EDELWEISS PUBLICATIONS
OPEN ACCESS

Volume 2 Issue 1 | PDF 156 | Pages 8

Edelweiss Applied Science and Technology

Review Article ISSN: 2576-8484

Type 1 Diabetes Mellitus: Issues, Challenges and Opportunities

Chrysanthus Chukwuma SR*

Affiliation: Executive Director, Centre for Future-Oriented studies, Abakaliki, Ebonyi State, Nigeria

***Corresponding author:** Chrysanthus Chukwuma SR, Executive Director, Centre for Future-Oriented studies, Abakaliki, Ebonyi State, Nigeria, Tel: +2348182457847, E-mail: cfos_nigeria@yahoo.com

Citation: Chukwuma SRC. Type 1 diabetes mellitus: Issues, challenges and opportunities (2018) Edelweiss Appli Sci Tech 2: 290-297

Received: Nov 09, 2018

Accepted: Dec 05, 2018

Published: Dec 08, 2018

Abstract

Diabetes is one of the most intensively researched disorders presenting several metabolic alterations, but the basic biochemical aberrations or defects have not been clearly elucidated because the disorder is characteristically of autoimmune disposition. In addition, it is an intricately complex disease that exhibits disparate and distinct outlook and magnitude of pathology with grim susceptibility to gene-environment interactions. Early or invariable developments of deteriorating clinical alterations culminate in expansive socioeconomic costs. Adequate data regarding type 1 diabetes incidence have been from regions with a high or intermediate incidence, particularly in Europe and North America where numerous registries have since been established. There is a paucity of data from Africa Asia, the Caribbean, Central America and South America. The availability of veritable standardized type 1 diabetes incidence data from these low incidence regions is extremely crucial to establish that the presumed broad variation in incidence pertains, and that a low incidence in those regions is exact and not the resultant impact of underestimated incident cases.

Keywords: Type 1 Diabetes Mellitus, Epidemiology, Demography, Prevalence, Incidence, Impact, Costs, Global, Population.

Introduction

Type 1 diabetes mellitus is a disease that has erstwhile been designated as insulin-dependent, childhood-onset, young adult-onset or juvenile-onset diabetes with essential insulin deficiency that requires daily insulin administration. Type 1 diabetes is an insulin-requiring chronic disorder due to the abrogation of pancreatic islet cells insulin generation culminating in elevated concentrations of blood sugar and gradual functional excoriation and degeneration of various organs and tissues. Elevated blood glucose concentrations activate oxidative stress with concomitant degeneration of DNA, lipid and protein macromolecules by free radicals with accelerated diabetes-linked nonenzymatic glycosylation or glycation of proteins and tissues damage in non-healthy persons, but not so in healthy persons. The aetiology of type 1 diabetes is unknown; and it presents symptoms such as excessive urine excretion or polyuria, incessant hunger and thirst, visual alterations, fatigue and emaciation which may precipitate abruptly [1]. Even though, type 1 diabetes permeates all age groups, numerous epidemiological investigations emphasize disease features with clinical disease in childhood and adolescence, and sometimes present difficulties of differentiation from certain forms of type 2 diabetes or Latent Autoimmune Diabetes in Adults, LADA [2].

Type 1 diabetes is an important and excruciating chronic disease of children globally, with resultant 8- to 10-fold excess risk of death in developed regions, whereas most cases die within a short period in developing countries [3], or where not adequately followed-up or registered may elude healthcare personnel in developed countries. A 60-fold internal gradient in the incidence of type 1 diabetes and epidemic periods have ostensibly been identified and reported. It is important to investigate and characterize the worldwide incidence, morbidity, mortality and healthcare of type 1 diabetes in order to effectively and efficiently collate and evaluate healthcare and economics of diabetes [4], promote and establish domestic and global training programmes in the epidemiology of diabetes [5, 6] to prevent and curb the debilitating disorder and its concomitant complications.

Childhood type 1 diabetes incidence reached increased heights globally towards the end of the 20th Century, but the aetiological factors associated with the augmentation are not properly documented [7] and elucidated. The diseases trajectory underlying type 1 diabetes has altered spatiotemporally with continuous evolution. Explication and elucidation of how the prevalence of type 1 diabetes was triggered could provide the modalities for its reversal. Attempts have been made to eradicate the anomalies inextricably-associated with diabetes via the application of derivative compounds of 1,3,4-thiadiazine with resultant reduction of blood glucose and HbA1c and increased insulin levels as evidenced in rats. The substances impede the erstwhile indicated pathogenetic mechanism and act as treatment drugs for the diabetes [8]. Type 1 diabetes has tended to become a non-communicable disorder with the most expansive discourse globally, with Europe and North America presenting an astronomical increase in the disease burden, and creating it as a paradigm in the transformation of the current worldwide trajectory regarding health and healthcare. It is not possible to prevent type 1 diabetes with the prevailing scant and diffuse information and knowledge or to explicate and elucidate the burden, trends and variations of prevalence rates of the disease and its sequelae as evidenced in several countries.

Global and Country-Specific Estimates of Type 1 Diabetes

At the end of the 1970s, epidemiological information of diabetes children showed an expansive geographical variation in type 1 diabetes incidence for the first time. From the 1960s to the inception of the 1980s, the data on type 1 diabetes incidence were available for merely a few populations, particularly from regions with intermediate or high risk for the disorder. Numerous registries were established globally since the mid-1980s. The deficiency of standardized data presented constraints for the determination of the veritable extent of the global variation in incidence or temporal trends [9]. Towards the end of the 1970s and the beginning of the 1980s, The Diabetes Epidemiology Research International Group (DERI) commenced aggregate data collation type 1 diabetes incidence [10].

The rigorous efforts of the DERI group resulted in the augmentation of the number of registries on diabetic children and to the establishment of the World Health Organization Project of Childhood Diabetes (DIAbetes MONdiale) in 1990 [11]. In addition, at the termination of the 1980s, the collaborative research project EURODIAB ACE was established [12] to collate data on type 1 diabetes in Europe. Reviews on type 1 diabetes incidence within populations have indicated that variations in the incidence are 60-fold ranging from the lowest to the highest rates [13]. The highest incidence was found in Caucasoid populations, particularly in northern Europe, and the lowest rates are found in Asia and South America. To this extent merely one trend analysis of type 1 diabetes incidence compared concurrently several, but limited number of populations was conducted by the DERI group [14]. Convergence in standardized procedures for collected incidence data worldwide provided the latitude for comparative assessment of temporal trends among diverse populations. An estimation of the temporal trends in type 1 diabetes incidence from incidence data was performed through a systemic literature review. Data statistical analysis was conducted to determine whether the incidence is increasing globally. Another objective was the quantitative evaluation as to the extent the change in type 1 diabetes incidence varied among populations.

