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Does Urbanization or Industrialization Have More Impact on the Increasing Prevalence of Diabetes in Developing Countries?

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Does Urbanization or Industrialization Have More Impact on the Increasing
Prevalence of Diabetes in Developing Countries?

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Abstract

Regardless of how developed a nation is, diabetes mellitus II and other noncommunicable diseases are becoming an increasing problem throughout the globe. However, as more developing countries are introduced to the advancements of industrialized technologies, as well as the shift from rural living to an urban environment they are experiencing a more marked increase in diabetes than anywhere else in the world. In this article we break down the categories of industrialization and urbanization into several key underlying factors that contribute to their proliferation of diabetes in the developing world.

For industrialization we assess the influence of food processing, agriculture system changes, as well as the major shifts in physical activity patterns. In regards to urbanization, we take a deeper look into diet trends, urban marketing systems, as well as the contrast with rural areas. Overall, the goal of this article was to evaluate these systems, and assess which of them has a larger influence on the rapid increase in diabetes amongst developing nations, as well as where we can address these concerns in a productive way. Throughout the study it was determined that industrialization has a more powerful grip and control over developing countries, and as a preceding nature to urbanization, has a higher influence on the diabetes problem worldwide.

Introduction

Through modern means of transportation and communication we live in a world where countries have an unprecedented sharing of ideas, mixing of culture, expansion of

influence and limitless opportunities. With that in mind, these interactions occur at different stages of development for each country it touches, generally high income countries sharing methods and means to lower income countries. Unfortunately these global pressures can have unintended consequences. One such unexpected result of this intermingling is Diabetes Mellitus II (DM II), an increasingly prevalent issue in lower income countries.

In this article I aim to highlight the importance of two systems of change : urbanization and industrialization. More specifically I will attempt to break down how these two dynamics have contributed to a global epidemic of diabetes in middle and low income countries. Furthermore, the goal of this research is to discern which of these two categories has more influence on the proliferation of DM II. Ultimately this is in hopes of developing an idea of where it would be best to invest resources into stifling the diabetes epidemic.

For the purpose of this article a few definitions must be made clear. Industrialization in the context of this article refers to a broad spectrum of technological advancement that enables increased food production or processing, promotes sedentary lifestyle, or mechanization that reduces required labor, as well as several others that will be discussed. (1,2) Urbanization will be referring to factors that relate to the density of a country, increased ease of transportation or access to commercial foods, but similarly cannot be exclusively summarized or attributed to these factors alone. (1,2) We will discuss these influential powers in the setting of low as well as middle income countries, where the most profound and rapid change is currently developing worldwide.

Furthermore, we will be exploring the relationship between these systems and developing countries. Developing countries are used synonymously in this article with low and middle income countries (LMIC). This distinction is made based on economic growth, and GDP per year, but these specific data points are not discussed in greater detail other than classification. These will often be compared to countries of higher developmental status or ‘Westernized’ countries. This is referring to the various regions, nations and states in Europe and the Americas. It will often be in the context of Westernization where much of the world is extensively influenced by historically Western cultures.

Background

Diabetes Basics and Global Trends

DM II is simple enough to understand : the body has developed an inefficiency in the metabolic processing of glucose, typically in the form of increased resistance to the insulin your body produces. Despite its simple nature (or perhaps because of it) diabetes has become one of the leading non-communicable diseases globally. With improved

healthcare around the world and rising life expectancies, non-communicable diseases and their management have risen to the top of policy discussions internationally. By the year 2030, it is expected that non-communicable diseases will account for five times as many deaths when compared to communicable disease. ⁽³⁾ Those stats alone should promote global action on diabetes control, yet social attention tends to stick on infectious causes and how to eliminate them. However, even though it is known how to prevent and treat the disease, year after year we see a marked increase in diagnoses worldwide, and it is not showing any signs of slowing down.

