



# Misconceptions about Insulin and Barriers to Insulin Initiation in Type 2 Diabetes among General Physicians in Southeast Nigeria

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## Authors' contributions

This work was carried out in collaboration among all authors. Author EU conceptualized the study and contributed to study design, literature review and manuscript writing. Author JO contributed in data acquisition and analysis while author EN contributed in results interpretation and critical review of the manuscript for important intellectual content. All authors read and approved the final manuscript.

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## ABSTRACT

**Aims:** The aim of this study was to evaluate the perceptions of general physicians (GPs) regarding insulin and determine the barriers to its initiation in patients with type 2 diabetes mellitus (T2DM).

**Study Design:** A cross-sectional, quantitative research.

**Place and Duration:** Enugu metropolis, Southeast Nigeria, between March and November 2018.

**Methodology:** We used structured self administered questionnaire to evaluate the perceptions of 64 GPs (45 males and 19 females) regarding insulin, and to elicit barriers to insulin initiation in subjects with T2DM.

**Results:** The mean (SD) age of the participants was 45.5 (11.7) years and their duration of general practice ranged from 3 – 38 years. Majority were private practitioners predominantly in the rural areas. Only 15 (23.4%) respondents had ever initiated insulin for outpatient with T2DM.

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Fear of hypoglycemia, anticipated patients' refusal of insulin, physician's lack of confidence, and concerns about needle pains were among the commonly reported barriers to insulin initiation. Others were socio-economic factors including concerns about affordability of insulin and frequent glycemic monitoring, and availability of insulin storage facilities.

There was a general consensus among the GPs on a number of misconceptions including that patients' adherence to oral glucose lowering drugs eliminates the need for insulin; that insulin should be reserved as a last resort; and that once initiated, insulin therapy is lifelong.

**Conclusion:** This study revealed that there are several physician-related barriers and misconceptions regarding insulin therapy for T2DM among GPs in Southeast Nigeria. Periodic training to improve GPs' attitude to insulin and optimize insulin utilization in T2DM is required.

*Keywords: Barriers; general practitioners; misconceptions; Nigeria; perceptions; primary care physicians; psychological insulin resistance; type 2 diabetes.*

## ABBREVIATIONS

DM : Diabetes mellitus

GP : General Practitioner

OGLD : Oral glucose lowering drugs

SPSS : Statistical Package for Social Sciences

SSA : Sub-Saharan Africa

T2DM : Type 2 diabetes mellitus

## 1. INTRODUCTION

Nigeria has since joined the league of many nations with a growing burden of diabetes mellitus (DM) and its complications. Current epidemiological data indicate that approximately 3 million adults in Nigeria are living with diabetes, nearly half of this number is yet undiagnosed, and at least 8 million adults have impaired glucose tolerance, putting them at high risk of developing DM [1]. As in most parts of the world, type 2 diabetes (T2DM) is the predominant form of the disease, accounting for about 95% of diabetes cases in Nigeria. Without good glycemic control, T2DM is associated with several life-threatening multi-organ complications and contributes significantly to premature mortality which has been shown to be more pronounced in low and middle income countries including sub-Saharan Africa (SSA) [1,2]. Confronting the rising trend in diabetes and curtailing its morbidities are therefore a compelling need in this sub region. To achieve this goal, knowledgeable and motivated diabetes care manpower is required, among other factors.

The discovery of insulin in the year 1921 revolutionized the management of DM as it marked the emergence of the first effective diabetes medication and heralded a new era of heightened optimism for the survival of persons living with the disease. Although a wide array of oral and injectable medications subsequently

joined the anti-hyperglycemic armamentarium, insulin arguably remains the most effective anti-diabetic drug till date [3]. Moreover, studies have shown that at least 50% of patients with T2DM experience partial or complete failure of oral glucose lowering drugs (OGLDs) within 6 – 10 years from the time of diabetes diagnosis and this phenomenon worsens with time [4,5]. The lack of long term sustainability of OGLDs in achieving glycemic control is ascribed to a progressive decline in beta islet cell function with associated insulin secretory defect. Consequently, most patients with T2DM will eventually require treatment optimization with insulin at some point in the course of the disease.