Another study to investigate and monitor attributes in childhood type 1 diabetes incidence globally [15] determined of type 1 diabetes incidence (per 100,000 per year) from 1990 to 1994 in children ≤14 years of age from 100 centers in 50 countries. An overall 19164 cases were diagnosed in study populations of 75.1 million children, whereby the annual incidence rates were calculated per 100,000 populations. The overall age-adjusted type 1 diabetes incidence differed from 0.1/100, 000 per year in China and Venezuela to 36.8/100,000 per year in Sardinia and 36.5/100,000 in Finland; thus representing a >350-fold variation in the incidence among the 100 populations globally. The worldwide pattern of incidence variation was evaluated by arbitrary grouping of the populations with a very low (<1/100,000 per year), a low (1-4.99/100,000 per year), an intermediate (5-9.99/100,000 per year), a high (10-19.99/100,000 per year), and a very high (≥20/100 000 per year) incidence). Among the European populations, 18 of 39 presented an intermediate incidence, and the rest had an elevated or very elevated incidence. Extremely high incidence (≥20/100,000 per year) was detected in Sardinia, Finland, Sweden, Norway, Portugal, the U.K., Canada and New Zealand [15]. The lowest incidence (<1/100, 000 per year) was realized from China and South America populations. The incidence increased with age and was the highest among children 10-14 years in most populations. The extent of global disparities in the childhood type 1 diabetes incidence was greater than previously described. The earlier reported polar-equatorial gradient in the incidence was not ostensibly strong as previously suggested, but the variation apparently took an ethnic and racial distribution in the global population.

An examination of the global type 1 diabetes incidence and trends from 1990-1999 [16] analysed type 1 diabetes incidence (per 100,000/year) in children aged ≤14 years from 114 populations in 112 centres in 57 countries. The incidence of type 1 diabetes trends were analysed by fitting Poisson regression models to the dataset. A total of 43013 cases diagnosed in the study populations of 84 million children, with age-adjusted incidence of type 1 diabetes among 112 centres (114 populations) varied from 0.1 per 100,000/year in China and Venezuela to 40.9 per 100,000/year in Finland. The average annual increase in incidence calculated from 103 centres was 2.8% (95% CI 2.4-3.2%). During the years 1990-1994, this increase was 2.4% (95% CI 1.3-3.4%) and during the second period of 1995-1999, it was slightly higher at 3.4% (95% CI 2.7-4.3%). The trends estimated for continents depicted statistically significant increases worldwide (4.0% in Asia, 3.2% in Europe and 5.3% in North America), excepting Central America and the West Indies where the trend decreased by 3.6% [16]. The trend in incidence diminished with age only among the European populations .The increasing global type 1 diabetes incidence suggestively necessitates continuous monitoring of incidence by the application of standardized procedures for planning or assessment of prevention strategies.

In 1988, an epidemiological study of type 1 diabetes in Europe [17], the EURODIAB collective group established prospective geographically-defined registers of new cases diagnosed below 15 years of age. The report utilized 16362 cases registered from 1989-94 by 44 centers being representative of most European countries and Israel and encompassing a population of circa 28 million children. The results established an expansive range of incidence rates within Europe and indicated that the rise in incidence during the period differed from country to country. Thus, the accelerated increase of type 1 diabetes in children aged under 5 years remains of particular concern. An identical study [18] based on 24423 children, registered by 36 centers, with full participation from 1989-1998 and representing most European countries with a population coverage of circa 20 million children, also confirmed the extensively broad range of incidence rates within Europe. Generally, the incidence rate is increasing, but is more pronounced in certain regions than in others. There is ostensible seasonality at disease onset even detectable in the youngest age-group.

Country-specific characteristics of type 1 diabetes matched by regions

Africa: Juvenile diabetes mellitus is ostensibly uncommon in sub-Saharan Africa, with environmental attributes, such as infection and resource deprivation contributing as primary determinants [19]. Gene-environment interactions in protective forms may play significant roles in African children in not displaying the same elevated rates as in European countries. Concordant observations have been made which undergird the hypothesis that transmission of viral infection from mother to fetus during the annual epidemic of viruses triggers the autoimmune process in pancreatic beta-cells in genetically vulnerable subjects who consequently develop clinical diabetes in childhood [20].

Childhood diabetes increases in Sudan where incidence figures have been determined to exceed other Arab countries, with identical findings tied to those from France and Italy [21]. It is assumed that type 1 diabetes forms the prevalent African pediatric diabetes. In recent years, achievements have included training and production of greater than sixty endocrinologists practicing in 14 African countries, as well as augmented training of other healthcare providers, enhanced access to insulin, and access to testing materials combined with patient education in native languages. There are extant lacunae in adequate provision of type 1 diabetes pediatric care in Africa in comparison to developed countries [22]. There is extant paucity of data regarding the burden, undiagnosed prevalence, access to healthcare, acute and chronic sequelae of type 1 diabetes in Africa. Inasmuch as there is perceived low diabetes incidence in African children, there is projected increase

in the immediate future that necessitates essential development of government paradigms and policies to manage pertinent inducing and debilitating factors concerning type 1 diabetes [23].

Finland and the Baltic States: It has been determined that type 1 diabetes in Finland of children aged 14 years or below is the highest worldwide; and the trend continues to increase [24]. The elevated type 1 diabetes incidence in Finnish children has not leveled off, but maintains an increasing trajectory.

A study was conducted to determine whether type 1 diabetes incidence was increasing globally or merely restricted to a select population, and to estimate the extent of change in incidence [25]. From 1960 to 1996, 37 studies in 27 countries were conducted. In compliance with the inclusion criteria the research periods ranged from 8-32 years. It was suggested that Type 1 diabetes incidence was increasing globally both in low and high incidence populations. It was projected that by 2010 the incidence could approach 50 per 100 000 a year in Finland and will be in excess of 30 per 100 000 a year in several other populations.

