Knowledge, Practice, and Attitude of patients and physicians towards insulin therapy in Type 2 DM: a cross sectional study in TASH patients and Physician from various universities in Ethiopia

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Research Article

Keywords: Type 2 DM, Insulin treatment, Treatment inertia

Posted Date: November 16th, 2021

DOI: https://doi.org/10.21203/rs.3.rs-1064545/v1

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Abstract

Background

As type 2 DM is a growing health problem worldwide early treatment and intensification of therapy will decrease the vascular complications as evidenced by large trials. Insulin therapy is delayed in this group of patients and multiple physician and patient factors are mentioned in different settings.

Methods

This study is a cross-sectional, quantitative descriptive study conducted on 221 patients at TASH endocrine clinic and 122 physicians working at TASH, residents visiting for detachment, and Yekatit 12 hospital. Conducted on Jul 1- Sep 30, 2020, G.C

Result

76% of physicians think taking insulin at the prescribed time is difficult while only 31.5% of patients think it's difficult. Hypoglycemia is one of the most fearful parts of having diabetes for 81.1% of patients on Insulin therapy. 87% of physicians and 76.6% of patients think insulin-treated diabetes controls life while. 56% of patients therapy know nothing about insulin therapy. 23% of patients said they will not accept insulin therapy the top reason being they will be afraid of insulin injection because they think it will be painful.

Conclusion

Physicians tend to overestimate the difficulty of insulin injection preparation and dose adjustment fears the risk of hypoglycemia when starting insulin therapy. More than half of our patients not on insulin therapy know nothing about insulin therapy which we have to improve. Even if patients not on insulin therapy overestimate insulin needle phobia and injection pain those who are already on insulin disagree with them.

Background

1.1 Introduction

Diabetes mellitus is a group of metabolic disorders characterized by abnormal glucose, fat, and protein metabolism. The defining feature of diabetes is hyperglycemia which leads to acute complications like DKA, HHS, or chronic micro-and macrovascular complications like nephropathy, neuropathy, retinopathy, cardiovascular diseases. Diabetes occurs due to an absolute or relative deficiency of insulin secretion along with a varying degree of peripheral resistance to insulin action.[1–4]
Globally the prevalence of diabetes reached 463 million in 2019 and this is estimated to reach 578 million by the year 2030 and 700 million in 2045.[5] Around 4 million deaths were caused by diabetes in the year 2012 and this includes 1.5 Million deaths related directly to diabetes and additional 2.2 million deaths due to complications related to diabetes (cardiovascular disease, chronic kidney disease, and tuberculosis) in 2012. In Africa, the total number of adults with diabetes is 19.4 million from those 1.7 million are Ethiopians.[6, 7] Previous studies have shown that the prevalence of diabetes in Ethiopia is around 6.5% in urban areas and 1.9% in a rural setting.[8, 9] A recent STEPS survey done by the Ministry of Health has found a prevalence of 3.2%.[10]

According to the WHO 2019 classification of diabetes, it is classified as Type 1 which is mainly immune-mediated β-cell destruction, Type 2 which is characterized by impaired insulin secretion with peripheral insulin resistance, Hybrid type which has both features of type 1 and types 2, Other Specific types, Unclassified which is a temporary classification until we do the investigations and observe the clinical course and hyperglycemia first detected during pregnancy.[1]

Type 2 Diabetes is the most common type accounting for around 90% of the cases.[11, 12] The proportion of patients with Type 2 DM which is undiagnosed varies from 24-62% across regions in the world.[7] Of all patients with Type 2 DM, 40% of the patients are asymptomatic during diagnosis and from those asymptomatic patients, 32% of them will have a microvascular complication at the time of diagnosis.[8]

As patients with type 2 diabetes are mostly asymptomatic during diagnosis and around 32% of them already have a microvascular complication during diagnosis achieving good glycemic control has shown significant benefit in different large clinical trials. The UKPDS trial showed significant benefit (12% reduction) in terms of diabetes-related endpoints (sudden death, death from hyperglycemia or hypoglycemia, fatal or non-fatal myocardial infarction, angina, heart failure, stroke, renal failure, amputation [of at least one digit], vitreous hemorrhage, retinopathy requiring photococoagulation, blindness in one eye, or cataract extraction); diabetes-related death (death from myocardial infarction, stroke, peripheral vascular disease, renal disease, hyperglycemia or hypoglycemia, and sudden death); all-cause mortality from an intensive glycemic control group and most of this benefit come from a reduction of microvascular complication by 25% and there was a borderline statically significant benefit in reducing Macrovascular complications. This was also proven in the long-term follow-up of these patients.[13, 14] In the Kumamoto study type 2 diabetic patients assigned to the intensive glycemic control group were shown to benefit from the treatment and lower incidence and progression of retinopathy and nephropathy were documented after 6 years of treatment.[15]

