

# The Implementation of Diet in Diabetic Versus Pre-Diabetic Patients in Long Term Texas Facilities

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## ABSTRACT

Diabetes Mellitus and Pre-Diabetes Mellitus are two of the fastest growing diseases in the world (Toft 1). While extensive research has been done regarding dietary regulations in Diabetics, there is a lack of pre-existing research addressing diet regulations in Pre-diabetics. Considering diet plays a crucial role in the recovery process of these patients, the scarcity of information regarding diet regulation in Pre-Diabetics is quite alarming. Thus, this study focuses on examining the implementation of diet in Diabetic versus Pre-diabetic patients in long term Texas Facilities. To assess the adherence to the CDC's Recommended Dietary Allowances, 12 long term Texas facilities participated in one or more of the following 3 methods: a quantitative questionnaire, qualitative interviews, and both a quantitative and qualitative dietary menu analysis. The results concluded that the extent to which the CDC'S recommended dietary allowances are implemented in the diet of Pre-diabetic patients in Texas facilities is much less efficient than in diabetics due to leniency of dietary regulation, granting of dietary requests, longer monitoring intervals, and lack of priority towards educating the patient on dietary restrictions in Pre-diabetics.

## Introduction

According to the Centers for Disease Control and Prevention (CDC), Diabetes Mellitus is one of the top 10 leading causes of death in the world. In 2023, an estimated 415 Million people worldwide will live with diagnosed diabetes (CDC). Of those numbers, the United States itself accounts for 37.3 million diabetics, equating 8.98% of the world's diabetic population (American Diabetes Association). The term Diabetes Mellitus (DM) is derived from "the Greek word diabetes, meaning siphon - to pass through and the Latin word mellitus meaning sweet" (Sapra 1). This is because diabetes is when excess sugar is found in the blood and urine. In medical terms today, Diabetes mellitus is defined as "a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both" (American Diabetes Association).

In some cases, when the body's blood glucose levels are higher than normal but not high enough to be diagnosed as diabetes, the term Pre-diabetes is used. Pre-diabetes (PreDM) usually occurs in people whose beta cells in their pancreas aren't making enough insulin to keep blood glucose in the normal range (National Institutes of Health). Over the past decade, the rates of Pre-Diabetics in the world have drastically increased. There are more than 96 million people aged 18 years or older who have prediabetes, and within the US alone, 38.0% of its adult population is diagnosed with Pre-Diabetes (CDC). To understand why many young Americans are becoming diabetic and pre-diabetic at such an alarming rate, several pre-existing studies have examined the factors that play into the endocrine disease.

## Gaps In Research

Two major long-term studies recognized by the University of John Hopkins as key studies in the understanding of Diabetes: "Da Qing IGT and Diabetes Study" conducted by Pan XR, and the "Diabetes Prevention Program Study" conducted by William C Knowler indicated that diet is a crucial variable in the recovery process of Diabetics and Pre-

Diabetics (Knowler 7). In fact, the importance of diet has been particularly emphasized in the Diabetic community, thus many hospitals that manage diabetics follow the CDC's Recommended Dietary Allowances or RDA's as a precaution when treating DM. However, while many Diabetic patients, specifically those who are hospitalized, practice the CDC's dietary restrictions strictly, it is unclear to what extent these RDA's are implemented in prediabetic patients, as no solid research has been done regarding the dietary regulations hospitals impose upon prediabetic patients. This has proven to be quite problematic as according to the National Institutes of Health, "around 5–10% of people with prediabetes become Diabetic annually" and "according to an ADA expert panel, up to 70% of these individuals will eventually develop Diabetes," despite being under medical supervision. This fact is what initiated the focus of this study, and eventually led to the question: To what extent are the CDC's Recommended Dietary Allowances implemented in the diet of Pre-Diabetic versus Diabetic patients within long term Texas facilities?

