CRS Diabetes: An Effective Model for Improving Family Medicine Resident Knowledge, Competence, and Performance in Diabetes Care

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The Chief Residents Summit on Intensifying Diabetes Management, now in its 15th year, has resulted in real-world improvements in patient outcomes and has shown itself to be an effective model for teaching diabetes to family medicine residents. This article describes the program and the evidence supporting its effectiveness.

Perhaps second only to the discovery of insulin a century ago, the past 10–15 years might be considered the golden age of diabetes care. Several new classes of medications and devices, as well as insulins that more closely mimic human physiology, have been introduced that enable greater treatment individualization (1). Moreover, several glucagon-like peptide-1 (GLP-1) receptor agonists and sodium–glucose cotransporter 2 (SGLT2) inhibitors have recently demonstrated significant reductions in cardiovascular events. Professional organizations that publish treatment guidelines have integrated these advances into their current recommendations, including the need for frequent assessment of treatment responses, with intensification as needed to achieve glycemic and other diabetes-related treatment targets (2,3).

Despite these advances, many people with type 2 diabetes do not achieve glycemic control, and few achieve simultaneous control of associated cardiovascular risk factors (4–6). Data extrapolated from the 2013–2016 National Health and Nutrition Examination Survey (NHANES) showed that 55.8% of people with type 2 diabetes were at their target A1C level, whereas only 17.3% reached control of the composite of A1C, blood pressure, and blood lipid targets (4). Inclusion of a BMI target lowered that proportion to <10%. Although analysis of data from the U.S. Diabetes Collaborative Registry yielded higher achievement of individual target levels (6), suboptimal disease management remains common.

This persistent suboptimal control of glycemia and other cardiovascular risk factors is not surprising. An analysis of NHANES data showed that the cascade of diabetes care, defined as the composite of diabetes diagnosis, linkage to care, and achievement of individual and combined treatment targets, was attained by 23% of U.S. adults diagnosed with diabetes in the 2013–2016 survey period (7). This proportion was not significantly different from attainment of this composite in the 2005–2008 survey period.

Therapeutic inertia is an important factor contributing to suboptimal achievement of treatment targets. Therapeutic inertia, which is sometimes called clinical inertia, has been loosely defined as "recognition of the problem, but failure to act" (8). The consequences of therapeutic inertia that leads to delay in needed treatment intensification in people with diabetes are well established and include shorter time to development of and increased rates of diabetes-related cardiovascular events (9–11). Moreover, a recent U.S. cost-modeling analysis showed that a 1-year delay in intensifying diabetes treatment was associated with an annual loss of ~13,390 life-years and increased total costs of $7.3 billion (12). These estimates were based on a population of 13.4 million people with type 2 diabetes, or approximately half of the U.S. population with diagnosed diabetes (13), having a baseline A1C of 9.0% and an A1C target of 7.0%.

Clinician factors, patient factors, and health care system factors, many of which are interrelated, all contribute to

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therapeutic inertia (14,15). Clinician-related factors include ever-evolving guidelines and treatment goals, new treatment options, formulary and insurance restrictions, time constraints during patient visits, clinician-patient communication issues, complexities in patient disease management resulting from multiple comorbid diseases, concerns about adverse events and treatment complexity, and lack of a multidisciplinary diabetes care team (16–19). Lack of knowledge regarding evolving evidence-based treatment and inability to confidently integrate this knowledge into clinical practice are key barriers to improving clinician factors that contribute to therapeutic inertia (20).

Recognizing the ongoing problem of therapeutic inertia, the American Diabetes Association in 2018 launched an initiative called Overcoming Therapeutic Inertia to promote the adoption of evidence-based practices, strategies, programs, and tools that address key determinants of therapeutic inertia in diabetes care, with the ultimate goal of facilitating more timely treatment modification and improving outcomes for adults with type 2 diabetes (21,22).

Development and Refinement of a Resident Education Program

In 2007, the Primary Care Education Consortium (www.pceconsortium.org) and its collaborating partners the Illinois Academy of Family Physicians (www.iafp.com) and the Primary Care Metabolic Group (www.pcmg-us.org) determined through discussions with peers, review of the literature, and evaluations from continuing medical education activities that limited diabetes education in medical school and residency programs was contributing to therapeutic inertia and suboptimal health outcomes for people with diabetes (23,24). To address this problem, the three organizations launched the Chief Residents Summit on Intensifying Diabetes Management (CRS Diabetes). The annual, weekend-long summit offers 12.5 hours of diabetes education to residents from family medicine programs across the United States. Annual financial and in-kind support for CRS Diabetes has been provided by grants from one or more pharmaceutical and medical device companies.

