minutes that made him/her sweat and breathe hard?; Indicator 6.10: On an average school day, about how many hours does (child's name) usually watch TV, watch videos, or play video games?". Finally children obesity may be affected by the school environment. This influence is presented in different ways. Children in school-age spend most of their time at school and school contributes to shape their habits. Some factors that may have an influence on eating behaviors are for example: peer effects, presence of vending machines, sport facilities, adherence to the National School Lunch Program. The main problem in US schools is related to school accountability and their autonomy in allocating money. For example an interesting study investigated how obesity rates may indirectly be affected by public program as *No Child Left Behind (NCLB)* a program that rewards schools that invest in the strengthening of mathematical capacities (30).

3.3.2 The causes of obesity: the built environment

State and Metropolitan Statistical Areas

Geography is another variable that has been recoded after data collection. It is related to the built environment for two reasons. Firstly there is evidence that overweight and obesity rates are different across States in the United States (20). In the NSCH respondents were asked to indicate in which State they live. Respondents were asked if they lived in a MSA (Metropolitan State Area) or in a rural area. However, as reported in

the methodology of the survey (10), this indicator was suppressed whenever the sum total population for all MSA areas - or the total population for the non-MSA areas in the State was less than 500,000 persons. This resulted in the suppression of the MSA identifier in 16 states. The MSA identifier was suppressed in Connecticut, Delaware, Hawaii, Massachusetts, Maryland, New Hampshire, Nevada, and Rhode Island because fewer than 500,000 persons lived in non-metropolitan areas. The MSA identifier was suppressed in Idaho, Maine, and Montana because fewer than 500,000 persons lived in metropolitan areas. The MSA identifier was suppressed in Alaska, North Dakota, South Dakota, Vermont, and Wyoming because the non-MSA population size and the MSA population size were both below the 500,000 threshold.

Features of the built environment

Differently from questions present in the section below, these are strictly connected to the built environment and specifically to the presence of clubs, organizations or sport teams. The other questions investigating features of the built environment were related to parental perceptions over the safety and the trust level in the neighborhood of respondents. One assumption that we have to make here is that a favorable built environment not only offers formal facilities but also facilitates social cohesion and attracts families with children and young adults. Or, on the opposite, because the built environment does not offer sufficient facilities, people have to count on reciprocal help. We finally include a variable that ask if the child has ever moved from the current place. Changing environment has been demonstrated to be one leading factor that may help in changing habits (31).

3.3.3Individual and behavioral factors related to obesity

Gender and ethnicity

Race was originally measured asking respondents to indicate their ethnicity. The US Bureau of Census recognizes seven races White, Black African, American Indian and Alaskan Native, Asian, Native Hawaiian and Other Pacific Islander alone, other race (alone) and two or more races[20]. The NSCH survey also included another dummy category – Hispanic or Latino – that is here separately treated. However, to protect the confidentiality of individual respondents and children, responses for the races were collapsed into four categories: white, African and Black American, other race and multiple races. Other race category includes children for whom only one of the three categories – Asian, NA/AN and NH/PI) was reported. Multiple races include children for whom more than one race was reported. A drawback of this analysis is that we could not distinguish how the effect of different factors impact on the obesity rates of Asians on one hand and AI/NA and NH/PI on the other. Traditionally the first group has the lowest obesity rate, while the second the highest (32). As we did for the income we have crossed race with weight status, data are reported in the table below.

*Table 3.3 BMI distribution (Binned) * Race classification for all states (White, Black, Multiracial, Other) Cross tabulation*

	Race classification for all states (White, Black, Multiracial, Other)				
	WHITE ONLY	BLACK ONLY	MULTIPLE RACE	OTHER	Total
Healthy Weight	59.8%	44.9%	57.2%	56.3%	57.1%

[20] The classification is made by the US Census Bureau. For example see: http://www.census.gov/population/race/

	Overweight					
		16.9%	17.7%	16.7%	17.7%	17.1%
	Obese					
		23.3%	37.4%	26.2%	26.0%	25.8%
Total						
		100.0%	100.0%	100.0%	100.0%	100.0%

Chi-square was significant at the 99% confidence level. Black individuals are systematically less normal weight and more overweight and obese than White Americans. Unfortunately we can't distinguish between BMI distribution of Hispanic Americans, Asian and American Indian and Native Alaskan. Language spoken at home can be considered as a proxy for race. In the original version of the questionnaire respondents had to indicate the answer the language spoken at home. Successively the information has been recoded into a binary variable with two options: English and non-English speaker. Also a simple marker for ethnicity is if the respondent has Hispanic origin or not. At the light of our model, it is important to answer to the following question: can we consider race a proxy for genetics or for family characteristic? The issue has been for long debated in the literature especially in the discipline of anthropometric (see for example 22).

The problem is that wherever some ethnicities suffer of some form of discrimination within a society, they have automatically less opportunities that the dominant ethnic group in terms of income and education. In this sense, even if there are ethnicities that are more likely to store fat than others, disentangle this effect from income effect is tricky. To understand to what extent different races have different opportunities I have analyzed official report on racial and ethnic discrimination in the United States. The Committee against racial discrimination of the United Nations Human Rights (UNCH) published a Report in 2008 observations on the state of the art (2008). Concerning United States, although significant steps have been contributed to reduce racial disparities (as for

example with the institution of the National Partnership for Action to End Health Disparities for Ethnic and Racial Minority Populations), there are still concerns and recommendations over the current practices. For example one big concern is the gap of the legal definitions of discrimination across States and the article of the Convention signed within the UN. The first recommendation says: "*the Committee recommends that the State party review the definition of racial discrimination used in the federal and state legislation and in court practice, so as to ensure, in light of the definition of racial discrimination provided for in article 1, paragraph 1, of the Convention,– that it prohibits racial discrimination in all its forms, including practices and legislation that may not be discriminatory in purpose, but in effect*" (34). In addition we have observed that in our sample black people have systematically a lower income than white population and this relation is significant. For example among those who have a higher income, black people are only the 8% while white are 82.7%. Some could argue that genetics could be somehow related to individual capabilities but there is no enough evidence for assuming this hypothesis. At the light of this discrimination and given the recognized correlation between obesity and income I conclude that, for our analysis, race can be conveniently considered a proxy for the socio-economic status. In particular I state that White Americans are more likely to have lower rates of overweight and obesity than Black Americans and other minorities. An only exception is for Asians. It is in fact amply documented that Asian populations living in the US has systematically lower degree of obesity and overweight rates but also higher level of income (21). However Different explanations may be addressed to explain these differences. Reasons could lie in external or internal causes. As regard the environment, for example, some minorities have usually

a lower income and educational level than white Americans or are less likely to change their food habits even when they have been lived abroad for decades. There is also evidence of a genetic predisposition to a malfunctioning of the endocrine system that can eventually lead to overweight and obesity. How these differences are distributed along different populations is something that needs to be further investigated, especially at the light of the recent phenomena of nutritional transition in several developing countries (35). In the United States a higher incidence of obesity in ethnic minorities could be explained by other variables, such as education and income. A lower educational level corresponds not only to a lower income, but also to less information about the risk of being overweight. On the other hand, given the lower prices of junk-food foods, people with a lower income tend to buy more unhealthy food and less fruits and vegetables. Ethnicity is clearly a variable that may affect BMI because of cultural norms, such as eating habits or length of breastfeeding (37). At the light of this, I decided to include this variable in the third group among other individual and behavioral characteristics that may be considered as more hybrid.

Health and other behavioral – psychological factors

Psychological and – more generally – behavioral factors have been recognized to be important in eating behaviors. For example binging, addiction and a lack of self-control have been largely studied from psychologists and also psychiatrists. Diets accompanied by psychological treatments have been shown to be more effective than those that are not. Behavioral treatments may be effective in preventing obese individuals from going back to their original weight in a short period. One of the greatest challenges for fighting obesity is changing eating behaviors such that a new balanced weight may be maintained

in the long run term. Pointing on long-run and long-lasting term goals is the ultimate goal of behavioral science.However it is the also the most difficult because behind the probability of its efficacy there is a deep understanding of the complex machine that the human beings. Insights from psychology and psychiatry are thus more than welcomed because of their capability of going beyond the surface. Some evidence from the academic literature has shown that overweight and obese children tend to be more aggressive and to adopt more bullying behaviors than the normal weight children. This is probably a reaction of their social exclusion, but in the long run we cannot exclude that this behavior will be consolidated (36).Another issue that is related to obesity is the Attention Deficit Hyperactivity Disorder (AHDH) – related to behavioral patterns and deficit attention (40). Low self-esteem is also related to weight problems. Children may indulge in food because they try to compensate some other deficiencies but at the same time if they feel excluded by their peers, perceiving themselves as good and acceptable becomes more difficult (38). It has to be said that these studies have also some genetic components. Several other psychological problems have been recognized to be related to obesity. For example there are anxiety, depression, sleeping disorders and also parental disorders (40). Given the increasing importance of these factors the National Survey of Children Health has collected a lot of information over these topics. As reported in the table above several questions about these topics have been included in the model.

We have also included parent perception of their child health of his/her own health. Although this is only a perception, information on health status may help to understand if – when present – weight problems are also associated to other health issues.

3.3.4 Cultural norms

Breastfeeding

Strong relations have been observed between current individual weight, length of breastfeeding and parental obesity. This finding has been acknowledged in the literature on obesity research. There is a strong link between the length of breastfeeding and the propensity of being overweight in childhood and later on in life. Infants who had been breastfed are more likely to introduce and to accept new foods in their future diet, because they were already used to be fed by maternal milk which contains flavors and nutrients of different foods. Although further research is needed for understanding how breastfeeding affects obesity later in life, its protective function has been recognized, at least for the first months (41).

A crucial question is to understand if breastfeeding can be considered a cultural norm (when the decision of breastfeeding a child and for how long only depends on maternal willingness). Data show how breastfeeding varies significantly across ethnicity and across States. If we assume a stable "breastfeeding capacity" in women population, differences shall depend on social and cultural factors. An interesting analysis can be found in Bentely and al. (42). Using an ecological model the authors try to understand which factors may contribute to the gap in breastfeeding rates among women of different ethnicities in the United States. These include mass media, political and economic context, community and environment, interpersonal and individual sphere. First of all media the role of mass media is addressed. Media exposure contributes to strengthen or change social norms, perceptions and beliefs. For example they cite a controversial

episode of the series Chicago Hope saying that it *portrayed an exclusively breastfed, 6 week old infant who, according to an autopsy report, died from heart failure, secondary to dehydration, which the chief physician said was indicative of starvation*. To what extent this may have influenced breastfeeding perception is difficult to measure, however the episode message connotes negatively maternal breastfeeding, strengthening this belief if already present or eventually change perception if beliefs were not well defined yet. They noted how "*print media also contribute to the perception that formula feeding is the norm and breastfeeding is not. Media images of formula feeding pervade American society, through ubiquitous television commercials for infant formula, bottles and related supplies*". And finally they address media's sexualization of women's breast. The media also have the power to affect social norms about breastfeeding because of the of women's breasts. For example they report how women's breasts have been used in advertise for selling alcohol, magazines, lingerie, perfume and many other consumer goods. Finally all the marketing of artificial milk for new-born babies may encourage mothers to substitute their milk with the advertised one. Concerning the political and environmental context, families with lower income and without any welfare protection may be negatively affected by the need of working in the decision of breastfeeding their children. For example the Centers for Disease and Control Prevention has reported that:"*breastfeeding rates in 1999-2006 were significantly higher among those with higher income (74%) compared with those who had lower income (57%)*" and also that "*Overall, the rates of breastfeeding at 6 months of age were significantly higher among Mexican-American (40%) and non-Hispanic white infants (35%) compared with non-*

Hispanic black infants (20%), but the rates for Mexican-American and non-Hispanic white infants were not significantly different" (43).

