

# The Challenges Involved in the Treatments of Diabetes Mellitus and the Importance of Implementing Public Health Policies to Regulate the Safety of Diabetic Medications

Michael Halim \*1

1 University of Salford, MSc Biomedical Science, Greater Manchester, United Kingdom

Corresponding author: Michael Halim

**Abstract:-** Diabetes mellitus is a common condition whose prevalence and incidence are on the rise all over the world. It is a condition in which autoimmune processes cause the gradual death of pancreatic  $\beta$ -cells. As a result, there is a gradual depletion of endogenous insulin until it is absent. Secondary defects in glucagon and, most likely, incretins occur due to the absence of  $\beta$ -cells. The primary phenotype is metabolic instability and extreme glycemic variability, caused by these various hormonal abnormalities. Patients also experience hypoglycemia unawareness as the disease progresses and deficiencies in their counterregulatory defenses. Intensive insulin therapy may result in a threefold increase in extreme hypoglycemia, making it challenging to regulate hyperglycemia effectively and safely. The critical aim of type 1 diabetes treatment has long been to achieve physiological mimicry of natural insulin secretion by monitoring, necessitating a significant amount of effort and knowledge of the underlying physiology.

Insulin therapy was a big move forward in treating type 1 diabetes, but frequent hyperglycemia has a significant impact on these patients' quality of life. This study discusses the current medical problems of managing hyperglycemia in patients with diabetes mellitus. The review summarizes insulin secretion and functions, as well as the difficulties associated with insulin administration. Table 1 also outlines the negative health consequences of low prescription adherence. Furthermore, the review emphasizes the importance of

**establishing a public health policy and regulatory body that guarantees the protection of all diabetes drugs on the market and introduces gene-based therapies as an alternative to traditional treatments.**

## I. INTRODUCTION

Reusch 2019 addresses the treatment crisis diabetic patients in the United States are facing during the 2019 American Diabetes Association (ADA) 79th Scientific Sessions. One crucial factor impeding the management of Type-2 diabetes mellitus is the adverse health outcomes that are associated with insulin-based treatments. Hypoglycaemia is a common effect of diabetes treatment that is characterized by low variability in blood sugar levels. Chandran et al. (2019) explains that patients who experience cases of severe hypoglycaemia require help of a third party in the resuscitation of the victim. It is known that severe cases of hypoglycaemia have led to fatal accidents or life-threatening injuries (Chandran et al. 2019).

## II. RESULTS AND DISCUSSION

### ➤ *Current medical challenges*

Insulin is the first line medical intervention for managing hyperglycaemia in patients suffering from diabetes mellitus. The secretion and functions of insulin and the importance is illustrated in figure 2 (Stumvoll, Goldstein, and van Haeften 2016). Figure 3 outlines the vital role insulin plays with regards to maintaining glucose homeostasis (Cantley and Ashcroft 2015).

