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Epidemiological surveillance of Type 2 diabetes among adolescents and children

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Abstract. With a high incidence of the condition worldwide, type 2 diabetes has emerged as one of the most worrisome chronic diseases. Type 2 diabetes has been identified in certain public health research to have an early beginning tendency, and the rapid rise in teen and child prevalence may be an epidemiological warning sign. This study uses systematic retrieval and induction techniques to examine the prevalence and trajectory of type 2 diabetes in children and adolescents. In this paper, the useful data and literature collected are discussed and sorted out in an attempt to establish a complete field of analysis of current type 2 diabetes, which is to critically discuss the practice of current epidemiological surveillance and screening systems for adolescents and children, and to propose possible constructive suggestions. This study finds that the development trend in adolescents and children may not be optimistic, and there are differences in risk based on geographic demography, gender, race, etc. Epidemiological screening and surveillance of type 2 diabetes in adolescents and children, as well as targeted public and individual prevention and intervention, could have significant implications.

Keywords: Adolescents, children, epidemiology, surveillance, type 2 diabetes

1. Introduction

Despite ongoing investments and interventions in public health, the trend of type 2 diabetes prevalence has not decreased as it has become one of the major hazards to human mortality [1]. On the other hand, type 2 diabetes' rising prevalence in children and adolescents is a public health concern that should not be ignored. Nevertheless, some research indicate that type 2 diabetes mellitus (T2DM) is also regarded as a less common condition among kids and teenagers. However, there has been a very ominous trend in the rise in incidence among the target demographic. For instance, in the United States, the prevalence of type 2 diabetes among children and adolescents increased by 30.5 percent between 2001 and 2009 and by 4.8 percent annually between 2002 and 2012 [2].

The importance of preventing the development of diabetes is emphasized by the present studies, which describe and assess the prevalence and development trend of type 2 diabetes. Some of the suggested suggestions and recommendations could be beneficial for both managing the illness and preventing type 2 diabetes. For instance, a screening, preventive, and early management program for kids and teens may be worthwhile to use given current trends [3]. Some of them also emphasize the importance of screening adolescents and children for type 2 diabetes. However, the effectiveness of screening may be doubted. For example, adolescents and children may be advised to use the same diagnostic methods and criteria for screening as adults, which are known to be ambiguous in classifying diabetes types [4].

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To improve the accuracy of screening methods, the screening population are suggested to be tested regularly or comprehensively diagnosed with a combination of various methods. Therefore, this paper makes a systematic induction of the current type 2 diabetes screening and epidemiological surveillance research in adolescents and children, and attempts to present a more comprehensive guidance of screening, diagnosis and management. This systematic review tends to focus on targeted literature and data statistics over the past five years. Possible sources of literature and data collection include but are not limited to: including PubMed, JAMA, Google Scholar, ADA (American Diabetes Association), etc.

Monitoring and preventing type 2 diabetes in adolescents and young children may therefore have significant ramifications. In order to better prevent the spread of type 2 diabetes in the target population, a thorough review and discussion of the most recent epidemiological surveillance literature on T2DM in children and adolescents may be important.

2. The development of t2dm in adolescents and children

About a decade ago, type 2 diabetes accounted for less than 3 percent of childhood diabetes worldwide. However, recent studies in developed countries show that this estimate exceeds 45 percent of children with diabetes [5]. Therefore, it is significant to conduct a systematic and comprehensive investigation of the current development of type 2 diabetes in adolescents and children. In addition, the developmental trends of type 2 diabetes among children and adolescents worldwide vary widely among countries, age groups and ethnic categories[6]. Some epidemiological studies show that there are many distinctions in the population distribution of T2DM among adolescents and children, such as geodemography, age, sex, race, etc.

First of all, a few decades ago, type 2 diabetes was relatively rare in developing countries. However, it is suggested that Asia may have the largest population of type 2 diabetes. Additionally, according to some epidemiological research, higher occurrences of type 2 diabetes are seen in Asian populations, particularly among Indians and Chinese people, which suggests that some developing Asian nations may have a higher prevalence of the disease [7]. According to Khan et al. (2020), China and India have the largest diabetes populations in the world [8]. Moreover, China has overtaken India as the epicentre of the global diabetes epidemic, with nearly 10% of adults suffering from diabetes and another approximately 150 million adults (15.5% of the population) suffering from pre-diabetes [7]. Therefore, given the large population base, China, as a developing country, may face great public health difficulties in monitoring and preventing type 2 diabetes. The prevalence of diabetes in China's adolescents and children is also remarkable; in 2002 and 2012, it was 0.24 percent and 0.52 percent, respectively, for children aged 7 to 17 and for teenagers. According to additional Chinese data, type 2 diabetes prevalence among individuals under the age of 18 increased from 4.1 in 1995 to 7.1 and 10.0 in 2010, respectively [8]. In addition, India has a diabetic population second only to China and may face a lack of adequate screening data, as well as important issues such as prenatal risks, overweight and obesity due to rapid urbanization [8]. A significant screening program from Taiwan has also revealed that type 2 diabetes is the primary contributor to diabetes in children there [9]. Most Asian societies lack surveillance and screening data for adolescents and children. The probable onset of type 2 diabetes in children and adolescents may be of concern given the high prevalence of diabetes in Asia. Therefore, developing countries with a large population base may face a more serious development trend due to multifaceted factors.

