

Challenges of Millennials (Generation Y) with non-insulin dependent type 2 diabetes in an increasingly “Diabetogenic” World

Krishan Kumar

Abstract— The significant increase of diabetes incidence since the 1980's is a cause of concern by health professionals and organisations. This global epidemic widely affects the millennial generation (1980-2000) because they are the largest generational cohort today. The increase of diabetes incidence among millennials coincides with significant environmental, cultural, work, lifestyle and diet revolutions which is rarely seen in the previous generational cohorts. This paper states the various challenges faced by millennials during the process of prevention and managing diabetes in their daily lives and the factors which could have led to the rise of this epidemic. Analysis of diabetes incidence data from previous generational cohorts is studied to uncover what factors could be linked to this rise of diabetes cases among millennials. Additionally, this paper explores the ways latest technology can play a bigger role in prevention and cure of diabetes in an effective manner. Such as harnessing the effectiveness of latest innovations like fitness tracking and big data for chronic disease data analysis for improved treatment and care.

Index Terms— type 2 diabetes, non-insulin dependent diabetes, millennials, diabetes in the young, chronic diseases, generation y, generation x, baby boomers, disease care

1 INTRODUCTION

1.1 Why study type 2(non-insulin dependent) diabetes (T2D)among millennials?

THE ever-multiplying prevalence cases of T2D diabetes among the millennial generation (Generation Y) is worrisome. Diabetes Australia states that diabetes is recognised as the world's fastest growing chronic condition with the number of people with T2D is growing globally. It has caused nearly 1.5 million deaths worldwide. Higher blood glucose levels also caused an additional 2.2 million deaths, by increasing the risks of cardiovascular and other diseases[1]. Millennials have become more susceptible to the diabetic epidemic due to living in a world with a “Diabetogenic” environment. According to Merriam-Webster English dictionary, the word “Diabetogenic” was first used in 1894 which means producing diabetes which describes the current situation of the world today. The World Health Organisation (WHO) states that there are 422 million diabetic cases in 2014 compared to only 108 million in 1980. This is a 290 percent increase in diabetic cases in only 36 years, a significant increase showcasing the severity of this epidemic[2].

Millennials are commonly referred as the group of people born between the year 1980 and the year 2000,[3] albeit much contradictory date ranges by different research associations. For this paper, it is assumed that the

millennial generation cohort are people born from 1982 to the year 2000. Understanding the behaviour and attitudes as well as general perceptions of diabetes among the millennials will enable researchers to understand the methods most effective to prevent or even reduce the prevalence of diabetes among millennials in today's fast paced world. As to fully understand how to cure an epidemic, it is essential to understand the root of its emergence without inadvertently overlooking external contexts which could have contributed to it. The purpose of this review is to understand millennials' challenges with diabetes when many factors come into play in their lifestyle choices such as the type of food intake, social pressures from respective social groups, the economy and even how culture and religion can affect food, health and lifestyle management among millennials which could prevent or promote insulin resistance and eventually lead to T2D.

2 WHO ARE THE MILLENNIAL GENERATION?

The term millennial was originally coined by Neil Howe and William Strauss in 1991 which was introduced in their book “Generations”[4]. These millennials grew up in a significantly different world from their predecessors where technology is a “life and soul”, to some extent as essential as food. “Change” is a familiar word to millennials, with change occurring at every moment in their lives in various forms, what they expect from the world is contrary to the expectations had by their parents and predecessors[3]. According to Nielsen, millennials make up about one-fourth of the US population, roughly 77 million, the largest cohort compared to any other previous generation[5]. For example, this difference in expectation can be seen in healthcare where 55 percent of millennials with diabetes

- Krishan Kumar is a pure science stream high school graduate from Malaysia. With a great passion in science and technology, he plans to pursue scientific research in the medical field in the near future.

E-mail: krishan@krishankumar.me

would rather trust a health app than a health professional for advice[6]. This shows that millennials whilst still trusting their physician for health matters would rather get multiple advice either from their surrounding relations or from the internet in addition of being independent when managing various matters be it in diabetes or other life situations.