Even if things are now chaining, before the Patient Protection and Affordable Care Act (2010) became effective, in many States breastfeeding in public places was punished by the law because was considered indecent. The indecency of breastfeeding in public places is a cultural norm because of the degree of acceptance varies across States and cultures. The role of community and environment can also be very important. The environment may facilitate breastfeeding practice if, for example, in hospitals, workplace or recreational centers there are quiet places for breastfeeding. At community level it has been shown that when mothers are provided with correct information about breastfeeding they are more likely to breastfeed for a longer time (7). The interpersonal sphere is also very important because of the social pressure from the social network. For example this evidence has been reported in Indian American communities (7). Some negative beliefs – operating at the individual level – can also induce "fear" or "shame". Two barriers that have been recognized as important factors are concerns about pain and breastfeeding in public. According to the Breastfeeding Report card of 2011, 74.6% of mothers answered "yes" when they were asked if *they have ever breastfed* of whom 44.3% were breastfeeding at sixth month (that is the recommended threshold for the maintenance of a healthy status later on in life).

Many efforts have being made for increasing actual breastfeeding rates. For example the Healthy People 2020 initiative of the US government recognizes among the physical determinants of maternal and child health the importance of breastfeeding as the most

complete form of nutrition for infants. At the light of this discussion I conclude that breastfeeding practice and length is a cultural norm.

Finally other variables may be used as indicators for cultural norms. In particular I have identified the following three. The first one investigated how many days a week the family is used to have a meal together. Eating patterns have been recognized to be very important for children nutrition and, particularly, sharing a dinner family would increase the probability of eating fruit and vegetables (44). Perceiving the household as the main consumption site of the adolescent is also of great importance for developing healthy eating patterns. In Mediterranean countries the family dinner is the most important moment of the day, when family gathers towards the table to spend some time together. In other cultures this is not common or even possible, as for example in the Horn of Africa or in cultures where women are not allowed to sit together with family males. Sharing a meal and eating together can be even embarrassing and cause stress in some cultures. Although these are extreme examples, we may assume that eating in front of the television or the increase in the frequency of eating outside has reduced the chances of spending some time and has dinner with family. The third cultural norm is the frequency with which family members attend a religious service. To the extent that believing in a certain faith determines some behavioral patterns such as praying during the day, celebrating rituals, going to worships, following some moral principles and even determine what to eat and what not to eat, religion can be safely considered a cultural norm. We do not expect that it will affect obesity in a direct way but, however, we can observe if stable eating patterns may have an indirect impact on weight adjustments and, more generally, eating behaviors. Finally there are the mutual help between families

living in the same neighborhoods that can also be considered a cultural norm. If for example in a given community neighborhood people are used to watch other's kids because they value reciprocal cooperation or because they like to appear good at others' eyes, this can be considered a cultural norm.

CHAPTER 4
Results and discussion

4.1 Description of the work

After having explained which variables we used, we run probit models. The dependent variable is the BMI, divided in three categories: healthy weight, overweight and obese. The independent variables are proxies for the family and school characteristics and the built environment (1), individual and behavioral characteristics (2) and cultural norms (3). As specified early, we assume that we are working with a population that is genetically stable.

4.2 Ordered Probit: BMI, family characteristics and the built environment

Family, School and Socio-Economic Status

We regressed the BMI with the following explanatory variables: health coverage, parental education, family structure, type of school (private or public), hours spent in

front of computer, hours in front of TV and frequency of physical activity. In the following Table we report results of coefficients' estimation.

Table 4.4 Ordered Probit – BMI and Family, School and SES

bmi_class	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
poverty_line	**-.1086625**	**.005589**	**-19.44**	**0.000**	**-.1196168**	**-.0977082**
health coverage	-.0264079	.0206537	-1.28	0.201	-.0668885	.0140727
educationr	**-.1207771**	**.0115443**	**-10.46**	**0.000**	**-.1434035**	**-.0981507**
famstruct	**.030541**	**.0055915**	**5.46**	**0.000**	**.019582**	**.0415001**
kind of school	**-.0419773**	**.0125501**	**-3.34**	**0.001**	**-.066575**	**-.0173795**
computer usage	**.001766**	**.0004541**	**3.89**	**0.000**	**.000876**	**.002656**
physical activi	-.0076477	.0056094	-1.36	0.173	-.0186419	.0033466
hours of TV	**.1297316**	**.00759**	**17.09**	**0.000**	**.1148554**	**.1446078**
/cut1	-.2177002	.0434715			-.3029028	-.1324976
/cut2	.3163532	.0434795			.2311349	.4015715

Ruling out the question on health coverage and the frequency of physical activity all the variables selected are significant ($p < 0.001$). Concerning the income we observe that the higher the income the less likely a person in expected to be obese. A similar pattern is observed for education: the higher the education level, the lower the probability of being obese. The probability of obesity decreases if a child lives in one-parent family. As regard school type children who opt for a public school are more likely to be overweight than children that go to a public school. Type of school may be used as an indicator for income. Time spent in front of the TV or in front of the computer has a positive effect on the probability of being overweight or obese.

Built Environment

We then regress the BMI on the following variables treated as proxies for the built environment. The first (*msa_stat*) indicates if the respondent lives in a rural or in a urban area; the second variable asked how many times the children participated in recreational

activities in the neighborhood (*social activity*); the third variable (*community service*) asked if he or she has been involved in any kind of community service; the fourth is the level of agreement with the belief that in the neighborhood where the respondent live people help out each other (*help neighborhood*); the fifth is related to mutual help with children between families (*mutual help children*); the sixth (*bad infl neigh*) asked to the respondents the level of agreement over the statement that in the neighborhood there are bad influences for the kids; the seventh asked about the safety perception of the neighborhood and the eight about the school (*safety at school*) and finally the ninth asked about the level of support of the neighborhood (*supportive neigh*).

Table 4.5 Ordered probit and built environment

bmi_class_	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]	
msa_stat	**-.1208162**	**.0206078**	**-5.86**	**0.000**	**-.1612067**	**-.0804257**	
social activity	**-.0220314**	**.0045474**	**-4.84**	**0.000**	**-.0309441**	**-.0131187**	
community serv	**-.1047451**	**.0208329**	**-5.03**	**0.000**	**-.1455768**	**-.0639134**	
Help neighborho	**.0847146**	**.0175306**	**4.83**	**0.000**	**.0503553**	**.1190739**	**Mutual**
help ch	**-.038337**	**.0178421**	**-2.15**	**0.032**	**-.0733069**	**-.0033672**	
Help neighbor2	.0331466	.0189154	1.75	0.080	-.0039269	.0702201	
Bad infl neigh	**-.0420053**	**.0085665**	**-4.90**	**0.000**	**-.0587952**	**-.0252153**	
Trust lev neigh	-.0048811	.0190227	-0.26	0.797	-.0421649	.0324028	
Safety percept	**.0508641**	**.0161264**	**3.15**	**0.002**	**.0192569**	**.0824713**	
Safety at scho	**-.0457992**	**.015226**	**-3.01**	**0.003**	**-.0756416**	**-.0159568**	
Safety at home	-.0331101	.024048	-1.38	0.169	-.0802433	.0140231	
Times moved ne	.005888	.0040112	1.47	0.142	-.0019738	.0137499	
Supportive nei	**-.1171113**	**.0462164**	**-2.53**	**0.011**	**-.2076939**	**-.0265287**	
/cut1	.1415963	.1284136			-.1100897	.3932823	
/cut2	.7318452	.128501			.4799878	.9837025	

Firstly we observe that living in a rural has a positive effect on the probability of being obesity than living in metropolitan areas. Children participation in social activity or community services there is instead associated to a smaller effect on the probability of being obese or overweight. As regard the attitude of helping each other in the neighborhood the greater is the level of disagreement the more likely is the probability of

observing an obese children. For the variable *mutual help* we observe that the more likely the respondents disagree with the statement *"There are people I can count on in this neighborhood"* the lower is her/his BMI. This result is consistent with our hypothesis under the assumption that people living in a supportive neighborhood (i.e. with a functioning built environment) are less likely in need of mutual help because they can, above all, count on the structures of their neighborhood. On the other hand, for the statement *"There are people in this neighborhood who might be a bad influence on my [child/children]"*, the higher the level of disagreement, the higher the probability of being obese. Concerning safety at school the higher the frequency with which a parent think that his/her children is safe at school the less likely he or she is overweight or obese. Finally concerning the overall perception of safety in the neighborhood we observe that the higher is the trust in the neighborhood, the lower the obesity level.

All these results point is the same direction: the built environment looks significant, however we have to analyze marginal effects of each variable in order to understand the intensity of the variable in affecting the probabilities of the three outcomes (healthy or normal weight, overweight and obese).

4.2.1 Marginal Effects: BMI and Environment

Family, School and Socio-Economic Environment

In this paragraph we quantify the effect of the family, the socio-economic status (SES) and the school environment. Marginal effects have been computed using STATA 12 at

the mean level (default option) of the other variables. Significant variables are marked in bold.

Table 4.6 Marginal effects for the family and school environment and SES

BMI Class	Normal (p=2)	Overweight (p=3)	Obese (p=4)
Poverty line	**.0415094**	**-.0107562**	**-.0307532**
Health coverage	.0101208	-.0025768	-.007544
Parental Education	**.0461372**	**-.0119554**	**-.0341818**
Family Structure	**-.0116668**	**.0030232**	**.0086436**
Kind of School	**.0160355**	**-.0041552**	**-.0118802**
Computer Usage	**-.0006746**	**.0001748**	**.0004998**
Physical Activity	.0029214	-.000757	-.0021644
Hours in front of the TV	**-.0495579**	**.0128418**	**.0367161**

Marginal levels of poverty line reveal that parents of children with a higher income are 4% more likely to be normal weight and 3% less likely of being obese. A children with a parent that has not obtained a diploma from high school has 4% lower probability of being normal weight than a child whose parents have at least a high school diploma and, similarly, has a 3% more probability of being obese. Living in a family with two parents decreases the probability of being normal weight by 1% which is definitely a very small effect. A relative small effect is also observed for the type of school attended, but the interpretation is consistent with our hypothesis.