Owing to the dearth of diabetes specialists in most countries of SSA, general physicians (GPs) are the major providers of diabetes care. In spite of the potential benefits of insulin, evidences show that GPs are generally reluctant to initiate insulin in persons with T2DM [6-8]. This situation has been ascribed majorly to inadequate knowledge and therefore lack of confidence in initiating insulin [8,9]. Furthermore, GPs are also reported to harbor many negative perceptions about insulin that constitute significant cog in the wheel of optimal diabetes care [6,10]. This inertia to employ insulin, sometimes termed "psychological insulin resistance," has been shown to vary from one country or region to another and in association with culture and healthcare systems [11]. Identification of country-specific barriers therefore is a necessary prerequisite to developing appropriate interventions to improve GPs' attitudes towards insulin and its utilization in the management of T2DM.

In spite of rising diabetes burden in SSA, no study has examined the barriers to insulin

initiation in primary care in this sub-region, to the best of our knowledge. The objectives of this study were therefore to evaluate general physicians' attitudes and barriers to insulin initiation in patients with type 2 diabetes mellitus in Southeast Nigeria.

## 2. METHODS

### 2.1 Subjects and Study Design

We conducted a cross-sectional study among GPs who participated in three diabetes training workshops in Enugu, Southeast Nigeria, between March and November 2018. The workshops were at the instance of pharmaceutical companies and drew participants from the five states that make up Southeast Nigeria. Self administered questionnaire was used to evaluate their perceptions regarding insulin and barriers to insulin initiation in patients with T2DM. The study was a pre-workshop evaluation and participation was voluntary after obtaining consent. Approval was obtained from the Research and Ethics Committee of Enugu State University Teaching Hospital.

### 2.2 The Questionnaire

A self administered questionnaire developed solely for the study was used to collect relevant data. The Questionnaire was validated by two diabetes specialists and tested for reliability by the split-half test method in a pilot study conducted among 10 internship doctors at the Enugu State University Teaching Hospital. It demonstrated good internal consistency of responses (Cronbach's alpha coefficient of 0.753 and 0.835 for each split group respectively, and a correlation between groups of 0.829, indicating a very strong reliability).

The survey instrument consisted of a section on demographic information, duration of medical practice, location and type of practice facility (government or private) and patient load per week. The respondents were then asked how frequent they initiated insulin for out-patients with T2DM. The responses were recorded on a three-point Likert scale from 0 (never), 1 (rarely) and 2 (regularly). This was followed by a multiple response question that required the respondents to identify perceived barriers to insulin initiation from a list of possible barriers that was provided based on literature reviews on physician barriers to insulin initiation [6–10]. To evaluate respondents' beliefs about insulin, a series of statements about insulin were provided to which

respondents were required to either agree or disagree.

### 2.3 Data Analysis

Data were analyzed descriptively with the Statistical Package for Social Sciences (SPSS) (IBM version 23.0; SPSS Inc., Chicago, IL, USA). Frequencies and percentages were computed for categorical variables while continuous variables were presented as means and standard deviations. Consensus on a belief item was deemed present if at least 50% of the respondents either agreed or disagreed to the item, otherwise there was no consensus on that belief item, according to a previously published study [7].

## 3. RESULTS

Out of 76 participants, 64 (84.2%) completed the survey. Their mean duration in general practice was  $17.3 \pm 11.6$  years, 65.6% were in private practice and 64.1% had their practice domiciled in rural areas. An average participant attended to between 11 and 20 diabetic patients per week. The characteristics of the respondents are shown in Table 1.