A study of type 1 diabetes incidence in 4 countries, Estonia, Latvia, Lithuania and Finland from 1983-1998 discretely on the two distinct periods of 1983-1990 and 1991-1998 [26] demonstrated that the type 1 diabetes incidence increased since 1983 in the three Baltic states and Finland. It was suggested that long-term monitoring is required for better detection in metamorphosis in incidence.

Scandinavia: There is paucity of data on the future of diabetes burden in Scandinavia. However, paradigmatic data on demographic, incidence, prevalence and mortality factors on Sweden indicate abating incidence at 1% annually with predicted prevalence increase in diabetes [27]. The investigation of age-period-cohort using 0-14 year-old children in Norway [28] showed that type 1 diabetes incidence among children increased during the study period, with both cohort effects been identified by employing the spatiotemporal scan statistics, but without applying age, period, and birth cohort modelling. These effects within the relatively homogenous population of Norway may be related non-genetic etiological attributes. The type 1 diabetes incidence rate has been rising in children resident in Denmark; and the steep rise has been attributed to the increased risk for cohorts who were born in the early 1980s [29].

Europe: An overview of age- and sex-specific type 1 diabetes incidence rates and trends in Czech children 0-14 years of age [30] depicted a significantly increased incidence that is at an intermediate level in comparison to other European countries. In Croatia [31], a study examined type 1 diabetes incidence and trends in children aged 0-14 years, and found that the rate of incidence placed Croatia in a group of countries with moderate risk for type 1 diabetes development. The average annual incidence increase of 9% was higher than in most European countries, and ostensibly indicative of changes due to the economic recovery of the country. From a prospective population-based incidence study in Austria, it was determined that all recently diagnosed patients with type 1 diabetes 0-<15 years of age, presented the steepest increase in the last 5 years under study as predominantly observed in the younger age groups [32].

Findings have corroborated that type 1 diabetes incidence increased rate in France are average in comparison to that obtainable in European countries during an extended period [33]. Also, the resultant linear and regular increase in incidence undergirds the hypothesis of causal environmental attributes diffusing over time. The available complementary data depicted the perspicuous functionality and implications of private medical and healthcare professionals in public health and epidemiology. The UK presents one of the highest type 1 diabetes rates globally for reasons which remain unexplicated or unelucidated [34].

Oceania: Childhood-onset type 1 diabetes incidence has significantly elevated in Western Australia with no indication of decreasing [35]. In contradistinction to other similar studies, a greater rate of increase was not detected in the youngest children. The remarkable increase in type 1 diabetes incidence in Victoria, Australia was greater than those obtained in other Australian States and industrialised countries, but the causal factors in the elevation are not pellucid, as the elevated caseload presents marked implications for diabetes health care in resource allocations [36].

North America: In 0-14 year-old [37], the province of NL demonstrated one of the highest incidences of T1DM reported worldwide. The incidence is increasing over a 19-yr study period. Type 1 diabetes incidence is increasing at an accelerated rate in the UK with circa 400, 000 persons currently being detected with the disease, of which 29, 000 were children. Although, it is axiomatically expressed that the USA harbours the greatest number of children with type 1 diabetes, there is data scarcity concerning adult-onset disease. The increase in incidence rate merely in youth is suggestive of youth-onset disease precipitating factors which contrast those of adult-onset disease [38]. Among US adults, the benchmark estimates on the national prevalence of type 1 diabetes diagnosed was 0.5% [39]. Another reason may be inadequate compilation of registries and follow-up whereby type 1 diabetes children die before adulthood and cause of death is listed as complications other than diabetes.

South America: The type 1 diabetes incidence increase in Santiago, Chile present data in concordance with the increase in Latin America and globally [40], with broad disparities among Chilean counties.

Caribbean: In 1997, diabetes prevalence rate in the Caribbean for children aged below15 years ranged from 0.3/10, 000 in Haiti to 6.4/10, 000 in Puerto Rico, with a consistently high incidence rate for Puerto Rico and the lowest for Barbados in the Caribbean [41].

Genetic and environmental factors influencing type 1 diabetes

A comparison of childhood type 1 diabetes incidence between Sweden and Lituania depicted incidence variability between the two countries, suggesting an intricately complex impact of environmental risk influences, certain of them attributed to wealth and socioeconomic status [42]. Disparities in type 1 diabetes incidence by age, sex and season at diagnosis of children aged 0-14 years in Spain did not undergird the hypothesis of decreased incidence of the disease in a north-to-south gradient across Europe [43]. Data on the incidence of type 1 diabetes from the subtropical region in southern Brazil were identical to the observation in developed nations, but could not establish the North-South gradient, ostensibly as a result of the European origin of residents in the area [44]. Type 1 diabetes incidence definitely displays an expansive geographical heterogeneity and variability as observed in 0-15 years old childrenin Spain [45] with a good number of its provinces having similar values as evidenced in Northern Europe.

A study in China depicted that geographic and ethnic variability of type 1 diabetes incidence suggest the influence of gene and environment interactions in the childhood diabetes development in diverse ethnic settings [46]. The overall type 1 diabetes incidence in Philadelphia, Pennsylvania, USA has been rising with similarity to other registries in the country [47]. The aetiology of the significant elevation of the disease in black subjects is not clear, and creates the importance for the establishment of type 1 diabetes as a reportable disorder for intensive investigation of the environmental risk factors attributable to the disease. Type 1 diabetes aetiology and natural history remain unknown, but both genetics and environmental effects are contributory to the disease developing [48-50]. Although, HLA genetics depict a major effect in type 1 diabetes aetiology, other genes also contribute to the

genetic impact, but the mode of inheritance of the disease remains unclear [51]. The genetic influence contributes 70-75% of the type 1 diabetes vulnerability [52]. Environmental factors ostensibly initiate or trigger the process with resultant degeneration of the beta cells and the initiation of diabetes [53, 54].