From the outset, CRS Diabetes has provided residents with an intensive educational experience covering various aspects of diabetes management, including the patient journey. Topics include nutrition, carbohydrate counting, lifestyle management, pathophysiology, noninsulin medications, insulin initiation and intensification, and medical care accessibility and affordability. Each year's program agenda has been refined based on residents' feedback from the previous year's program, as well as a needs survey of pre-registrants for the current year's program. In recent years, a "hot topics" session has been added to address timely issues such as blood glucose monitoring, cardiovascular risk, and hypoglycemia.

In addition to updates to summit content, key changes have been made in the format and design of CRS Diabetes through the years. The program has evolved from a primarily didactic experience to one that immerses residents in the learning experience. This format includes demonstrations, hands-on skills workshops, panel discussions, problem-based learning, small-group breakout sessions, an educational game, and informal gatherings. Residents who attend the summit have used continuous glucose monitoring (CGM) systems and insulin pumps, in conjunction with carbohydrate counting at each meal during the program, to partially simulate the patient experience of living with diabetes. Although the 2020 CRS Diabetes program was held virtually due to coronavirus disease 2019 protocols, most residents were still provided with a CGM system and instructions on how to use it and interpret the data to make hypothetical adjustments in management.

Program Evaluation Tools

The program has used several evaluation tools to assess summit attendees' participation, satisfaction, learning, competence, and performance, as outlined in levels 1–5 of a conceptual model proposed by Moore et al. (25) for planning and assessing continuous learning for physicians. These include a pre-registrant survey, pre-/post-test questions for most sessions, session evaluations, and a survey conducted 6 weeks post-summit.

Since 2017, level 6 outcomes (25) have also been assessed by asking residents to provide anonymized pre-/post-summit A1C data for patients they select. In 2017 and 2018, these data were part of residents' participation in the American Academy of Family Physicians (AAFP) Metric Diabetes Program. Data relating to the frequency of other patient assessments (e.g., assessments of kidney, eye, and foot health) were also collected by the AAFP Metric Diabetes Program. Since the AAFP Metric Diabetes Program ended in 2019, participating residents have provided A1C data on selected patients directly to summit

TABLE 1 Summary of CRS Diabetes Evaluation Tools

Evaluation Tool	Completed by Resident	Issues Assessed
Pre-registration survey	Before registration	• Familiarity with guidelines • Treatment goals • Patient management challenges • Specific questions regarding medications • Barriers to initiating basal insulin • Knowledge of available medications • Comfort with various aspects of diabetes management • Cardiovascular outcomes • Comments
Pre-/post-test questions	At beginning/end of individual sessions	• Knowledge of diabetes epidemiology, pathophysiology, and treatment recommendations • Patient management
Session evaluations	At end of each session	• Participation • Satisfaction • Quality • Commercial bias • Achievement of learning objectives • Anticipated practice changes • Comfort levels with individual medication classes • Comments
Program evaluation	At summit conclusion	• Participation • Satisfaction • Quality • Comments
Post-summit survey	6 weeks post-summit	• Practice changes implemented • Comfort levels with medication classes • Comfort levels with specific aspects of patient management
Pre-/post-summit anonymized patient-level data	3–5 months post-summit	• A1C levels for resident-selected patients

organizers. The outcomes assessed with each evaluation tool are listed in Table 1. Resident responses for each question are averaged with pre-/post-summit differences calculated where possible. All comments are tabulated verbatim.

Outcomes

From 2007 through 2019, ~50 residents per year participated in CRS Diabetes, which was held at a conference center in Florida. In 2020, CRS Diabetes was held virtually; 72 residents participated.

Session and Program Evaluations

Results of the evaluations (n = 37) conducted at the conclusion of CRS Diabetes in 2020 showed that the average overall satisfaction rating was 4.95 out of a possible 5 (1 = poor, 2 = needs improvement, 3 = average, 4 = above average, 5 = excellent) (Figure 1). These ratings are consistent with resident evaluations from the previous 13 years of CRS Diabetes. Additional ratings from 2020 ranged from 4.84 to 4.92 out of a possible 5, with no resident rating a criterion <4. These ratings demonstrate the high quality, usefulness, and relevance to practice of the CRS Diabetes learning experience.