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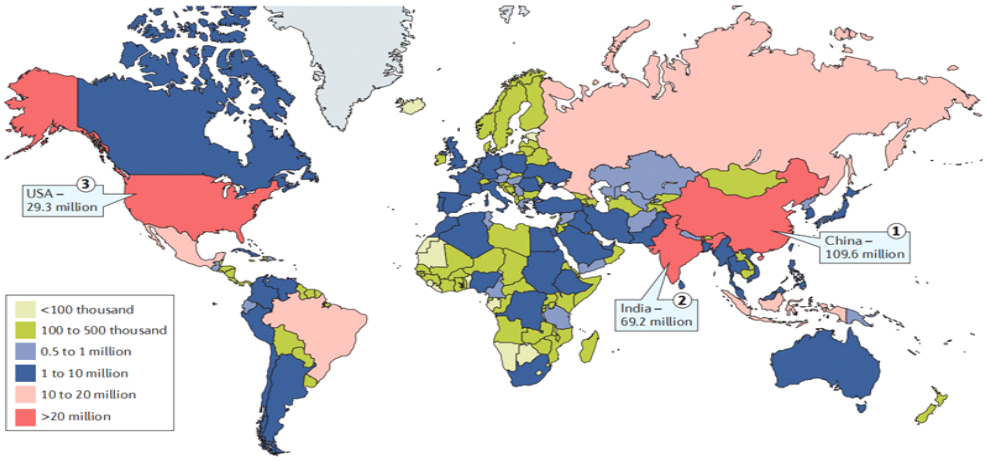

Figure 1. Estimated total number of adults (20–79 years) living with diabetes [2]

In some developed parts of Asia, adolescents and children also face a higher incidence of type 2 diabetes. For example, in Japan, 80 percent of new cases of childhood and adolescent diabetes are diagnosed with T2DM [8]. In South Korea, the overall prevalence of T2DM among adolescents increased by 30.5 percent between 2001 and 2009 [8]. In addition, some developed western regions show quite high prevalence rates and continue to rise in the context of continued public intervention. The incidence of T2DM in children has been increasing in the United States, Canada, the United Kingdom, etc [6]. In general, T2DM develops rapidly and widely in adolescents and children.

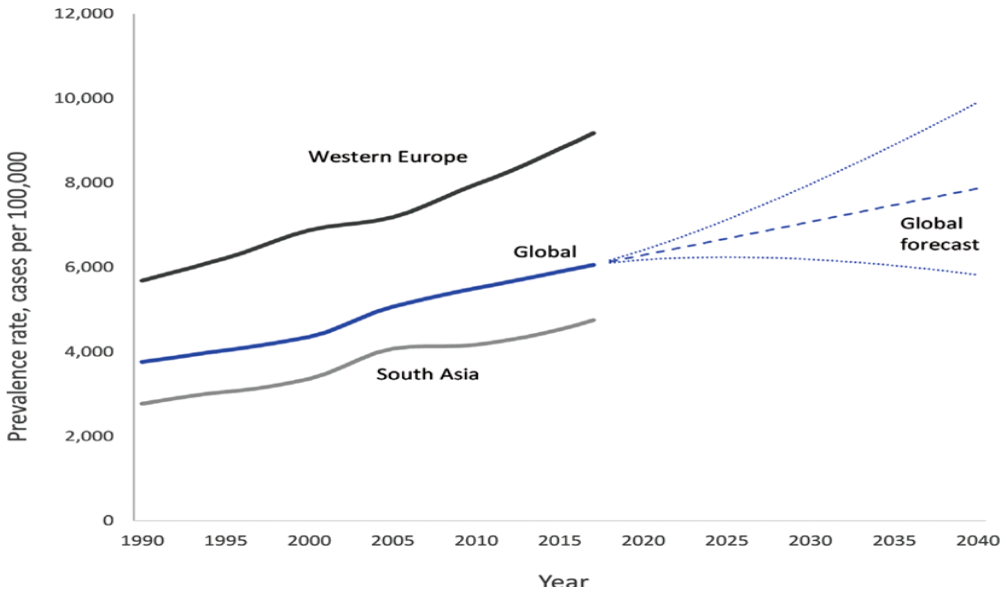

Figure 2. Trends in the prevalence of type 2 diabetes [1]