Clinical characteristics and socioeconomic impact of type 1 diabetes

Epidemiological study of global type 1 diabetes with regard to inter alia the biological, cultural, demographic and geographic populace regarding the aetiology, natural history, risks and sequelae depicted that type 1 diabetes incidence increased 2-5% globally, while the prevalence rate was circa 1 in 300 in the USA in age 18n years persons [55]. Risk factors for type 1 diabetes study areas must include identification of gene-environment interactions [56] as trends and targets for intervention in the clinical care and outcome, complex and intricate aetiological factors, prevention, therapeutic regimens and cure of and for the disease. Thus, it is vital to detect the pathognomic symptoms of the disease, such as hunger and thirst, polydipsia, polyuria, weight loss in new-onset type 1 diabetes, and later concomitant diabetes ketoacidosis, DKA [31]. Also, DKA has been detected at diagnosis as a life-threatening acute sequel of type 1 diabetes with higher frequency in developing than in developed countries [57]. Debilitating diabetic ketoacidosis and infections contribute to mortality of diabetes patients requiring insulin [58].

Childhood-onset type 1 diabetes increasingly bears elevated mortality risk in comparison to the general population, as is evident in cardiovascular diseases [59]. To abate these mortality rates, it is pertinent to focus on defined prevention and abatement of acute metabolic sequelae, identification of psychiatric vulnerability, and prompt detection and treatment of cardiovascular diseases and other inextricably-linked factors. Antecedent to late sequelae, marked excess mortality may be extant following type 1 diabetes diagnosis in childhood, but variations in the excess across nations cannot be explicated or elucidated [60]. Subjects with childhood –onset type 1 diabetes in Australia have 4-6 times mortality rate compared to Tasmanian population studied, and the excess mortality is more debilitative amongst female than male subjects [61]. Results have also shown that the mortality experience for type 1 diabetes subjects in Japan and the USA was more debilitative than in Finland and Israel [62].

A Japanese Study that compared mortality and incidence of end-stage renal disease (ESRD) in type I diabetes individuals who attended a diabetes clinical setting with subjects who did not, showed that the subjects who had attended the diabetes centre had treble the chance for better prognosis for survival than those who neglected to do so, especially when undergirded with a specialist integrated management system and a multidisciplinary workforce [63]. It is suggested that childhood diabetes constitutes of an array of pathogenic mechanisms which overlap, including those usually linked to both type 1 and type 2 diabetes [64]. These demonstrate ample therapeutic and diagnostic considerations in the racial and heterogeneous dispositions of type 1 diabetes.

Insulin protocol and metabolic control in non-adults having type 1 diabetes were assessed and evaluated in a cross-sectional, non-population-based study of 22 pediatric settings from Japan and 17 other countries in Europe and North America [65]. It was detected that several insulin injection regimens were employed in pediatric diabetic settings with ostensibly augmented diabetes management, especially in young adults with achievement close to normoglycaemia in merely few subjects. In like manner, short-term mortality and poor prognosis are substantially manifested among blacks and Latinos than whites in the USA presenting with type 1 diabetes due to disparities and discrepancies in comprehensive diabetes healthcare [66].

Type 1 diabetes was found to constitute the most presenting diabetes amongst young people in Belgium with a rate of 97% [67]. Medical consultations and necessary treatment materials are virtually free due to the Social Medicine Protocol of Belgium with aim for the provision of good quality of life and to obviate long-term sequelae via the maintenance of blood glucose content approaching normoglycaemia and HbA1c level below 7%. It is suggested that diabetes education and treatment be initiated spontaneously and pari passu in paediatric diabetic clinical settings supported by a multidisciplinary ensemble of specialists and essential carbohydrate twice daily allocation [67] to prevent degenerative disorders, as well as rapid- and long-acting insulin analogues [68] to improve quality of life without essentially decreasing HbA1c. It has also been recommended that multidisciplinary approach be adopted in sub-Saharan Africa for effective and efficient management of diabetes as a newfangled healthcare delivery and educational paradigm to combat long-term sequelae.

An evaluation of the global mortality geographic variation of type 1 diabetes of age 0-24 years depicted greater than 10-fold magnitude between developed and Eastern European countries [69]. The regions of highest mortality were evidenced in Eastern Europe, Japan and Russia; whereas areas presenting best prognosis related to type 1 diabetes included Canada, Central and Northern Europe. The data assumed an expansive type 1 diabetes mortality regional variation as presented in developed areas. Also, this ecological research suggests mortality disparities to be associated with an encompassing and diabetes-linked care, of which the excess mortality rates are potentially preventable and reducible. Previous study has strongly indicated that young adult type 1 diabetes individuals pose increased risk of premature mortality disparities in the mortality risk across countries, with both Japan and USA having the main dilemma of an ostensibly excess of premature mortality rate among young people presenting with diabetes [70].

A study was conducted on Japanese type 1 diabetes patients not exceeding 40 years of age when transition occurred from pediatric to adult care in combination with the healthcare management and prognosis [71]. More than 50% of the pediatric care patients at age 15 years sustained treatment and management until after age 30 years, depicting that transition was not steady and that the attending healthcare physician during the period was not a prognostic factor or interrelated with mortality. A vast majority of new-onset type 1 diabetes cases in China were established in adults, whereas the lowest incidence was demonstrated in children [72]. Latent autoimmune diabetes in adults, LADA is characteristically an aberrant pattern of type 1 diabetes in persons from the third decade of life presenting initial response to oral hypoglycaemic agents, cachexia and destruction of glutamic acid decarboxylase autoantibody, GAD-Ab, with accelerated excoriation of pancreatic beta-cells secretory functionality resulting from the debilitating activity of the autoantibodies [73].

It was determined that socioeconomic variables had no impact on HbA1c levels, rather diabetes duration and protein intake were significant determinants of HbA1c status; thus preempting the importance of balanced nutrition/diet for long-term glycaemic control in India [74]. On the investigation of the incidence, clinical and mortality status of youth with diabetes in Bolivia, it was found that the country had a low type 1 diabetes incidence, with reasonable achievement of glycaemic control despite paucity of resources. Certain subjects presented with adverse sequelae and debilitating cardiovascular risk profiles [75]. Certain patients presented with monogenic diabetes, profound renal degeneration, high BMI, as well as increased triglycerides and cholesterol.