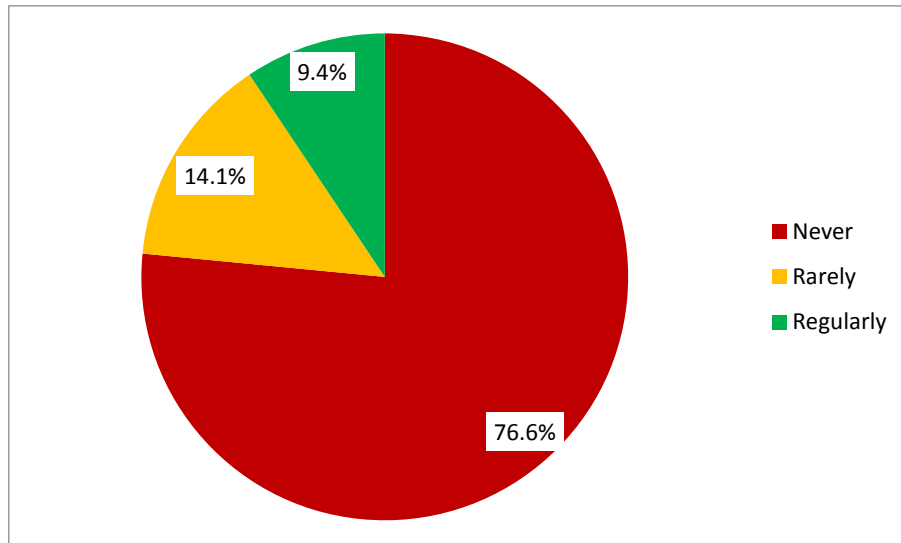
Only 15 respondents (23.4%) had ever initiated an out-patient with T2DM on insulin. Out of this number, 6 (9.4%) reported that they regularly practiced it while 9 (14.1%) rarely initiated T2DM subjects on insulin (Fig. 1).

When asked to provide reasons(s) militating against insulin initiation for T2DM, fear of hypoglycemia was the commonest reason and was given by 81.3% of the respondents followed by feeling that patients will reject insulin. Concerns about needle pains, insulin storage and affordability were reported by 65.6%, 59.4% and 57.8% of the respondents respectively. 62.5% of the respondents reported that they lacked confidence to initiate insulin. Other reported barriers are shown in Fig. 2.

The beliefs and perceptions of the respondents regarding insulin therapy for T2DM are shown in Fig. 3. Majority (71.7%) of the GPs believed that insulin should not be initiated at diagnosis of T2DM except in emergency situations, 59.4% believed that insulin therapy in T2DM should be as a last resort, while 57.8% believe that once initiated, insulin cannot be stopped for life. There was no consensus on whether insulin initiation should be reserved for the specialist and whether insulin reduces patients' quality of life.

**Table 1. Demographic characteristics of the study population**

<b>GP characteristics</b>	<b>Total (n = 64)</b>
Mean age, years ± SD	45.5 ± 11.7
Female gender, n (%)	19 (29.7)
Mean duration of practice, years ± SD	17.3 ± 11.6
Type of practice, n (%)	
Government	22 (34.4)
Private	42 (65.6)
Location of practice, n (%)	
Urban	23 (35.9)
Rural	41 (64.1)
Diabetic patients load/week, n (%)	
≤ 10	20 (31.3)
11-20	32 (50.0)
> 20	12 (18.8)



**Fig. 1. General practitioners' insulin initiation practices for out-patients with type 2 diabetes mellitus in Southeast Nigeria**

**4. DISCUSSION**

In spite of its long term global experience as a potent and safe treatment for hyperglycemia, insulin remains grossly underutilized in subjects with T2DM especially in primary care. This is due to several barriers and misconceptions regarding insulin by both diabetic patients and their care givers. In this study, we evaluated primary care physicians' barriers to insulin initiation and misconceptions regarding insulin therapy in T2DM.