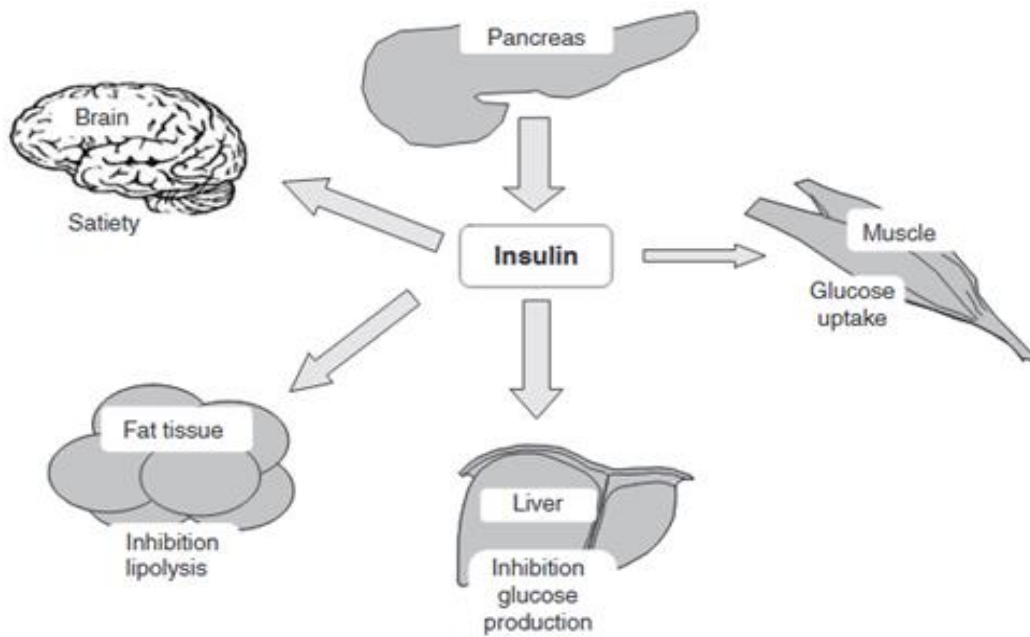
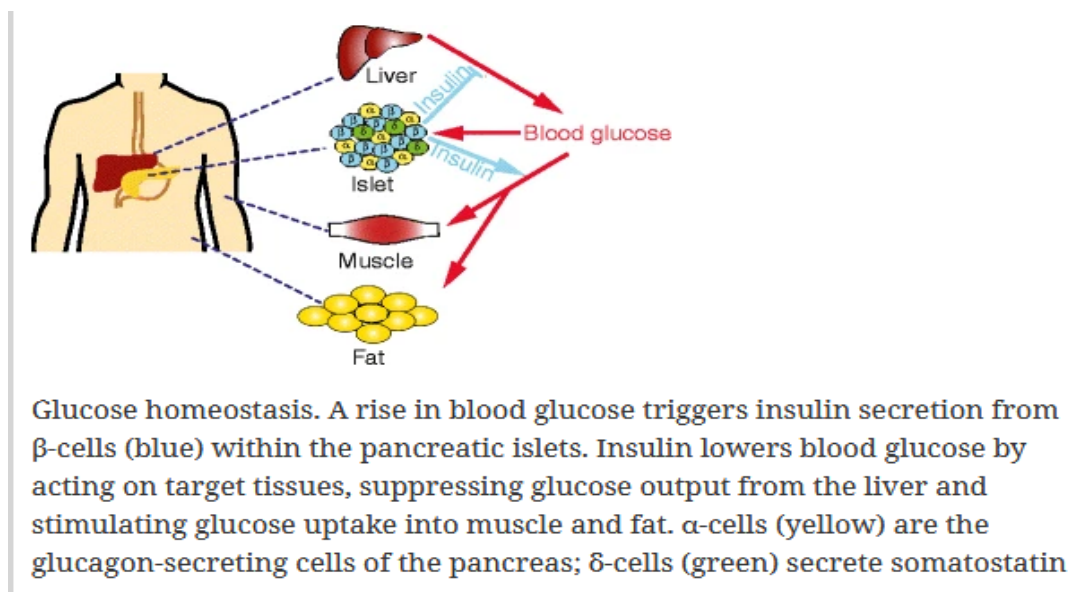


Figure 1: Insulin secretion and functions (Stumvoll, Goldstein, and van Haefen 2016).



Glucose homeostasis. A rise in blood glucose triggers insulin secretion from  $\beta$ -cells (blue) within the pancreatic islets. Insulin lowers blood glucose by acting on target tissues, suppressing glucose output from the liver and stimulating glucose uptake into muscle and fat.  $\alpha$ -cells (yellow) are the glucagon-secreting cells of the pancreas;  $\delta$ -cells (green) secrete somatostatin

Figure 2: The role of insulin in maintaining glucose homeostasis (Cantley and Ashcroft 2015)

