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IntroductionDiabetes mellitus (DM) is a disorder of the endocrinesystem, occurring as a result of the pancreas' inability to produce insulin(Type 1), or the body's capability to respond to insulin and/or impairedinsulin production (Type 2). Poor regulation of blood glucose levels can leadto hyperglycaemia (high blood glucose), with early symptoms commonly presentingas increased thirst, hunger, urination, as well as blurred vision. Long termcomplications may manifest through vascular disease, impaired kidney function, opticand nerve damage, limb amputations as well as an increased susceptibility toinfection. Heart disease remains to bethe leading cause of mortality in DM1. TIDM is caused by autoimmune destruction of pancreatic betacells responsible for insulin secretion, whereas TIIDM is thought to have anumber of risk factors, such as age, obesity, lack of exercise, as well asgenetic predisposition. There is currently no known cure for DM, and so managementof the condition normally consists of a lifelong combination of dietarymeasures, exercise, as well as drugs which help to regulate blood glucoselevels. This includes the injectable administration of insulin, and/or the useof oral medication which help to improve blood glucose regulation.

Diabetes was once thought of as a condition which onlyafflicted the affluent; however an increasing body of literature seems to suggestthat this is no longer the case35. Global BurdenIt is estimated that in 2014, there were around 422 millionpeople living with diabetes, with 1. 5 million deaths occurring in 2012 as aresult of diabetes. An additional 2. 2 million deaths have been attributedcardiovascular disease, chronic kidney disease and tuberculosis relatedhigher-than optimal blood glucose levels.

Over the past decade, diabetes prevalence has risenfaster in low- and middle-income countries than in high-income countries, withno less than three-quarters of diabetics now living in these regions26. The WHO's Eastern Mediterranean region currently bears the greatest prevalenceof diabetes2. This essay hopes to evaluate how factors such as access toquality health care, socio-economic development, as well as migration affectthe burden of type 2 diabetes mellitus (as this type accounts for around 90-95%of diabetic cases globally40), using research already undertaken inregions with relatively high prevalence rates, so as to inform policy makingfor nations where the burden is increasing, such as in Africa. The infrastructure of healthcare systems across Africavaries substantially, with many countries lacking adequate structuralcapability to effectively respond to the increasing burden of non-communicablediseases.

This is resulting from a combination of vertical and/or ear-markedfunding for certain diseases by external donors, as well as decisions to allocatefunding and recourses already available towards the management of acuteconditions and infections. With vascular disease already being a leading cause ofmortality worldwide31, it would be useful to take into considerationmanagement strategies for diabetes, which could help to also reduce the globalburden cardiovascular disease. A number of studies have also identified diabetes asincreasing the risk of developing active tuberculososis30. Theglobal burden of diabetes is also important to consider then in the globalfight against tuberculosis. Diabetes can also present a heavy burden economically, via direct costs to service users' pockets, to healthsystems and society, in addition to indirect costs attributable to

prematuremortality, temporary disability and permanent disability attributable tosecondary complications arising from the condition39. Access to Quality HealthcareDefinitions of ‘ access tohealth services’ are variable ranging from the narrow focus approach of serviceentry to the multidimensional approach, which includes: availability, acceptability, affordability, and accommodation4. Thedelivery of effective therapy in relation to diabetes management requiresseveral components; continuity of care, uninterrupted access to medicines and syringes, tools for diagnosis and follow-up, availability of trained healthcare workers, government policies and the role ofdiabetes associations10.

Limited access to healthcare can present a number ofchallenges to the management of diabetes, such as case detection and treatmentdelivery. Early case detection, for example can help to prevent the onset oflong term complications arising from diabetes. Individuals with undiagnosedTIIDM can remain so for years, and are considered be at significantly higherrisk of cardiovascular disease than individuals without; failure then in makinga diagnosis could restrict one’s access to treatment potentially resulting indeath3. It is estimated that globally, around 45.