Finally hours spent in front of the TV confirmed what it is usually observed in the literature. As the number of hours spent in front of the TV increases, children have the 4% less probability of being normal weight and 3% probability of being obese.

Built Environment

We proceed with the analysis of the marginal effects of the built environment. Significant variables are marked in bold.

Table 4.7 Marginal effects for the built environment

BMI Class	Normal (p=2)	Overweight (p=3)	Obese (p=4)
msa_stat	**.0422854**	**-.0159913**	**-.0262941**
social activities	**.0076142**	**-.0029515**	**-.0046627**
community service	**.0366001**	**-.0138907**	**-.0227094**
Help neighborhood	**-.0292781**	**.0113491**	**.017929**
Mutual help children	**.0132496**	**-.0051359**	**-.0081137**
Help neighborhood 2	-.0114557	.0044406	.0070151
Bad influence neigh	**.0145174**	**-.0056274**	**-.00889**
Trust level neigh	.0016869	-.0006539	-.001033
Safety perception	**-.0175791**	**.0068142**	**.0107649**
Safety at school	**.0158286**	**-.0061356**	**-.009693**
Safety at home	.0114431	-.0044357	-.0070074
Times moved new add	-.002035	.0007888	.0012461
Supportive neigh	**.0413986**	**-.015354**	**-.0260446**

First of all we observe that moving from a rural to a urban area increases the probability of being normal weight by 4% and decreases the probability of being obese by 2%. A similar pattern is observed for children that are involved in social activity, although the marginal effect is negligible. For those involved in community service we observe that children involved in some community service have a 3% more probability of being normal weight and 2% less of being obese. For the variable *help neighborhood* (*original question: people in this neighborhood help each other out*) for each movement towards disagreement, the probability of being normal weight decreases by 2% while the probability of being obese increases by 1.8%. Concerning *mutual help* in the neighborhood we confirm what hypothesized before: individuals who have to count more on reciprocal help than on neighborhood facilities, are more likely to be overweight and obese. However we observe small marginal effects (~1%). For the question related to the perceived safety of the neighborhood (question formulated as *how often do you feel [CHILD] is safe in your community or neighborhood? Would you say never, sometimes, usually, or always?*), each step towards a higher frequency determines a decrease in the

probability of being normal and an increase in the probability of being obese although marginal effects are against small (~1%). This finding result to be counterintuitive with our hypothesis. Variables safety at school and bad influence are instead consistent with our research hypothesis. Parents that perceive their community free from bad influences (1) and that believe their children are safe at school (2) are more likely to have normal weight and less likely to have obese kids. However marginal effects are small. Finally the variable supportive neighborhood resulted to have an important effect. Specifically, parents who agreed have a 4% more probability of having normal weight and 2% less probability of having obese children. This analysis yields to the conclusion that the role of built environment matters. Further research is however needed to better understand the impact of the neighborhood on children eating habits and their physical activity.

4.3 Ordered Probit: BMI and Other Variables behavioral patterns and psychological factors

We proceed with the analysis of the role played by individual and behavioral characteristics. The following variables have been included in the probit model: gender, primary language spoken at home (as a proxy for ethnicity), diagnosis of the children with any anxiety or depression problem, parent evaluation of child's health status, diagnosis of some other behavioral difficulties (such as concentration or emotional disorders), if the children engages in bullying behaviors, if he or she solves conflicts, if

he or she feels inferior and finally the frequency with which he or she wears a helmet when riding. This latter question is used as a proxy for risk-taking behavior.

Table 4.8 Ordered probit and behavioral/psychological factors

bmi_class	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Gender	**-.1940103**	**.0113054**	**-17.16**	**0.000**	**-.2161684**	**-.1718522**
Anxiety/Depress	**.2071105**	**.0077112**	**26.86**	**0.000**	**.1919968**	**.2222242**
Children health	**.0568576**	**.0161092**	**3.53**	**0.000**	**.0252841**	**.0884311**
Diff selected	**.1101907**	**.012551**	**8.78**	**0.000**	**.0855913**	**.1347902**
Bullies	**-.0297544**	**.006848**	**-4.34**	**0.000**	**-.0431762**	**-.0163326**
Solve conflicts	.0121851	.0123008	0.99	0.322	-.0119239	.0362942
Feel worth less	**-.047322**	**.012125**	**-3.90**	**0.000**	**-.0710866**	**-.0235574**
Unhappy	.0131028	.0136083	0.96	0.336	-.013569	.0397745
Wearing helmet	**.0378961**	**.0045059**	**8.41**	**0.000**	**.0290647**	**.0467275**
/cut1	.3974307	.0407617			.3175393	.4773221
/cut2	.9353584	.0408885			.8552185	1.015498

We here observe that female are less likely to be obese than man. All the variables related to psychological and social disorders resulted to be significant. Most of them were formulated as dummy variables. In general, a bad health status has a positive effect on the probability of being obese or overweight and a positive effect is also observed for other kind of behavioral problems. Engage in bullying behaviors has a negative effect on the possibility of having a higher BMI. A children who feels worthless or inferior has a higher probability of being overweight and obese. Evidence from these last two questions is consistent with the problem of social marginalization and the literature on weight stigma[21]. Finally the higher the frequency with which a child wear a helmet, the higherthe BMI.

[21] See reference n.39 of Paper 2.

4.4.1 Marginal Effects: BMI and behavioral/psychological variables

We then proceed with the analysis of marginal effects.

Table 4.9Marginal effects and behavioral/psychological factors

BMI Class	Normal (p=2)	Overweight (p=3)	Obese (p=4)
Gender	**.0747158**	**-.018673**	**-.0560429**
Anxiety/Depress diagn	**-.0797609**	**.0199338**	**.0598271**
Children health perc	**-.0219938**	**.0053373**	**.0166565**
Diff selected areas	**-.0424359**	**.0106056**	**.0318303**
Bullies	**0114588**	**-.0028638**	**-.008595**
Solve conflicts	-.0046927	.0011728	.0035199
Feel worthless/Inf	**.0182243**	**-.0045546**	**-.0136697**
Unhappy	-.005046	.0012611	.0037849
Wearing helmet	**-.0145943**	**.0036474**	**.0109469**

First of all we observe that females have the 7% more probability than males of being normal weight and 5% less probability of being obese. Children who has being diagnosed with anxiety or depression are 7% less likely of being normal weight and 5% more being obese. A similar pattern is observed for other type of emotional problems (original question: *overall, do you think that [CHILD] has difficulties with one or more of the following areas: emotions, concentration, behavior, or being able to get along with other people?).* Answering "yes" has a negative effect on the probability of being normal weight (probability falling by 4%) and a positive effect on obesity (increasing by 3%). The other marginal effects are too small to have a significant impact. Psychological and behavioral factors seem thus relevant variables in affecting obesity and overweight rates. Further research may study this type of relations.

4.5 Ordered Probit: BMI and Cultural Norms

We have regressed BMI on the following four proxies of cultural norms: if the child has been breastfed, if family gather together for a meal at least once per week, if the child regularly attends religious service and the likelihood of people living in the same neighborhood to watch out each other's children. The only two that resulted to be significant are if the child has ever been breastfed and the likelihood with which respondents are used to watch out each other's children.

Table 4.10Ordered probit and cultural norms

bmi_class	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Breastfeeding	**-.2283589**	**.024997**	**-9.14**	**0.000**	**-.2773522**	**-.1793656**
Family meal	-.0036174	.0055901	-0.65	0.518	-.0145738	.007339
Religious serv	-.0046691	.0089682	-0.52	0.603	-.0222465	.0129083
Neigh rec hel	**.0749729**	**.0135765**	**5.52**	**0.000**	**.0483634**	**.1015823**
/cut1	-.1967835	.0478794			-.2906254	-.1029415
/cut2	.1360999	.0478687			.0422791	.2299208

Only first and last variables are significant. Breastfeeding has a positive effect on the probability of having a healthy weight and also reciprocal help in the neighborhood. The more they help each other, the more less likely their children will be obese.

4.5.1 Marginal Effects: BMI and cultural norms

To understand the impact of cultural norms we need to examine marginal effects.

Table 4.11Ordered probit and cultural norms

BMI Class	Normal (p=2)	Overweight (p=3)	Obese (p=4)
Breastfeeding	.0895339	.000245	-.0897789
Family meal	.0014314	-.0000183	-.0014131
Religious service	.0018476	-.0000236	-.001824
Neigh reciprocal help	-.0296666	.0003792	.0292874

A child who has been breastfed has 8% more probability of being normal weight and 8% less probability of being obese. The marginal effect of the frequency with each people in the same neighborhood watch out each other's children is also considerable (~3% in both cases).This would suggest that if the social ties are higher – or if people living in the same neighborhood have to count more on mutual help than on other kind form of support for their family – the probability of becoming overweight is higher. We conclude that, under the assumption that breastfeeding and mutual help are culturally determined, cultural norms are important.

4.5.2 Ordered Probit estimation: BMI and breastfeeding with fixed effects

The number of those who responded to the question related to breastfeeding – a proxy for cultural norm – was disproportionally lower than the average observations we have for all the other variables (11,302 against 60,000). We have was thus to isolate the breastfeeding variable and estimate a probit model using BMI as dependent variable, breastfeeding and income level as the independent and controlling for State and ethnicity as fixed effects. Alaska is the reference group. The values reported in the table below indicate if the variable considered has a positive or negative effect on BMI.

Table 4.1 Ordered probit regression. Estimation of breastfeeding and income on obesity with State as a fixed effect

bmi_class	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
B	-.1847777	.0263362	-7.02	0.000	-.2363958	-.133159
Poveerty Line	-.1123795	.0110997	-10.12	0.000	-.1341345	-.0906244