However, the inconvenience to insulin administration includes daily access to injection syringes (Lind et al. 2015). Moreover, cases of insulin overdose are becoming a common in patients who are provided with high prescription doses (Cantley and Ashcroft 2015). Adjusting insulin dosage before eating and immediately after a meal is a great challenge to most diabetic patients (Stumvoll, Goldstein, and van Haefen 2016). According to Wu, Lu, and Zhu (2018) high insulin doses are inappropriate for patients who

register low blood glucose levels below 10 to 12 mmol/L as it could lead to insulin overdose or brain damage. A challenge to self-administration of insulin has increased the rates of drug non-adherence among patients (Borghetti et al. 2018). Consequently, the adverse health effects of low adherence to medication are very likely to occur as indicated in Table 1 below.

Table 1: Type-2 Diabetes mellitus health complications. (Wu, Lu, and Zhu 2018).

Complication categories	Specific types
Metabolic	Cardiovascular (atherosclerosis, hypertension, stroke) Obesity Muscle malformations Skin itching Infections (chronic skin or leg infections) Keton-urea
Eye complications	Visual damage and blur Cataract Fundus hemorrhages and vessel leakage
Kidney failure	Nephropathy
Cancer	Colon cancer and so on
Brain damage	Cognitive impairments Tiresome feeling and insomnia Lack mental concentrations Mental depression

➤ *The big questions according to public opinion*

There is a need to implement public health policies and a governing body to ensure the safety standards of all diabetes medications available in the market. The distribution of anti-hyperglycaemic drugs such as rosiglitazone led to a public uproar due to the adverse effects on patient’s cardiovascular system (Borghetti et al. 2018). Therefore, the Federal Drug Administration should implement new regulations that will outline the side effects of all diabetes drugs before being certified as fit for human consumption (Moura et al. 2018). Substandard synthetic drugs reach the patients due to unscrupulous pharmaceutical companies that overlook patient’s wellbeing in exchange for monetary benefits. Therefore, it is imperative for stringent measures should be put in place against pharmaceutical companies that violate the standards of care outlined by the American Diabetes Association (ADA). Table 2 below articulates the most common diabetic drug therapies that have adverse health effects on humans.

Table 2: Diabetes drug therapies and adverse events (Wu, Lu, and Zhu 2018).

Drug and therapy	Mechanisms of action	Adverse events
Insulin and its derivatives	Glucose metabolisms	Not significance
Sulphonylurea	Stimulate insulin secretions	Gastrointestinal (20-30%) Infections (20%)
Biguanide (Metformin)	Decrease amount of sugar productions by liver	Metabolisms
Acarbose Voglibose	α-glucosidase inhibitors	Gastrointestinal (20-30%)
Pioglitazone	Receptor agonists	Heart failure (1-5%) Bladder carcinoma (1-2%)
Exercise	Mimics insulin actions	Not significance
Curcumin Resveratol	Plant chemicals Wider biochemical pathways	Low
Other melbine	Variable	Variability
α-thioctic acids (Lipoic acid)	Disease complications	Not obvious
New anti-diabetic drugs	SGLT-2 inhibition DPP4 antagonists	Under investigations

➤ *Ethical considerations*

According to pharmacological studies the ultimate goal of the government and public healthcare systems is to monitor the distribution of high toxic drugs to the general public. Members of Parliament, healthcare is all about access. Therefore, patients should be provided with safe and most affordable drug options available in the market. Medical practitioners have a crucial role in reducing the number of patient deaths due to wrong drug prescriptions. For example, the American Diabetes Association provides sourcebook notes and guidelines on insulin prescriptions that should be followed all medical practitioners (American Diabetes Association 2019).

➤ *Future trends*

Children, whose grandparents were diagnosed with type-2 diabetes have a threefold risk of developing diabetes attributable to a positive history (Stumvoll, Goldstein, and van Haeften 2016). However, medical advancements promise the introduction of gene therapy which is a low hanging fruit for the treatment of monogenetic diabetes. Gene therapy will be practical in treating diabetes variations caused by a missing or altered genetic genes (Kleinberger, and Pollin, 2015). Some of the promising medical inventions include the genome-wide scans and the identification of candidate genes that lead to disease progression.