Accordingly, 92% of residents reported that they would absolutely change their practice behavior, and 100% felt more competent as a physician as a result of participating in CRS Diabetes. Similarly, resident comfort improved markedly from pre-registration to the conclusion of CRS Diabetes for initiating basal insulin and basal-bolus insulin, as well as prescribing GLP-1 receptor agonists and SGLT2 inhibitors (Figure 2). For example, 41% of residents felt comfortable or very comfortable initiating basal insulin before CRS Diabetes compared with 100% after

FIGURE 1 Average ratings by residents at the conclusion of CRS Diabetes in 2020 (n = 37). Q&A, questions and answers.

CRS Diabetes. Of key importance is that none of the residents expressed being uncomfortable or not very comfortable after CRS Diabetes with respect to initiating basal insulin or basal-bolus insulin or prescribing a GLP-1 receptor agonist or an SGLT2 inhibitor.

6-Week Follow-Up Survey

The 6-week follow-up survey (n = 32) confirmed findings from the evaluation conducted at the conclusion of CRS Diabetes. One hundred percent of the residents confirmed their commitment to change practice, with 94%

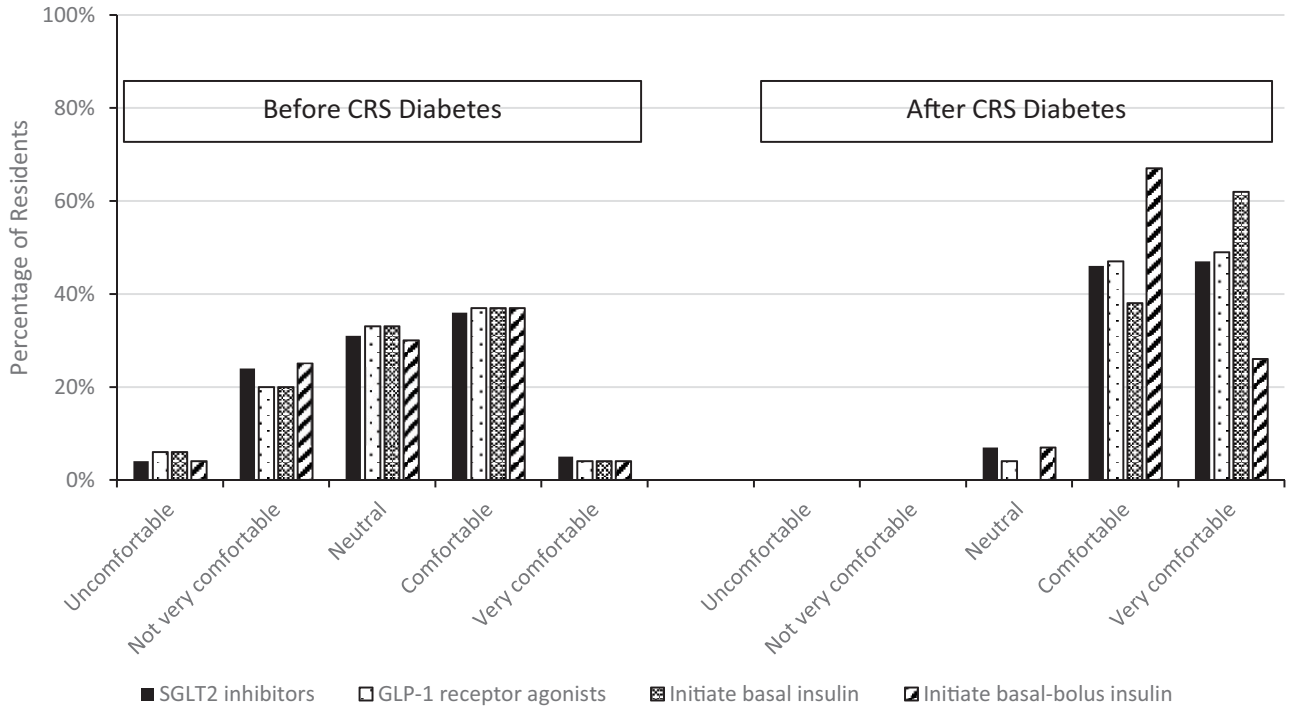

FIGURE 2 Percentage of residents uncomfortable, not very comfortable, neutral, comfortable, and very comfortable with various aspects of diabetes care before and after CRS in 2020. Before CRS Diabetes n = 85; after CRS Diabetes n = 45.

having changed their practice after CRS Diabetes. In fact, 62% of residents indicated that they planned to make further changes to improve patient care. Additionally, 84% of the residents had presented or were planning to soon present to fellow residents a key highlights slide presentation of CRS Diabetes given to them at the conclusion of the program.