Alabama_2	.1953427	.1168766	1.67	0.095	-.0337313	.4244166
Arkansas_3	**.255556**	**.1215546**	**2.10**	**0.036**	**.0173133**	**.4937987**
Arizona_4	.0712037	.119977	0.59	0.553	-.1639468	.3063543
California_5	.0428808	.1171737	0.37	0.714	-.1867754	.2725369
Colorado _6	-.0171575	.1213413	-0.14	0.888	-.254982	.220667
Connecticut _7	.0311535	.1151348	0.27	0.787	-.1945065	.2568135
DC_8	**.2550097**	**.1255362**	**2.03**	**0.042**	**.0089633**	**.501056**
Delaware _9	.080417	.1198411	0.67	0.502	-.1544673	.3153014
Florida _10	.0697468	.1188242	0.59	0.557	-.1631443	.3026379
Georgia _11	-.0255956	.121591	-0.21	0.833	-.2639096	.2127185
Hawaii _12	-.0482154	.118819	-0.41	0.685	-.2810962	.1846655
Iowa _13	.0689185	.118594	0.58	0.561	-.1635214	.3013584
Idaho _14	.1569871	.1195634	1.31	0.189	-.0773529	.391327
Illinois _15	.1376623	.1152996	1.19	0.232	-.0883208	.3636453
Indiana _16	.1102025	.1177106	0.94	0.349	-.1205059	.340911
Kansas_17	.2028342	.123998	1.64	0.102	-.0401975	.4458659
Kentucky_18	.1149768	.1177204	0.98	0.329	-.1157509	.3457045
Louisiana _19	**.2798075**	**.1174735**	**2.38**	**0.017**	**.0495636**	**.5100513**
Massachusetts_20	-.0467609	.1194794	-0.39	0.696	-.2809362	.1874144
Maryland _21	.1139119	.1194623	0.95	0.340	-.1202299	.3480538
Maine _22	.097334	.1193772	0.82	0.415	-.1366411	.331309
Michigan _23	-.0023554	.1169396	-0.02	0.984	-.2315528	.226842
Minnesota_24	.1250629	.1170971	1.07	0.286	-.1044432	.354569
Missouri_25	.0626685	.1166586	0.54	0.591	-.1659781	.291315
Mississipi_26	**.2342617**	**.121745**	**1.92**	**0.054**	**-.0043542**	**.4728775**
Montana_27	.0184303	.1203414	0.15	0.878	-.2174345	.2542951
North Carol_28	.0499509	.1168682	0.43	0.669	-.1791066	.2790085
North Dakota_29	-.0117061	.1231398	-0.10	0.924	-.2530557	.2296436
Nebraska_30	-.0683347	.1227923	-0.56	0.578	-.3090032	.1723337
New Hemphire_31	-.046189	.1185669	-0.39	0.697	-.2785759	.1861979
New Jersey_32	.1557683	.1207119	1.29	0.197	-.0808226	.3923593
New Mexico_33	**.262689**	**.1243422**	**2.11**	**0.035**	**.0189827**	**.5063953**
Nevada_34	.0681765	.1210949	0.56	0.573	-.1691651	.3055181
New York_35	.1018303	.1219368	0.84	0.404	-.1371615	.3408221
Ohio_36	.073979	.112628	0.66	0.511	-.1467678	.2947258
Oklaoma_37	.1899395	.1204173	1.58	0.115	-.0460741	.4259531
Oregon_38	-.0645928	.1216953	-0.53	0.596	-.3031113	.1739257
Pennsylvania_39	-.0539081	.1167073	-0.46	0.644	-.2826503	.1748341
Rhode Island_40	.1772601	.1167312	1.52	0.129	-.0515289	.406049
South Carol_41	.0869028	.1190072	0.73	0.465	-.146347	.3201527
Dakota_42	.1410745	.1178643	1.20	0.231	-.0899353	.3720844
Tennessee_43	**.2416978**	**.1171433**	**2.06**	**0.039**	**.0121011**	**.4712946**
Texas_44	.1383079	.1194779	1.16	0.247	-.0958645	.3724804
Utah_45	.0735661	.1310234	0.56	0.574	-.183235	.3303673
Virginia_46	-.0239764	.1174678	-0.20	0.838	-.254209	.2062562
Vermont_47	**.2462924**	**.1239212**	**1.99**	**0.047**	**.0034114**	**.4891734**
Washington_48	-.0148814	.121363	-0.12	0.902	-.2527485	.2229857
Wisconsin_49	.0690113	.1174302	0.59	0.557	-.1611476	.2991703
West Virgin_50	.0399183	.1144585	0.35	0.727	-.1844163	.2642529
Wyoming_51	-.0415552	.1200808	-0.35	0.729	-.2769093	.1937988
/cut1	-.5280161	.0926386			-.7095844	-.3464477
/cut2	-.1903495	.0925651			-.3717738	-.0089252

Ordered probit regression Number of obs = 10491
LR chi2(52) = 263.54
Prob> chi2 = 0.0000
Log likelihood = -10263.068 Pseudo R2 = 0.0127

We observe an inverse relation between obesity and breastfeeding. A shift from “no” to yes” in the answer “Was [S.C.] ever breastfed?” determines a decrease in obesity. The same relation is observed for income, where lower income levels have a negative effect

on obesity. As regard the States, all the shifts must be related to Alaska. Significance is observed only for selected States, suggesting that obesity is higher in Arkansas, District of Columbia, Louisiana, Mississippi, New Mexico, Tennessee and Vermont. With the exception of DC and Vermont, all these States are located in the South of the United States where poverty is higher and minorities are more concentrated. This finding is consistent with academic literature. We have then estimated a probit using breastfeeding as the independent variable and ethnicity as a fixed effect.

Table 4.2. Ordered probit with ethnicity as a fixed effect

bmi_class_	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
B	-.2046139	.025377	-8.06	0.000	-.2543519	-.1548759
Black_2	.407433	.0421034	9.68	0.000	.3249118	.4899542
Multiple race_3	.111707	.0513439	2.18	0.030	.0110747	.2123392
Other_4	.026777	.053844	0.50	0.619	-.0787554	.1323093
/cut1	-.22249	.0227457			-.2670708	-.1779093
/cut2	.1117789	.0227031			.0672817	.1562762

A shift from “white” to “black or to “other race” has a positive effect on BMI. The reference group is White Americans. This finding has been largely confirmed in the relevant academic literature (see Part 2).

4.5.2.1 Marginal Effects

In order to quantify the effects, we have calculated the marginal effects of ethnicity on, respectively, outcome 2 (healthy weight), outcome 3 (overweight) and outcome 4 (obese). Marginal effects are calculated at the mean value of the other independent variables and in this first model we have only breastfeeding length that is 1.5.

Table 4.3 Marginal Effects of breastfeeding and ethnicity and BMI

BMI Class	Normal (p=2)	Overweight (p=3)	Obese (p=4)
Breastfeeding Length	.0804178*	-.0001157	-.0803021*
Black	-.1549014*	-.0063622*	.1612636*
Multiple Race	-.0438969*	-.0000543	.0439512*
Other	-.010588	.00012	.0104681*

Reference group for race: White Americans
*p < 0.005

A couple of things are here worth to note. First we observe that a child who has been breastfed has a 8% more probability of being normal weight later in life than a child who has not and, similarly, a 8% less probability of being obese. A black individual has 15% less probability of being normal weight than a White and 16% of being obese. Individuals classified under multiple race categories – including American Indian and Asian population – have 4% more and 4% less of being, respectively, normal and obese.

CHAPTER 5
Conclusion and Further Research

In the third part we have tried to explore the effect of several aspects on the likelihood of being overweight or obese. Although significant, not all the variables analyzed have important marginal effects on the different outcomes. Results can be summarized and grouped as follows.

Family characteristics and the built environment

- Income and education play a significant role. These two variables are usually highly correlated. Higher education and income allow individuals to be more informed about their health and to afford healthier food products (which are usually more expensive than high-caloric foods). More educated people may also have a higher willingness to pay for healthy food than those who are informed but decide to differently allocate their familiar budget. Another interesting hypothesis to study is if the attention paid to "eating healthy" depends on a real awareness of harms related to bad food habits or instead if it is a status symbol.
- People living in a supportive neighborhood and children involved in community service are also more likely to be less obese and overweight. This would suggest that the built environment plays a positive role on the probability of being overweight or obese. Information may circulate with higher frequency – as for

example happens in urban areas – people are supportive and more likely to understand the social problems of the community they live in.

Individual and behavioral factors

- Ethnicity is also a discriminant factor as well as gender. White Americans are more protected against obesity than other minorities; further studies should try to disentangle the genetic effect and the income effect. Given that minorities have on average a lower level of income they may have less chances to buy healthy food. However it could also be explored if these systematic differences depend by historical and cultural factor. Why minorities have less rewarding jobs than White Americans? Women are also less exposed to obesity. Under our assumptions, ethnicity is a proxy for socio-economic differences unrelated to genetics.
- Finally a significant role is played by psychological variables. This evidence is consistent with the part of the literature that addresses behavioral disorders with an imbalanced way of eating.

Cultural Norms

- Breastfeeding is a protective factor against the probability of being overweight and obese. If we assume that breastfeeding practice is a cultural norm, our analysis confirm the importance of training pregnant women about the role of breastfeeding as a protective factors against several pathologies including obesity.

This analysis confirms the complexity of the obesity phenomenon that to be addressed – by academic researchers or policy decision makers require a synergic approach. Given that the assumption of the parallel slope assumption may not be consistent with the categorization of our variables, next analysis may use multinomial logit models. The weight of cultural norms should be further addressed in developing adequate public policies for tackling obesity and studies on the built environment should be also promoted. The latter are important to develop indirect strategies to favor a reduction in obesity and overweight rates.

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APPENDIX

STATA Analysis – Bmi and Breastfeeding

```
xi: oprobitbmi_class_percentiles  s6q59  poverty_line_binnedi.state
```