The ADVANCE trial in patients with intensive glycemic control (HgA1C -6.5%) has shown a 10% reduction in the combined outcome of macrovascular as well as microvascular events mainly due to a 21% relative reduction in nephropathy. In the ACCORD trial which relatively involved patients with long-standing Type 2 DM, there was a reduction of microvascular complications like retinopathy, nephropathy. But there was increased cardiovascular mortality in the intensive arm and the study was discontinued early.[16–18]
The VADT trial was performed to define the benefit of intensive glycemic control in patients with poorly controlled long-standing Type 2 DM with a mean duration of 11.5 years after diagnosis with 40% of the patients already with cardiovascular events. There was no difference in the occurrence of cardiovascular events between the intensive and conventional treatment groups.[19]

Target HgA1C levels in Type 2DM patients should be individualized according to the patient life expectancy, the already developed micro and macrovascular complications. Generally, the target HgA1C level is <7%. However, in those patients with long-standing diabetes with complications, elderly, children, comorbidity, and those with recurrent hypoglycemia and difficult to control diabetes despite appropriate therapy including insulin the less stringent target (<8%) is appropriate.[20]

The treatment of Type 2 DM starts with diabetes education, lifestyle measure, and prevention of microvascular and cardiovascular complications, and avoidance of drugs that exacerbate micro and macrovascular complications. The first-line pharmacologic treatment is Metformin unless contraindicated. The other treatments depend on whether there are established cardiovascular diseases or not, HF or CKD. If ASCVD or CKD predominates the preferred management will be GLP-1 RA or SGLT2i with proven CV benefit and should be started if the eGFR allows. If the priority is weight loss and Metformin is the first-line therapy and if still, the HgA1C is high, the addition of SGLT2i or GLP-1 RA or Addition of DPP-4 is possible. If cost is the major issue after we start the patient on metformin, we can add SU or TZD, and if still there is high HgA1C we can add basal insulin. For patients with HgA1C >10% or 2% above target HgA1C despite triple or dual therapy we have to consider to start the patients on injectable GLP-1 RA initially and if the HgA1C is still above the target we have to start the patients on basal insulin but if the patient has HgA1C >11% and has symptoms and evidence of catabolism like weight loss, polydipsia or polyuria we have to consider insulin as a first-line injectable. To avoid inertia we have to assess each patient every 03-06 months.[21–23]

Eventually, many patients with Type 2 DM will require insulin therapy; so, we have to educate all patients about the possibility of the need for insulin therapy and we have to counsel them not to consider it as a personal failure.

1.2 Literature review

Type 2 Diabetes is a group of metabolic disorders characterized by insulin resistance and progressive absolute insulin deficiency due to β-cell depletion over the years. Insulin could be used as initial therapy in patients with severe hyperglycemia at presentation and with catabolic features, patients with difficulty to differentiate the type of diabetes, or after oral hypoglycemic therapy failed to control hyperglycemia. [21] [24]

Achieving tight glycemic control as early as possible after the diagnosis of type 2 DM has shown to be beneficial in preventing microvascular as well as macrovascular complications as shown in the UKPDS study.[13] Despite this evidences, there is significant clinical inertia on initiating and intensifying oral medication as well as initiating insulin therapy when indicated.[25]
As we go through works of literature there are multiple reasons quoted by the physicians as well as by patients for not initiating or accepting insulin therapy.[26] GAAP study is a multi-centered survey conducted in 8 countries. Most physicians on this survey report that many insulin-treated patients do not have adequate glucose control (87.6%) and they would have treated aggressively if not for the fear of hypoglycemia. The majority of patients and/or physicians regard insulin treatment as restrictive, more patients see insulin treatment as positive than negative impact on their lives. [27] Another international survey DAWN study involving 13 countries showed patients and provider attitudes about insulin therapy differ significantly. Patients rate the clinical efficacy of insulin as low and blame themselves if they had to start insulin. Patients who are not managing their diabetes well consider insulin therapy as beneficial. Most nurses and general practitioners (50–55%) delay insulin therapy until necessary, but specialists and opinion leaders are less likely to do so.[28]