8% of all diabetes cases in adults areestimated to be undiagnosed11. More than 80% of deaths from diabetes are currentlyoccurring in developing countries, where access to proper healthcare andfinancial means are an implicating factor9. In addition to poor access to affordable insulin, diabeticsin low and middle income countries can face wide price variations resultingfrom the complexity of supply chains, location of purchase, as well

as themanner by which it is purchased. For example, the price of insulin from asingle producer can vary from US$9 in Zimbabwe to over US$44 in the Congo 9. Affordable access to measurement tools which can be used in assessing long termglycaemic control, such as glycosylated haemoglobin concentrations (Hb1Ac)may also affect the quality of care that can be delivered by healthcareprofessionals32.

The undersupply, as well as oversupply of medication canalso be associated with poor outcomes in health. In a study conducted by Chenand colleagues12, only around 50% of diabetes patients followed uppost-initial diagnosis, were receiving an appropriate supply of medication. Thesame study also identified that oversupply of medication could result inincreased disease-related hospitalisations and emergency department visits, aswell as an increased burden of cost.

Undersupply of medication was also foundto increase disease related hospitalisation but for different reasons. Even when governmentsprovide anti-diabetic medication free of charge for economically disadvantagedgroups, in practice, many eligible patients do not have access to these schemes19. A systematic review by Paduch et al. 20 identifieda number of pyscho-social barriers to healthcare use for individuals sufferingfrom diabetes. These ranged from cultural beliefs that men should not careabout their health, a preference for traditional healers21, andreligious beliefs which may predispose individuals to fatalistic attitudes.

Thedecision to not pursue treatment, or opt for a therapy which may not provideadequate glycaemic control could then lead to deterioration in

health. One may initially consider the lack of refrigerationfacilities to affect access to insulin which has not been affected bytemperature (as this is normally kept in refrigeration). However, recentdiscussions have identified solutions to overcome this potential obstacle todelivering quality care41. MigrationMigration may occur forvarious reasons: For voluntary migrants the desire or need to leave the countryof origin may be stronger than the desire to stay, and/or the receiving countryis in need of the type and class of labor that the migrants have to offer29, whereas involuntary migration can occur due to displacement resulting from war, persecution, or natural disasters. Globally, the total number ofmigrants in 2015 exceeded 244 million and is not expected to reduce5, with healthcare systems in upper-middle and high income countries facingsignificant challenges in providing equitable, accessible and culturallycompetent healthcare for growing ethnic minority groups4. Therelation between migration status and disease pattern is complex due topotential underlying factors related to their country of origin, their new hostcountry, and possibly also by the migration process itself6.

FigureX highlights the various factors which may act as determinants towardsdeveloping TIIDM17, as a result of migration. The World Health Organisationhas identified migrant and refugee populations with non-communicable diseasesto be at greater vulnerability of adverse events related to their condition. Forced displacement could result in disruption to the continuity of access tohealth and medication, loss of prescriptions, as well as irregular foodsupplies. Such circumstances could help to deteriorate the condition ofindividuals already suffering from diabetes. The legal, or documented status of a migrant, is one ofthe most important determinants

of the access of migrants to health services ina country16, where non-documentedstatus may also result in the underutilisation of healthcare services33. A number of studies haveidentified migrant populations to have a greater prevalence of TIIDM incomparison to their host populations22, 23.

Migrants may also be atgreater risk of developing TIIDM in relation to their native counterparts; migrant Asian Indians living in the UK werefound to be more obese, to have higher blood pressure, total cholesterol, andblood glucose levels, and to be more insulin-resistant than their non-migrantsiblings living in India31. Cultural and languagebarriers may also impair the capabilities of migrant populations to seekhealthcare, or effectively utilise services where and when accessed. Lack ofeducation regarding diabetes, poor understanding of host population healthsystems, and well as mistrust of healthcare professionals may also have anegative impact on undertaking preventative measures, service access, andtreatment adherence18. The process of acculturation, which often occurs alongside migration, can result in changes to dietary habitsof migrants which may increase their risk of developing TIIDM. One trend whichhas been observed is an increased fat and overall energy intake, with areduction in carbohydrates, as well as a switch from whole grains and pulses tomore refined forms of carbohydrates27, 28.