3 TYPE 2 DIABETES (T2D) BEFORE MILLENNIALS

Before the millennial generation, there were the generation X (1966-1976) and the baby boomers (1946 - 1965)[7]. The statistics of diabetes before the millennials are in small numbers with few reports on diabetes among the generation X and baby boomers. However, a study of diabetic incidence from the 1970s to the 1990s showed that obesity and diabetes occurrences doubled. Additionally, there were a 2.5 percent increase in diabetes cases in the 1990s compared to the 1970s[8]. Medical records from other studies confirm the recurring pattern where diabetes incidences increased from the year 1985 to 1989 (millennials) compared to year 1960 to 1965 (baby boomers) in both men and women[9].

Another statistic showed that as the amount of synthetic organic chemical (SOCs) increased in the environment across the decades, the number of diabetes incidence increased accordingly[10]. Some examples of SOC are pesticides, defoliants, fuel additives[11]. They do not occur naturally in the environment and are man-made. Generation X and baby boomers showed a lower incidence of diabetes as the production of these chemicals where lower whereas incidence of diabetes continue to increase among millennials proportional to the increase of chemical production. This suggests that there may be a link between the diabetes epidemic and exposure to SOC. How does this prevalence of chemicals exposed in our daily lives impact our metabolic health and become the cause of diabetes especially since it has provided much progress and convenience? It is a proposition that must be re-evaluated further to understand if this could be causing the significance prevalence of diabetes among the millennial generation in which careful monitoring of diabetes incidence may be required if current trends of diabetes continue to rise.

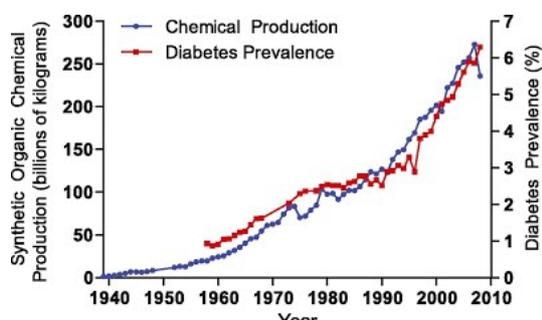


Figure 1 Type 2 Diabetes Prevalence and Chemical Production by Neel and Sargis (2011)

4 HEALTH & DIABETES LITERACY AND CONCERNS FOR MILLENNIALS

Millennials are the first digital native citizens. Their acquisition of health and diabetes knowledge is no longer restricted to physical sources. Social media and the internet have become powerful tools to educate and influence millennials behavioural patterns in health[12]. A recent study conducted in Central Pennsylvania showed that 18-year-old high school students millennials were better able to answer health application questions. It shows that they are optimistic to utilise the internet to gain and change their behaviours towards health. This shows a different pattern in information acquisition compared to previous generations related to diabetes[13]. On the other hand, a contrasting research states that college millennials between the ages of 17-26 years have average eHealth literacy skills even though being connected to the internet for the most of their lives[14].

Sanofi US found out that only 74 percent of millennials perceived that diabetes is a serious health concern compared, to 84 percent of older adults. Millennials seem to care less about diabetes compared to the previous generation. Although millennials seem to know more about the disease compared to older adults in general, they do not have much care about it. While this proves that millennials are generally more literate with health and diabetes information, their lack of concern for this disease is a worrisome behaviour for their future wellbeing.

Health and diabetes management of millennials are compromised because a demanding fast paced lifestyle and workforce requires them to beat work for longer periods of time[15]. Thus, with lesser time for proper nutritious meals, quick grab or fast food appears to be the logical time saving and cost effective choice resulting in poor glycaemic control for persons with or without diabetes[16]. This will cause insulin resistance, and T2D in the long run. In addition, this phenomenon occurs because of various economic challenges faced by the millennial generation. As post-recession citizens, millennials have significantly lower spending capabilities compared to their previous generation counterparts[16]. This lead to millennials moving to cheaper, quick to get and eat food. Surprisingly, even with such poor food intake, millennials are still the least obese among the generational gap. Millennials who are currently in their younger, fit days still have fast metabolic rates. However, if such poor habits are not curbed sooner, their current unhealthy habits can lead to serious health problems in the future and laying a strong foundation for diabetes and every other secondary outcomes of the disease that is associated comes with it [17]. Elissa Violino, a registered dietician and certified diabetes educator (CDE) with CDE Help Team*, Sanofi US said "With high levels of education and unprecedented access to information, millennials have the means to know more about diabetes than any generation in history. Diabetes is becoming more common, so it is necessary that we provide all people, including millennials, with the

information and tools they need to help reduce the risk of or help manage their diabetes, as well as understand treatment options." [18].

