How Family Physicians Practice the Principle of Remission Along the Glycemic Continuum

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Abstract

Introduction: Recent evidence reveals that diabetes and prediabetes (preDM) can be reversed to normal glucose regulation (NGR) through significant weight loss, but how physicians clinically identify the principles of partial and complete remission of diabetes is largely unknown. **Methods:** As part of the cross-sectional omnibus survey conducted in March 2019 at a professional annual meeting in the United States, physician participants answered case scenario questions about the diagnosis and documentation of patients with preDM and type 2 diabetes (T2DM). **Results:** Of the registered conference attendees, 387 (72.7%) responded. When presented with the initial case of preDM, 201 physicians (70.8%) selected R73.03 Prediabetes. In a follow-up encounter with improved lab results, 118 physicians (58.7%) indicated that they would not chart any diabetes-related code and 62 (30.8%) would chart preDM again. When presented with the case of T2DM, 256 physicians (90.1%) indicated E11.0–E11.9 Type 2 Diabetes. In the follow-up encounter, only 38 (14.8%) coded a diagnosis reflecting remission from T2DM to prediabetes and 211 (82.4%) charted T2DM. **Conclusion:** Physicians may be reluctant to document diabetes regression as there is little evidence for long-term outcomes and "downgrading" the diagnosis in the medical record may cause screenings to be missed. Documenting this regression in the medical record should communicate the accurate point on the continuum of glucose intolerance with both the patient and the care team.

Introduction

More than 422 million adults worldwide (8.5% of the population) were estimated to have type 2 diabetes mellitus (T2DM) in 2014.[1] In the United States an estimated 34.1 million people aged 18 years or older had diabetes (13.0% of the adult population) and 88 million (33.5%) had prediabetes (preDM) as of 2018.[2] Diabetes was the fifth leading diagnosis for adult ambulatory medical office visits in the United States in 2016.[3] Primary care physicians, rather than endocrinologists, provide approximately 85% of disease-related care to patients with diabetes in the US.[4] A similar provision of care to patients with diabetes has emerged in the UK.[5] In the UK, approximately 10% of total NHS expenditure, representing an annual £14 billion pounds, is used to treat diabetes and its complications.[6] The last US estimate of the annual cost of diabetes and complications was $327 billion,[7] and this cost is expected to continue to increase. These costs have necessitated that primary care physicians focus on both preventing progression to T2DM and individualizing glycemic management to limit complications of T2DM.

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Just more than a decade ago, *Diabetes Care* published a consensus statement regarding another, somewhat novel idea: the remission of T2DM to either preDM or normal glucose regulation (NGR).[8] Since then, studies have established the attainability of remission through intensive lifestyle interventions led by both primary care physicians and research teams[9,10] and examined the incidence of remission in community settings without intensive interventions.[11] However, outside of the context of clinical trials or intervention, it is unknown how primary care physicians practice the principle of remission of diabetes.

Studies indicate the importance of weight loss and maintenance in preventing and resolving preDM and T2DM.[12,13] Patients with T2DM who completed and maintained extensive weight loss of at least 15 kg have experienced prolonged remission of diabetes to either preDM or NGR.[9,14-19] Recent evidence reveals that preDM can be reversed to NGR through significant weight loss (–7% of body weight).[20-23] Since publication of the Diabetes Prevention Program (DPP), physicians have been implored to counsel patients with preDM regarding effective strategies to decrease the risk of cardiovascular disease and progression to T2DM.[24] This evidence indicates that, with therapeutic lifestyle change, the road to diabetes is not unidirectional.

The lack of a cohesive definition of preDM among leading organizations may create a disparity among how physicians use the term clinically.[25-27] Nevertheless, all agree that there is a range of hyperglycemia between accepted values for normoglycemia and T2DM that is associated with future development of T2DM and cardiovascular disease. Communicating this to the patient and the care team via the electronic medical record gives the best risk assessment and can help guide future treatment. The American Diabetes Association (ADA) guidelines[27] establish the standard of care for physicians diagnosing and treating diabetes and prediabetes in the United States.

Recognizing preDM and diabetes as a continuum of glucose intolerance, this study aims to identify if family physicians document the principles of regression and remission of preDM and T2DM.