Migration may also occurdomestically from rural to urban environments; the changes in lifestyle thatthis may bring may also be associated with an increased prevalence in TIIDM34. Rural migrants may also be less likely to access healthcare services (orexperience greater difficulty in doing so)

compared to their urban counterparts36. Socio-economic development Certainrisk factors implicated in the development of diabetes are also known to beassociated with socioeconomic status (SES). Obesity, physical inactivity, smoking, and low birth weight have all been described as risk factors forTIIDM. In Western societies these factors have often been associated with lowsocioeconomic status15. DeSilva and colleagues have also acknowledged that in high incomecountries, prevalence, poor management and complications of diabetes exhibit asocial gradient, with higher proportions observed among lower socioeconomicgroups37. Interestingly, in manydeveloping and transitional countries, diabetes prevalence increases with SESwhereas the reverse is true in developed nations22.

Aroundtwo thirds of diabetes patients live in urbanised areas, with those in thelower socio-economic classes being disproportionally affected. The reasons forthis are still poorly understood, but unhealthier lifestyles may be consideredas a contributing factor7. Astudy conducted in Spain found that the prevalence ofTIIDM in individuals with lower SES was reported as 2. 17 times as much as otherindividuals, with the prevalence of obesity, sedentary lifestyle, and abnormalblood lipid concentrations also being found to be higher in TIIDM patients of alower socio-economic status8. The global rise in obesity has also been paralleled with anincrease in the prevalence of TIIDM14. With obesity oftendisproportionately affecting lower socio-economic classes, it is also importantthen to consider the impact of obesity and its role in the development ofTIIDM. Obesity can be caused by a numberof factors, such as a high energy-dense diet, consuming highly processed foods(often

having high sugar and fat content), as well as lack of physical activity. The SES of an individual may exert an influence in propagating these riskfactors.

An individual of lower SES may have less income available in order tosource healthy foods at an affordable cost, or live in an area where there is ahigh concentration of fast food outlets, where fiscally cheap, nutrient poorfoodstuffs are commonplace44. Living in such an environment couldincline the individual regularly consume such foods, thereby increasing theirrisk of developing obesity, and potentially TIIDM as a consequence of suchlifestyle choices. In many countries diabetes may demand a large financialburden on the individual and their families, leading households into poverty. For example in Sudan the total median cost for diabetes care was US$283, ofwhich one third was spent on insulin 13. 37.

9% of Ugandan diabetespatients also resorted to missing and omitting medication due to not being ableto afford it 19. Increased SES may also help to improve access to medicines; Christiani and colleagues19 found high income groups in a region ofrural southwestern China were more likely to be treated with any anti-diabeticmedication, than those of a lower income group. Tao and co-workers on the otherhand, found decreased SES being associated with poor metabolic control, as wellas a greater incidence of diabetes-related complications38. Global Health ActorsThere are a number of globalhealth actors currently working towards combatting the growing global diabetesepidemic: Pharmaceutical IndustryWith medication being anintegral component to the management of diabetes post-onset, the

diabetesepidemic would naturally be of concern to the pharmaceutical industry for anumber of reasons.

Novo Nordisk is a pharmaceutical companyof Danish origins, having a historical base in insulin manufacture, andcurrently provides around a half of the world's insulin24. Thecompany currently outlines a number of commitments in their ' Access to Health'approach 25, with a focus on improving accessibility, affordability, availability toinsulin therapy in resource poor settings, as well as advocating equal rightsand accessibility to healthcare. Sanofi, another leading pharmaceutical company in the field of diabetes, currentlysupports a wide of programs globally which involve engaging with civil societyorganisations26.

The focus of these programs vary according to theneeds of the populations where they are being conducted, however the majorityof these initiatives place emphasis on education and promotion of preventionstrategies for the condition. It has also undertaken partnerships with otherpharmaceutical companies in order to further development of noveloral-anti-diabetic agents. World HealthOrganisation The contributions ofWHO towards tackling the global diabetes epidemic is mainly focused onadvocacy, as well as the provision of technical guidance. WHO published its very first report on the global burden ofdiabetes in 20162, where it identified a number of measures whichcan be implemented by governments in order to address the epidemic, calling onother arms of governance such as trade and agriculture to consider the impacttheir policies will have on health.