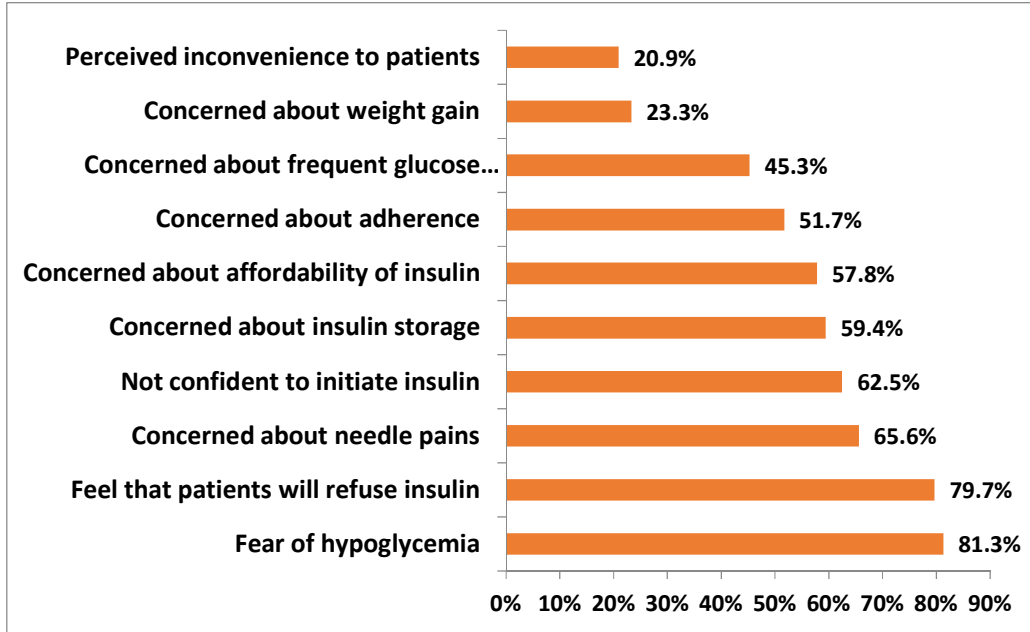
Our study showed a huge lack of experience with insulin among the GPs as less than a quarter of them had ever initiated insulin in T2DM, and less than one in ten regularly did so in their routine

clinical practice. This suggests the existence of strong inertia towards insulin therapy in subjects with T2DM, consistent with previous studies that had demonstrated high reluctance to initiate insulin among GPs [6-10].

Fear of hypoglycemia was the most reported barrier to insulin initiation among our respondents. Concern about hypoglycemia has been consistently reported as a significant factor militating against insulin initiation in primary care [9,10,12]. Although hypoglycemia is a potentially life threatening complication of insulin therapy, its rate and severity have been shown to be minimal in both interventional and observational studies [13-15]. In the Outcome Reduction with Initial Glargine Intervention (ORIGIN) trial, the rate of

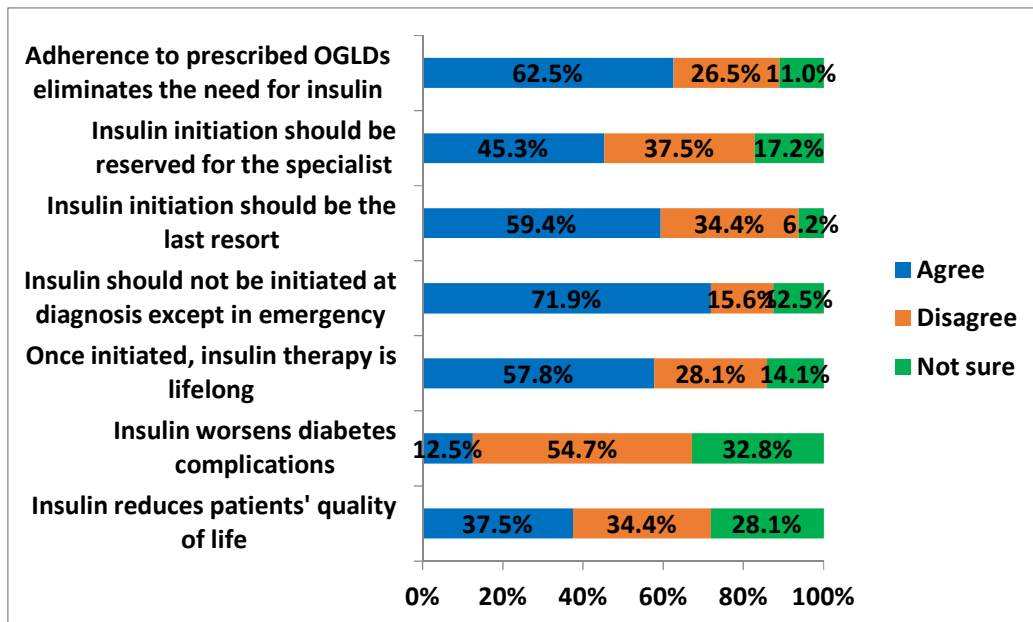
hypoglycemia was very low despite maintaining tight glucose control by systematic titration of basal insulin (glargine) [14]. Similarly, a large non