## Literature Review

Prior studies such as the NIDDK-sponsored Diabetes Prevention Program (DPP), investigate the importance of diet in the treatment of Diabetic patients. The DPP was a 15-year long term study conducted in the United States from 1987 to 2002 across 27 clinical centers. This study sampled 3,234 participants of different ethnicities to test whether lifestyle changes such as diet would delay or prevent Diabetes Mellitus. Participants followed the DPP Lifestyle Change Program, throughout the duration of the study, as controlled clinical trial subjects, and were monitored "16 times in the first 24 weeks, and then every 2 months with at least 1 phone call between visits" (NIH). Within the first 3 years, the data collected over the course of the study up to that point had shown researchers that the "DPP Lifestyle Change Program lowered their chances of developing Diabetes Mellitus by 58 percent" (NIH). These favorable results stayed consistent and "at the 10-year follow-up participants who took part in the DPP Lifestyle Change Program continued to have a delay in the development of diabetes by 34 percent—and developed diabetes about 4 years later compared with participants who took a placebo" (NIH). At the end of the 15-year duration of the study, researchers were able to conclude that with a consistent regulation of diet alongside other lifestyle changes, it is possible to delay the onset of Diabetes or even prevent the disease completely, thus proving that diet plays a crucial role in the recovery of these patients.

The idea of regulating diet later earned the term Medical nutrition therapy (MNT), in modern medicine, and enforces dietary regulation habits based on the results deduced from the DPP. The Journal "Diabetes Spectrum" published by the American Diabetes Association reiterates the results from the DPP study, and emphasizes the importance "of MNT during hospitalization, along with tighter medical management..." in order "...to help individuals with diabetes achieve blood glucose targets" (Swift 3). In fact, the importance of diet is specifically stressed in the Diabetic community, that the article mentions that although "clear guidelines and recommendations exist regarding MNT for diabetic patients"...and that hospitals are always looking for ways to better implement them in patients and avoid inconsistent nutrient intake (Swift 5). To better implement these regulations, the hospitals follow a series of steps such as nutrition screening and referral, assessment, monitoring, intervention and meal planning. These steps direct "a systematic problem-solving method that dietetics professionals use to critically think and make decisions to address nutrition-related problems and provide safe and effective quality nutrition care" (Pritchett 27). Furthermore, "the consistent carbohydrate meal plan is beginning to gain acceptance in hospitals" as both the CDC and ADA have advocated the benefits of the diet to facilities. In fact, the CDC has even created standard guidelines for Diabetics in regards to dietary regulation called the "CDC's National Diabetes Prevention Program." In other words, while extensive research and efforts have been put into implementing the best dietary regulations for Diabetic patients in hospitals, it is unclear whether these regulations are implemented to the same extent in hospitalized Pre-Diabetics.

The reason for the lack of strict dietary regulations in Pre-Diabetics is unclear. Although not many studies have been conducted to demonstrate the benefits of a good diet in Pre-Diabetics, the "DA QING IGT AND DIABETES STUDY" conducted by Pan XR and recognized as a key study in the understanding of Diabetes by the Johns

Hopkins University, alongside other minimal research proves that diet plays a significant role in preventing the onset of Diabetes in Pre-Diabetics or treating Pre-Diabetes as well. To elaborate, the Da Qing IGT and Diabetes study was conducted in 1986 in China with a total of 110,660 participants from 33 facilities. The purpose of this study was to determine whether dietary regulations in those who were Pre-Diabetic may develop or reduce risk of the onset of Diabetes. Participants were randomly placed in either of three groups: diet only, exercise only, or diet plus exercise. The results for the diet only group demonstrated a 31% ( $P < 0.03$ ) reduction in risk of developing Diabetes (Pan 2). Thus, concluding diet interventions cause a “significant decrease in the incidence of diabetes over a 6-year period among those with IGT (Pre-Diabetes)” (Pan 2).

Despite the research done in regards to dietary restrictions in Pre-Diabetics, due to a possible lack of several studies in regards to this topic, it is unclear whether hospitals implement any specific diet or enforce dietary restrictions such as the MNT or CDC’s RDA’s in Pre-Diabetics. To fill this gap in the literature, this study aims to understand the extent to which facilities implement dietary restrictions in Pre-Diabetics in comparison to Diabetics.

## Research Design and Methodology

### Study Design

This study focuses on understanding the extent to which the CDC’s RDA’s are implemented in Diabetic versus Pre-Diabetic patients. The goal of the research is to understand if there is a difference in the dietary regulations hospitals impose upon both types of patients, and if so, to understand why, in order to potentially decrease the onset of diabetes progression.

A three-part triangulation method design was used, incorporating a quantitative questionnaire, qualitative interviews, and both a quantitative and qualitative dietary menu analysis. This design provided unique insight into the topic at hand, as it permitted analyzing the data from many different aspects, as well as derive details pre-existing studies may have overlooked (e.g Diabetes Prevention Program Study)

To begin assessing the research question, a stratified random sampling method was used to sample 3 long term Texas facilities from each of the 4 regions in Texas, in order to fairly represent the parameter. It is important to note that children’s hospitals were avoided during the sampling process, as not only does this demographic of individuals require a deeper level analysis, due to the lack of sufficient information of dietary regulations in diabetics and pre-diabetics under 18, but also because a larger scale of varying factors may deter results if taken from a young population. Thus, during the sampling process, a total of 42 hospitals were contacted through the email stated on their website, and 27 hospitals were contacted through the phone number stated on their website. In the end, a total of 12 hospitals that were all contacted through email, agreed to participate.