The DIPP FACTOR, a prospective observational study done in Korea shows patients’ related factors for delay in insulin initiation included older age, shorter duration of diabetes, and lower HgA1C. Physicians related factors included age between 50-60, women sex, and the number of patients consulted per month <1000 especially patient's refusal (33.6%) and physician's concern of patient's noncompliance (26.5%) were the major physician reported reason for delaying insulin therapy. The inconvenience of insulin therapy (51.6%) and fear of injection (48.2%) were the major reason for the patient’s refusal.[29]

Patients from China gave the following reason for resisting insulin therapy: inconvenience (64.3%); concerns over addiction (24.6%); pain (14.3%); side effects (14.1%); and high cost (13.6%).[30] In a study done at Turkish primary care, most patients (57.4%) considered that insulin was a drug of last resort; 34% thought that insulin lowered blood glucose level to an extreme degree and 14.9% disagreed. 27.6% of them thought self-injection was hard, another 27.6% required someone else to administer the injection, 33% say insulin injection was painful.[31]

According to a Caribbean study done in Trinidad, factors that delay insulin therapy included limited knowledge concerning insulin therapy, failure to conduct a regular and routine assessment of HgA1C values, perception of insulin being painful, fear of needle, hypoglycemia, weight gain, scaring at the injection site and embarrassment were specific barriers.[32]

A study from Kenya on psychological resistance to insulin in type 2 DM patients showed a prevalence of 82.6% and those who were already on insulin therapy have lesser psychological resistance compared to the non-insulin users.[33]

In Ethiopia in a study done at TASH majority of patients with type 2 DM have uncontrolled fasting glucose level and the factors which are significantly associated with poor glycemic control were longer duration of diabetes (AOR = 2.72 95%CI:1.16–6.32), and being on insulin therapy (AOR = 3.01 95% CI: 1.5–5.9).[34] There is no data for Ethiopia regarding patient's and physician's attitudes and knowledge in starting insulin in Type 2 diabetes.
Significance Of The Study

As discussed in the aforementioned introduction and literature review, type 2 diabetes is becoming a major health care burden in the world as well as in Ethiopia and it continues to increase in the coming years as estimated by IDF. Early treatment and prevention of complications are some of the areas where countries that are struggling economically like ours should focus on. Because of the financial as well as health care system strains that we have, the management of micro and macrovascular complications will be difficult.

As most of our patients with Type 2 Diabetes have poor glycemic control and insulin is an affordable injectable medication in our setup knowing the attitude, practice, and knowledge of patients and physicians and intervening based on the result will be a good solution for improving diabetes care of patients with uncontrolled hyperglycemia. This study involves residents, GPs and Internists, and patients from TASH and Yekatit 12 Hospital and visiting residents for detachment at TASH. As there is no data for our setup this will be a good starting point to have an idea about physician and patient’s knowledge, practice, and attitude about insulin therapy.

Method

3.1 Objectives

3.1.1 General objective

- To assess physicians and patient’s knowledge, practice, and attitude towards insulin therapy in Type 2 DM patients

3.1.2 Specific Objectives

- To assess the knowledge of physicians treating T2DM patient about insulin therapy
- To describe barriers for initiating insulin therapy in patients with indications
- To Asses practice of insulin therapy in Type 2 DM patients among patients and physicians
- To assess the patient’s knowledge about insulin therapy

3.2. Study Area

The study was conducted on T2DM patients in TASH endocrine clinic and Residents, GP, Internists at TASH, Yekatit 12 hospital, Zewditu hospital, Mizan Tepi University, Debrebrhan university, Ras Desta Hospital, Jimma university medical center, Dilla university referral hospital, Adama medical college Arsi University, and St. Paul millennium medical college were who gave consent was involved.

3.3. Study design
This study is a cross-sectional, quantitative descriptive study

**3.4. Study Period**

The study was conducted from July-1 to September-30, 2020

**3.5. Source population**

T2DM patients attending Endocrine clinic at TASH and Internal medicine residents at TASH and those visiting residents for detachment from other universities, Internists, and General practitioners working at Yekatit 12 hospital, Ras Desta hospital, Debrebrhan hospital, Dilla university hospital, Mizan tepi Hospital.

**3.5.1. Sampling Methods**

All General Internists, all residents, and General practitioners working in the Diabetic clinic who consented filled the online survey tool was included.

The sample size for the patients was calculated with the following formula: assuming 95% CI and P=0.82 taking the 82% psychological resistance reported in the Kenyan study.

\[
n = \frac{Z^2 \times (p) \times (1-p)}{d^2} = \frac{1.96^2 \times 0.82 \times (1-0.82)}{0.05^2} = 221
\]

**3.5.2. Sample size**

A total of 122 physician and 221 patient was interviewed by convenient sampling from those interviewed patients 110 T2DM patients were not on Insulin therapy and 111 on insulin therapy were interviewed using a structured questionnaire.