5 MODERN ENVIRONMENTAL FACTORS THAT CAUSE DIABETICS AMONG MILLENNIALS

The main modern environmental factor of diabetics among millennials would be food. As much as technology has improved the quality of life of millennials compared to any other previous generation, it is quite ironic as technologies that are involved in food production, farming and processing gives millennials the opportunity to ingest more calorically dense foods in high amounts[19].

In addition, health professionals worry that the rise of a sedentary lifestyle among young people due to work or playing computer online games may lead to weight gain and eventually T2D[20]. The modern lifestyle and conveniences has promoted people especially the millennials to unknowingly live a sedentary lifestyle. Instead of staircases, there are lifts (elevators). Why walk when one can drive. Lesser calories are burnt by the body because of an increasingly sedentary lifestyle where excess calories are being stored in the body which is bound to lead into health problems in the long run. Long working hours also promote such a lifestyle especially when millennials may not have excess time to spare for extra physical activities.

Stress has been linked to diabetes because it activates the fight or flight response in the body. In a diabetic, this fight or flight response does not work as efficiently due to the body cells not receiving the energy required because insulin does not convert glucose into energy efficiently. Excess glucose then remains in the bloodstream increasing blood sugar[21]. Furthermore, millennials have been commonly referred as the most stressed generation because of increasing demands in work and life. According to APA CEO Norman B. Anderson, money and finances have remained the top stressor since 2007 among millennials. Stress is a worrying pattern among millennials since it can lead to not only diabetes but also various other physical problems such as hypertension.

A report due in 2018 by the Lancet Commission will examine the various roles of modern environmental influences on obesity. While this report is focused on obesity, it can be associated with T2D as obesity is directly linked with T2D cases across the world. It will examine various modern factors such as food systems, physical activity, and nutrition. The Lancet states that exposing and challenging unhealthy working environments, living, and dietary habits is essential rather than dismissing them as unavoidable consequences of modern life.

6 ECONOMIC FACTORS WHEN MANAGING CHRONIC DISEASES LIKE DIABETES

This paper mentions that millennials are the generation living in a post-recession world. The lower available spending abilities pose a unique challenge when it comes to managing their diabetes[22]. The cost of managing diabetes continues to rise day by day as governments change policies, cut expenditure and subsidies on national healthcare systems due to the increasing strains on the system due to a weak economy. In addition to being a financial strain on the patients themselves, chronic diseases like T2D are a huge strain financially on government healthcare systems across the world. According to the American Diabetes Association, diabetes is the leading reason of decrease in productivity at work. Additionally, in 2012, the cost of diabetes was \$245 million, showcasing the huge costs of this disease [23]. The World Health Report states that the economic impact of non-communicable chronic diseases such as T2D and obesity have cost the Pacific islands \$1.95 million which is nearly 60 percent of government health budget of Tonga [24]. As T2D becomes increasingly common among millennials, it will most definitely weaken their productivity and impact their economic prosperity. It may impact their ability to properly self-manage, get the required treatment methods or even eating the right foods especially if they are from the lower income spectrum.

6.1 Type 2 diabetes, a rich man's disease?

Families on a low income or below the living wage may face challenges when trying to put food on a table. While healthier food options such as fruits and vegetables is the obvious choice in preventing, and curing T2D, it is much costlier than cheap fast food. While T2D may be reversible and totally preventable, it poses some challenges among millennials. Different family backgrounds, culture, religion and even economic challenges proves a complex way to prevent and reverse this disease. On the other hand of the spectrum, T2D is also caused by excess. People with higher source of income would consume even more food as it is available to them because they have higher access to calories. Not to feed hunger but as a sense of pleasure from eating. The WHO (World Health Organisation) found that most of the 422 million adults living with diabetes are, in fact, in poorer countries[25]. Dr Margaret Chan, WHO Director-General states: *"If we are to make any headway in halting the rise in diabetes, we need to rethink our daily lives: To eat healthily, be physically active, and avoid excessive weight gain. Even in the poorest settings, governments must ensure that people are able to make these healthy choices and that health systems are able to diagnose and treat people with diabetes"* T2D is not necessarily a rich man's disease because even the poor face it in increasing numbers. Many factors come into play when catching this disease.