bmi_class_percentiles	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
s6q59	**-.1847777**	**.0263362**	**-7.02**	**0.000**	**-.2363958**	**-.1331597**
poverty_line_binned	**-.1123795**	**.0110997**	**-10.12**	**0.000**	**-.1341345**	**-.0906244**
Alabama_2	.1953427	.1168766	1.67	0.095	-.0337313	.4244166
Arkansas_3	**.255556**	**.1215546**	**2.10**	**0.036**	**.0173133**	**.4937987**
Arizona_4	.0712037	.119977	0.59	0.553	-.1639468	.3063543
California_5	.0428808	.1171737	0.37	0.714	-.1867754	.2725369
Colorado _6	-.0171575	.1213413	-0.14	0.888	-.254982	.220667
Connecticut _7	.0311535	.1151348	0.27	0.787	-.1945065	.2568135
DC_8	**.2550097**	**.1255362**	**2.03**	**0.042**	**.0089633**	**.501056**
Delaware _9	.080417	.1198411	0.67	0.502	-.1544673	.3153014
Florida _10	.0697468	.1188242	0.59	0.557	-.1631443	.3026379
Georgia _11	-.0255956	.121591	-0.21	0.833	-.2639096	.2127185
Hawaii _12	-.0482154	.118819	-0.41	0.685	-.2810962	.1846655
Iowa _13	.0689185	.118594	0.58	0.561	-.1635214	.3013584
Idaho _14	.1569871	.1195634	1.31	0.189	-.0773529	.391327
Illinois _15	.1376623	.1152996	1.19	0.232	-.0883208	.3636453
Indiana _16	.1102025	.1177106	0.94	0.349	-.1205059	.340911
Kansas_17	.2028342	.123998	1.64	0.102	-.0401975	.4458659
Kentucky_18	.1149768	.1177204	0.98	0.329	-.1157509	.3457045
Louisiana _19	**.2798075**	**.1174735**	**2.38**	**0.017**	**.0495636**	**.5100513**
Massachusetts_20	-.0467609	.1194794	-0.39	0.696	-.2809362	.1874144
Maryland _21	.1139119	.1194623	0.95	0.340	-.1202299	.3480538
Maine _22	.097334	.1193772	0.82	0.415	-.1366411	.331309
Michigan _23	-.0023554	.1169396	-0.02	0.984	-.2315528	.226842
Minnesota_24	.1250629	.1170971	1.07	0.286	-.1044432	.354569
Missouri_25	.0626685	.1166586	0.54	0.591	-.1659781	.291315
Mississipi_26	**.2342617**	**.121745**	**1.92**	**0.054**	**-.0043542**	**.4728775**
Montana_27	.0184303	.1203414	0.15	0.878	-.2174345	.2542951
North Carolina_28	.0499509	.1168682	0.43	0.669	-.1791066	.2790085
North Dakota_29	-.0117061	.1231398	-0.10	0.924	-.2530557	.2296436
Nebraska_30	-.0683347	.1227923	-0.56	0.578	-.3090032	.1723337
New Hemphire_31	-.046189	.1185669	-0.39	0.697	-.2785759	.1861979
New Jersey_32	.1557683	.1207119	1.29	0.197	-.0808226	.3923593
New Mexico_33	**.262689**	**.1243422**	**2.11**	**0.035**	**.0189827**	**.5063953**
Nevada_34	.0681765	.1210949	0.56	0.573	-.1691651	.3055181
New York_35	.1018303	.1219368	0.84	0.404	-.1371615	.3408221
Ohio_36	.073979	.112628	0.66	0.511	-.1467678	.2947258
Oklaoma_37	.1899395	.1204173	1.58	0.115	-.0460741	.4259531
Oregon_38	-.0645928	.1216953	-0.53	0.596	-.3031113	.1739257
Pennsylvania_39	-.0539081	.1167073	-0.46	0.644	-.2826503	.1748341
Rhode Island_40	.1772601	.1167312	1.52	0.129	-.0515289	.406049
South Carolina_41	.0869028	.1190072	0.73	0.465	-.146347	.3201527
Dakota_42	.1410745	.1178643	1.20	0.231	-.0899353	.3720844
Tennessee_43	**.2416978**	**.1171433**	**2.06**	**0.039**	**.0121011**	**.4712946**
Texas_44	.1383079	.1194779	1.16	0.247	-.0958645	.3724804
Utah_45	.0735661	.1310234	0.56	0.574	-.183235	.3303673
Virginia_46	-.0239764	.1174678	-0.20	0.838	-.254209	.2062562
Vermont_47	**.2462924**	**.1239212**	**1.99**	**0.047**	**.0034114**	**.4891734**
Washington_48	-.0148814	.121363	-0.12	0.902	-.2527485	.2229857
Wisconsin_49	.0690113	.1174302	0.59	0.557	-.1611476	.2991703
West Virginia_50	.0399183	.1144585	0.35	0.727	-.1844163	.2642529
Wyoming_51	-.0415552	.1200808	-0.35	0.729	-.2769093	.1937988
/cut1	-.5280161	.0926386			-.7095844	-.3464477
/cut2	-.1903495	.0925651			-.3717738	-.0089252

```
-------------------------------------------------------------------------------
```

```
.
xi: oprobitbmi_class_percentiles  s6q59  poverty_line_binnedi.state
i.state           _Istate_1-51        (naturally coded; _Istate_1 omitted)

Iteration 0:   log likelihood = -10394.835
Iteration 1:   log likelihood = -10263.096
Iteration 2:   log likelihood = -10263.068
Iteration 3:   log likelihood = -10263.068

Ordered probit regression                         Number of obs   =      10491
LR chi2(52)     =     263.54
Prob> chi2     =     0.0000
Log likelihood = -10263.068                       Pseudo R2       =     0.0127
```

xi: oprobitbmi_class_percentiles s6q59 i.racer

```
Iteration 0:   log likelihood = -10659.664
Iteration 1:   log likelihood = -10567.868
Iteration 2:   log likelihood = -10567.838
Iteration 3:   log likelihood = -10567.838

Ordered probit regression                         Number of obs   =      10769
LR chi2(4)      =     183.65
Prob> chi2     =     0.0000
Log likelihood = -10567.838                       Pseudo R2       =     0.0086

------------------------------------------------------------------------------
bmi_class_percentiles |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
----------------------+-------------------------------------------------------
 s6q59    |  -.2046139    .025377    -8.06   0.000    -.2543519   -.1548759
_Iracer_2 |    .407433   .0421034     9.68   0.000     .3249118    .4899542
_Iracer_3 |    .111707   .0513439     2.18   0.030     .0110747    .2123392
_Iracer_4 |    .026777    .053844     0.50   0.619    -.0787554    .1323093
----------------------+-------------------------------------------------------
               /cut1 |    -.22249   .0227457                      -.2670708   -.1779093
               /cut2 |   .1117789   .0227031                       .0672817    .1562762
------------------------------------------------------------------------------
```

Marginal effects after oprobity = Pr(bmi_class_percentiles==2) (predict, p outcome(2))
=   .4518747

```
------------------------------------------------------------------------------
Variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
BL*          |   .0804178      .00987    8.15   0.000    .06107  .099766   .704708
Black*       |  -.1549014      .01504  -10.30   0.000   -.18437 -.125433   .08691
Multiple Race*|  -.0438969      .01998   -2.20   0.028  -.083065 -.004729   .053208
Other*       |   -.010588      .02126   -0.50   0.618  -.052247  .031071   .047544
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

Marginal effects after oprobit y = Pr(bmi_class_percentiles==3) (predict, p outcome(3))=
.13259544

```
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
BL*      |  -.0001157      .00033   -0.35   0.727  -.000766  .000534   .704708
_Black* |  -.0063622      .00165   -3.85   0.000  -.009598 -.003127   .08691
Multiple Race3*|  -.0000543       .0004   -0.14   0.892  -.000836  .000727   .053208
Other*  |     .00012      .00016    0.75   0.456  -.000195  .000435   .047544
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

Marginal effects after oprobity y = Pr(bmi_class_percentiles==4) (predict, p outcome(4))
= .41552986

```
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
BL*      |  -.0803021         .01   -8.03   0.000  -.099898 -.060706   .704708
Black*   |   .1612636      .01656    9.74   0.000   .128807  .193721   .08691
Multiple Race*|   .0439512      .02035    2.16   0.031   .004074  .083828   .053208
Other*   |   .0104681       .0211    0.50   0.620  -.030886  .051823   .047544
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

STATA Analysis – Bmi and Environment

Family, School and Socio-Economic Environment

. tab poverty_line_binned, nolab:

```
   (Binned) |      Freq.     Percent        Cum.
------------+-----------------------------------
          1 |     10,288       15.58       15.58
          2 |      2,027        3.07       18.65
          3 |     19,804       30.00       48.65
          4 |     33,899       51.35      100.00
------------+-----------------------------------
      Total |     66,018      100.00
```

. tab s3q01: Does [CHILD] have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicaid?

```
          p |      Freq.     Percent        Cum.
------------+-----------------------------------
     No = 0 |      5,145        7.17        7.17
    Yes = 1 |     66,595       92.83      100.00
------------+-----------------------------------
      Total |     71,740      100.00
```

. tab ind3_1: Does (child's name) have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicaid? (S3Q01)

```
includ |      Freq.     Percent        Cum.
------------+-----------------------------------
     No = 0 |      5,145        7.17        7.17
    Yes = 1 |     66,595       92.83      100.00
------------+-----------------------------------
```

. tab education: What is the highest level of education attained by anyone in your household?

```
             |      Freq.     Percent        Cum.
-------------+-----------------------------------
<HS = 1      |      2,099        2.93        2.93
HS = 2       |     14,481       20.20       23.13
>HS = 3      |     55,105       76.87      100.00
-------------+-----------------------------------
      Total  |     71,685      100.00
```

. tab famstruct: Family structure type

```
               Family structure type |      Freq.     Percent        Cum.
```

```
---------------------------------+-----------------------------------
   TWO PARENT BIOLOGICAL/ADOPTED = 1 |     44,399       63.42       63.42
          TWO PARENT STEPFAMILY = 2 |      7,087       10.12       73.54
SINGLE MOTHER, NO FATHER PRESENT = 3 |     14,746       21.06       94.60
                           Other = 4 |      3,777        5.40      100.00
---------------------------------+-----------------------------------
                           Total     |     70,009      100.00
```

. tab s7q01: What kind of school is [CHILD] currently enrolled in? Is it a public school, private school, or home -school

```
                                 Freq.     Percent        Cum.
-----------------------+-----------------------------------
                Public = 1 |     51,980       86.15       86.15
               Private = 2 |      6,923       11.47       97.62
        Home-schooled = 3 |      1,255        2.08       99.70
Not enrolled in school = 4 |        180        0.30      100.00
-----------------------+-----------------------------------
                     Total |     60,338      100.00
```

. tab s7q27: On an average school day, about how many hours does [CHILD] use a computer for purposes other than schoolwork?

```
|      Freq.     Percent        Cum.
-----------------------------+-----------------------------------
                        None |     11,324       18.94       18.94
                           1 |     14,602       24.42       43.36
                           2 |      6,645       11.11       54.48
                           3 |      2,095        3.50       57.98
                           4 |        859        1.44       59.42
                           5 |        496        0.83       60.25
                           6 |        178        0.30       60.55
                           7 |         75        0.13       60.67
                           8 |         69        0.12       60.79
                           9 |         10        0.02       60.81
                          10 |        131        0.22       61.02
                          12 |         17        0.03       61.05
                          13 |          2        0.00       61.06
                          14 |          5        0.01       61.06
                          15 |        195        0.33       61.39
                          16 |          2        0.00       61.39
                          20 |        154        0.26       61.65
                          21 |          1        0.00       61.65
                          22 |          4        0.01       61.66
                          23 |          9        0.02       61.67
                          24 |         65        0.11       61.78
MORE THAN 0,LESS THAN 1 HOUR |     20,655       34.55       96.33
          DON'T OWN COMPUTER |      2,193        3.67      100.00
-----------------------------+-----------------------------------
                       Total |     59,786      100.00
```

. tab ind6_10: On an average school day, about how many hours does (child's name) usually watch TV, watch videos, or play video games? (S7Q28 -- ages 6-17 only)

```
           Freq.     Percent        Cum.
---------------    +-----------------------------------
             None =0|      4,180        6.96        6.96
  1 hour or less =1 |     29,772       49.58       56.55
    2 - 3 hours = 2 |     22,275       37.10       93.64
4 hours or more = 3 |      3,817        6.36      100.00
---------------+-----------------------------------
              Total |     60,044      100.00
```

. tab ind1_5: During the past week, on how many days did (child's name) exercise or participate in physical activity for at least 20 minutes that made him/her sweat and breathe hard? (S7Q21 -- ages 6-17 only)

```
|        Freq.     Percent        Cum.
```

```
------------+-----------------------------------
     0 days = 0 |      6,653       11.10       11.10
 1 - 3 days = 1 |     18,069       30.15       41.25
 4 - 6 days = 2 |     20,951       34.96       76.21
   Everyday = 3 |     14,261       23.79      100.00
------------+-----------------------------------
          Total |     59,934      100.00
```

. oprobitbmi_class_percentilespoverty_line_binned s3q01 ind3_1 educationr famstruct s7q01 s7q27 ind1_5 ind6_10