These 12 facilities were then emailed a formally written request, outlining the purpose of the study, their willingness to participate, and confidentiality measures.

## Results

### Quantitative Results

The questionnaire (Appendix B) was completed by twelve facilities. Table 1 is an analysis of the frequency and percentage of criteria met/not met in total for all participating facilities per question regarding Diabetic patients. Table 2 is an analysis of the frequency and percentage of criteria met/not met in total for all participating facilities per question regarding Pre-diabetic patients. Provided with each question is the criteria needed to comply with the CDC’s recommendation. For example, to meet the criteria for question 4, the facility must restrict total carbohydrate intake to  $<130$

g/day, according to the CDC. Table 1 compiles the data in regards to Diabetic patients, whereas Table 2 compiles the data in regards to Pre-Diabetic patients.

**Table 1:** *Frequency and Percentage of Criteria Met/Not Met Per Question for Diabetic Patients (n=12)*

Question with Criteria calculated to meet recommendation according to the CDC	Met Criteria Frequency (%)	Did not meet Criteria Frequency (%)
1. How much carbohydrates do you provide in a day? Criteria = <130 g/day	12 (100)	0 (0)
2. How many non-starchy vegetables do you provide in a day? Criteria = 165g< and <275g	5 (41.67)	7 (58.33)
3. How much meat, fish, or poultry do you provide in a day? Criteria = >=85g	12 (100)	0 (0)
4. How much red meat, hamburgers, or meat products do you provide in a day? Criteria = <70g	10 (83.33)	2 (16.67)
5. How many nuts or pretzels do you provide per week? Criteria = >28g and <57g	10 (83.33)	2 (16.67)
6. How much fruit do you provide in a day? Criteria = 85g	8 (66.67)	4 (33.33)
7. How much whole grain do you provide in one day? Criteria = >110g and <165g	10 (83.33)	2 (16.67)
8. How many sweet or carbonated beverages do you provide per day? Criteria = <1	12 (100)	0 (0)

*Note. Total Frequency of Responses that Met the Criteria= 79, Total Frequency of Responses that Did not Meet Criteria= 17*

As shown in Table 1, for diabetic patients the total frequency of responses that met the criteria was 79, and total frequency of responses that did not meet the criteria was 17.

**Table 2:** *Frequency and Percentage of Criteria Met/Not Met Per Question for Pre-Diabetic Patients (n=12)*

Question with Criteria calculated to meet recommendation according to the CDC	Met Criteria Frequency (%)	Did not meet Criteria Frequency (%)
1. How much carbohydrates do you provide in a day? Criteria = <130 g/day	12 (100)	0 (0)
2. How many non-starchy vegetables do you provide in a day? Criteria = 165g< and <275g	10 (83.33)	2 (16.6)
3. How much meat, fish, or poultry do you provide in a day? Criteria = >=85g	2 (16.67)	10(83.33)
4. How much red meat, hamburgers, or meat products do you provide in a day? Criteria = <70g	2 (16.67)	10 (83.33)
5. How many nuts or pretzels do you provide per week? Criteria = >28g and <57g	2 (16.67)	10 (83.33)
6. How much fruit do you provide in a day? Criteria = <85g	3 (25)	9 (75)
7. How much whole grain do you provide in one day? Criteria = >110g and <165g	8 (66.67)	4 (33.33)
8. How many sweet or carbonated beverages do you provide per day? Criteria = <1	10 (83.33)	2 (16.67)

*Note. Total Frequency of Responses that Met the Criteria= 49, Total Frequency of Responses that Did not Meet Criteria= 47*

Whereas in Table 2, for Pre-diabetic patients, the total frequency of responses that met the criteria was 49, and total frequency of responses that did not meet criteria was 47.

Table 3 summarizes the results of Tables 1 and 2 amongst all the facilities. This table depicts the frequency and percentage of adherence to the CDC for Diabetic patients and Pre-Diabetic patients in the sampled facilities.