In Mexico, the general risk factors encompassed ER visits and hospitalization at older age in the start of diabetes, adverse acute

complications, chronic microvascular and macrovascular derangements including smoking, co-morbidities, interaction between diabetes duration greater than a decade, with HbA1c levels as risk factors for hospitalization [76]. About 1/3 of type 1 diabetes subjects present with diabetic retinopathy and debilitating pathogeneticity frequently observed as salient persistent proteinuria, glomerular filtration rate decline, and elevated arterial hypertension [4]. There exist increased incidence and prevalence of type 1 diabetes with special predilection to the USA and Northern Europe. Elevated mortality and morbidity result in type 1 diabetes patients having renal disorders. In type 1 diabetes subjects with incessant proteinuria, ultimately death results within 5-10 years of diagnosis. The economic and social effects of end stage renal disease are enormous with increasing costs at accelerating rates.

The worldwide prevalence and concomitant impact of type 1 diabetes have increased significantly, especially in sub-Saharan Africa. The population faces discrete challenges and constraints in addressing the disease due to inter alia limited healthcare funding for noncommunicable diseases, inadequate availability for, and access to research funding and guidelines which are unique to the African population presenting expansive disparities in knowledge and information among rural and urban patients as well as inequities and inequalities in all the healthcare sectors [77]. There is an extant need for proper and contextual representative surveillance research and data of the global diabetes epidemic in the Middle East and North Africa in order to complement the understanding of the palpable burden of diabetes, and to motivate the design and implementation of the prevention and control of the disease because there is paucity of information regarding diabetes risk in the regions [78]. These pose a unique constraint in the development of effective and efficient healthcare management system for children in Saudi Arabia, for instance, as the largest country in the Middle East occupying an expansive land mass with an ever-increasing population having approximately ¼ under the age of 14 years. An excess of 35, 000 children and adolescents in Saudi Arabia present with type 1 diabetes in comparatively disproportionate stance to global type 1 diabetes [79].

A report projected worldwide drugs market of type 1 diabetes to grow with a CAGR of 7.4% from 2018-2024 [80]. The increasing incidence and prevalence of type 1 diabetes constitute the paramount factor governing the drugs market of type 1 diabetes. These are occasioned by its increasing awareness, access to therapeutic substances, novel advanced insulin delivery pumps and pens, as well as improved drug delivery regimens to augment type 1 diabetes drug market. Astronomical costs of insulin delivery systems, such as insulin auto injector and pump may inhibit market growth. Due to the elevated incidence of the disease in the North American population and familiarization with novel innovative insulin delivery systems and the creation of numerous opportunities within the forecast era of 2018-2024 in the jurisdiction and also in the Asia Pacific ambient owing to its rapidly ageing population and improved healthcare paradigm.
The pecuniary implications of the rise in diabetes prevalence amongst middle-income nations contribute to major constraints and challenges to equitable allocation of health system and healthcare management as concern to the entire Society. Diabetes constitutes a salient economic burden in the Caribbean and Latin America [81]. The overall diabetes cost was estimated at circa USD102-123 billion in the 29 Latin American countries in 2015, with one case being USD1088-1818, while per capita National Health Expenditures in the LAC averaged USD1061.

Discussion and Conclusion

Type 1 diabetes constitutes a chronic, autoimmune metabolic derangement with characteristic expansive perturbation of pancreatic beta-cells, concomitant insulin deficiency and associated hyperglycaemia. Particular environmental factors precipitate the autoimmune pathways in genetically susceptible children and adolescents. Type 1 diabetes is relatively less common than type 2 diabetes, but it poses greater morbidity and mortality than the latter. Numerous reports on type 1 diabetes incidence have suggested that the incidence is rising. The aim of this study is inter alia to determine whether the incidence is increasingly globally or restricted to a selected population, and to estimate the magnitude of the metamorphosis in incidence.

The expansive variation in childhood type 1 diabetes incidence rates within Europe may be partially explicated by indicators of national prosperity. These indicators could reflect disparities in environmental risk factors, such as nutrition/diet or lifestyle which are relevant in the determination of incidence rate the expansive variation in childhood type 1 diabetes incidence rates within Europe may be partially explicated by indicators of national prosperity. These indicators could reflect disparities in environmental risk factors, such as nutrition/diet or lifestyle which are relevant in the determination of incidence rates [81].

Type 1 diabetes in childhood is more predominant, but ¼ of cases diagnosed are in adults. There are generally clinical characteristics of type 1 diabetes, such as classic new-onset, hyperglycaemia in the absence of acidosis that is a common presentation at childhood including aforementioned symptoms, diabetic ketoacidosis, and silent or asymptomatic incidental discovery when certain children are diagnosed with type 1 diabetes antecedent the onset of clinical symptoms [82]. Globally, specific estimates of type 1 diabetes incidence and prevalence grouped by association in various regions have contributed to the understanding of the spatiotemporal trends of the disease. Both Biophysical State Index (Ibs) and life expectancy at birth (Ibs proxy) significantly correlated to type 1 diabetes in disparate country categories via cultural background, socioeconomic status and geographical region [83]. Natural selection abatement has suggestively contributed to rising prevalence of type 1 diabetes globally. Epidemiological total population study of the disease could solve the issue and challenges in the identification of rising type 1 diabetes prevalence. An expansive variation is extant in global type 1 diabetes incidence rates with the highest in Finland and Sardinia by >45/100, 000 under age 15 years of age and lowest in sections of China [84] and sub-Saharan Africa. Several countries, for instance, in Europe and Middle East as well as Australia depicted that the autoimmune-mediated type 1 diabetes incidence in children <15 years of age increased by 2-5% yearly [82, 84].

Type 1 diabetes treatment is a challenging issue in developing regions, but not so in developed countries where those living with the disease have easier access insulin, glucometer strips and other materials from government subvention or personal savings. Non-industrialised countries are faced with inadequate resources, limitation in diagnosis, insulin initiation and storage, family, marital and emotional issues and challenges [85]. Since type 1 diabetes affects a few people compared to the general population, it is palpably ignored by governments and policy maker. The socio-economic status in developing regions does not provide the latitude for the required insulin therapy and inextricably-linked monitoring of blood glucose. It is pertinent to spread awareness regarding the metabolic disorder and its sequelae and to undergird government health and healthcare ambient regarding the consequences, pros and cons, in the administration of medicinal drugs for the treatment of diabetes [6, 8].