**3.6 Inclusion and exclusion criteria**

**3.6.1. Inclusion criteria**

- All Internists, internal medicine residents, and general practitioners who gave consent for the study working at the Diabetes clinic in TASH, Yekatit 12, Zewditu Hospital and visiting residents for detachment from other university hospitals in TASH
- T2DM patients on follow up at TASH diabetes clinic

**3.6.2. Exclusion criteria**

- All patients and physicians who will not provide informed consent
- Those patients with no record of HgA1C in the past 03-06 month

**3.7. Study variables**
3.7.1. Independent variables

- Age
- Gender
- Level of practice
- Year of experience
- Number of patients with Type 2 DM which have been seen each month on average

3.7.2. Dependent variables

- Knowledge about insulin therapy in Type 2 DM patients
- Attitude about insulin therapy in type 2 DM patients
- The practice of insulin therapy in type 2 DM patients

3.8. Data collection

Data collection was conducted using a structured questionnaire prepared for the patients (separate questionnaire prepared for patients on insulin therapy and those not started insulin yet) by the main investigator and nurses at the diabetic clinic. The physician's questionnaire was sent to them via e-mail and telegram individually using google forms separately by the main investigator. The questionnaires were pretested on 10 patients and 10 residents.

3.9. Data quality assurance

The quality of the data was assured by a daily on-site visit and checking for completeness of data by the main investigator and the online survey was sent by the investigator.

3.10. Data management and analysis

After checking the data quality by the principal investigator, the data entry was done to MS. Excel 2019 for data cleaning and coding then exported to Statistical Package for Social Sciences (SPSS) Version 26 for analysis.

Result

A total of 224 patients was interviewed using a structured questionnaire and 221 were selected and 3 were discarded for incomplete data. A total of 122 Physicians who consented to the online survey was included in the study.

4.1. Characteristics of the participants

A total of 122 physicians 111 patients on insulin therapy and 110 patients not on insulin therapy were involved. (Table:1) Physician Mean age 28.9±2.4 years and 71.3% of them are males. 77.9% of them were
internal medicine residents and 12.3% were General practitioners; one endocrinologist and one endocrine fellow were also involved. Of all physicians, 56.6% had an experience of 3-5 years. The average number of patients seen per month was a median of 15.
|                          | Patients on Insulin Therapy (n=111) | Patients not on insulin therapy (n=110) |
|--------------------------|-------------------------------------|----------------------------------------|
| **Age (mean, SD)**       | 54.5 ± 11.3                         | 55.18 ± 11.9                           |
| **Sex**                  | Female 73 (65.8%)                   | 61 (55.5%)                             |
| **Residence**            | Urban -96.4%                        | Urban -97.3%                           |
|                          | Rural -3.6%                         | Rural -2.7%                            |
| **Level of Education**   | Illiterate-10 (9%)                  | Illiterate-7 (6.4%)                    |
|                          | Primary education-16 (14.4%)        | Primary education-24 (21.8%)           |
|                          | Secondary Education-53 (47.7%)      | Secondary Education-31 (28.2%)         |
|                          | Tertiary Education-28 (25.2%)       | Tertiary Education-35 (31.8%)          |
|                          | Advanced Degree-4 (3.6%)            | Advanced Degree-13 (11.8%)             |
| **Duration of diabetes in Years** | 14.9 ± 9.1                         | 7.45 ± 5.6                             |
| **Last HgA1C**           | 8.84% ± 2.08%                      | 8.02% ± 2.07%                         |
| **Percentage of patients who remember their last HgA1C** | 70.3%                              | 70.9%                                  |

**Physicians (n=122)**

|                          |                                    |
|--------------------------|-------------------------------------|
| **Age (mean, SD)**       | 28.9 ± 2.4                          |
| **Sex n (%)**            | Male-87 (71.3%)                     |
| **Level of practice**    | Endocrinologist-1 (0.8%)           |
|                          | Endocrine fellow-1 (0.8%)          |
|                          | Internist-10 (8.2%)                 |
|                          | Internal medicine resident-95 (77.9%) |
|                          | General practitioner-15 (12.3%)    |
Patients on Insulin Therapy (n=111) | Patients not on insulin therapy (n=110)
---|---
**Year of experience** | **Year of experience**
1-12 months-12 (9.8%) | 1-12 months-12 (9.8%)
1-2 years-31 (25.4%) | 1-2 years-31 (25.4%)
3-5 years-69 (56.6%) | 3-5 years-69 (56.6%)
>5 Years-10 (8.2%) | >5 Years-10 (8.2%)

**Average no of T2DM Patients seen/month (median)** | 15
| 1.TASH-89 (73.3%) |
| 2, Yekatit 12-6 (4.9%) |
| 3, Dilla University referral hospital-9 (7.4%) |
| 4, Other-18 (14.8%) |

(Table:1) The mean age of patients was 54.5±11.3 and 55.18 ± 11.9 years for those on insulin therapy and not on insulin respectively. The majority of patients were females 65.8% and 55.5% for those on insulin therapy and not on insulin respectively. The duration of diabetes is 14.9±9.1 years for those on insulin therapy currently and 7.45±5.6 years for those not on insulin therapy.