Recent estimates show that there are upwards of 382 million diabetics worldwide, and it is estimated that the global population of people diagnosed with diabetes will skyrocket by over 50% - reaching nearly 600 million by 2035. ^(2,4) This dramatic rise in cases will be felt most in countries that are experiencing rapid socioeconomic development and change. Some studies have shown that over 80% of people with diabetes are in developing countries. ^(5,6) Within these estimates, it is expected that the greatest increase in diabetics will be found in developing areas such as Pakistan, India, Bangladesh, Brazil, Indonesia, and Sub-Saharan Africa to name a few. Though it will not be the focus of this article, it is worth noting that the demographic in developing countries that this increase in diabetes is expected to occur primarily in those aged 45-64. ⁽³⁾ Many times this demographic was being diagnosed for the first time as a result of the studies they were involved in, a truly harrowing thought. Furthermore, this evaluation of data was considered an underestimation and was meant to indicate a lower limit. This is in part due to scarcity of data collection in some countries (such as Southeast Asia, for

example) where the growth is expected to be upwards of an 150% increase, significantly more than developed nations. (6,7)

As stated previously, the risk factors have been well established and well researched for diabetes (4,8,9,13) ; consuming foods that are high in saturated fats and sugars, reduced physical activity, smoking tobacco, excessive alcohol. Unfortunately there is little education, monitoring or surveillance, let alone prevention methods established in developing nations. (13, 14) The healthcare system reform required to integrate reliable methods of addressing diabetes and other non-communicable diseases is no small task. It is therefore crucial to assess the systems that are introduced and implemented that lead to these risk factors.

It is expected that rural areas in developing countries would experience half the increase when compared to areas influenced by the effects of urbanization. In some countries where urban and rural lifestyles are drastically separated, the rural population was estimated to have even as low as one fourth of the cases when compared to urbanized areas. (6,7, 15) Unfortunately, in many studies the rural populations tend to be diagnosed as a result of the study, without any knowledge of the severity of their condition prior to joining. The data from developing countries shows that we must acknowledge and discern what it is exactly about urbanization that creates such an environment for diabetes to develop in. We will take a deeper dive into several aspects of urbanization and what areas are most problematic in the proliferation of diabetes.

Urbanization

Urbanization is not exclusively the result of increasing population density of an area. Economic development is often a preceding factor to urbanization. As a country becomes more economically developed, there is an associated increased purchasing power in the area. This then intertwines a variety of factors such as increased accessibility to food, aggressive marketing systems that advertise food and food services to a wider audience. (16) Subsequently this will be followed by a migration of the population with more income to more urban areas. This migration incorporates the shift in occupations available to a population based on changes in technology - which is included for discussion under industrialization later - that enable less strenuous physical labor. To extrapolate this further, this shift creates unseen difficulties with at-home meal preparation. In order to adapt to this, many more people are using ready-to-eat meals and services that offer highly processed diets. (14, 15) Overall, this leads to the problem of excessive energy intake and a diminished amount of energy output, leading to the problem at hand of rising diabetes rates. Even though the process of events and their consequences can easily be laid out, it is harder to discern where action should be taken, and which aspects of this cascade are most related to the spike in obesity and diabetes worldwide.

Clearly, it is important to dig into the bigger picture of societal changes when considering the rise of non-communicable disease such as diabetes. In the 2016 PURE study (Prospective Urban and Rural Epidemiological) study that evaluated low and middle income countries at the social and economic level, they were able to show that diabetes was higher in lower income countries (6) in wealthy nations. Even more importantly, they were able to show that this higher rate of diabetes could not be

explained by all of the conventional risk factors they assessed. This in part may be answerable by assessment of the societal systems surrounding these populations. (11, 13)

In developing countries with lower incomes it needs to be stated that migration to an 'urban' environment does not remove the existence of poverty. It must also be recognized that the impoverished populations take on a different face in urban areas : slums, and squatting often will arise with the development of urbanization. Even amongst the poor that can afford housing there are still observable changes to lifestyle such as watching television where modernized food marketing creates stimuli that can facilitate new dietary habits. These impoverished individuals often will have the least amount of choice in their diet through the options available to them, and the cost they can actually afford. (15)

Urban Marketing Systems

As laid out previously, the relationship between economic development and subsequent marketing within the population has an undeniable correlation with increasing rates of obesity within the target population, and subsequently, diabetes diagnoses. Often this marketing is established through food distribution channels, and presents options such as minimal cost, larger portion sizes, simplicity or lack of preparation, all of which have mass appeal. (16)

Marketing systems within an urban population are generally trying to do a good thing - it is meant to raise economic development and promote growth. However,

amongst poor nations global retailers and national chains have an overwhelming buying power when compared to local options. They are able to offer newfound variety, and convenience that is attractive especially in areas where options were previously quite limited. Marketing research takes advantage by adapting to local tastes and preferences, which appears in a sense as accommodation. This goes even deeper, as packaging, distribution and advertising itself will adapt to the targeted audience. However, methods of tailoring a product, chain, or brand or food towards these developing countries is being exploited as a cultural good, but is not being produced by the culture itself.