Understanding some of these facts with millennials may prove useful to healthcare providers in finding effective strategies in preventing and reversing T2D. This disease should be increasingly cured through lifestyle medicine

methods instead of just relying on medication because it is cheap and easily accessed by the patients. Traditional medications have shown not to be the most effective method resolving this epidemic because what may work with some patients may not work with others.

7 CULTURAL AND RELIGIOUS FACTORS THAT AFFECT DIABETES

Culture is the characteristics and knowledge of a group of people, defined by everything from language, religion, cuisine, social habits, music and arts[26]. A person's viewpoint of the world is constantly changing based on the upbringing of a person and based on the community surrounding them. A study done on Thai patients shows that the way they managed their diabetes is highly connected according to their belief systems which consist of a blend of modern and traditional knowledge. For example, some patients blamed the cause of their illness as being due to biomedical factors such as genetics, and cultural and religious factors such as karma. The analysis also revealed that some aspects of Thai life facilitate diabetes self-management while other aspects hamper good control of the illness. For example, Buddhist values of moderation contribute positively to dietary change, while, on the other hand, the importance of rice in the Thai diet can impede successful self-management strategies. In addition, food plays a crucial role especially in Asian cultures. While religion may press the value of moderation, culture may be another barrier and cause self-management of diabetes to no avail. Food has become a source of communications and has become an essential part of people's lives that forms close bonds, no longer just as a survival mechanism[27]. Food is also an intricate part and parcel of culture and even religion.

As the millennial generation is so obsessed with food and fitness, [28] they might find it complicated to combine what is actually needed and required for diabetic self-management or prevention versus what surrounding culture requires them to do. The older generations might encourage consumption at high amounts usually by the millennials grand or great-grandparents who love spoiling them with high glycaemic food be it fast food or sugary sweets[29]. While they may have a good intent and a sign of prosperity[30] but it is inevitably bad for the person's health in the long run.

Another study conducted among millennials below the age of 40, a predominately south Asian community in Leeds that culture significantly influences diabetes management and treatment [31]. For example, certain people stated that they had diabetes because "it is the will of god" while others believe that it is because of their past deeds. The study noted that being overweight in that community is considered prosperous and well-being. Traditional cultural foods as of that south Asian communities are full of fats and oils. The millennial generation is affected by cultural and religious factors that affect not only diabetes, but food intake, fitness and even perceptions of treatment of the disease. This shows

the society around diabetic millennials pay a crucial role when helping one to self-manage diabetes because the people around them are the main motivation to successfully self-care diabetes effectively or worsen their conditions. Some social and cultural norms might be hard to avoid especially in their respective communities. For example, while eating traditional foods which in some cultures might not be proper for persons with diabetes, it is still eaten anyways because it may be a sign of disrespect if one doesn't consume. In addition, while eating in large amounts is a sign of prosperity in certain cultures, it is most unsuitable to the diabetic. How millennials with diabetes overcome these challenges or how to assist them with these challenges should be incorporated together when diagnosing, prescribing treatments respectively.

8 THE RISE OF TECHNOLOGICAL HEALTH SOLUTIONS FOR DIABETIC MILLENNIALS

Technology plays an important part in managing diabetes not only among millennials but for any persons living with this disease today. Technology also has the potential not only to transform diabetes care but revolutionise it. Millennials also trust technology more and want more doctors to integrate technology during the treatment process and more likely to connect with them through health apps to manage their lifestyle and health goals. The main attraction of using technology such as smartphone apps to track their diet and glucose levels is the simplicity and cost effectiveness. This allows millennials to have all their health data at the touch of their fingertips which assists them in managing their chronic diseases and being more engaged in their personal care.