(Fig:1) The HgA1c was mean of 8.8 for those on insulin and 8.02 for those not on insulin therapy which is not statically significant (p=0.205(person correlation test))

**5.2. Physician and patient’s perception and reason for non-adherence to insulin therapy**

Seventy-six percent of physicians think taking insulin at a prescribed time is difficult while only 31.5% of patients think it’s very difficult or somewhat difficult. Physicians think measuring blood glucose routinely is difficult at 88.5%. Ninety-six percent of physicians wish to have an insulin treatment that would cover patients in case they forget a dose and 89.2% of patients wish the insulin regimen that would fit daily life changes. (Table:2)

Experiencing low blood glucose events is one of the most fearful parts of having diabetes for 81.1% of patients on Insulin therapy. Eighty-seven percent of physicians think insulin-treated diabetes takes control of life, but 76.6% of patients agree with them. Sixty percent of physicians think it is hard to live a normal life while managing diabetes and 66.6% of patients agree with them.
Table 2
; Patient and physician perceptions of insulin treatment

| Categories                                           | Patient | Physicians |
|------------------------------------------------------|---------|------------|
| Patient difficulties#                                 | 31.5%   | 76.2%      |
| Taking insulin at the prescribed time or with meals every day | 32.4%   | 73.7%      |
| Number of daily injections                            | 14.4%   | 68%        |
| Following the physician’s instructions                | 15.3%   | 54.1%      |
| Preparing injections                                  | 21.6%   | NA         |
| Adjusting insulin dose                                | 20.7%   | 88.5%      |
| Measuring blood glucose routinely                     | NA      | 87.7%      |
| Changing the time of insulin to meet daily needs      |         |            |

| Opinion§                                              |         |            |
| I would treat my patients’ diabetes more aggressively if there was no concern over hypoglycemic events | NA      | 82%        |
| I feel like I have to choose between efficacy and safety when treating diabetes patients with insulin | 83.8%   | NA         |
| Wish there was an insulin treatment that would cover patients in case they forget a dose | 89.2%   | NA         |
| Wish for good control with insulin that does not need to be injected every day | 81.1%   | 87.7%      |
| Wish the insulin regimen would fit daily life changes | 76.6%   | 59.9%      |
| Experiencing low blood glucose events is one of the most fearful parts of having diabetes | 66.6%   |            |
| Insulin-treated diabetes controls life                |         |            |
| Hard to live a normal life while managing diabetes    |         |            |

# -Very difficult and somewhat difficult §-strongly agree or somewhat agree

Being too busy, traveling, or changing normal routine and embarrassing to inject in public was the top 3 reasons for the omission of insulin doses mentioned by patients. The top 3 reasons mentioned by physicians as a possible cause of non-adherence of insulin therapy is Traveling and changing normal routine, forgetting to take insulin during traveling. (Table:3)
Table 3
; Reason for not taking insulin

| Reasons                                | Patients % Rank | Physicians % Rank |
|----------------------------------------|-----------------|-------------------|
| Too busy                               | 33.3% 1         | 13.9% 8           |
| Forgot                                 | 19.0% 4         | 39.3% 3           |
| Challenging to take insulin at the same time every day | —               | 39.3% 3           |
| Fall asleep                            | 19.0% 4         | 8.1% 10           |
| Skipped Meal                           | 9.5% 5          | 36% 4             |
| Embarrassing to inject in public       | 23.8% 3         | 25.4% 6           |
| Traveling or changing normal routine   | 28.5% 2         | 44.2% 1           |
| Did not take insulin out/forgot to take it while traveling | —               | 40.1% 2           |
| The regimen is to complicated          | 9.5% 5          | 7.3% 11           |
| Injection are painful                  | —               | 14.7% 7           |
| Stress or emotional problems           | 19.0% 4         | 30.3% 5           |
| Avoid weight gain                      | —               | 9.0% 9            |
| Other                                  | —               | 5.7% 12           |

Almost all patients use insulin syringes to administer insulin and the mean duration of insulin therapy was $9.44 \pm 7.87$ years. Eighty-eight percent of patients inject two times daily and 95% of them said they are content with the current insulin strategy. Seventy-four percent of patients receive the treatment for free and 96.3% of them reported insulin is expensive whenever they have to buy it. (Table 4) Nineteen percent of patients admitted they missed insulin doses sometimes and 62.3% of physicians think their typical patient may have missed insulin injections.