Thus, it is imperative to focus on expansive clinical trials which compare the appropriateness of diverse diabetes medications to provide the guidelines for healthcare providers on which patients to prescribe certain drugs. There tends to be decrease in diabetes complications in certain parts of the world, and the survival and quality of life have improved tremendously, but financial constraints and awareness have restricted ample access to type 1 diabetes prevention, control and treatment, as well as meeting the informed inventiveness and creativity of gadgets, such as the closed-loop systems. The essential management

and access to medicinal drugs are more imperative than high-tech systems in developing countries or elsewhere. There is extant optimism with opportunities for the future in unraveling the metabolic and cellular processes in convergence for researchers, clinicians, healthcare providers and policy makers to undertake intensive measures regarding the issues, challenges and presenting opportunities underlying type 1 diabetes and its sequelae which are solvable [86].

References

1. WHO. Diabetes. 2017
2. Diaz-Valencia PA, Bougneres P and Vallenon A-J. Global epidemiology of type 1 diabetes in young adults and adults: a systemic review (2015) BMC Public Health 15: 255.
3. WHO Diamond Project Group. WHO Multinational Project for Childhood Diabetes (1990) Diabetes Care 13: 1062-1068.
4. Chukwuma Sr C. Type 1 diabetic nephropathy: clinical characteristics and economic impact (1993) J Diabetes Complications 7: 15-27.
5. Chukwuma Sr C. Type II diabetic nephropathy in perspective (1995) J Diabetes and its Complications 9: 55-67.
6. Chukwuma Sr C. Convergence on the constraints and challenges in the awareness, prevention, treatment and control of type 2 diabetes and related conditions (2018) GJMR 17.
7. Gale AE. The rise of childhood type 1 diabetes in the 20th Century (2002) Diabetes 51: 3353-3361.
8. Ural Federal University. Russian scientists developed new approaches to treating diabetes. 2017.
9. LaPorte RE, Tajima N, Åkerblom HK, Berlin N, Brosseau J and et al. Geographic differences in the risk of insulin-dependent diabetes mellitus: the importance of registries (1985) Diabetes Care 8: 101-107.
10. Rewers M, LaPorte RE, King H and Tuomilehto J. Trends in the prevalence and incidence of diabetes: insulin-dependent diabetes mellitus in childhood (1988) World Health Stat Q 41: 179-189.
11. WHO DIAMOND Project Group on Epidemics. Childhood diabetes, epidemics, and epidemiology: an approach for controlling diabetes (1992) Am J Epidemio 135: 803-816.
12. Green NA, Gale EA and Patterson CC. Incidence of childhood-onset insulin-dependent diabetes mellitus: the EURODIAB ACE study (1992) Lancet 339: 905-909.
13. Karvonen M, Pitkäniemi M, Pitkäniemi J, Kohtamäki K, Tajima N and et al. Sex difference in the incidence of insulin-dependent diabetes mellitus: an analysis of the recent epidemiological data. (1997) Diabetes Metab Rev 13: 275-291.
14. DERI-Diabetes Epidemiology Research International Group. Secular trends in incidence of childhood IDDM in 10 countries (1990) Diabetes 39: 858-864.
15. Karvonen M, Viik-Kajander M, Moltchanova E, Libman I, LaPorte R and et al. Incidence of childhood Type 1 diabetes worldwide. Diabetes Mondiale (DiaMond) Project Group (2000) Diabetes.Care 23: 1516-1526.
16. The DIAMOND Project Group. Incidence and trends of childhood type 1 diabetes worldwide 1990-1999 (2006) Diabet Med 23: 857-866.
17. EURODIAB ACE Study Group. Variation and trends in incidence of childhood diabetes in Europe (2000) Lancet 355: 873-876.
18. Green A and Patterson CC. EURODIAB TIGER Study Group, Europe and Diabetes. Trends in the incidence of childhood-onset diabetes in Europe 1989-1998 (2001) Diabetologia 44: 3-8.
19. Swal AB, Lutale JL and McLarty DG. Prospective study of incidence of juvenile diabetes mellitus over 10 years in Dar es Salaam, Tanzania (1993) BMJ 306: 1570-1572.
20. Ursic-Bratina N, Battelino T, Krzisnik C, Laron-Kenet T, Ashkenazi I and et al. Seasonality of birth of children (0 to 14 years) with type 1 diabetes mellitus in Slovenia (2001) J Pediatr Endocrinol Metab 14: 47-52.
21. Elamin A, Omer MI, Zein K and Tuvemo T. Epidemiology of childhood type 1 diabetes in Sudan, 1987-1990 (1992) Diabetes Care 15: 1556-1559.
22. Piloya-Were T, Sunni M, Ogle GD and Moran A. Childhood diabetes in Africa (2016) Curr Opin Endocrinol Diabetes Obes 23: 306-311.
23. Steyn NP, Mchiza ZJ and Kengne AP. Future challenges for pediatric diabetes management in developing countries: lessons from Africa (2015) Expert Rev Endocrinol Meta 10: 75-86.
24. Tuomilehto J, Karvonen M, Pitkäniemi J, Virtala E, Kohtamäki K and et al. Record-high incidence of Type 1 (insulin-dependent) diabetes mellitus in Finnish children. The Finnish Childhood Type 1 Diabetes Registry Group (1999) Diabetologia 42: 655-660.
25. Onkamo P, Väänänen S, Karvonen M and Tuomilehto J. Worldwide increase in incidence in Type 1 diabetes – the analysis of the data on published incidence trends (1999) Diabetologia 42: 1395-1403.
26. Podar T, Solntsev A, Karvonen M, Padaiga Z, Brigis G and et al. Increasing incidence of childhood-onset type 1 diabetes in 3 Baltic countries and Finland 1983-1998 (2001) Diabetologia 44: 17-20.
27. Andersson T, Ahlbrom A and Carlsson S. Diabetes prevalence in Sweden at present and projections for year 2050 (2015) PLoS One 10: e0143084.
28. Aamodt G, Stene LC, Njolstad, Søvik O and Joner G. The Norwegian Childhood Diabetes Study Group. Spatiotemporal trends and age-period-cohort modelling of the incidence of type 1 diabetes among children aged <15 years in Norway 1973-1982 and 1989-2003 (2007) Diabetes Care 30:884-889.
29. Svensson J, Carstensen B, Molbak A, Christau B, Mortensen HB and et al. Increased risk of childhood type 1 diabetes in children born after 1985 (2002) Diabetes Care 25: 2197-2201.
30. Cinek O, Lanska V, Kolouskova S, Sumník Z, Snajderová M and et al. Type 1 diabetes mellitus in Czech children diagnosed in 1990-1997: a significant increase in incidence and male predominance in the age 0-14 years. Collaborators of the Czech Childhood Diabetes Registry (2000) Diabet Med 17: 64-69.
31. Stipancic G, La Grasta Sabolic L, Malenica M, Radica A, Skrabic V and et al. Incidence and trends of childhood Type 1 diabetes in Croatia from 1995 to 2003 (2008) Diabetes Res Clin Pract 80: 122-127.
32. Schober E, Rami B and Waldhoer T. Steep increase of incidence of childhood diabetes since 1999 in Austria. Time trend analysis 1979-2005. A nationwide study (2008) Eur J Paediatr 167: 293-297.
33. Mauny F, Grandmottet M, Lestradet C, Guitard J, Crenn D and et al. Increasing trend of childhood type 1 diabetes in Franche-Comte (France): analysis of age and period effects from 1980 to 1998 (2005) Eur J Epidemiol 20: 325-329.
34. JDRF 2015.
35. Haynes A, Bower C, Bulsara MK, Jones TW and Davis EA. Continued increase in the incidence of childhood type 1 diabetes in a population-based Australian sample (1985-2002) (2004) Diabetologia 47: 866-870.
36. Chong JW, Craig ME, Cameron FJ, Clarke CF, Rodda CP and et al. Marked increase in type 1 diabetes mellitus