interventional study involving 26 non Western countries –the A1chieve study –reported marked improvement in glycemc and vascular profile in



**Fig. 2. Barriers to out-patient insulin initiation for type 2 diabetes expressed by general practitioners in Southeast Nigeria**

*Note: Results are based on the following survey question: Some doctors express some concerns and worries regarding insulin initiation in out-patients with type 2 diabetes. Which of the following constitute significant barriers to initiating type 2 diabetes patients on insulin in your practice (tick all applicable responses)*



**Fig. 3. General practitioners' perceptions regarding insulin initiation in patients with type 2 diabetes mellitus in Southeast Nigeria**

both insulin naïve and experienced T2DM subjects treated with insulin analogs, without increase in adverse effects such as hypoglycemia and weight gain [15]. Fear of hypoglycemia therefore should not preclude treatment intensification in subjects with T2DM. Physician fear and anxiety over insulin initiation may actually be a reflection of inadequate knowledge and skills about insulin usage and this may explain why its prevalence is significantly lower among diabetes specialists than generalists [16]. This scenario may have also played out in our study as nearly two-thirds of our respondents expressed lack of confidence in initiating insulin. The fear as well as the risk of insulin-induced hypoglycemia could therefore be significantly reduced in primary care by adequate physician training as well as instituting other measures such as choosing insulin analogs which have lower propensity to cause hypoglycemia [15,17], setting individualized glycemic targets [3], adequate patient education and frequent self glucose monitoring [18].

Most of our respondents reported that anticipation of patients' refusal of insulin constituted a barrier to its initiation and about 65% considered injection pains as a limiting factor. Refusal of insulin by diabetic patients is actually well documented in literature [11,19]. However, this has largely been blamed on psychological unpreparedness of the physician as a result of inadequate knowledge and skills, resulting in inability to clear patients' misconceptions regarding insulin [20]. It is therefore deducible that patients' resistance to insulin closely mirrors physicians' reluctance to initiate insulin and patients are more likely to accept insulin if they are convinced on the need for its initiation. Primary care physicians have repeatedly raised concerns about needle pains in previous studies [6-8,19,20]. Needle phobia is indeed a commonly reported patient barrier to insulin initiation and many patients would reportedly accept insulin if it were not administered by injection [11,12]. Injection phobia however reduces drastically once the first shot is pulled off [21]. Furthermore, appropriate needle selection, correct injection technique, avoiding needle reusage and use of modern insulin delivery devices have been shown to reduce injection pains significantly [22].