Methods

The survey questions were part of a larger cross-sectional omnibus survey conducted by the Clinical Investigations Committee of the Uniformed Services Academy of Family Physicians (USAFP). USAFP is a nationwide chapter of the American Academy of Family Physicians, the national association of U.S. family physicians. Using ADA guidelines[28] as a framework, the research team wrote case scenarios followed by multiple-choice questions for participants to choose the single best answer. Prior to data collection, the USAFP Clinical Investigations committee evaluated questions for face and content validity: (1) consistency with the overall subprojects' aim, readability, and

existing evidence of reliability and validity; and (2) as needed, questions were modified following pretesting for flow, timing, and readability.

Box 1 and Box 2 present the case questions. We considered ICD-10 codes selected to be surrogates for documentation in the electronic medical record. Box 1 presents the two questions that assessed physician identification of preDM and then potential regression to normoglycemia. Box 2 presents the two questions that assessed physician identification of T2DM and potential remission to preDM.

BOX 1.

> George Curry, a 51 year old male, presents to clinic for follow up lab results.
> Hemoglobin A1C: 5.8 Fasting glucose: 115
> Lipid panel Total Chol: 198, HDL: 48; Triglycerides: 115
> His current vital signs are BP: 127/78 and BMI: 26. He has a history of hypertension.
>
> How would you most likely code this patient encounter?
> A. R73.03 prediabetes
> B. E11.0–E11.9 Type 2 diabetes
> C. E74.9 Disorder of carbohydrate metabolism, unspecified
> D. would not code with a diabetes-related diagnostic code
>
> When Curry returns to the clinic in 6 months for a follow up appointment with you, he reports that he has successfully changed his diet and increased his physical activity. His only active prescription is Lisinopril for his hypertension.
> Hemoglobin A1C: 5.2 Fasting glucose: 99
> Total Chol: 178, HDL: 51; Triglycerides: 102
> His current vital signs are BP: 124/79 and BMI: 24.5.
>
> How would you most likely code this patient encounter?
> A. R73.03 prediabetes
> B. E11.0–E11.9 Type 2 diabetes
> C. E74.9 Disorder of carbohydrate metabolism, unspecified
> D. would not code with a diabetes-related diagnostic code

BOX 2.

> Kevin Williams, a 54 yo male, presents to clinic for follow up lab results.
> Hemoglobin A1c: 7.1 Fasting Glucose: 155
> Lipid panel TC: 231, HDL: 35; Triglycerides: 174
> His current vital signs are BP: 131/ 88 and BMI: 29. He has a history of hypertension.
>
> How would you most likely code this patient encounter?
> A. R73.03 prediabetes
> B. E11.0 – E11.9 Type 2 diabetes
> C. E74.9 Disorder of carbohydrate metabolism, unspecified
> D. would not code with a diabetes-related diagnostic code

BOX 2. (continued)

When Williams returns to the clinic in 6 months for his follow up appointment with you, he reports that he has changed his diet and increased his physical activity. His only active prescription is Lisinopril for his hypertension.
Hemoglobin A1c: 6.2 Fasting glucose: 124
Lipid panel TC: 195, HDL: 43; Triglycerides: 145
His current vital signs are BP: 130/82 and BMI: 28.5.

How would you most likely code this patient encounter?
A. R73.03 prediabetes
B. E11.0 – E11.9 Type 2 diabetes
C. E74.9 Disorder of carbohydrate metabolism, unspecified
D. would not code with a diabetes-related diagnostic code

Table 1. Participant Demographics.

Gender (n = 284)	
Male	179 (63%)
Female	105 (37%)
Practice setting (n = 282)	
Academic	133 (46.8%)
Non-academic[a]	149 (52.5%)
Percent of time spent in clinical care	Mean 54.68 (sd 31.99)
Number of year of practice	Mean 10.89 (sd 8.24)

[a]Includes the following practice settings: outpatient family health clinic, family health clinic with inpatient duties or obstetric duties, urgent or acute care clinic, inpatient only, and "other".