incidence in children aged 0-14 yr in Victoria, Australia, from 1999 to 2002 (2002) Pediatr Diabetes 8: 67-73.

37. Newhook LA, Grant M, Sloka S, Hoque M, Paterson AD and et al. Very high and increasing incidence of type 1 diabetes mellitus in Newfoundland and Labrador, Canada (2008) Pediatr Diabetes 9: 62-68.
38. Rogers MAM, Kim C, Banerjee T and Lee JM. Fluctuations in the incidence of type 1 diabetes in the United States from 2001 to 2015: a longitudinal study (2017) BMC Med 15:199.
39. Xu G, Liu B, Sun Y, Du Y, Hu FB and et al. Prevalence of diagnosed type 1 and type 2 diabetes among US adults in 2016 and 2017: population-based study (2018) BMJ 362.
40. Carrasco E, Perez-Bravo S, Dorman J, Mondragón A and Santos JL. Increasing incidence of type 1 diabetes in population from Santiago of Chile – trends in a period of 18 years (1986-2003) (2006) Diabetes Metab Res Rev 22: 34-37.
41. Fraser de Llado TC, Gonzalez de Pijem L and Hawk B. Incidence of IIDM in children living in Puerto Rico. Puerto Rican IDDM Coalition (1998) Diabetes Care 21: 300-308.
42. Pundziute-Lyckå A, Dahlquist G, Urbonalte B and Zalinkevicius R. Time trend of childhood type 1 diabetes incidence in Lithuania and Sweden, 1983-2000. (2004) Acta Paediatr 93: 1519-1522.
43. Lora-Gomez RE, Morales-Perez FM, Arroyo-Diez FJ and Barquero-Romero J. Incidence of Type 1 diabetes in children in Caceres, Spain, during 1988-1999 (2005) Diabetes Res Clin Pract 69: 169-174.
44. Lisboa HR, Graebin R, Butzke L and Rodrigues CS. Incidence of type 1 diabetes mellitus in Passo Fundo, RS, Brazil (1998) Braz J Med Biol Res 31: 1553-1556.
45. Bahillo CMP, Hermoso lF, Garcia FJA et al. (2006) Epidemiology of type 1 diabetes in children and adolescents aged less than 15 years in the provinces of Castilla y Leon. An Pediatr (Barc) 65: 15-21.
46. Li XH, Li TL, Yang Z, Liu ZY, Wei YD and et al. A nine-year prospective study on the incidence of childhood type 1 diabetes mellitus in China (2000) Biomed Environ Sci 13: 263-270.
47. Lipman TH, Jawad AF, Murphy KM, Alan Tuttle MSW, Thompson RL and et al. Incidence of type 1 diabetes in Philadelphia is higher in black than white children from 1995 to 1999: epidemic or misclassification? (2006) Diabetes Care 29: 2391-2395.
48. Maahs DM, West NA, Lawrence JM and Mayer-Davis EJ. Chapter 1: Epidemiology of Type 1 Diabetes (2010) Endocrinol Metab Clin North Am 39: 481-497.
49. Chukwuma Sr C. Is diabetes a model for gene-environment interaction in premature senescence? (2014) JBAH 14.
50. Onyiriuka AH and Ifebi E. Ketoacidosis at diagnosis of type 1 diabetes in children and adolescents: Frequency and clinical characteristics (2013) J Diabetes Metab Disord 12: 47.
51. McLarty DG, Kinabo L and Swal AB. Diabetes in tropical Africa: a prospective study, 1981-7.II. Course and prognosis (1990) BMJ 300: 1107-1110.
52. Skrivarhaug T, Bangstad HJ, Stene LC, Sandvik L, Hanssen KF and et al. Long-term mortality in a nationwide cohort of childhood-onset type 1 diabetic patients in Norway (2006) Diabetologia 49: 298-305.
53. Patterson CC, Dahlquist G, Harjutsalo V, Joner G, Feltbower RG and et al. Early mortality in EURODIAB population-based cohorts of type 1 diabetes diagnosed in childhood since 1989 (2007) Diabetologia 50: 2439-2442.
54. Riley MD, McCarty DJ, Couper DJ, Humphrey AR, Dwyer T and et al. The 1984 Tasmanian insulin treated diabetes mellitus prevalence cohort: an eight and a half year mortality follow-up investigation (1995) Diabetes Res Clin Pract 29: 27-35.
55. DERI-The Diabetes Epidemiology Research International Study. International analysis of insulin-dependent diabetes mellitus mortality: a preventable mortality perspective (1995) Am J Epidemiol 142: 612-618.
56. Uchigata Y, Asao K, Matsushima M, Sato A, Yokoyama H and et al. Impact on mortality and incidence of end-stage renal disease of education and treatment at a diabetes center among patients with type 1 diabetes: comparison of two subgroups in the Japanese DERI cohort (2004) J Diabetes and its Complications 18: 155-159.
57. Libman JM, Pietropaolo M, Arslanian SA, LaPorte RE and Becker DJ. Evidence for heterogeneous pathogenesis of insulin-treated diabetes in black and white children (2003) Diabetes Care 26: 2876-2882.
58. Morgensen HB, Robertson KJ, Anstoot HJ, Danne T, Holl RW and et al. Insulin management and metabolic control of type 1 diabetes mellitus in childhood and adolescence in 18 countries. Hvidore Study Group on Childhood Diabetes (1998) Diabet Med 15: 752-759.
59. Lipton R, Good G, Mikhailov T, Freels S and Donoghue E. Ethnic differences in mortality from insulin-dependent diabetes mellitus among people less than 25 years of age (1999) Pediatrics 103: 952-956.
60. Dorchy H. Management of children and adolescents with diabetes mellitus: personal experience (2005) Rev Med Brux 26: 246-254.
61. Chukwuma Sr C. Clinical, economic and healthcare constraints and challenges using insulin analogues in the treatment and control of diabetes in vulnerable populations (2017) Acta Medica Scientia 3.
62. Matsushima M, LaPorte RE, Maruyama M, Shimizu K, Nishimura R and et al. Geographic variation in mortality among individuals with youth-onset diabetes mellitus across the world. DERI Mortality Study Group. Diabetes Epidemiology Research International (1997) Diabetologia 40: 212-216.
63. DERIMSG-Diabetes Epidemiology Research International Mortality Study Group (1991) Diabetes Care 14: 49-54.
64. Onda Y, Nishimura R, Morimoto A, Jano H, Utsunomiya K and et al. Diabetes Epidemiology Research International (DERI) Mortality Study Group. Age at transition from pediatric to adult care has no relationship with mortality for childhood-onset type 1 diabetes in Japan (2016) PLoS One 11: e0150720.
65. Weng J, Zhou Z, Guol L, Zhu D, Ji L and et al. Incidence of type 1 diabetes in China, 2010-13: population based study (2018) BMJ 360: 5295.
66. Muazu SB, Okpe I and Anumah F. The prevalence and characteristics of latent autoimmune diabetes in adults subset among type two diabetes mellitus patients in Northern Nigeria. (2016) Annals African Med 15: 163-170.
67. Joseph M, Shyansasunder AH, Gupta RD, Anand V and Thomas N. Demographic details, clinical features, and nutritional characteristics of young adults with Type 1 diabetes mellitus-A South Indian tertiary center experience (2016) Indian j Endocr Metab 20: 799-804.
68. Gomez ED, Gregory GA, Nostas MC, Middlehurst AC, Jenkins AJ and et al. Incidence and mortality rates and clinical characteristics of type 1 diabêtes among children and young adults in Cochabamba, Bolivia (2017) J Diabetes Res 1: 8.
69. Doubova SV, Ferreira-Hernassillo A, Perez Cerevis R, Barsoe C, Gryzbowski-Gainza E and et al. Socio-demographic and clinical characteristics of type 1 diabetes patients associated with emergency room visits and