For example, fresh markets such as public markets, farmers markets, or fish markets are being outcompeted by these cheaper and larger supermarkets. Not only are these open markets often a local representation of culture and tastes, but the fresh markets are a reliable source of fresh foods that are typically lower in fat, sugars and salts and of a higher quality. Unfortunately this is often at a higher cost, and so the supermarkets have started to replace them in poorer areas where it is more affordable. It is important to recognize that this shift to larger companies also brings about higher reliability - fresh open markets are more dependent on catch or growth patterns that are less controlled environments than what supplies the supermarkets and larger corporations rely on. (1, 2, 16)

Even beyond the options of where food can be bought to be used and prepared at home, the introduction of food services that prepare food for you such as global fast food chains are a rising problem. There has been well documented relationships between fast food consumption and obesity as well as diabetes. (17) Though it is true that local cultures often have their own version of 'fast food' available, undoubtedly they suffer similar

issues from competitions as the markets do. Chains from Western companies take over after they create a new location offering variety and portion size that cannot be challenged by local food vendors. (16)

Another specific branch of marketing that leads to unhealthy population shifts in obesity and diabetes is how companies are targeting children with their advertisements and products. The impact can be seen on all types of media that children consume such as computers, cell phones, televisions, paper products like journals, notebooks, or even the use of toys by fast food companies. (2, 16) These approaches have been successful in wealthy nations and have adapted to developing countries with massive success as well. By utilizing all forms of media, advertisements can readily access any consumer no matter where they live in the world.

In addition, product placement in movies have been associated with creating scenes of eating and drinking that have a noticeable impact on food demand amongst youths in popular movies. Though children are not the exclusively affected by these bombardments, exposures at younger ages does have a more powerful and lasting impact than at older demographics. Some countries have begun to explore stronger control of the media regarding food advertisement, similarly to how tobacco marketing has been affected. (1,2, 16)

Diet Changes

As urbanization extends its reach, the alteration of local diets to a more ‘Western’ model tends to follow. The influence of marketing and management as listed previously propagates unhealthy food retail leading to higher intake of unhealthy fats and oils, sugars, refined carbohydrates and animal products. These are introduced and then popularized in urban areas and are starting to spread even to rural areas in some countries. (1,2)

There are several other layers within a ‘diet change’ itself that is causing this diabetes problem. An example of this is food insecurity and food ‘deserts’. Insecurity refers to socioeconomically vulnerable populations that have limited access to food, often due to cost vs. income of the individuals, transportation issues, or even high competition within the area. Deserts are defined as an area that not only has low income, but has low physical access to food in general and can be found in developed and developing countries alike. (12) This can be further complicated by food ‘swamps’ which appear when an area has a high number of food retailers, but very few if any of those retailers are considered healthy. This undernutrition often goes unregulated and can cause major health concerns in these areas. (12) These conditions are truly dismal, and often will impact the poorest urban areas where individuals have a difficult time moving away from into better areas.

The American Diabetes Association Diabetes Care journal showed in a 2018 study that populations in areas with higher food insecurity had elevated A1C counts when compared to food-secure areas. (12) This conundrum deserves to be clearly outlined and stated : The poorest urban areas do not have high food security, the food they are able to

secure is lacking in nutrition, and as a result of the lack of nutrition will develop health complications such as diabetes.

Rural Trends

It is estimated that 55% of all low and middle income populations worldwide are living in a rural environment. (6) Just like urban areas, rural diabetes trends follow a similarly concerning outlook. In addition to the implied risk of urbanization and industrialization and the risks that are associated with it, rural populations have much fewer opportunities to address diabetes. For example, there are significantly fewer studies about rural health in general, and this is extrapolated significantly when considering developing nations. Furthermore, local awareness, access to treatment, education, and control of diabetes is minimal. (6,7,8) It is estimated that almost half of diabetics in the world are undiagnosed, and a large percentage of that estimation is thought to be in rural areas. (6,7) However, taken on a different look this also offers a unique opportunity to produce action towards helping rural communities before conditions get worse.