The prevalence of type 2 diabetes is also clearly influenced by gender, as well. For instance, there is a risk disparity between young men and women, with women having higher risk than men [9]. In addition, the incidence rate of type 2 diabetes among adolescents is generally higher in females than males, but the proportions are different [8]. However, the majority of adolescents affected in South Korea are male, which may be due to the relatively high prevalence of obesity in South Korean youngsters [8]. There are several possible explanations for the sex-based differences in prevalence. For example, a meta-analysis of cohort studies suggests that there may be gender differences in the effect of

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alcohol in reducing the risk of T2DM because of possible physiological gender differences in alcohol pharmacokinetics, such as alcohol eliminating [2]. However, there remain gender prevalence differences, especially among adolescents and children. In general, females are more vulnerable to gender differences among adolescents and children.

Inequality in prevalence and risk of death among adolescents and children is also associated with racial differences. It is argued that young people in minority groups who also have type 2 diabetes have a higher risk of comorbidities and death [10]. In addition, some studies support unequal risk based on racial differences. For instance, the prevalence and incidence of type 2 diabetes among young people vary by race, with some minorities having rates much higher than the general population [7]. These include indigenous populations in the Americas and Australia, as well as Africans and Asians, etc. There are several possible explanations for the racial inequality in type 2 diabetes risk. For example, Asians generally have a higher percentage of total fat than whites at certain BMI and may therefore be at a higher risk of developing type 2 diabetes than whites [2]. In addition, antibodies to islet cell autoimmunity are present in at least 10 percent of adolescents and children diagnosed with type 2 diabetes, but this depends on the ethnicity of the patient [11]. In conclusion, supporting incidence surveys and surveillance based on racial differences, as well as developing targeted diabetes management programme, may help curb the development of ethnic-based health inequalities.

3. Guides on feasible prevention and intervention

T2DM in children and adolescents has emerged as a major global public health concern with distinct traits and demographics [11]. The provision of feasible prevention and intervention measures at both the public and individual levels may help halt the rapid expansion of type 2 diabetes in adolescents and children. At the public level, first of all, it is important to carry out continuous and effective screening and surveillance of T2DM in the target population. Epidemiological surveillance will likely include prevention of type 2 diabetes in early age groups through continued trend analysis, predictive research and collaboration with social organizations [8].

In addition, early screening for hidden cases in society is also important. In Saudi Arabia, a nationwide cross-sectional study based on the family population argues that more than 90 per cent of youngsters with diabetes have no awareness of their disease [3]. These hidden cases require public health systems to screen for IFG and diabetes early, especially in obese children and adolescents. The timely detection of hidden cases can help pinpoint the current type 2 diabetes epidemic and future trends. In addition, early screening and diagnosis are helpful for timely treatment and management, and may further mitigate the tendency of type 2 diabetes.

On the other hand, treatment options, educational methods, dietary guides differ significantly between people with different outcomes of diagnoses [4]. Therefore, accurate diagnosis is crucial. Typically, the diagnosis of type 2 diabetes involves two steps: determining the presence of diabetes, and then determining the type of diabetes. Generally speaking, diagnostic criteria for juvenile-onset diabetes mellitus are based on measuring blood glucose and symptoms [11]. However, it may be difficult for adolescents and children, especially children, to distinguish in various types of diabetes in large-scale screening. A large-scale screening project of type 2 diabetes in children in Taiwan shows the difficulty in distinguishing, and the classification through the report based on retrospective interview and family doctor may not be highly effective [9]. Therefore, providing diagnostic recommendations for adolescents and children may help improve the overall accuracy of screening efforts. For example, family self-monitoring glucose programs should be individualized, and medication management for adolescents and children should be specialized [4]. In addition, accurate diagnosis requires repeated testing, to improve diagnostic accuracy [6].

Third, the public health sector should actively engage in social and family-oriented information and education. It has been suggested that families, medical institutions, or some diabetes specialists do not always fully understand the increased risk in adolescents and children, their over-confident familiarity with adult-onset type 2 diabetes may also reveal a lack of understanding of type 2 diabetes in the juvenile. Therefore, it is necessary to carry out targeted publicity and education for the society and the public

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[4]. In addition, educating families with adolescents and children with type 2 diabetes to understand the prevention, guidance and management means of type 2 diabetes, and changing the lifestyle of family members through education is of great significance for young people to manage type 2 diabetes. [5].