```
note: ind3_1 omitted because of collinearity
Iteration 0:   log likelihood = -49615.314
Iteration 1:   log likelihood = -48875.907
Iteration 2:   log likelihood = -48875.659
Iteration 3:   log likelihood = -48875.659

Ordered probit regression                         Number of obs   =      53163
LR chi2(8)      =    1479.31
Prob> chi2     =     0.0000
Log likelihood = -48875.659                       Pseudo R2       =     0.0149

------------------------------------------------------------------------------
bmi_class_percentiles |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
----------------------+-------------------------------------------------------
poverty_line_binned    |  -.1086625    .005589   -19.44   0.000    -.1196168   -.0977082
s3q01         |  -.0264079   .0206537    -1.28   0.201    -.0668885    .0140727
ind3_1        |          0  (omitted)
educationr    |  -.1207771   .0115443   -10.46   0.000    -.1434035   -.0981507
famstruct     |    .030541   .0055915     5.46   0.000      .019582    .0415001
s7q01         |  -.0419773   .0125501    -3.34   0.001     -.066575   -.0173795
s7q27         |    .001766   .0004541     3.89   0.000      .000876     .002656
ind1_5        |  -.0076477   .0056094    -1.36   0.173    -.0186419    .0033466
ind6_10       |   .1297316     .00759    17.09   0.000     .1148554    .1446078
----------------------+-------------------------------------------------------
/cut1 |         -.2177002   .0434715                      -.3029028   -.1324976
/cut2 |           .3163532   .0434795                       .2311349    .4015715
------------------------------------------------------------------------------
```

. mfx, predict(p outcome(2))

```
Marginal effects after oprobit
      y  = Pr(bmi_class_percentiles==2) (predict, p outcome(2))
         =   .6158413
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
povert~d |   .0415094      .00213   19.44   0.000   .037325  .045694   3.20719
s3q01*|   .0101208      .00794    1.27   0.202  -.005442  .025684   .930516
educat~r |   .0461372      .00441   10.46   0.000   .037494  .054781    2.7521
famstr~t |  -.0116668      .00214   -5.46   0.000  -.015853  -.00748   1.70607
   s7q01 |   .0160355      .00479    3.34   0.001   .006639  .025432   1.16148
   s7q27 |  -.0006746      .00017   -3.89   0.000  -.001015 -.000335   10.4942
  ind1_5 |   .0029214      .00214    1.36   0.173  -.001278  .007121   1.71666
 ind6_10 |  -.0495579       .0029  -17.10   0.000  -.055239 -.043877   1.42167
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

. mfx, predict(p outcome(3))

```
Marginal effects after oprobit
      y  = Pr(bmi_class_percentiles==3) (predict, p outcome(3))
         =  .18050177
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
povert~d |  -.0107562      .00057  -18.81   0.000  -.011877 -.009635   3.20719
s3q01*   |  -.0025768      .00199   -1.30   0.194  -.006469  .001316   .930516
educat~r |  -.0119554      .00115  -10.36   0.000  -.014217 -.009694    2.7521
```

```
famstr~t |   .0030232      .00056    5.45   0.000   .001935  .004111   1.70607
   s7q01 |  -.0041552      .00124   -3.34   0.001  -.006593 -.001718   1.16148
   s7q27 |   .0001748      .00005    3.88   0.000   .000087  .000263   10.4942
  ind1_5 |   -.000757      .00056   -1.36   0.173  -.001846  .000331   1.71666
 ind6_10 |   .0128418      .00077   16.65   0.000    .01133  .014354   1.42167
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

. mfx, predict(p outcome(4))

```
Marginal effects after oprobit
      y  = Pr(bmi_class_percentiles==4) (predict, p outcome(4))
         =  .20365693
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
povert~d |  -.0307532      .00158  -19.42   0.000  -.033858 -.027649   3.20719
s3q01*   |   -.007544      .00595   -1.27   0.205  -.019215  .004127   .930516
educat~r |  -.0341818      .00327  -10.46   0.000  -.040588 -.027775    2.7521
famstr~t |   .0086436      .00158    5.46   0.000   .005542  .011745   1.70607
   s7q01 |  -.0118802      .00355   -3.34   0.001  -.018842 -.004919   1.16148
   s7q27 |   .0004998      .00013    3.89   0.000   .000248  .000752   10.4942
  ind1_5 |  -.0021644      .00159   -1.36   0.173  -.005276  .000947   1.71666
 ind6_10 |   .0367161      .00215   17.08   0.000   .032504  .040929   1.42167
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

Built Environment

. tab msa_stat: Metropolitan Statistical Area (Only in states that meet the 500,000 threshold)

```
|        Freq.     Percent        Cum.
------------    --+-----------------------------------
Not in an MSA = 0 |     13,796       28.09       28.09
    In an MSA = 1 |     35,313       71.91      100.00
--------------+-----------------------------------
            Total |     49,109      100.00
```

. tab s7q12:During the past week, how many days did [CHILD] participate in clubs, organizations, or sports teams?

```
      Freq.     Percent        Cum.
------------+-----------------------------------
   None = 0 |     15,783       31.28       31.28
          1 |      8,832       17.50       48.79
          2 |      8,790       17.42       66.21
          3 |      6,136       12.16       78.37
          4 |      3,431        6.80       85.17
          5 |      4,416        8.75       93.92
          6 |      1,408        2.79       96.71
  Every day |      1,659        3.29      100.00
------------+-----------------------------------
      Total |     50,455      100.00
```

. tab s7q17: During the past 12 months, has [CHILD] been involved in any type of community service or volunteer work at school, church, or in the community

```
      Freq.     Percent        Cum.
------------+-----------------------------------
     No = 0 |     12,220       34.83       34.83
    Yes = 1 |     22,860       65.17      100.00
```

```
------------+-----------------------------------
      Total |     35,080      100.00

. tab s7q17, nolab
```

. tab s10q01: “People in this neighborhood help each other out.” Would you say that you definitely agree, somewhat agree, somewhat disagree, or definitely disagree with this statement?

```
|                 Freq.     Percent        Cum.
------------------    -+-----------------------------------
   Definitely agree = 1 |     31,817       45.34       45.34
     Somewhat agree = 2 |     29,748       42.39       87.73
  Somewhat disagree = 3 |      5,049        7.19       94.92
Definitely disagree = 4 |      3,564        5.08      100.00
--------------------+-----------------------------------
              Total |     70,178      100.00
```

. tab s10q02: “We watch out for each other’s children in this neighborhood.” [READ ONLY WHEN NEEDED: Would you say that you definitely agree, somewhat agree, somewhat disagree, or definitely disagree with this statement?]

```
                    |      Freq.           Percent        Cum.
------------------    -+-----------------------------------
   Definitely agree = 1 |     40,550       58.02       58.02
     Somewhat agree = 2 |     21,973       31.44       89.46
  Somewhat disagree = 3 |      4,082        5.84       95.30
Definitely disagree = 4 |      3,285        4.70      100.00
--------------------+-----------------------------------
                Total |     69,890      100.00
```

. tab s10q03: “There are people I can count on in this neighborhood.” [READ ONLY WHEN NEEDED: Would you say that you definitely agree, somewhat agree, somewhat disagree, or definitely disagree with this statement?]

```
                          Freq.           Percent        Cum.
------     --------------+-----------------------------------
   Definitely agree = 1 |     46,212       65.72       65.72
     Somewhat agree = 2 |     17,061       24.26       89.98
  Somewhat disagree = 3 |      3,326        4.73       94.71
Definitely disagree = 4 |      3,720        5.29      100.00
--------------------+-----------------------------------
              Total |     70,319      100.00
```

. tab s10q04: “There are people in this neighborhood who might be a bad influence on my [child/children].” [READ ONLY WHEN NEEDED: Would you say that you definitely agree, somewhat agree, somewhat disagree, or definitely disagree with this statement?]

```
                          Freq.     Percent        Cum.
--------------------+-----------------------------------
   Definitely agree = 1 |     15,676       22.62       22.62
     Somewhat agree = 2 |     17,604       25.40       48.02
  Somewhat disagree = 3 |     12,532       18.08       66.10
Definitely disagree = 4 |     23,490       33.90      100.00
--------------------+-----------------------------------
              Total |     69,302      100.00
```

. tab s10q05: “If my child were outside playing and got hurt or scared, there are adults nearby who I trust to help my child.” [READ ONLY WHEN NEEDED: Would you say that you definitely agree, somewhat agree, somewhat disagree, or definitely disagree with this statement?]

```
|                          Freq.     Percent        Cum.
--------------------+-----------------------------------
   Definitely agree = 1 |     51,912       73.94       73.94
```

```
     Somewhat agree = 2 |     13,562       19.32       93.26
  Somewhat disagree = 3 |      2,242        3.19       96.45
Definitely disagree =4 |      2,490        3.55      100.00
-----------------   ---+-----------------------------------
                 Total |     70,206      100.00
```

. tab s10q06:How often do you feel [CHILD] is safe in your community or neighborhood? Would you say never, sometimes, usually, or always?

```
|                  Freq.     Percent        Cum.
------------+-----------------------------------
      Never = 1 |      1,184        1.67        1.67
  Sometimes = 2 |      6,807        9.58       11.25
    Usually = 3 |     26,745       37.64       48.89
     Always = 4 |     36,317       51.11      100.00
------------+-----------------------------------
      Total |     71,053      100.00
```

. tab s10q07: How often do you feel [he/she] is safe at school? Would you say never, sometimes, usually, or always?

```
|                     Freq.     Percent        Cum.
------------    +-----------------------------------
      Never = 1 |        353        0.60        0.60
  Sometimes = 2 |      4,671        8.00        8.60
    Usually = 3 |     20,736       35.50       44.10
     Always = 4 |     32,657       55.90      100.00
------------    +-----------------------------------
      Total     |     58,417      100.00
```

. tab s10q08: How often do you feel [he/she] is safe at home? Would you say never, sometimes, usually, or always?

```
|                  Freq.     Percent        Cum.
---------    ---+-----------------------------------
      Never = 1 |         81        0.11        0.11
  Sometimes = 2 |        902        1.27        1.38
    Usually = 3 |      7,554       10.61       11.99
     Always = 4 |     62,692       88.01      100.00
------------+-----------------------------------
          Total |     71,229      100.00
```

. tab s11q06r: How many times has [S.C.] ever moved to a new address?

```
|                  Freq.     Percent        Cum.
------------+-----------------------------------
       None |     19,026       26.81       26.81
          1 |     17,219       24.26       51.07
          2 |     11,576       16.31       67.38
          3 |      9,716       13.69       81.07
          4 |      5,370        7.57       88.64
          5 |      3,226        4.55       93.18
          6 |      1,775        2.50       95.68
          7 |        907        1.28       96.96
          8 |        629        0.89       97.85
          9 |        201        0.28       98.13
         10 |        653        0.92       99.05
         11 |         57        0.08       99.13
 12 OR MORE |        618        0.87      100.00
------------+-----------------------------------
      Total |     70,973      100.00
```