### III. CONCLUSION

Diabetes is a personal and national epidemic that is getting worse amid existing attempts to tackle it. Patients with diabetes should be closely monitored to ensure that all glycemic and nonglycemic care targets are met and maintained to prevent insulin overdose. To ensure that all diabetes products on the market are healthy, the Federal Drug Administration should enact new rules outlining the side effects of all diabetes drugs before they are approved for human consumption. Pharmaceutical firms that breach treatment standards and provide patients with substandard synthetic medicines should face harsh penalties. Furthermore, patients should have access to the safest and most affordable medication choices on the market. Gene therapy may be helpful in the future for treating diabetes variants caused by absent or changed genetic genes.

### REFERENCES

[1]. American Diabetes Association, 2019. 9. Pharmacologic approaches to glycemic treatment: standards of medical care in diabetes—2019. *Diabetes care*, 42(Supplement 1), pp.S90-S102. <https://doi.org/10.2337/dc19-s009>

[2]. Borghetti, G., von Lewinski, D., Eaton, D.M., Sourij, H., Houser, S.R. and Wallner, M., 2018. Diabetic cardiomyopathy: current and future therapies. Beyond glycemic control. *Frontiers in physiology*, 9, p.1514. <https://doi.org/10.3389/fphys.2018.01514>

[3]. Cantley, J. and Ashcroft, F.M., 2015. Q&A: insulin secretion and type 2 diabetes: why do  $\beta$ -cells fail?. *BMC biology*, 13(1), p.33. <https://doi.org/10.1186/s12915-015-0140-6>

[4]. Chandran, K., Tai, K.P., Toh, M.P.H.S., Phng, F.W.L., Seah, D.E.J. and Wu, C.X., 2019. Development and Validation of a Primary Care Tool to Identify Patients With Type 2 Diabetes Mellitus at High Risk of Hypoglycemia-Related Inpatient Admissions. *Journal of Endocrinology and Metabolism*, 9(3), pp.43-50. <https://doi.org/10.14740/jem563>

[5]. Kleinberger, J.W. and Pollin, T.I., 2015. Personalized medicine in diabetes mellitus: current opportunities and future prospects. *Annals of the New York Academy of Sciences*, 1346(1), p.45. <https://doi.org/10.1111/nyas.12757>

[6]. Lind, M., Hirsch, I.B., Tuomilehto, J., Dahlqvist, S., Ahrén, B., Torffvit, O., Attvall, S., Ekelund, M., Filipsson, K., Tengmark, B.O. and Sjöberg, S., 2015. *Liraglutide in people treated for type 2 diabetes with multiple daily insulin injections: randomised clinical trial (MDI Liraglutide trial)*. *Bmj*, 351, p.h5364. <https://doi.org/10.1136/bmj.h5364>

[7]. Moura, C.S., Rosenberg, Z.B., Abrahamowicz, M., Bernatsky, S., Behloul, H. and Pilote, L., 2018. Treatment discontinuation and clinical events in type 2 diabetes patients treated with dipeptidyl peptidase-4 inhibitors or NPH insulin as third-line therapy. *Journal of diabetes research*, 2018. <https://doi.org/10.1155/2018/4817178>

[8]. Reusch, J.E., 2019. The Diabetes Story: A Call to Action: 2018 Presidential Address. *Diabetes care*, 42(5), pp.713-717. <https://doi.org/10.2337/dci18-0050>

[9]. Stumvoll, M., Goldstein, B.J. and van Haeften, T.W., 2016. *Pathogenesis of type 2 diabetes*. In *Type 2 Diabetes* (pp. 27-40). CRC Press. <https://doi.org/10.3109/9780849379581-3>

[10]. Wu, J.D., Lu, Y. and Zhu, H., 2018. *Type 2 Diabetes Preventions, Treatments and New Drug Developments*. <https://doi.org/10.2174/1876524601808010022>