Socioeconomic factors including affordability of insulin and lack of proper insulin storage facilities were identified by over half of our respondents as barriers to insulin initiation. Due to a high poverty

rate, financial constraint has been a common denominator in most studies evaluating quality of healthcare delivery in sub-Saharan Africa [23,24]. Nigeria has been designated the "poverty capital" of the world according to the World Poverty Clock, with nearly half of the population living in extreme poverty [25]. Moreover, out-of-pocket expenditure on healthcare is the norm as less than 5% of the population is covered by health insurance [26]. Insulin treatment in T2DM is also associated with additional financial burden of performing frequent self glucose monitoring which has severely limited its use in Nigeria [27]. It is also noteworthy that the bulk of our respondents practice in rural areas which are more likely to harbor the socioeconomically disadvantaged people who may not even have access to refrigerators. Furthermore, the rural communities often suffer infrastructural deprivation such as electricity that is required for proper insulin storage. In contrast to our finding, affordability of insulin and/or challenges with its storage do not constitute significant barriers to insulin initiation in developed affluent societies [7,9,10]. The situation in our clime could be ameliorated by provision of subsidy on insulin as well as expanding health insurance coverage.

Many misconceptions about insulin were observed among our respondents. For instance, there was a consensus among the GPs that insulin should be initiated in T2DM only as a last resort, and that once initiated, insulin therapy is lifelong. Other negative perceptions about insulin to which the GPs reached consensus include that insulin should not be initiated at the time of diagnosis of T2DM except in emergency situation, and that adherence to OGLDs eliminates the need for insulinization. Similar misconceptions among GPs regarding insulin were reported in other studies of this nature [6,7,19,20]. In a survey involving 9 Arab countries, 73.6% of family physicians preferred to delay insulin initiation until it was the last resort [6]. In another study, Hayes et al. [7] reported that only 39% of the GPs were aware that most patients with T2DM will eventually require insulin regardless of their compliance with dietary advice and prescribed oral medications. These and other misconceptions about insulin raise doubts about GPs' knowledge of the pathogenesis of T2DM, diabetes treatment guidelines as well as the benefits of intensive glucose control; and therefore underscore the need for further training of the GPs in this regard. The GPs are probably not aware that at the time of diagnosis of T2DM,

beta islet cell function had declined by nearly half and progressively declines with time such that most patients would eventually require insulin in spite of adherence to lifestyle modifications and OGLDs [4,5]. Furthermore, the GPs need to know that early insulinization in T2DM has been shown to offer some benefits including improvement in beta cell function and insulin sensitivity, as well as long term reduction in the risk of microvascular complications through a “legacy effect” associated with early intensive glycemic control [28,29]. The American Diabetes Association recommends that insulin be initiated at the time of diagnosis of T2DM in the presence of severe hyperglycemia (blood glucose > 300 mg/dl and/or hemoglobin A1c > 10%), and/or presence of catabolic features such as severe weight loss [30]. Insulin is therefore never a “last resort” and should be initiated as timely as possible to control hyperglycemia and prevent the development or retard the progression of diabetes related complications.

One of the limitations of this study is the fact that the participants were accessed through workshop attendance. This might have led to recruitment bias since GPs who are less knowledgeable may be more likely to honor invitation to participate in a training workshop. Our sample therefore is not only small, but may not be a true representative of the GPs in Southeastern Nigeria, thereby limiting the generalizability of our findings. Furthermore, our findings were based on self report and may not accurately reflect actual behavior.

## 5. CONCLUSIONS

This survey revealed a great depth of inertia to initiate insulin in subjects with T2DM, among general physicians in Southeast Nigeria. Several barriers to insulin initiation were uncovered, ranging from concerns about safety of insulin, particularly hypoglycemia, to concerns about patients’ acceptance of injectable therapy, needle pains, adherence to insulin regimen, and problems of affordability and storage of insulin. Lack of confidence in insulin initiation was also a prominent barrier expressed by the GPs who also harbored several negative perceptions about insulin. Many of these reported barriers and misconceptions could be addressed through periodic training of the GPs with a view to keeping them up-to-date with the best approaches to proper diabetes care including treatment optimization with insulin. Future qualitative studies involving both diabetic patients

and primary care physicians are needed for more in-depth explorations of barriers and facilitators of insulin initiation in patients with type 2 diabetes.