Access to essential medicines such as insulin, lipidmodifying, anti-hypertensive, and anti-diabetic medication have also beenrecognised to not always be readily available in low and middle-incomecountries, as well as the availability of basis diagnostic tools to facilitateearly case detection. The WHO also operates a program specifically dedicated to thepromotion of health of migrant populations42. A resolution waspassed on the 29th May 2017, urging member states to consider thepromotion of a framework containing priorities and guiding principles in orderto promote the health of refugees and migrants. The WHO Essential Medicines andHealth Products (EMP) Department works with countries to promote affordableaccess to quality, safe and effective medicines, vaccines, diagnostics andother medical devices. Built on three main pillars – access, innovation andregulation – EMP promotes policies and technical capacities in low-resourcedhealth systems, develops international standards for the manufacturing andregulation of health products and provides guidance for health systemseverywhere to deliver them safely and cost-effectively45. Non-State ActorsThere are also a number of non-state actors which areinvolved in dealing with diabetes.

The InternationalDiabetes Federation (IDF) is an umbrella organization of over 230 nationaldiabetes associations in 170 countries and territories27. Much oftheir work involves advocacy, as well as conducting research, the compilationof evidence based guidelines and epidemiological studies (allowing for thepublication of resources such as the IDF Diabetes Atlas), with an aim tofacilitate policy making and care delivery. The IDF also conducted a report in 2016 on the perspective of people andhealthcare professionals on the access to medicines and supplies for peoplewith diabetes. The

InternationalInsulin Foundation (IFF) is an organisation which conducts activities whichare specific to improving access to insulin for populations that requireit. The IIF has developed tools toassess access, such as the RAPIA (Rapid Assessment Protocol for Insulin Access)46, as well as undertake research collaborations with otherorganisations so as to inform key-stakeholders in low and middle-incomecountries.

The World DiabetesFoundation is an organisation whose work focuses on reach the poorestpopulations suffering from diabetes globally. Their activities can be dividedinto three main categories; improving access to diabetes care, promotingprimary prevention and awareness, as well as advocacy. Projects are undertakenaround the world in under a ‘ focus area’, of which include tackling TIIDMthrough various measure such as improving care access, as well as the doubleburden of diabetes and tuberculosis47 National GovernmentsGovernments around the world have undertaken a wide range ofapproaches to contributory social security schemes, employer-based healthinsurance and tax-based schemes to improve migrants’ health and access tohealth services. For example, some countries of migrant origin that heavilyrely on remittances, such as Sri Lanka and the Philippines, put in placeinsurance schemes for their overseas migrant workers. Countries of migrantdestination, including Thailand, offer health services to certain categories ofregistered migrants and their families through a compulsory migrant healthscheme. Brazil, Spain and Portugal are examples of countries that have adopteda policy of equal access to coverage for all migrants irrespective of theirlegal status.

Other initiatives are led by trade unions and employees. Forinstance, in Argentina, employers of rural migrant workers contribute apercentage of their workers' salaries towards a special fund that covers socialbenefits, including health insurance43. Although these interventions may not be inherently directedtowards tackling diabetes, measures such as what has been outlined above wouldhelp to improve access to health services in general. Some governments havetaken an approach to policy making which considers its impact on health, suchas in Australia. SouthAustralia has implemented a health-in-all-policies approach, which emphasisesthat government objectives for a healthy population are best achieved when allsectors include health and wellbeing as a key component of policy development44. Conclusion andRecommendations The increasing global burden of diabetes is something which hasonly been recently acknowledged by the World Health Organisation.

However, dueto the numerous long term complications that can arise from poor diabetesmanagement, both in terms of financial cost and health, diabetes is a conditionwhich should be taken with serious consideration. Much work is being done to improve access to diabetes carearound the world, especially by non-state actors, but national governments mustalso take responsibility in ensuring that adequate care can reach populationsin need. National governments can also play an important role in shaping policyin such a way that always prioritises the health of its population, as well asimprove the socio-economic status of its citizens. Addressing other healthepidemics such as obesity through the use of frameworks such as the WorldCancer Research Fund International's

NOURISHING framework44 may helpto alleviate the future burden of diabetes The delivery care of migrant populations may prove to be achallenge for several reasons, be that due to language or cultural barriers, oftheir temporary status, but one may consider from an ethical perspective thatquality care should be provided as a moral duty, especially if the same levelcan be easily delivered to its own citizens.