According to the scoring framework, the facilities demonstrate an 82.29:17.71 ratio of “did meet” to “did not meet” respectively in Diabetic patients, and a 51.04:48.96 of “did meet” to “did not meet” respectively in Pre-Diabetic patients.

**Table 3:** *Frequency and Percentage of Adherence to the CDC for Diabetic patients and Pre-Diabetic patients In Totality for All Facilities (n=12)*

Adherence to CDC	Met Ratio as (%)	Did not Meet Ratio as (%)
Diabetic Patients	82.29%	17.71%
Pre-Diabetic Patients	51.04%	48.96%

From a statistical point of view, a 50:50 ratio of outcomes that closely resembles the data from the Pre-Diabetic column implies that there are no external factors altering the data. In the case of this study, the ratio may imply that the sampled hospitals exhibit little to no regulation of dietary habits in Pre-diabetic patients, allowing them to choose their diet options at random.

The supplemental question provided the subjects with one open-ended question. The responses portray that all of the facilities that presented an answer for this question indicated that a “...consistent carb (60-90 gm carbs per meal) or regular/cardiac diet with no dessert (or sugar free desserts),” was provided to Diabetic patients, and “...food with high protein and low carbohydrate low fat diet” was provided to Pre-Diabetic patients. It is important to note that Facility C responded with “...N/A” in response to the supplemental question regarding Pre-Diabetic patients, possibly indicating that no specific diet is enforced upon Pre-Diabetic patients, yet responded that “...for discharge can educate on plate model method or carb counting” for Diabetic patients.

## Qualitative Results

### *Interviews*

The interviews were conducted both in person and through google meet; 3 out of 4 interviews were conducted through google meet, and one interview was conducted in person at Facility B. Here, it is important to note that no location bias was involved, as each facility was once again read the confidentiality measures emphasizing anonymity in the study.

The qualitative data from interviews were transcribed using the Miles and Huberman's (1994) iterative coding process. After four iterations of coding the transcripts, 4 final themes emerged as being the most prevalent: 1) Ingredients/Portion Control; 2) Consideration; 3) Correlations; 4) Deterring Factors.

### **Ingredients/Portion Control**

When posed with the question “briefly describe the main ingredients you incorporate into meals for Diabetic versus Pre-Diabetic residents,” all 4 of the interviewed facilities mentioned that Diabetic patients follow a Consistent Carb diet, restricting patients to “...get 45-60 grams at breakfast, lunch, and dinner, and 30 grams with their snack” (Facility B). In contrast to this, Facility K stated that Pre-Diabetic patients who have “never had a diet before may put on a low

carb or carb counting diet,” to begin with for precaution, however over time their diet may regress to “no concentrated sweets diet for patients that are prediabetic, or a regular diet with no dessert or sugar free with still some portion control” (Facility K). While all 4 facilities stated that portion control was a closely monitored factor for both Diabetics and Pre-Diabetic, Facility B mentioned that Pre-Diabetic “...may get more juice than a regular diabetic,” and while “...they try to balance reduced sugar produced doesn't mean no sugar across the board” (Facility B). An example of reduced sugar Strawberry Sorbet was given to elaborate on this fact. Facility B also mentioned that they serve “mostly whole wheat rolls for diabetic and Pre-diabetic patients, but Pre-Diabetic patients can request white bread if they don't want to eat whole wheat rolls” (Facility B).

### **Considerations**

Both facilities highlighted two main considerations: food brought in from family, and the patient's specific condition. Facility D stated “families bring in stuff, but it is encouraged they eat what is here,” because oftentimes they “are just asking family members to bring in stuff that they are not supposed to be eating” (Facility D). Facility B complied with this statement and admitted when it comes to food from families “we don't look too closely for prediabetic though” (Facility B). Facility B and D went on to state that in Pre-Diabetics, “if you find they are eating more sugary food, we look into their IBM, insulin levels and other factors to assess how to keep them in a safe range,” whereas in diabetics, diet is non-negotiable thus checking BMI or insulin levels to regulate diet is not a common practice.

### **Correlations**

In regards to correlations between diet and progression of illness, all 4 facilities stated that diet restrictions may depend on the patients' specific recovery rate and conditions. However, this recovery is more closely monitored in Diabetics. In Pre-Diabetic patients, correlations of diet to illness progression is deduced mainly from the patient's general insulin levels, and BMI, which is monitored at longer intervals compared to a continuous glucose monitor (CGM) that constantly measures blood glucose levels.