Fifty-six percent of patients think their diabetes is mostly under control and only 2.7% of patients think their diabetes is under control. Eighty-seven percent of physicians think a significant number of diabetes patients are still not reaching target HbA1c adequate blood glucose levels with insulin treatment.
Table 4
Insulin usage practice in patient on insulin therapy

| Insulin Usage experience                  | Response          |
|------------------------------------------|-------------------|
| Insulin administering device             | Syringe-110(99.1%)|
|                                          | Pen-1(0.9%)       |
| Duration of insulin therapy in years     | 9.44 ± 7.87       |
| Number injection per day                 | 1 injection-13(11.7%)|
|                                          | 2 injections-98(88.3%)|
| The convenience of the current insulin strategy | Yes-95(86.4%)   |
|                                          | NO-15(13.6%)      |
| Self-administration of insulin           | Yes-96(86.5%)     |
|                                          | No-15(13.5%)      |
| Pain during injection                    | Never-55(49.5%)   |
|                                          | Sometimes-53(47.7%)|
|                                          | Most times-3(2.7%)|
| Receive insulin for free                 | Yes-74.8%         |
| Is it costly when you have to buy insulin| Yes-96.3%         |
| Have you ever missed your insulin?       | Yes-21(18.9%)     |
|                                          | No-90(81.1%)      |

5.3. Knowledge and Perception of patients not on insulin therapy

Fifty-six percent of patients in our clinic not started on insulin therapy know nothing about insulin therapy and 50.9% of patients want more communication from their doctors about insulin therapy. (Table 5)
Table 5
knowledge about Insulin therapy in non-insulin treated T2DM patient

|                                           | Yes Count | Row N % | No Count | Row N % | Don't know Count | Row N % |
|-------------------------------------------|-----------|---------|----------|---------|------------------|---------|
| If your doctor ever recommended insulin   | 75        | 68.2%   | 26       | 23.6%   | 9                | 8.2     |
| therapy to better control your diabetes   |           |         |          |         |                  |         |
| would you take it?                         |           |         |          |         |                  |         |
| Have you ever felt the need for more      | 56        | 50.9%   | 54       | 49.1%   |                  |         |
| communication from your doctor about      |           |         |          |         |                  |         |
| insulin therapy?                          |           |         |          |         |                  |         |

How much do you know about insulin

| Frequency | Valid Percent |
|-----------|---------------|
| A great deal | 13        | 11.8 |
| Some       | 10           | 9.1  |
| Little     | 25           | 22.7 |
| Nothing    | 62           | 56.4 |

Twenty-three percent of patients said they will not accept insulin therapy if insulin is recommended by their treating physicians the top reasons, they mentioned are they will be afraid of insulin injection because they think it will be painful. 38.4% of patients fear passing out due to low blood sugar.

5.4. Knowledge and practice of physicians

There was a statistically significant difference between Internists, Internal medicine residents on the frequency of HgA1C follow-up and agreement on a significant number of patients, not achieving target HgA1C. Sixty percent of Internists wait for>6 months to intensify treatment if patients are not achieving target HgA1C while 41.1% of internal medicine residents and 60% of General practitioners intensify therapy within 3 months.
|                                | Internist (n=10) | Internal medicine resident (n=95) | GP (n=15) | P-value# |
|--------------------------------|-----------------|----------------------------------|-----------|----------|
| Target HgA1C                  | 0               | 17.9%                            | 20%       | 0.346    |
| HgA1C<6.5                     | 100%            | 80.0%                            | 73.3%     |          |
| HgA1C<7                       | 0               | 2.1%                             | 6.7%      |          |
| HgA1C<8.5                     |                 |                                  |           |          |
| How long do you wait to start insulin if HgA1C is off-target? |                 |                                  |           |          |
| <3 month                      | 40%             | 11.6%                            | 6.7%      | 0.205    |
| 3-6 month                     | 50%             | 71.6%                            | 66.7%     |          |
| 1-2 year                      | 10%             | 12.6%                            | 26.7%     |          |
| 6 month-1 year                | 0               | 4.2%                             | 0         |          |
| How frequently do you follow the HgA1c level? |                 |                                  |           | 0.013    |
| Every 3 month                 | 30%             | 40%                              | 40.0%     |          |
| 3-6 month                     | 20%             | 43.2%                            | 13.3%     |          |
| Every 6 month                 | 50%             | 16.8%                            | 46.7%     |          |
| A significant number of patients are off-target glycemic control |                 |                                  |           | 0.048    |
| Agree                         | 90%             | 90.5%                            | 66.7%     |          |
| Disagree                      | 10%             | 9.5%                             | 33.3%     |          |