Results

The sampling frame included all 532 registered attendees of the annual USAFP scientific assembly. Data were collected anonymously in March 2019 from the start date of the USAFP Annual Meeting through 14 days after the end of the conference. Data were anonymously collected online from participants at the meeting via a link within the USAFP conference mobile application. There was one live session presentation of Omnibus Survey questions and two subsequent conference announcements within the mobile application encouraging survey participation. Three post-conference email survey invitations were sent to registered conference attendees via their listed registration email addresses.

This study received approval from the Uniformed Services University of Health Sciences Institutional Review Board.

Results

All 532 registered conference attendees were eligible to complete the omnibus survey for 2019. Of these, 387 attendees (72.7%) responded. We excluded 65 responses that did not answer the questions from this section. As this is a study of clinical practice, we also excluded 38 responses from medical students or non-responders to the question asking year of medical school or residency graduation. Therefore, 284 responses are included in analysis. See Table 1 for respondent demographics.

The first case described a 51-year-old male presenting with a hemoglobin A1C of 5.8% and fasting glucose of 115 mg/dL and BMI of 26. When presented with this case of preDM, 201 physicians (70.8%) selected R73.03 Prediabetes. In the follow-up encounter, the patient had an A1C of 5.2%, fasting glucose of 99 mg/dL and weight loss to BMI 24.5. Of the 201 physicians who selected R73.03 Prediabetes in the first vignette, 118 physicians (58.7%) indicated that they would not chart any diabetes-related ICD-10 code, reflecting the patient's achieved normal glucose regulation. Sixty-two of the 201 (30.8%) physicians would chart preDM again.

The second case described a 51-year-old male who presented with a hemoglobin A1C of 7.1% and fasting glucose of 155 mg/dL and BMI of 29. When presented with this case of T2DM, 256 physicians (90.1%) indicated E11.0–E11.9 Type 2 Diabetes. In the follow-up encounter, the patient had an A1C of 6.2% and a fasting glucose of 124 mg/dL and successful weight loss to BMI of 28.5. Of the 256 physicians who charted "E11.0–E11.9 Type 2 Diabetes," only 38 (14.8%) coded a diagnosis reflecting remission from T2DM to preDM in the follow up encounter, and 211 (82.4%) physicians would have charted T2DM again.

In this sample, 25 physicians (8.8%) would code for regression in both patient cases, 82 physicians (28.9%) would code for regression in the preDM case but not the T2DM case, and 68 (23.9%) did not code for regression in either case. In a chi-square test comparing documenting regression or remission of preDM to that of T2DM, there was a significant association between regressing the T2DM diagnosis and regressing the preDM diagnosis, *McNemar's* χ^2 (1) = 74.30, $P < .001$. Table 2 presents chi-square test between physician identification of regression of preDM and remission of T2DM cases.

Discussion

Despite recent studies and proposed guidelines for remission, our survey of family physicians indicates a "practice habit" that does not align with the principle of remission. Physicians in this sample overwhelmingly did not communicate successful or partial remission to the healthcare team via the medical record. The survey methodology limits our ability to explain this physician practice, but we suggest three potential explanations. First, this habit could be due to lack of primary care physician awareness of the possibility of remission of T2DM. Second, physicians may be reluctant to "remove" the diagnosis because of the comparatively

Table 2. Chi-Square Test* between Physician Identification of Regression of Prediabetes and Remission of Type 2 Diabetes Cases.

	Physicians did not identify remission of the T2DM diagnosis	Physicians identified remission of the T2DM diagnosis
Physicians did not identify regression of the prediabetes diagnosis	55	2
Physicians identified regression of the prediabetes diagnosis	82	25

*McNemar's χ^2 (1) = 74.30, P < .001.

less robust evidence for patients who have achieved remission of T2DM through lifestyle changes alone rather than patients who have accomplished this through metabolic surgery. Third, we hypothesize that a systematic barrier may be preventing physicians from documenting a remission in the patient's record.

Physician and systems level intervention can change this practice habit—when physicians document both the possibility and achievement of remission of T2DM, they will communicate and model practice behaviors that encourage patient movement along the spectrum of glucose intolerance from hyperglycemia to normal glucose regulation. At the physician level, we advocate for wider dissemination of the research surrounding the potential of remission and helping primary care physicians learn how to incorporate that into their practice. At the systems-level, we argue that an ICD-10 code that explicitly labels remission, for example, "Personal history of Type 2 Diabetes, in partial remission" or ". . . in complete remission," should be created to accurately reflect the current status of the patient.