## CONSENT

Written informed consent was obtained from all individual participants included in the study.

## ETHICAL APPROVAL

Approval for this study was obtained from the Enugu State University Ethics and Research Committee.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. International Diabetes Federation. Diabetes Atlas 9<sup>th</sup> Edition. International Diabetes Federation; 2019. Available:<https://www.diabetesatlas.org/data/en/country/145/ng.html> (Accessed 17<sup>th</sup> March 2020)
2. World Health Organization Global Report on Diabetes. World Health Organization; 2016. Available:<https://www.who.int/publications-detail/global-report-on-diabetes> (Accessed 30<sup>th</sup> March, 2020)
3. Inzucchi SE, Bergenstal RM, Buse JB, Diamant M, Ferrannini E, Nauck M, et al. Management of hyperglycemia in type 2 diabetes, 2015: A patient-centered approach: Update to a position statement of the American Diabetes Association and the European Association for the Study of Diabetes. *Diabetes Care*. 2015;38:140–149.
4. Fonseca VA. Defining and characterizing the progression of type 2 diabetes. *Diabetes Care*. 2009;32(2):151–156.
5. Matthews DR, Cull CA, Stratton IM, Holman RR, Turner RC. UKPDS 26: Sulphonylurea failure in non-insulin-dependent diabetic patients over six years: UK Prospective Diabetes Study (UKPDS) Group. *Diabet Med*. 1998;15: 297–303.
6. Lakkis NA, Maalouf GJ, Mahmassani DM, Hamadeh GN. Insulin therapy attitudes and beliefs of physicians in Middle Eastern