### **Deterring Factors**

Facility C stated that Pre-Diabetic patients are not educated as much on diet restrictions as long as the food they select does not significantly influence their BMI or insulin levels, therefore, oftentimes their diet may differ from regular Diabetic patients. For example, “...they may get more juice than a regular diabetic” however “...we are cutting back on options that Pre-Diabetic patients may have” (Facility C). “Regarding the same matter, Facility B stated, “...I think we have made that change recently in the last couple months “in trying to mimic Diabetic patients' diet (Facility B).

### ***Dietary Menu Analysis***

Lastly, the diet menus provided by Facility B also agreed with the prior statement as Facility B's menu mentioned the prohibition of commercial food or food from the family for diabetics, and mentioned that sodas would only be catered by requests from pre-diabetics. The menu not only confirmed results from the questionnaire and interviews, but also allowed me to truly determine if there was a difference in the way both illnesses were viewed, by medical professionals and patients themselves. Thus, reflecting the level of strictness in diet regulation of both types of patients.

## Discussion

### Evolution of Hypotheses

The initial hypothesis was “the CDC’s recommended dietary allowances are implemented in the diet of Diabetic patients more strictly than in Pre-Diabetic patients within Endocrinology units in Texas hospitals.” This hypothesis was deduced correct from the collected data. It is important to note that the sampled data only applies to Texas units. While Pre-diabetic patients are not entirely free to eat whatever they desire, data reflects that facilities are 30% more likely to adhere to the CDC’s criteria in cases of Diabetic patients than in Pre-Diabetic patients.

### Fulfillment of Gaps in the Research

This study addresses several gaps in the pre-existing research. First, while there are many studies that analyze Diabetic patient diets in facilities, there is a lack of sufficient research regarding dietary regulations in hospitalized Pre-Diabetics. Furthermore, the CDC only has a page that precautions Diabetic patients regarding diet, lifestyle, and other habits, however, the CDC and even the American Diabetes Association does not have a page adumbrating guidelines for Pre-Diabetic patient precautions. Furthermore, the targeted subjects: nutritionists, chefs, dining directors, and dieticians were not the subjects in any of the pre-existing studies done about Diabetic patients in facilities. Additionally, the setting of this study is focused on long term Texas facilities, thus limiting the deduced results to only long-term Texas facilities. Future studies can imitate this study on a larger scale to determine if the same trend is seen elsewhere, or replicate the same study with a different demographic of individuals.

Finally, the most prominent gap was understanding the extent to which CDC recommended guidelines were implemented in the sampled facilities in Diabetic versus Pre-Diabetic patients. This served as the main purpose for conducting the study.

## Conclusions

By compiling results from the mixed-method design, it can be concluded that the extent to which the CDC’S recommended dietary allowances are implemented in the diet of Pre-diabetic patients in Texas facilities is much less efficient than in diabetics due to leniency of dietary regulation, granting of dietary requests, longer monitoring intervals, and lack of priority towards educating the patient on dietary restrictions in Pre-diabetics. This conclusion is applicable to all long-term Texas facilities to a significantly accurate measure, as each of the three parts in the mixed methods design corroborated each other. Thus, even without replicating the study several times, the results can be applied to deduce conclusions regarding all Texas long term facilities.

## Implications

The results of this study may allow facilities to re-evaluate the extent to which they enforce CDC guidelines regarding diet in Pre-Diabetic patients. This could potentially push facilities like Facility B to work faster to close the gap between the difference in diets in Diabetic versus Pre-Diabetic patients. Furthermore, this can potentially spark an interest in large scale organizations such as the CDC or ADA to create a page intended to guide Pre-Diabetic patients in regulating their diet to prevent the onset of Diabetes at a global scale.



## Limitations

A significant limitation to this study was the lack of cooperation/responses from many facilities. Over 42 facilities were contacted through email, and over 27 facilities were phoned in hopes of a quicker collection of responses, however, 95% of the contacted facilities did not respond or declined participation. The 12 sample hospitals, although statistically a large enough sample to deduce results for long term Texas facilities, the presented results are not fully representative of all facilities in the United States, thus deterring accurate representation of nationwide facilities.

## Areas for Future Research

As this study explores a new topic, there is still potential for more accurate results by sampling a larger number of facilities, in and out of Texas. Therefore, the results can be applied to make conclusions about facilities outside of Texas as well with more accurate representation. Future researchers can also further research the correlation of diet in Pre-Diabetic patients to understand if it has a significant effect on the progression of the illness. Although it was briefly assessed in this study, the conclusions were purely based on the interviewee's perspective.

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