# Fishers exact test
Fifty-five percent of physicians said they will mention insulin therapy at the time of diagnosis and 45.6% of them mention it at the time of intensifying oral treatment.

Only 81.2% of physicians start the patients on insulin therapy at the time of diagnosis if HgA1C >10% and 90.9% of them will start the patient on treatment if HgA1C is above target despite dual or triple therapy.

**Discussion**

In this study, we tried to show differences in perception between patients and physicians about insulin therapy. There is no significant difference between those taking insulin and those not on insulin therapy on the HgA1C level which shows treatment is not being intensified timely in study patients. Although more than half of physicians think preparing injection is difficult for patients but only 15.3% of patients agree with them and this is comparable to The GAAP study in which only 10.3% of patients reported difficulty. Only 21.6% of patients said it's difficult to adjust the insulin dose; on the GAAP survey, 16.8% of them reported difficulty which will make it easier to recommend adjusting insulin dose according to their requirement.[27]

The majority (88.5%) of our physicians feel they have to choose between efficacy and safety when they treat diabetes with insulin and which is higher compared to Japanese physicians involved in the GAAP study which was 62%. This is probably due to the lesser availability of self-blood glucose monitoring in our setup.[35]

Most of our patients and physicians agree on a wish for possible insulin regimen that would cover if patients forget to take a dose or fits daily life which was 96.7% of physicians and 83.8% patients which are comparable to the GAAP study 92.5% and 91.2% for patient and physicians respectively.[27]

Compared to the patients on the GAAP study more patients in our setting said it is hard to live a normal life while managing diabetes 66.6% Vs 54.4%. [27] this could be 96.3% of them said it's expensive for them to buy insulin. In the Kenyan study, 46.1% of patients feel insulin management will make life less flexible.[33]
Nineteen percent of patients admitted they missed insulin doses sometimes which is lesser than the GAAP study participants which were 33.2%, and 62.3% of physicians think their typical patient may have missed insulin injections which is still lesser than the physicians in the GAAP study 72.5%. The top reason mentioned by patients for the omission of insulin dose is being too busy both on the GAAP and our patients. Traveling was the second most common reason reported by both patients and physicians in our setting as well as in the GAAP study.[27]

When we see our patients not yet started on insulin therapy compared to the Trinidad study more than half of the 56.4% Vs 38% of patients admitted know nothing about insulin and 22.7% Vs 34.1% know a little about insulin therapy [32]which shows a great knowledge gap in our patients compared to our physicians reported only 54.7% of them to mention about insulin therapy at the time of diagnosis of T2DM.

More than half of our patients not on insulin therapy want more communication about insulin therapy from their physicians and 43.6% of them reported their physicians have recommended them insulin therapy to better control their diabetes which is greater than the patients in Trinidad which were 15%. When our patients were asked if they would take insulin if recommended by their doctor, 68.2% of them said they will take it which is better than the Trinidad study which was 54.6%, and even if it’s not directly comparable 82.7% of Kenyan patients has Psychological resistance to insulin therapy.[32][33]

The two top reasons for refusing insulin therapy by patients, not on insulin therapy is fear of insulin needles (79.6%) and possible pain during injection 46.1% of patients which is higher than Trinidad patients reported 54% and 56% respectively.[32] However, half of our insulin-treated patients reported they have never felt pain during injection.

There is no statistically significant difference between Internists, internal medicine residents, and GPs on the target HgA1C, delay to initiate insulin if HgA1C is off-target, intensification of therapy, and agreement on patients may fail to take insulin as prescribed. But there was a statically significant difference in the frequency of HgA1C follow-up in which 50% of internists and 46.7% of GPs want to follow HgA1C every 6 months while 43.2% of residents want to follow every 03-06 months which is in line with the ADA 2020 recommendation.[22] The other area which shows a significant discrepancy between physicians is the significant number of patients has off-target HgA1C where 33.3% of GPs tend not to agree with this opinion but 90% of our internists and 90.5% of our Residents agree on this idea which is in line with the Japanese patients on GAAP study.[35]