The latest trend of technological health solutions is mHealth (mobile health). This technology is increasingly becoming common among millennials and it is most commonly accessed via their smartphones[32]. The increase in smartphone penetration among the millennial generation makes it an attractive way to find and research information via their handheld gadget. This is evident with the increasing number of health apps in respective smartphone apps store. These apps not only help the patient in simplifying processes in their disease management process but collect valuable data insights which can prove pivotal to the healthcare provider. For example, apps can collect blood sugar levels for T2D in the period of the whole day compared to a single time during check-up or monitor blood pressure. The popularity of these solutions is proven with the significant numbers of downloads of these apps. It is reported that the number of downloads will reach 1.7 billion in year 2017, [33] especially when millennials are known as the health conscious generation[34].

Latest innovations such as Big Data and Analytics can prove revolutionary in terms of diabetic treatment. Big Data is the process of continuously collecting lots of data with the purpose of analysing and finding out new

patterns which would be completely invisible using conventional methods. For diabetics, innovations such as continuous collection of blood sugar levels without pricking the finger can provide valuable information in the data pool of a patient and prescribe lifestyle prevention strategies is proven to be one of the most effective methods in curing diabetes compared to medication alone[35]. Using Big Data and machine learning methods allows creation of prediction models for the onset development of T2D[36]. New type of treatment is formed by using Big Data which is called precision medicine. It is based on long-term data collected from patients and analyses them to identify new risk factors. Risk factors that can predict the probability of catching diabetes include

1. Fasting blood sugar
2. Long-term blood sugar (HbA1C)
3. Total triglycerides
4. Family history of high blood sugar
5. Waist measurement
6. Height
7. Waist-to-hip ratio

Not only does Big Data solutions help patients, but it dramatically gives new form of data toward the healthcare provider. As patient record that blood glucose every day or even wearable activity trackers shed much needed insight on the lifestyle habits of the patient. The potential of this new source of data is significant. Personalised treatment strategies can be formed by healthcare providers to find effective new ways to ensure their patients are cured in the quickest manner to alleviate future problems and reduce suffering[37]. This is essential because millennials face more challenges with chronic diseases like T2D and a holistic approach must be taken to identify all areas of one's background to cure and prevent T2D from happening. Connie Chitwood-Vu, Telecare certified diabetes educator said in a statement. *"Technology is fuelling a new approach to disease management. People are embracing the industry's move to digital health as their trust in the value of using technology to monitor and manage health has increased."*

9 CONCLUSION

As the largest generational cohort, millennials are at the highest risk in diabetes because of being exposed to a "Diabetogenic" environment for the longest period since birth. While generations before millennials (generation X and baby boomers) have diabetes, a wide range of modern factors such as environment, economy, culture, religion, family background, diet and lifestyle pose a challenge when millennials manage, cure or prevent diabetes in their daily lives. These factors have contributed to the doubling of diabetes incidence among millennials since the 1980's. When comparing diabetes statistics with the previous generations before millennials, there seems to be a link of incidence of diabetes cases with the increase of production of synthetic chemical. However, this is not yet conclusive. Most of the evidence

stated in the paper seem to point all or most of the diabetes cases with environmental factors. Genetic factors play only a minor role in catching T2D. Although millennials have higher access to health information, they are less concerned about diabetes therefore it is essential to increase technology usage in the treatment of diabetes to increase awareness while further engaging and using innovative solutions to assist millennials in managing, treating and preventing diabetes in their hectic lifestyles.

Based on these factors, this paper attempts to strengthen the idea that millennials do indeed face a bigger challenge with diabetes be it if they have caught the disease or not. This paper uncovered segments in the daily lives of millennials that could contribute to the rising number of diabetes cases among the millennial generation. The methods used to treat or prevent these diseases from the previous generation may not work as effectively with the millennial generation because of new factors that have come into play. More research is required to understand what other challenges or environmental factors in the daily lives of millennials in this "Diabetogenic" world that could increase or decrease the incidence of diabetes.

During this review, it is realised that there may be less data for diabetes incidence before the millennial generation (before the 1980's). More research data is required to be compiled on the number of incidence of diabetes in the previous generations before the millennials so that a thorough analysis can be done to see what factors present today that has not been there in the previous generations that is contributing to the significant increase of diabetes incidence among millennials today. This is necessary to formulate new methods of effective and early prevention, detection and cure of diabetes.

ACKNOWLEDGEMENT

The author would like to thank Bina Patel for being a guiding hand in addition to being source of inspiration throughout the duration of this review.