. tab ind5_4: During the past 12 months, has (child's name) been involved in any type of community service or volunteer work at school, church, or in the community? (S7Q17 -- ages 12-17 only)

```
|                    Freq.     Percent        Cum.
-------------------------------    +-----------------------------------
           Did NOT participate = 0 |     12,220       34.83       34.83
Participated in volunteer work = 1 |     22,860       65.17      100.00
-------------------------------    +-----------------------------------
                         Total     |     35,080      100.00
```

. oprobitbmi_class_percentiles msa_stat s7q12 s7q17 s10q01 s10q02 s10q03 s10q04 s10q05 s10q06 s10q07 s10q08 s11q06r ind5_4 ind7_1

```
note: ind5_4 omitted because of collinearity
Iteration 0:   log likelihood =  -14817.48
Iteration 1:   log likelihood = -14679.244
Iteration 2:   log likelihood = -14679.159
Iteration 3:   log likelihood = -14679.159

Ordered probit regression                         Number of obs   =      18203
LR chi2(13)     =     276.64
Prob> chi2      =     0.0000
Log likelihood = -14679.159                       Pseudo R2       =     0.0093

------------------------------------------------------------------------------
bmi_class_percentiles |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
----------------------+-------------------------------------------------------
msa_stat |  -.1208162   .0206078    -5.86   0.000    -.1612067   -.0804257
s7q12 |  -.0220314   .0045474    -4.84   0.000    -.0309441   -.0131187
s7q17 |  -.1047451   .0208329    -5.03   0.000    -.1455768   -.0639134
s10q01 |   .0847146   .0175306     4.83   0.000     .0503553    .1190739
s10q03 |   .0331466   .0189154     1.75   0.080    -.0039269    .0702201
s10q04 |  -.0420053   .0085665    -4.90   0.000    -.0587952   -.0252153
s10q05 |  -.0048811   .0190227    -0.26   0.797    -.0421649    .0324028
s10q06 |   .0508641   .0161264     3.15   0.002     .0192569    .0824713
s10q07 |  -.0457992    .015226    -3.01   0.003    -.0756416   -.0159568
s10q08 |  -.0331101    .024048    -1.38   0.169    -.0802433    .0140231
s11q06r |    .005888   .0040112     1.47   0.142    -.0019738    .0137499
ind5_4 |          0  (omitted)
ind7_1 |  -.1171113   .0462164    -2.53   0.011    -.2076939   -.0265287
----------------------+-------------------------------------------------------
/cut1 |   .1415963   .1284136                     -.1100897    .3932823
/cut2 |   .7318452    .128501                      .4799878    .9837025
------------------------------------------------------------------------------
```

mfx, predict (p outcome(2))

```
Marginal effects after oprobit
      y  = Pr(bmi_class_percentiles==2) (predict, p outcome(2))
         =  .70393188
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
msa_stat*|   .0422854       .0073    5.79   0.000   .027983  .056588   .706752
s7q12    |   .0076142      .00157    4.85   0.000   .004534  .010694   2.23721
   s7q17*|   .0366001      .00735    4.98   0.000   .022186  .051014   .705598
  s10q01 |  -.0292781      .00606   -4.83   0.000  -.041152 -.017404    1.6767
  s10q02 |   .0132496      .00617    2.15   0.032   .001164  .025335     1.542
  s10q03 |  -.0114557      .00654   -1.75   0.080  -.024268  .001357    1.4318
  s10q04 |   .0145174      .00296    4.90   0.000   .008716  .020319   2.64792
  s10q05 |   .0016869      .00657    0.26   0.797  -.011199  .014573   1.29654
  s10q06 |  -.0175791      .00557   -3.15   0.002  -.028502 -.006656   3.40037
  s10q07 |   .0158286      .00526    3.01   0.003   .005515  .026142   3.37659
  s10q08 |   .0114431      .00831    1.38   0.169  -.004847  .027733   3.83398
 s11q06r |   -.002035      .00139   -1.47   0.142  -.004752  .000682   2.31116
  ind7_1*|   .0413986      .01668    2.48   0.013   .008703  .074094   .882657
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

mfx, predict (p outcome(3))

```
Marginal effects after oprobit
```

```
      y  = Pr(bmi_class_percentiles==3) (predict, p outcome(3))
         =  .16598362
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
msa_stat*|  -.0159913      .00271   -5.90   0.000  -.021299 -.010683   .706752
s7q12    |  -.0029515      .00061   -4.82   0.000  -.004151 -.001752   2.23721
   s7q17*|  -.0138907      .00274   -5.06   0.000   -.01927 -.008512   .705598
  s10q01 |   .0113491      .00236    4.81   0.000   .006725  .015973    1.6767
  s10q02 |  -.0051359      .00239   -2.15   0.032  -.009825 -.000447     1.542
  s10q03 |   .0044406      .00254    1.75   0.080  -.000529   .00941    1.4318
  s10q04 |  -.0056274      .00115   -4.88   0.000  -.007887 -.003367   2.64792
  s10q05 |  -.0006539      .00255   -0.26   0.797  -.005649  .004341   1.29654
  s10q06 |   .0068142      .00216    3.15   0.002   .002571  .011057   3.40037
  s10q07 |  -.0061356      .00204   -3.00   0.003  -.010141  -.00213   3.37659
  s10q08 |  -.0044357      .00322   -1.38   0.169  -.010752  .001881   3.83398
 s11q06r |   .0007888      .00054    1.47   0.142  -.000265  .001843   2.31116
  ind7_1*|   -.015354      .00591   -2.60   0.009  -.026943 -.003765   .882657
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

mfx, predict (p outcome(4))

```
Marginal effects after oprobit
      y  = Pr(bmi_class_percentiles==4) (predict, p outcome(4))
         =   .1300845
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
msa_stat*|  -.0262941      .00461   -5.70   0.000  -.035335 -.017254   .706752
s7q12 |  -.0046627      .00096   -4.84   0.000   -.00655 -.002776   2.23721
   s7q17*|  -.0227094      .00463   -4.91   0.000  -.031778  -.01364   .705598
  s10q01 |    .017929      .00371    4.83   0.000   .010653  .025205    1.6767
  s10q02 |  -.0081137      .00378   -2.15   0.032  -.015515 -.000712     1.542
  s10q03 |   .0070151        .004    1.75   0.080  -.000832  .014862    1.4318
  s10q04 |    -.00889      .00181   -4.90   0.000  -.012445 -.005335   2.64792
  s10q05 |   -.001033      .00403   -0.26   0.797  -.008924  .006858   1.29654
  s10q06 |   .0107649      .00341    3.15   0.002   .004074  .017456   3.40037
  s10q07 |   -.009693      .00322   -3.01   0.003   -.01601 -.003375   3.37659
  s10q08 |  -.0070074      .00509   -1.38   0.169  -.016983  .002969   3.83398
 s11q06r |   .0012461      .00085    1.47   0.142  -.000418   .00291   2.31116
  ind7_1*|  -.0260446      .01078   -2.42   0.016  -.047171 -.004918   .882657
```

BMI and Other Variables behavioral patterns and psychological factors

. tab s1q01: is S.C. male or female?

```
                Freq.     Percent        Cum.
------------+-----------------------------------
   Male = 1 |     36,803       51.22       51.22
 Female = 2 |     35,043       48.78      100.00
------------+-----------------------------------
      Total |     71,846      100.00
```

. **tab planguage: What is the primary language spoken in your home?**

```
|                          Freq.     Percent        Cum.
------    -------------+-----------------------------------
          English = 1 |     68,955       96.02       96.02
Any other language = 2 |      2,859        3.98      100.00
-------------------+-----------------------------------
             Total |     71,814      100.00
```

. **tab s2q22: Has a doctor or health professional ever told you that [CHILD] has any of the following conditions]? Depression or Anxiety disorder**

```
|                Freq.     Percent        Cum.
----------    --+-----------------------------------
         No = 0 |     67,949       94.78       94.78
        Yes = 1 |      3,740        5.22      100.00
--------    ----+-----------------------------------
          Total |     71,689      100.00
```

. tab s2q01: In general, how would you describe [CHILD]'s health? Would you say [his/her] health is excellent, very good, good, fair, or poor?

```
|                  Freq.     Percent        Cum.
-------    -----+-----------------------------------
  Excellent = 1 |     45,891       63.89       63.89
  Very Good = 2 |     17,368       24.18       88.07
       Good = 3 |      7,027        9.78       97.85
       Fair = 4 |      1,335        1.86       99.71
       Poor = 5 |        207        0.29      100.00
------------+-----------------------------------
          Total |     71,828      100.00
```

. tab s2q59: Overall, do you think that [CHILD] has difficulties with one or more of the following areas: emotions, concentration, behavior, or being able to get along with other people?

```
|             Freq.     Percent        Cum.
------------+-----------------------------------
      No = 0|     58,944       82.28       82.28
    Yes = 1 |     12,696       17.72      100.00
------------+-----------------------------------
      Total |     71,640      100.00
```

. tab s7q45: [He/She] bullies, or is cruel or mean to others.

```
                 Freq.     Percent        Cum.
------------   +-----------------------------------
      Never = 1|     47,644       78.98       78.98
  Sometimes = 2|     11,901       19.73       98.71
    Usually = 3|        449        0.74       99.45
     Always = 4|        331        0.55      100.00
----------   --+-----------------------------------
      Total    |     60,325      100.00
```

. tab s7q59: [He/She] tries to resolve conflicts with classmates, family, or friends

```
. |                   Freq.     Percent        Cum.
------------    +-----------------------------------
      Never = 1 |      2,062        3.44        3.44
  Sometimes = 2 |     15,064       25.10       28.53
    Usually = 3 |     20,959       34.92       63.45
     Always = 4 |     21,942       36.55      100.00
------------+-----------------------------------
      Total |     60,027      100.00
```

. tab s7q48: [He/She] feels worthless or inferior

```
|                Freq.     Percent        Cum.
------------+-----------------------------------
      Never = 1 |     42,110       70.18       70.18
  Sometimes = 2 |     16,646       27.74       97.92
    Usually = 3 |        730        1.22       99.14
     Always = 4 |        518        0.86      100.00
------------+-----------------------------------
      Total |     60,004      100.00
```

. tab s7q62: [He/She] is unhappy, sad, or depressed.

```
                |      Freq.     Percent        Cum.
```

```
------------  +-----------------------------------
      Never =1  |     34,581       57.38       57.38
  Sometimes = 2 |     24,633       40.87       98.25
    Usually = 3 |        695        1.15       99.40
     Always = 4 |        361        0.60      100.00
------------+-----------------------------------
      Total |     60,270      100.00
```

. tab s7q63: [He/She] is withdrawn, and does not get involved with others

```
. |                   Freq.     Percent        Cum.
-----------    -+-----------------------------------
      Never = 1 |     50,251       83.32       83.32
  Sometimes = 2 |      8,899       14.76       98.08
    Usually = 3 |        677        1.12       99.20
     Always = 4 |        481        0.80      100.00
------------+-----------------------------------
      Total |     60,308      100.00
```