Most of our physicians mention insulin therapy at the time of diagnosis or during the intensification of oral therapy. Despite ADA 2020 guideline recommendation to start patients on insulin therapy for patients with evidence of catabolism only 50.8% of our physicians start these patients on insulin therapy, for those with HgA1C >10% at diagnosis only 55.7% of our physicians start these patients on insulin therapy, for patients with difficult to differentiate between type 1 and type 2 DM 81.2% of our physicians start these patients on insulin therapy and for patients with HgA1C above target despite dual or triple oral therapy 90.9% of our physicians start these patients on insulin therapy.[22]
Limitation of the study

The study participant patients are from single-center which may not be representative of the whole diabetic population in our country. The number of physicians involved in the study is small and we need a survey involving more internists and General practitioners in the future.

Conclusion

Most of our patients both in the insulin group and those not on insulin have poor glycemic control. Physicians tend to overestimate the difficulty of insulin injection preparation and dose adjustment fears the risk of hypoglycemia when starting insulin therapy. More than half of our patients not on insulin therapy know nothing about insulin therapy which we have to improve. Even if patients not on insulin therapy overestimate insulin needle phobia and injection pain those who are already on insulin disagree with them.

Recommendation

We need to educate our patients more about insulin therapy and possibly create a forum for patient-to-patient education on our diabetes follow up clinics

We need a continuous medical education forum on updated guidelines and treatment recommendations possibly online with GPs and Internists working out of teaching centers.

Abbreviations

**DM** - Diabetes Mellitus

**WHO** - World Health Organization

**HHS** - Hyperglycemic Hyperosmolar State

**DKA** - Diabetic Ketoacidosis

**ASCVD** - Atherosclerotic Cardiovascular Diseases

**CKD** - chronic kidney disease

**TASH** - Tikur Anbesa Specialized Hospital

**eGFR** - Estimated Glomerular Filtration

**SGLT2i** - Sodium-Glucose Transporter 2 Inhibitor

**GLP-1 RA** - Glucagon-Like Peptide-1 – Receptor Agonist
Declarations

11.1. Ethics approval and consent to participate

The protocol approvals are obtained from the ethical review committee of the Department of Internal Medicine. Written informed consent to participate in the study was obtained from all the participants and all the participants were adults.

11.2. Consent for publication

Not applicable. No person's details, images, or videos are being used in this study.

11.3. Availability of data and materials

The datasets analyzed during the current study are available from the corresponding author on reasonable request.

11.4. Competing interests

The authors declare that they have no competing interests.

11.5. Funding

The only funder for the study was Addis Ababa University. The funding body did not have any role in study design, data collection, and data analysis, interpretation of data, or in writing the manuscript.

11.6. Authors Contribution

All the stated authors are equally involved in the study together with the corresponding author. All authors read and approved this manuscript.

11.7. Acknowledgment

We would like to express our deepest gratitude, Endocrine unit nurses of Tekur Anbesa hospital, Our Patients and physicians participated on the study and We would like to thank the Department of Internal medicine and Addis Ababa University for the funding and support.
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**Figures**

**Figure 1**
Mean HgA1c of patients on insulin therapy and Not on Insulin

**Figure 2:** Reason for not accepting insulin therapy when recommended by physicians

| Reason                                         | Percentage |
|------------------------------------------------|------------|
| Would you be afraid of insulin needle injection | 76.9       |
| Do you think insulin injections would be painful | 46.1       |
| Would you feel embarrassed by taking an insulin... | 42.3       |
| Passing out (coma)                             | 38.4       |
| Low sugar                                      | 34.6       |
| Do you think it would be difficult to control your... | 34.6       |
| Scarring around injection sites                | 26.9       |
| Do you think insulin therapy is expensive      | 26.9       |
| Weight Gain                                    | 23         |
| Do you feel that taking insulin injections would be... | 23         |
| Do you think your glucose level would be better... | 23         |
| Shorter life                                   | 0.3        |

**Figure 2**

See image above for figure legend.

**Figure 3:** Physicians response to when they mention about insulin therapy to T2DM patients

| Event                                | Valid Percent | Frequency |
|--------------------------------------|---------------|-----------|
| When you begin treatment with insulin | 14.7          | 55        |
| When prescribing an injectable treatment... | 6.5           | 56        |
| At the time of intensifying oral treatment | 13.1          | 54.9      |
| When prescribing the first treatment  | 16            | 57        |
| At the time of diagnosis of diabetes  | 67            |           |

**Figure 3**

See image above for figure legend.
Figure 4: Indication for starting Insulin

See image above for figure legend.

Figure 4