Physicians surveyed in our study were more likely to code for regression from preDM to NGR (58.7%), than regression from T2DM to preDM (14.8%). This may be due to a lack of physician awareness of the possibility of partial or complete remission of T2DM and preDM. Though case reports of remission of T2DM have existed since 1953[29] and recent studies demonstrate partial or complete remission of T2DM through intensive lifestyle interventions,[9-11,23,30] T2DM is almost unanimously regarded among physicians as a lifelong disease. Peer-reviewed literature has framed patient beliefs that T2DM is able to be cured as evidence that patients have unrealistic expectations of treatment[31] and that "providers should educate patients on the natural history of diabetes."[32] Another possible reason for the difference between T2DM and preDM is adherence to different proposed measures of remission.[8] The physicians in our study may follow proposed measures of remission that require a full year between glucose measurements, and they may have counseled the patient in the second vignette as still having "diabetes" because of the time between the initial lab and follow-up vignette. Other proposed measures do not require a full year.[33]

Physicians may be appropriately reluctant to choose a "lesser" diagnosis than T2DM once patients have met proposed criteria for remission, as there is yet little evidence for long-term outcomes in patients who achieved remission without bariatric or metabolic surgery. It is recommended that patients who have met criteria for remission continue to have screening tests performed for complications of T2DM,[8,30] and "downgrading" the diagnosis in the medical record may cause these screenings to be missed.

Primary care physicians may be rightly concerned that, without a way to accurately document remission, there is a risk that patients will not have the recommended screening exams for micro- and macrovascular complications of T2DM performed should the code be removed from their charts. Users of the SNOMED-CT system of coding in electronic medical records (EMRs), primarily in the UK, can document "Type II diabetes mellitus in remission (disorder)."[34] Though an ICD-10 code exists to document a "history of resolved diabetes mellitus after bariatric (weight loss) surgery," no such code exists for remission through lifestyle changes alone.[35] This presents a logistical barrier to documenting the clinical status of regression along the diabetes continuum.

Throughout this paper, we use the terms regression and remission, reflecting how literature describes patient success with diabetes management. Etymologically, remission[9-11,13,16,29,30,36] infers the absence of disease. More traditionally used in reference to cancers,[37] the connotation of remission is that the disease is gone. Although patients talk about the cure of diabetes,[32] physicians are unlikely to describe diabetes dichotomously.[8] Physicians recognize the potential of recurrence and the long-term damage already suffered by the pancreas, liver, kidneys, and blood vessels. Regression is a term less used in the literature, most often described as analogous to partial remission from T2DM to preDM[20,21,23] but is a clearer descriptor of backward movement along a continuum. Regression implies that the patient can move both ways along a diagnostic continuum—disease progression or disease regression.[22] Physicians need to be intentional about the words they use with patients, with each other, and in the literature.

Further study, including qualitative inquiry, regarding physician knowledge, attitudes, and beliefs about these concepts should be conducted to determine why physicians are not doing so. Long-term studies of the effects of remission of preDM and T2DM on morbidity and mortality in patients

are needed to better inform the clinical implications of periods of hyperglycemia.

As with all self-reported surveys, the responses to our study questions are subject to social desirability bias, such that the actual documentation and patient communication options chosen by the respondents may not accurately reflect clinical practice. Findings are also limited by the quantitative nature of data collection that did not allow physicians to explain why they selected the diagnostic codes. As discussed, physicians may different proposed measures of remission. Generalizability of findings are limited to U.S. family physicians.

Conclusion

Our study found that family physicians are more likely to document regression of preDM to NGR than they are to document regression of T2DM to either preDM or NGR. We propose that documenting this clinical status change in the EMR should communicate the most accurate point on the continuum of glucose intolerance with both the patient and the care team. An ICD-10 code reflecting the current status of the patient, for example, "Personal history of Type 2 Diabetes, in partial remission" or ". . . in complete remission," should be created.

Disclaimer

The views expressed within this publication represent those of the authors and do not reflect the official position of the U.S. Air Force, Uniformed Services University of the Health Sciences, Henry M. Jackson Foundation, or the U.S. Government, the Department of Defense at large.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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