. tab s7q23: How often does [he/she] wear a helmet when riding a bike, scooter, skateboard, roller skates, or rollerblades? Would you say never, sometimes, usually or always?

```
               Freq.     Percent        Cum.
------------+-----------------------------------
      Never = 1|     13,753       28.64       28.64
  Sometimes = 2|      8,792       18.31       46.94
    Usually = 3|      7,273       15.14       62.09
     Always = 4|     18,209       37.91      100.00
------------+-----------------------------------
      Total |     48,027      100.00
```

. oprobitbmi_class_percentiles s1q01 s2q22 s2q01 s2q59 s7q45 s7q59 s7q48 s7q62 s7q63 s7q23

```
Iteration 0:   log likelihood = -44601.269
Iteration 1:   log likelihood = -43911.805
Iteration 2:   log likelihood = -43911.576
Iteration 3:   log likelihood = -43911.576

Ordered probit regression                         Number of obs   =      47177
LR chi2(10)     =    1379.39
Prob> chi2     =     0.0000
Log likelihood = -43911.576                       Pseudo R2       =     0.0155

------------------------------------------------------------------------------
bmi_class_percentiles |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
----------------------+-------------------------------------------------------
               s1q01 |  -.1940103   .0113054   -17.16   0.000    -.2161684   -.1718522
               s2q22 |   -.140812   .0272684    -5.16   0.000    -.1942571    -.087367
               s2q01 |   .2071105   .0077112    26.86   0.000     .1919968    .2222242
               s2q59 |   .0568576   .0161092     3.53   0.000     .0252841    .0884311
               s7q45 |   .1101907    .012551     8.78   0.000     .0855913    .1347902
               s7q59 |  -.0297544    .006848    -4.34   0.000    -.0431762   -.0163326
               s7q48 |   .0121851   .0123008     0.99   0.322    -.0119239    .0362942
               s7q62 |   -.047322    .012125    -3.90   0.000    -.0710866   -.0235574
               s7q63 |   .0131028   .0136083     0.96   0.336     -.013569    .0397745
               s7q23 |   .0378961   .0045059     8.41   0.000     .0290647    .0467275
----------------------+-------------------------------------------------------
               /cut1 |   .3974307   .0407617                      .3175393    .4773221
               /cut2 |   .9353584   .0408885                      .8552185    1.015498
------------------------------------------------------------------------------
```

. mfx, predict (p outcome(2))

```
Marginal effects after oprobit
      y  = Pr(bmi_class_percentiles==2) (predict, p outcome(2))
         =  .60473939
```

```
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.      z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
   s1q01 |   .0747158      .00435   17.17   0.000   .066185  .083247   1.46822
   s2q22*|   .0531889      .01007    5.28   0.000   .033446  .072932   .054751
   s2q01 |  -.0797609      .00297  -26.86   0.000  -.085581  -.07394    1.4768
   s2q59*|  -.0219938      .00626   -3.51   0.000  -.034258  -.00973   .188079
   s7q45 |  -.0424359      .00483   -8.78   0.000  -.051909 -.032962   1.23085
   s7q59 |   .0114588      .00264    4.35   0.000    .00629  .016628   3.05399
   s7q48 |  -.0046927      .00474   -0.99   0.322  -.013977  .004592   1.31986
   s7q62 |   .0182243      .00467    3.90   0.000   .009072  .027376   1.43733
   s7q63 |   -.005046      .00524   -0.96   0.336  -.015318  .005226   1.17547
   s7q23 |  -.0145943      .00174   -8.41   0.000  -.017995 -.011193   2.62757
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

. mfx, predict (p outcome(3))

```
Marginal effects after oprobit
      y  = Pr(bmi_class_percentiles==3) (predict, p outcome(3))
         =  .18443551
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.      z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
   s1q01 |   -.018673      .00112  -16.63   0.000  -.020873 -.016473   1.46822
   s2q22*|  -.0145956      .00301   -4.84   0.000  -.020504 -.008687   .054751
   s2q01 |   .0199338       .0008   25.02   0.000   .018372  .021495    1.4768
   s2q59*|   .0053373      .00147    3.62   0.000   .002447  .008228   .188079
   s7q45 |   .0106056      .00122    8.71   0.000   .008219  .012992   1.23085
   s7q59 |  -.0028638      .00066   -4.34   0.000  -.004158 -.001569   3.05399
   s7q48 |   .0011728      .00118    0.99   0.322  -.001148  .003493   1.31986
   s7q62 |  -.0045546      .00117   -3.90   0.000  -.006846 -.002264   1.43733
   s7q63 |   .0012611      .00131    0.96   0.336  -.001306  .003828   1.17547
   s7q23 |   .0036474      .00044    8.35   0.000   .002791  .004504   2.62757
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

. mfx, predict (p outcome(4))

```
Marginal effects after oprobit
      y  = Pr(bmi_class_percentiles==4) (predict, p outcome(4))
         =   .2108251
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.      z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
   s1q01 |  -.0560429      .00327  -17.15   0.000  -.062446 -.049639   1.46822
   s2q22*|  -.0385933      .00707   -5.46   0.000  -.052443 -.024743   .054751
   s2q01 |   .0598271      .00223   26.78   0.000   .055448  .064206    1.4768
   s2q59*|   .0166565      .00478    3.48   0.000   .007279  .026034   .188079
   s7q45 |   .0318303      .00363    8.78   0.000   .024722  .038938   1.23085
   s7q59 |   -.008595      .00198   -4.34   0.000  -.012472 -.004718   3.05399
   s7q48 |   .0035199      .00355    0.99   0.322  -.003444  .010484   1.31986
   s7q62 |  -.0136697       .0035   -3.90   0.000  -.020535 -.006805   1.43733
   s7q63 |   .0037849      .00393    0.96   0.336   -.00392   .01149   1.17547
   s7q23 |   .0109469       .0013    8.41   0.000   .008395  .013498   2.62757
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

BMI and Cultural Norms

. tab ind1_3: Was (child's name) ever breastfed or fed breast milk? (S6Q59 -- ages 0-5 only)

```
 (S6Q59 -- a    |      Freq.     Percent        Cum.
------------   +----------------------------------
         No = 0|      3,347       29.61       29.61
```

```
        Yes = 1|      7,955       70.39      100.00
------------+-----------------------------------
      Total    |     11,302      100.00
```

.

. tab s8q03: During the past week, on how many days did all the family members who live in the household eat a meal together?

```
|                  Freq.     Percent        Cum.
-----------    -+----------------------------------
       None = 0 |      3,349        4.67        4.67
          1 = 1 |      2,720        3.79        8.46
          2 = 2 |      5,014        6.99       15.45
          3 = 3 |       7,067        9.85       25.29
          4 = 4 |      8,679       12.10       37.39
          5 = 5 |     10,723       14.94       52.33
          6 = 6 |      4,644        6.47       58.80
  Every day = 7 |     29,560       41.20      100.00
--------    ----+----------------------------------
          Total |     71,756      100.00
```

. **tab s8q02r: About how often does SC attend a religious service?**

```
                                                 Freq.     Percent        Cum.
-------------------------------------    ---+----------------------------------
                                  None = 0 |     14,237       19.90       19.90
At least once per year but less than on = 1 |      5,543        7.75       27.65
At least once per month but less than o = 2 |     12,186       17.03       44.69
At least once per week but less than da = 3 |     39,007       54.53       99.21
                                 Daily = 4 |        563        0.79      100.00
-----------------------------------------+----------------------------------
                                    Total |     71,536      100.00
```

. **tab s10q02: "We watch out for each other's children in this neighborhood." [READ ONLY WHEN NEEDED: Would you say that you definitely agree, somewhat agree, somewhat disagree, or definitely disagree with this statement?]**

```
                       |      Freq.     Percent        Cum.
--------------------+----------------------------------
   Definitely agree = 1 |     40,550       58.02       58.02
     Somewhat agree = 2 |     21,973       31.44       89.46
  Somewhat disagree = 3 |      4,082        5.84       95.30
Definitely disagree = 4 |      3,285        4.70      100.00
--------------------    +----------------------------------
              Total     |     69,890      100.00
```

. oprobitbmi_class_percentiles ind1_3 s8q03 s8q02r s10q02

```
Iteration 0:   log likelihood =  -10816.82
Iteration 1:   log likelihood = -10757.119
Iteration 2:   log likelihood = -10757.117
Iteration 3:   log likelihood = -10757.117

Ordered probit regression                         Number of obs   =      10924
LR chi2(4)      =     119.41
Prob> chi2      =     0.0000
Log likelihood = -10757.117                       Pseudo R2       =     0.0055

------------------------------------------------------------------------------
bmi_class_percentiles |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
----------------------+-------------------------------------------------------
              ind1_3 |  -.2283589    .024997    -9.14   0.000    -.2773522   -.1793656
               s8q03 |  -.0036174   .0055901    -0.65   0.518    -.0145738     .007339
              s8q02r |  -.0046691   .0089682    -0.52   0.603    -.0222465    .0129083
```

```
               s10q02 |   .0749729   .0135765     5.52   0.000     .0483634    .1015823
----------------------+------------------------------------------------------------------
                /cut1 |  -.1967835   .0478794                     -.2906254   -.1029415
                /cut2 |   .1360999   .0478687                      .0422791    .2299208
------------------------------------------------------------------------------
```

. **mfx, predict (p outcome(2))**

```
Marginal effects after oprobit
      y  = Pr(bmi_class_percentiles==2) (predict, p outcome(2))
         =  .44915436
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
  ind1_3*|   .0895339      .00968    9.25   0.000   .070563  .108505   .705328
   s8q03 |   .0014314      .00221    0.65   0.518  -.002904  .005767   5.45139
  s8q02r |   .0018476      .00355    0.52   0.603  -.005108  .008803   1.94425
  s10q02 |  -.0296666      .00537   -5.52   0.000  -.040196 -.019137   1.61232
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

. **mfx, predict (p outcome(3))**

```
Marginal effects after oprobit
      y  = Pr(bmi_class_percentiles==3) (predict, p outcome(3))
         =  .13209289
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
  ind1_3*|    .000245      .00038    0.64   0.522  -.000505  .000995   .705328
   s8q03 |  -.0000183      .00003   -0.64   0.525  -.000075  .000038   5.45139
  s8q02r |  -.0000236      .00005   -0.51   0.607  -.000114  .000066   1.94425
  s10q02 |   .0003792      .00013    2.89   0.004   .000122  .000636   1.61232
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

. **mfx, predict (p outcome(4))**

```
Marginal effects after oprobit
      y  = Pr(bmi_class_percentiles==4) (predict, p outcome(4))
         =  .41875275
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
  ind1_3*|  -.0897789      .00986   -9.11   0.000  -.109104 -.070454   .705328
   s8q03 |  -.0014131      .00218   -0.65   0.518  -.005693  .002867   5.45139
  s8q02r |   -.001824       .0035   -0.52   0.603   -.00869  .005042   1.94425
  s10q02 |   .0292874       .0053    5.52   0.000   .018892  .039683   1.61232
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

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