Of particular interest is that 97% of residents agreed or strongly agreed that they feel comfortable initiating and modifying therapy to meet each patient's needs, interests, and capabilities. Nearly all residents (94%) expressed being comfortable or very comfortable titrating medication doses compared with 49% during pre-registration.

Residents also expressed a greater likelihood of prescribing insulin, GLP-1 receptor agonists, and SGLT2 inhibitors. For example, 74% indicated being more or much more likely to prescribe basal insulin; similar results were observed for prandial insulin. Conversely, 30% indicated being less or much less likely to prescribe a sulfonylurea. Residents' comfort remained high regarding patient education/coaching, patient communication, nutrition/carbohydrate counting, promoting patient adherence/self-management, selecting initial dosing regimens of medications, titrating doses of medications, and managing medication-related adverse events, with 84–100% reporting being comfortable or very comfortable.

Elements to facilitate residents' understanding of the journey experienced by patients with diabetes have been increasingly integrated into CRS Diabetes. One of these has been for residents to invite their patients to share how diabetes affects their life. The follow-up survey showed a significant increase in this regard, with more than half of residents (54%) asking patients how diabetes affects their life during ≥61% of patient visits (Figure 3).

Anonymized Patient-Level Data

For the past several years, level 6 outcomes were assessed by requesting that residents submit A1C data from anonymous patients they select. Pre- and post-program data submitted by each resident were for the same patients. The A1C levels were the last level before the program and the first level after the program. The change in pre- to post-program A1C levels ranged from −0.70 to −1.10% (Figure 4). Interpretation of these findings must be done cautiously since no adjustment has been made for confounding factors that may have influenced the results. Nonetheless, these improvements in the A1C level over the 4-year time period when these data were collected are consistent with resident feedback about feeling more comfortable with intensifying therapy and changing practice, thereby suggesting that participation in CRS Diabetes contributed to these improvements in patient health outcomes.

Discussion

A key goal of CRS Diabetes has been to address knowledge, competence, and performance gaps among family

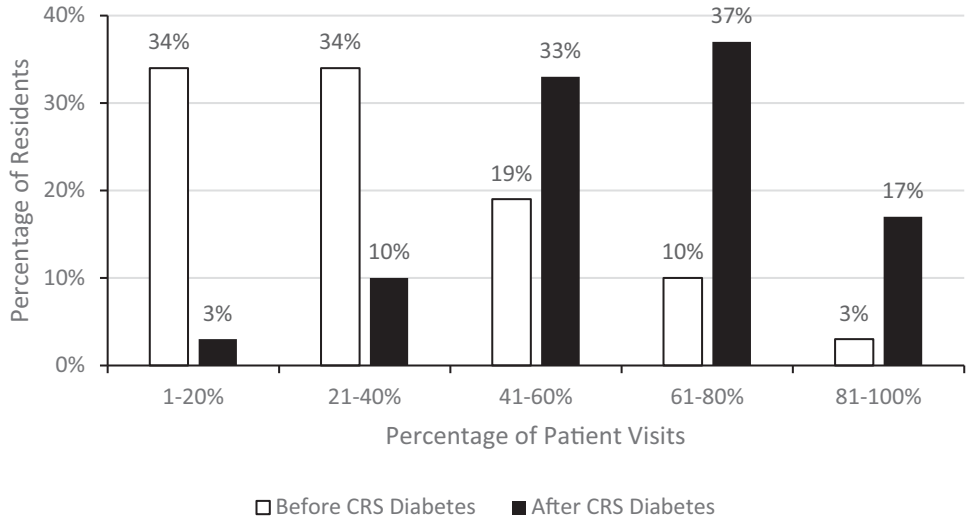

FIGURE 3 Frequency with which residents inquired about patient quality of life before and after CRS Diabetes in 2020. White bars = at pre-registration (n = 85); black bars = 6-week follow-up survey (n = 32).