REFERENCES

- [1] National Diabetes Services Scheme, "Diabetes Globally," 2015. [Online]. Available: <https://www.diabetesaustralia.com.au/diabetes-globally>. [Accessed: 25-Feb-2017].
- [2] World Health Organization, "WHO | Diabetes," WHO, 2016. [Online]. Available: http://www.who.int/topics/diabetes_mellitus/en/. [Accessed: 28-Jan-2017].
- [3] Goldman Sachs, "Millennials Infographic," "our thinking," 2016. [Online]. Available: <http://www.goldmansachs.com/our-thinking/pages/millennials/>. [Accessed: 28-Jan-2017].
- [4] "What Is A 'Millennial' Anyway? Meet The Man Who Coined The Phrase." [Online]. Available: <http://www.forbes.com/sites/samanthasharf/2015/08/24/what-is-a-millennial-anyway-meet-the-man-who-coined-the-phrase/#7f671761278b>. [Accessed: 05-Feb-2017].

- [5] The Nielsen Company, "MILLENNIALS- BREAKING THE MYTHS," 2014.
- [6] "55% of Diabetic Millennials Would Trust A Health App Over Health Professionals." [Online]. Available: <http://hitconsultant.net/2015/06/10/55-millennials-trust-health-app-health-professionals/>. [Accessed: 08-Feb-2017].
- [7] WJ Schroer, "Generation X, Y, Z and the others." 2016.
- [8] C. Fox, M. Pencina, J. Meigs, R. Vasan, Y. Levitzky, and R. D'Agostino, "Trends in the Incidence of Type 2 Diabetes Mellitus From the 1970s to the 1990s: the Framingham Heart Study," *Circulation*, vol. 113, no. 25, pp. 2914-8, 2006.
- [9] C. L. Leibson, P. C. O'Brien, E. Atkinson, P. J. Palumbo, and L. J. Melton, "Relative contributions of incidence and survival to increasing prevalence of adult-onset diabetes mellitus: a population-based study.," *Am. J. Epidemiol.*, vol. 146, no. 1, pp. 12-22, Jul. 1997.
- [10] "Diabetes Incidence and Historical Trends." [Online]. Available: <http://www.diabetesandenvironment.org/home/incidence>. [Accessed: 21-Feb-2017].
- [11] "New Mexico Environment Department Drinking Water Bureau Synthetic Organic Chemicals." [Online]. Available: <https://www.env.nm.gov/dwb/contaminants/SOCs.htm>. [Accessed: 27-Feb-2017].
- [12] N. J. Gray, J. D. Klein, P. R. Noyce, T. S. Sesselberg, and J. A. Cantrill, "Health information-seeking behaviour in adolescence: the place of the internet," *Soc. Sci. Med.*, vol. 60, no. 7, pp. 1467-1478, 2005.
- [13] T. Lloyd *et al.*, "Health knowledge among the millennial generation.," *J. Public Health Res.*, vol. 2, no. 1, pp. 38-41, Apr. 2013.
- [14] M. Stelfelson, B. Hanik, B. Chaney, D. Chaney, B. Tennant, and E. A. Chavarria, "eHealth literacy among college students: a systematic review with implications for eHealth education.," *Journal of Medical Internet Research*, vol. 13, no. 4. *Journal of Medical Internet Research*, p. e102, 01-Dec-2011.
- [15] "Millennial Careers: 2020 Vision Facts, Figures and Practical Advice from Workforce Experts," 2016.
- [16] "Top Health Concerns for Millennials." [Online]. Available: <http://www.concentra.com/newsroom/articles/top-health-concerns-for-millennials/>. [Accessed: 28-Jan-2017].
- [17] "Millennial Generation Has Fewer Obese People, But Poor Eating Habits And High Alcohol Use Persist." [Online]. Available: <http://www.medicaldaily.com/eating-habits-millennial-generation-alcoholic-drinks-obese-people-388874>. [Accessed: 28-Jan-2017].
- [18] "New Survey Finds Differences In Attitudes About Diabetes Based On Age - Oct 15, 2014." [Online]. Available: <http://www.news.sanofi.us/2014-10-15-New-Survey-Finds-Differences-In-Attitudes-About-Diabetes-Based-On-Age>. [Accessed: 08-Feb-2017].
- [19] "WHO | Diabetes: the sweet irony of modern technology," WHO, 2011.