This was further complicated by the variable definition used by some articles when referring to a rural population. In some studies a rural population was considered a small village, or a remote location that is far from a city. This would often be associated with a population less than two hundred. However, some 'rural' areas were nearby cities that would inhabit tens of thousands of people. In a recent study reviewing the comparison to urban and rural areas, they recommended a more heterogeneous definition when referring to a rural population, and more solidly defining what characteristics would refer to a rural area. (6,7) Considering the rate at which urbanization is spreading, a

universal definition of a rural setting should look not only at population density and area size, but also at lifestyle characteristics of the population such as occupation, travel methods, technology, access, nearby cities and their population, etc. An analysis of these factors could create a more focused definition of ‘rural’ regions, and enable more reliable data collection and studies of such areas. (6)

It is clear that these are several dimensions within the realm of urban development that is leading to an unseen rise in type II diabetes mellitus worldwide. Despite the efforts thus far of developing as well as already developed nations, this trend is a challenge to address that needs attention from large-scale regulatory efforts. Furthermore, this shift in global patterns of urbanization is directly intertwined with the technological advance that allows us to organize these spaces. It is key to differentiate these two major drivers resulting in this nutrition transition and diabetes proliferation through all corners of the globe.

Industrialization

Massive global shifts through technological innovation has accomplished incredible things across the globe. The transportation methods that connect us through land, sea, and air are more accessible than ever before. The internet, smart phones and wireless data has reached almost all corners of the world, allowing us to be connected wherever we go. Engineering and manufacturing technologies allow faster, easier and more efficient assembly of goods that we can hardly keep up with technological

advancements. However amazing these technological advances are, they have also brought about unforeseen damage in its wake. These rapid shifts in technological advancement permits the average worker to save more energy throughout their shift. Their commute to and from work is becoming faster and more reliable. At home, the consumer indulges in leisure activities that require very little work on their part such as television, browsing the internet, video games, reading, and a countless variety of other mediums that are being adapted to a progressively electronic world.

It is clear that large shifts in access to technology have reduced energy expenditure throughout the day for individuals across the globe. In developed nations this lifestyle is well known. This particular lifestyle of ‘Western’ societies is having its influence on developing nations as it comes hand-in-hand with the technology that is advancing the society around them. This is seen most in the more labor-intensive occupations such as manufacturing, farming and mining. (1,2,20) Furthermore, the way that food is produced and distributed has been improved with the available technology in these sectors. To explore the overlying issue of diabetes, we must understand these underlying system changes that are causing it.

Agricultural Systems

The global approach to agriculture has been dramatically changed with the increased availability of education and technology regarding crop production. Global investment in agriculture has enabled extremely low prices on common global

commodities. Many of these commodities themselves have had associations with increased obesity and diabetes such as animal-source foods, sugar and other caloric sweeteners, and vegetable oils. One such example is how technology was previously developed in order to extract oil from seeds such as corn and soybean. Since then, breeding technologies have been utilized to increase oil content, causing a boom in availability of cheap oils worldwide.

Classically the agricultural system has attempted to address the issue of global hunger by supplying animal sourced foods and filling foods that are easy to grow like starches. Unfortunately, these crops are also considered ‘cash crops’ due to their economic cost being low with high profits and high demand. (17, 23,24) In light of this, the funding and control of agricultural systems has grown more in the realm of the private sector and less in the form of government control. So despite the research and science showing the unhealthy nature of these products the profits have been prioritized over alternative goods. Unfortunately, this shift in the agricultural system to a more private nature will take significant economic and political shifts for the incentive to grow healthier options. As for now, the profits of these cheaply produced, high energy products will continue to dominate the distribution of foods to developing economies, and stimulate diabetes growth alongside it. (19,20,21)