hospitalizations in Mexico (2018) BMC Health Services Register 18: 602.

70. Pastakia SD, Pekny CB, Manyara SM and Fischer I. Diabetes in sub-Saharan Africa – from policy to practice to progress: targeting the existing gaps for future care for diabetes (2017) Diabetes Metab Syndrome and Obesity: Targets and Therapy 10: 247-263.
71. Zabetian A, Keli MH, Echouffo-Tcheugui JG, Venkat-Narayen KM and et al. Diabetes in the Middle East and North Africa (2013) J Diab Res 101: 106-122.
72. Robert AA, Al –Dawish A, Mujammami M and Al-Dawish MAT. Type 1 diabetes mellitus in Saudi Arabia: A soaring epidemic (2018) Int J Pediatrics.
73. Business Wire. Type 1 diabetes drugs market: global industry analyses, trends, market size and forecasts up to 2024. 2018
74. Barcelo A, Arredondo A, Gordillo-Tobar A, Segovia J and Qiang A. The cost of diabetes in Latin America and the Caribbean in 2013: Evidence for decision and policy makers (2017) J Global Health 7: 020410.
75. Tuomilehto-Wolf E and Tuomilehto J. HLA antigens in insulin-dependent diabetes mellitus (1991) Ann Med 23: 481-488.
76. Dahlquist G and Mustonen L. Childhood onset diabetes – time trends and climatological factors (1994) Int J Epidemiol 23: 1234-1421.
77. Todd JA. Genetics of Type 1 diabetes (1977) Pathol Biol (Paris) 45: 219-227.
78. Kyvik KO, Green A and Beck-Nielsen H. Concordance rates of insulin dependent diabetes mellitus: a population based study of young Danish twins (1995) BMJ 311: 913-917.
79. Blom L, Nyström L and Dahlquist GG. The Swedish childhood diabetes study: vaccinations and infections as risk determinants for diabetes in childhood (1991) Diabetologia 34: 176-181.
80. Virtanen SM, Räsänen L, Aro A, Ylönen K, Lounamaa R and et al. Feeding in infancy and the risk of type 1 diabetes mellitus in Finnish children. The 'Childhood Diabetes in Finland' Study Group. (1992) Diabet Me 9: 815-819.
81. Patterson CC, Dahlquist G, Soltesz G and Green A. EURODIAB ACE Study Group. Europe and Diabetes. Is childhood-onset type 1 diabetes a wealth-related disease? An ecological analysis of European incidence rates (2001) Diabetologia 44: 9-16.
82. Levitsky LL. Epidemiology, presentation, and diagnosis of type 1 diabetes mellitus in children and adolescents. 2018.
83. You WP and Henneberg M. Type 1 diabetes prevalence increasing globally and regionally: the role of natural selection and life expectancy at birth (2016) BMJ. Open Diabetes Res Care 4: e000161.
84. Silink M. Childhood diabetes: A global perspective (2002) Horm Res. 57: 1-5.
85. Kesavadev J, Sadikot SM, Saboo B, Shrestha D, Jawad F and et al. Challenges in type 1 diabetes management in South East Asia: descriptive situational assessment (2014) Indian J Endocrinol Metab 18: 600-607.
86. Wolf A, Kofman N. What are the biggest challenges and opportunities in diabetes (2015)