At the individual level, the recommendations available mainly focus on lifestyle changes. Lifestyle changes are an effective prevention and management tool for individuals when diagnosed with T2DM [11]. For instance, lifestyle interventions can reduce the incidence of diabetes in high-risk patients and those with impaired glucose tolerance [5]. Additionally, there is no doubt that regular exercise can improve blood sugar levels, lower the risk of cardiovascular disease, and aid in the prevention of type 2 diabetes [5]. To sum up, take into account that prevention, intervention and management of the disease in the young probably differ from adults. Thus, health programme possibly should be specifically developed based on the current epidemiological understanding of the target population. It might be crucial to provide guidance and support at both the public and personal aspects.

4. Conclusion

In conclusion, type 2 diabetes mellitus has rapidly increased in the past few decades, becoming one of the most concerned chronic diseases. In addition, recent epidemiological surveillance studies suggest that there has been a rapid progression and expansion of T2DM in adolescents and children. This essay comprehensively discusses the risk and development trend of type 2 diabetes mellitus in adolescents and children. It demonstrates that differences in the risk of the disease among adoles-cents and children were based on geographic population, gender, ethnicity, etc. In addition, epide-miological screening and surveillance for type 2 diabetes in adolescents and children, as well as tar-geted public and individual prevention and intervention, may have a positive impact. However, there are some limitations in this paper. For example, the relationship between the vulnerability of ethnic minorities and unequal socio-economic status is not considered. Secondly, age differences among adolescents and children were not discussed, and there may be a differentiated distribution of the risk among adolescents and children based on age. Therefore, testing the correlation between the higher risk of developing the disease among ethnic minorities and socioeconomic inequality may be an open question worth exploring in the future. In addition, it may be also meaningful to conduct age-group comparative studies within children and adolescents.

References

[1] Khan, M.A.B.; Hashim, M.J.; King, J.K.; Govender, R.D.; Mustafa, H.; Al Kaabi, J. Epidemiology of type 2 diabetes—Global burden

[2] of disease and forecasted trends. J. Epidemiol. Glob. Health 2020, 10, 107–111. [CrossRef] [PubMed]

[3] Zheng, Y., Ley, S. & Hu, F. Global aetiology and epidemiology of type 2 diabetes mellitus and its complications. Nat Rev Endocrinol 14, 88–98 (2018). https://doi.org/10.1038/nrendo.2017.151

[4] Al-Rubeaan, K. National surveillance for type 1, type 2 diabetes and prediabetes among children and adolescents: a population-based study (SAUDI-DM)J Epidemiol Community Health 2015;69:1045-1051.

[5] American Diabetes Association; 13. Children and Adolescents: Standards of Medical Care in Diabetes−2020. Diabetes Care 1 January 2020; 43 (Supplement_1): S163–S182. https://doi.org/10.2337/dc20-S013

[6] Khadar, Jabbar & Nair, Abilash. (2018). Type 2 Diabetes Mellitus in Children. 10.5005/jp/books/14155_31.

[7] Mayer-Davis, EJ, Kahkoska, AR, Jefferies, C, et al. ISPAD Clinical Practice Consensus Guidelines 2018: Definition, epidemiology, and classification of diabetes in children and adolescents. Pediatr Diabetes. 2018; 19(Suppl. 27): 7– 19. https://doi.org/10.1111/pedi.12773

[8] Chen, L., Magliano, D. & Zimmet, P. The worldwide epidemiology of type 2 diabetes mellitus—present and future perspectives. Nat Rev Endocrinol 8, 228–236 (2012). https://doi.org/10.1038/nrendo.2011.183

DOI: 10.54254/2753-8818/3/20220233

[9] Hong YH, Chung IH, Han K, Chung S; Taskforce Team of the Obesity Fact Sheet of the Korean Society for the Study of Obesity. Prevalence of Type 2 Diabetes Mellitus among Korean Children, Adolescents, and Adults Younger than 30 Years: Changes from 2002 to 2016. Diabetes Metab J. 2022;46(2):297-306.

[10] Wei J, Sung F, Lin C, Lin R, Chiang C, Chuang L. National Surveillance for Type 2 Diabetes Mellitus in Taiwanese Children. JAMA. 2003;290(10):1345–1350. doi:10.1001/jama.290.10.1345

[11] Lawrence JM, Divers J, Isom S, et al. Trends in Prevalence of Type 1 and Type 2 Diabetes in Children and Adolescents in the US, 2001-2017. JAMA. 2021;326(8):717–727. doi:10.1001/jama.2021.11165

[12] Zeitler, P, Arslanian, S, Fu, J, et al. ISPAD Clinical Practice Consensus Guidelines 2018: Type 2 diabetes mellitus in youth. Pediatr Diabetes. 2018; 19(Suppl. 27): 28– 46. https://doi.org/10.1111/pedi.12719