Food processing

Historically the way food was prepared and preserved was not by any means considered harmful for human consumption or health. However, in the current era, food processing has been upended and is intrinsically related to industrialization. The ability to mass produce and manufacture products has taken on a shape made almost exclusively by cheap ingredients and additives. (17) These foods have been proven to cause diabetes in high and middle income countries, and is now a problem in the lower income nations. The current ability to produce these ‘ready to eat’ products is deemed ‘ultra-processing’. These products are, shockingly, often not made from foods, but from additives and other industrial class ingredients. These industrial ingredients are either extracted from foods, created in a laboratory from organic sources, or derived from foods. These products are durable, in contrast to fresh products which are perishable, making them appealing to the corporations producing them. (18,19) They often have high glycemic content while conversely having low micronutrient, fiber content and cost - which is appealing to consumers because they feel satiated while saving money.

The companies that are paying for this industrial ultra-processing are mostly transnational food and beverage corporations that have large capital and influence. Unfortunately this trend is expanding into developing countries due to its affordability and accessibility. Global brand recognition enables these large corporations to target vulnerable developing nations due to minimal competition for their services. This leads to high market concentration and market power primarily in the hands of large foreign companies in these developing countries. (17,18,19) Similarly to agricultural systems, the policies and actions that would be required to stop this profit driven domination of the food processing sector will be a challenge to stop.

Decreased Activity

In addition to the dietary changes globally, physical activity, and more importantly inactivity has been a common shift seen. This is inseparable with the aforementioned improvements in technology in the modern day-to-day lifestyle. As a result, the world is becoming more obese, and seeing higher levels of diabetes and other non-communicable diseases. (1,2) At the core, this is due to energy imbalance so the major areas for intervention relate to dietary intake and energy expenditure. In general providers will encourage those at risk to increase their physical activity output, in addition to managing the dietary options available. (21, 22)

Industrialization has led to a higher number of jobs in the service sector, while simultaneously diminishing the required physical energy by each job. Though this is a trend starting in urban populations, it has begun to spread into rural populations as well. Lighter shift work has high correlation with elevated BMI, which is associated with obesity and diabetes. There has also been extensive research in China showing that the increasing number of motorized transport has resulted in an 80% higher chance of being obese. (21, 25, 26) These unfortunate trends were predicted to increase throughout China, and represent trends amongst developing countries overall.

Methods

This literature review was performed throughout the summer of 2020, with a heavy focus on articles and evidence most recently published. Search terms were centered around general global diabetes trends, and narrowed down to isolate material regarding the research question of this article. Examples of search terms include Diabetes Mellitus II, Urbanization, Industrialization, Developing Countries, Low-and-Middle-Income Countries, and many others. Several hundred articles were explored, though ultimately only 30 were selected. There was no exclusion criteria for searches or for the overall review, but gestational diabetes, type I diabetes, and rare forms of diabetes were not used for data collection. Standard definition of diabetes mellitus II was defined by WHO criteria and American Diabetes Association guidelines. This review was accomplished independently, and only full-text reviews were performed. Articles were chosen with a preference of primary studies of diabetic research within countries considered lower or middle income. When available, systematic reviews were also utilized. Electronic peer reviewed literature such as PubMed, and Google Scholar were the primary database used for searches. The physical library at Augsburg University, as well as alternative online databases through the library directory were also employed. All sources obtained and utilized have been listed under the references section for review. Initial documentation and subsequent iterations were completed through Google Drive via Google Docs.

Discussion

In assessing the question of urbanization and industrialization and their influence on the increasing prevalence of diabetes across the developing world, we have tried to discern which of them are more influential. Within articles that have researched these two systems of change, it is clear they have significant depth in their contribution to the worldwide spread of diabetes. Said plainly, industrialization and urbanization play such integral roles in the rising problem of diabetes in developing countries that it can no longer be ignored in addressing the issue of global diabetes care. Fortunately in this review we have shown that both of these areas have a good body of research exploring each of these problems in isolation of one another.

However, in reality it is difficult to disentangle the two identities from one another and without doing so, there is a challenge of discovering where to approach a solution to these problems. Industrialization is in a broad sense required for urbanization to occur. I did not come across any situations where a country was able to urbanize without a prior acceleration in technology available. (10,15) In practice, these are often implemented at the same time upon these developing nations, instead of a stepwise function. This is because the advancements have already been developed by other nations, and so there is no need for a progressive development and all of the change is instead at once.