- Arab countries. *Fam Pract.* 2013;30(5): 560–567.
7. Hayes RP, Fitzgerald JT, Jacober SJ. Primary care physician beliefs about insulin initiation in patients with type 2 diabetes. *Int J Clin Pract.* 2008;62:860–868.
  8. Haque M, Emerson SH, Dennison CR, Navsa M, Levitt NS. Barriers to initiating insulin therapy in patients with type 2 diabetes mellitus in public-sector primary health care centres in Cape Town. *South African Medical Journal.* 2005;95(10):798–802.
  9. Furler J, Spitzer O, Young D, Best J. Insulin in general practice: Barriers and enablers for timely initiation. *Aust Fam Physician.* 2011;40(8):617–621.
  10. Tan AM, Muthusamy L, Ng CC, Phoon KY, Ow JH, Tan NC. Initiation of insulin for type 2 diabetes mellitus patients: What are the issues? A qualitative study. *Singapore Med J.* 2011;52(11):801–809.
  11. Ellis K, Mulnier H, Forbes A. Perceptions of insulin use in type 2 diabetes in primary care: A thematic synthesis. *BMC Fam Pract.* 2018;19. Available:<https://doi.org/10.1186/s12875-018-0753-2>
  12. Ng C, Lai P, Lee Y, Azmi S, Teo C. Barriers and facilitators to starting insulin in patients with type 2 diabetes: A systematic review. *Int J Clin Pract.* 2015;69(10):1050–1070.
  13. Home PD, Dain MP, Freemantle N, Kawamori R, Pfohl M, et al. Four-year evolution of insulin regimens, glycaemic control, hypoglycaemia and body weight after starting insulin therapy in type 2 diabetes across three continents. *Diabetes Res Clin Pract.* 2015;108:350–359.
  14. Gerstein HC, Bosch J, Dagenais GR, Diaz R, Jung H, Maggioni AP, et al. ORIGIN Trial Investigators. Basal insulin and cardiovascular and other outcomes in dysglycemia. *N Engl J Med.* 2012;367: 319–328.
  15. Home P, Naggar NE, Khamseh M, Gonzalez-Galvez G, Shen C, Chakkarwar P, et al. An observational non-interventional study of people with diabetes beginning or changed to insulin analogue therapy in Non-Western countries: The achieve study. *Diabetes Res Clin Pract.* 2011;94:352–363.
  16. Grant RW, Wexler DJ, Watson AJ, Lester WT, Cagliero E, Campbell EG, et al. How doctors choose medications to treat type 2 diabetes: A national survey of specialists and academic generalists. *Diabetes Care.* 2007;30:1448–1453.
  17. Kristensen PL, Tarnow L, Bay C, Nørgaard K, Jensen T, Parving HH, et al. Comparing effects of insulin analogues and human insulin on nocturnal glycaemia in hypoglycaemia-prone people with type 1 diabetes. *Diabet Med.* 2017;34:625–631.
  18. Lee YK, Ng CJ, Lee PY, Khoo EM, Abdullah KL, Low WY, et al. What are the barriers faced by patients using insulin? A qualitative study of Malaysian health care professionals' views. *Patient Preference and Adherence.* 2013;7:103–109.
  19. Rita SL, Lubaki FJ, Bompeka LF, Ogunbanjo GA, Ngwala LP. Prevalence and determinants of psychological insulin resistance among type 2 diabetic patients in Kinshasa, Democratic Republic of Congo. *Afr J Prim Health Care Fam Med.* 2019;11(1):e1-e5. DOI: 10.4102/phcfm.v11i1.1993
  20. Peyrot M, Rubin RR, Lauritzen T, Skovlund SE, Snoek FJ, Matthews DR, et al. International DAWN Advisory Panel. Resistance to insulin therapy among patients and providers: Results of the cross-national Diabetes Attitudes, Wishes, and Needs (DAWN) study. *Diabetes Care.* 2005;28:2673–2679.
  21. Kruger DF, LaRue S, Estepa P. Recognition of and steps to mitigate anxiety and fear of pain in injectable diabetes treatment. *Diabetes Metab Syndr Obes.* 2015;8:49–56.
  22. Spollett G, Edelman SV, Mehner P, Walter C, Penfornis A. Improvement of insulin injection technique: Examination of current issues and recommendations. *Diabetes Educ.* 2016;42:379–394.
  23. Soors W, Dkhimi F, Criel B. Lack of access to health care for African indigents: A social exclusion perspective. *Int J Equity Health.* 2013;12:91.
  24. Doctor HV, Nkhana-Salimu S, Abdulsalam-Anibilowo M. Health facility delivery in Sub-Saharan Africa: Successes, challenges, and implications for the 2030 development agenda. *BMC Public Health.* 2018;18(765). Available:<https://doi.org/10.1186/s12889-018-5695-z>
  25. World Poverty Clock. Available:<https://worldpoverty.io/map> (Accessed 4<sup>th</sup> April, 2020)



26. Onwujekwe O, Hanson K, Uzochukwu B. Examining inequities in incidence of catastrophic health expenditures on different healthcare services and health facilities in Nigeria. PLoS One. 2012;7(7): e40811.  
DOI: 10.1371/journal.pone.0040811
27. Ugwu ET, Orjioke CJG, Young EE. Self monitoring of blood glucose among patients with type 2 diabetes mellitus in Eastern Nigeria: Need for multi-strategic interventions. Curr Diabetes Rev. 2018;14(2):175-181.
28. Laiteerapong N, Ham SA, Gao Y, Moffet HH, Liu JY, Huang ES, et al. The legacy effect in type 2 diabetes: Impact of early glycemic control on future complications (the Diabetes & Aging Study). Diabetes Care. 2019;42:416–426.
29. Hu Y, Li L, Xu Y, Yu T, Tong G, Huang H, et al. Short-term intensive therapy in newly diagnosed type 2 diabetes partially restores both insulin sensitivity and  $\beta$ -cell function in subjects with long-term remission. Diabetes Care. 2011;34:1848–1853.
30. American Diabetes Association. Pharmacologic approaches to glycemic treatment: Standards of medical care in diabetes—2020. Diabetes Care. 2020;43: S98–110.

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