- [20] "Is Technology Causing a Lifetime of Pain for Millennials?" [Online]. Available: <http://www.healthline.com/health-news/is-technology-causing-a-lifetime-of-pain-for-millennials-050415#6>. [Accessed: 16-Feb-2017].
- [21] American Diabetes Association, "Stress: American Diabetes Association®." [Online]. Available: <http://www.diabetes.org/living-with-diabetes/complications/mental-health/stress.html?referrer=https://www.google.com/>. [Accessed: 16-Feb-2017].
- [22] "How The Millennial Generation Could Affect The Economy Over The Next Five Years." [Online]. Available: <http://www.forbes.com/sites/laurashin/2015/04/30/how-the-millennial-generation-could-affect-the-economy-over-the-next-five-years/#41e58cd61e8a>. [Accessed: 11-Feb-2017].
- [23] American Diabetes Association, "The Cost of Diabetes: American Diabetes Association®," *Diabetes.Org*, 2015. [Online]. Available: <http://www.diabetes.org/advocacy/news-events/cost-of-diabetes.html>. [Accessed: 12-Feb-2017].
- [24] L. Chen *et al.*, "WHO Library Cataloguing-in-Publication Data."
- [25] "Diabetes was once a problem of the rich. Now it belongs to the poor. - The Washington Post." [Online]. Available: https://www.washingtonpost.com/news/to-your-health/wp/2016/04/06/diabetes-was-once-a-problem-of-the-rich-now-it-belongs-to-the-poor/?utm_term=.a57801ca8d0e. [Accessed: 25-Feb-2017].
- [26] "What is Culture? | Definition of Culture." [Online]. Available: <http://www.livescience.com/21478-what-is-culture-definition-of-culture.html>. [Accessed: 30-Jan-2017].
- [27] Nevana Stajcic, "Understanding Culture: Food as a Means of Communication."
- [28] J. Pinsker, "Millennials Are Foodies: Consequences for Restaurants, Agriculture, and Grocery Stores - The Atlantic," *The Atlantic*, 2015. [Online]. Available: <http://www.theatlantic.com/business/archive/2015/08/millennial-foodies/401105/>. [Accessed: 30-Jan-2017].
- [29] M. Roberts and S. Pettigrew, "The Influence of Grandparents on Children's Diets," 2010.
- [30] R. Fox, "Food and eating: an anthropological perspective," *Soc. issues Res. Cent.*, pp. 1-22, 2003.
- [31] A. G. Naeem and N. AG, "The role of culture and religion in the management of diabetes: a study of Kashmiri men in Leeds.," *J. R. Soc. Promot. Health*, vol. 123, no. 2, pp. 110-116, Jun. 2003.
- [32] J. Cho, M. M. Quinlan, D. Park, and G. Y. Noh, "Determinants of adoption of smartphone health apps among college students," *Am. J. Health Behav.*, vol. 38, no. 6, pp. 860-870, 2014.
- [33] "Report: 1.7B to download health apps by 2017 | MobiHealthNews." [Online]. Available: <http://www.mobihealthnews.com/20814/report-1-7b-to-download-health-apps-by-2017>. [Accessed: 16-Feb-2017].
- [34] "14 Facts About Millennials And The Economy That Everyone In Business Should Know - Business Insider." [Online]. Available: <http://www.businessinsider.my/millennial-facts-2014-5/?r=US&IR=T#HVq0S7hblZgAHZ1z.97>. [Accessed: 27-Feb-2017].
- [35] "Using data analytics to improve diabetes prevention - GenoKey Blog." [Online]. Available: <http://blog.genokey.com/using-data-analytics-improve-diabetes-prevention/>. [Accessed: 12-Feb-2017].
- [36] "How To Cure Diabetes With Precision Medicine -." [Online]. Available: <http://www.johnsnowlabs.com/dataops-blog/how-to-cure-diabetes-with-precision-medicine/>. [Accessed: 16-Feb-2017].
- [37] "Millennials want personal health records on the go | Healthcare IT News." [Online]. Available: <http://www.healthcareitnews.com/news/millennials-want-personal-health-records-go>. [Accessed: 11-Feb-2017].