When evaluating the available information, industrialization stands out as having a larger influence on diabetes worldwide than urbanization alone, especially in these developing nations. (1,2,3,17,18) Considering how the advancement of technology has

changed the amount of physical activity, how food is processed and the way agricultural systems function in developed nations, the trend that is starting to spread in low and middle income countries is more than concerning - it is a pressing issue that needs to be addressed quickly. (17,18,21) Furthermore, the steps and methods of industrialization occur earlier in the development of a nation and has a longer time to influence the culture and population it affects. Unfortunately, the systems behind industrialization are much more challenging to address because they are often controlled by the private sector instead of by governments.

Global and national food companies have the power behind food quality, and food production. They control the primary production by the agricultural sector, as well as the factories that process the food, and distribute them. (19,20) These are exclusively run by profits, a sobering realization. (16, 17,20) The pressures required in order for these companies to enhance the quality of their food, promote policy changes to address global obesity and diabetes is a daunting task. The approach towards solving this needs to be akin to the conquering of big tobacco industries. The new enemy of 'big food' is a different beast entirely because food is a required substance, whereas tobacco is an elective one.

Another point to consider that was reviewed is the unethical marketing practices still seen in low and middle income countries, and in fact showed the inverse relationship - as product marketing and sales declined in developed nations, it was shifted towards targeting developing ones such as China. (16,26,30) This led to an overall increase in sales for the companies, notably producers of sweetened beverages such as Coca-Cola and

PepsiCo. This raises the question of how long it will take for companies such as these to be held accountable in developing nations. If similar regulations that have been put in place on these companies in Europe and the United States could be put in place for low and middle income countries, the impact on global diabetes trends would almost certainly diminish with it. (29)

This review also shows that urbanization's influence cannot be ignored, despite being an ancillary problem when compared to the industrialization of developing countries. The contrast seen in these articles between rural populations and urban environments in their diabetes prevalence is profound. (6,7,8) Urban and rural comparison trials were able to convincingly show that diabetes levels were not completely explained by conventional risk factors in lower income countries, and suggested that some of the factors we have discussed play a significant role as well. (6,7) In addition, these lower income countries are more burdened by economic cost of the disease, which has been proven to be reduced through more affordable medicines, implementation of universal health care coverages, as well as supporting early diagnosis and treatment. (11)

With these pressures facing developing countries, it is crucial for developed nations to consider at what level they need to suggest change to stifle the spread of diabetes toward the developing countries. Recommendations from previous research indicates that an effective method would be to have the powerful global companies in charge of distribution and marketing of materials to better regulate the way in which they service these developing nations as they are a particularly vulnerable population. In addition, assessing how these developing nations themselves are able to enact change and

prevent things from getting worse. This is achieved through education, and policy changes in order to uplift the nation's ability to prevent and treat diabetes and the causes of it within the systems surrounding it. Both of these approaches should be harmonious to the unifying goal of producing healthier lives.

Conclusions and Recommendations

The impact that industrialization and urbanization have on the global prevalence of DM II is undeniable, and difficult to completely quantify. However, with this careful review we are able to show the significance that industrialization has in particular on developing countries, and the lasting effects that it has. (1,2,4,6,18) This is a challenging health issue to address, but at the writing of this article, some promise exists. Global food companies have implemented some food labeling and safety regulations, as well as marketing restrictions in developed nations. In addition, countries in Asia and Latin America have taken steps to tax unhealthy products to discourage individuals from purchasing them. (1,2, 20) Some countries have attempted to conquer this at the school level, such as implementing requirements on where schools can purchase foods, and limiting the amount of processed foods allowed within the school. Methods like these have resulted in decreased consumption in Europe and the United States.

Health education and awareness is another clear area where developing countries can benefit from highly. (13) This is also an area where practicing providers can take the lead and work with their patients to improve outcomes. By educating individuals on the personal as well as the systemic causes behind diabetes and its risk factors patients can know where they can make the most positive changes. Explaining the problems found caused by industrialization such as sedentary habits in leisure, stagnation at work, and over-consumption of fast and easy processed meals is crucial to improving health outcomes. Through encouragement of exercise, avoiding processed foods, and prioritizing healthy diet the individual impact can cause widespread awareness and change.

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