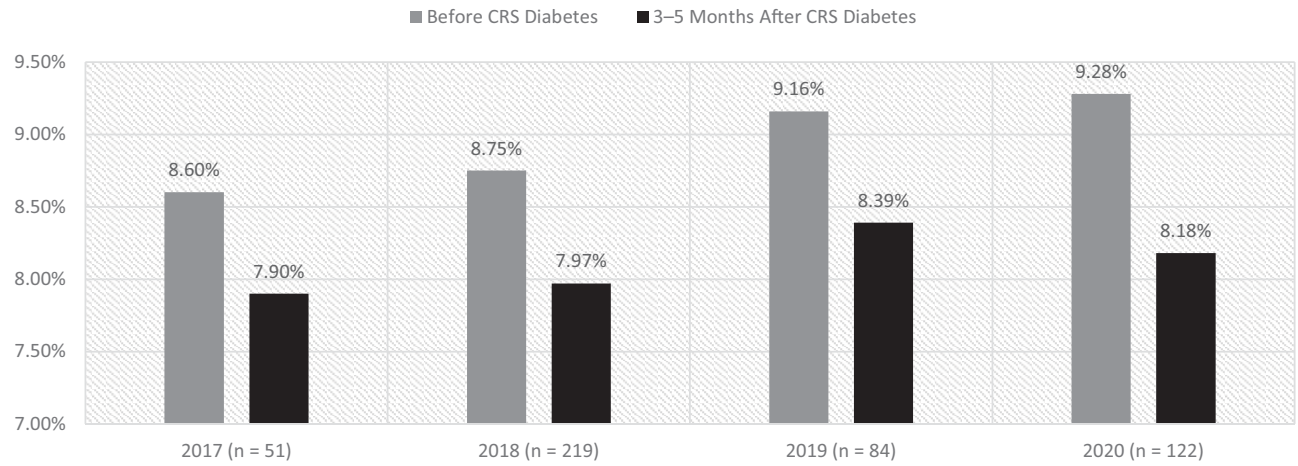

FIGURE 4 Average patient A1C before and after resident participation in CRS Diabetes, 2017–2020.

medicine residents, enabling them to overcome therapeutic inertia and thereby provide better care to their patients with diabetes. Several findings indicate that this goal has been achieved. At the conclusion of the virtual program in 2020, nearly all of the residents (92%) indicated that they absolutely planned to change their practice. The 6-week follow-up survey showed that 94% had changed their practice behaviors, demonstrating a high level of motivation among the residents. A key finding is that 100% of the residents who completed the 6-week follow-up survey indicated that they feel more competent as a physician.

Additional findings indicating that residents are better able to overcome therapeutic inertia after participating in CRS Diabetes include greater reported comfort generally providing care to their patients with diabetes, as well as greater comfort in initiating and using insulin, GLP-1 receptor agonists, and SGLT2 inhibitors. More than 90% indicated feeling comfortable or very comfortable promoting patient adherence and self-management, selecting initial dosing regimens, and titrating doses of medications. Residents also felt much more comfortable managing medication-related adverse events. Concerns about adverse events, particularly hypoglycemia, are a common factor contributing to therapeutic inertia (26–28).

The strongest indicator that residents were better able to overcome therapeutic inertia is the improvement seen in level 6 outcomes (i.e., reductions in patients' A1C levels) achieved in the 4 years these data were collected. The reductions in A1C observed after resident participation in CRS Diabetes must be interpreted cautiously since other factors may have influenced this finding. However, the fact that similar results were observed over all 4 years that these outcomes were assessed suggests that resident participation in CRS Diabetes was a contributing factor.

Several elements in the design of CRS Diabetes likely contributed to the observed improvements among residents. First, the 12.5-hour length of the program enabled addressing numerous gaps in practice, including those related to competence and performance. Second, CRS Diabetes was designed to immerse the residents to actively participate in the multiformat learning experience, including the patient experience, rather than take a more passive role. Evaluation results, including resident comments, indicated this feature was highly valued by the residents.

In summary, the high ratings from resident evaluations in 2020 were consistent with results from evaluations of previous CRS Diabetes programs. This finding suggests that multiformat education designed to address gaps in knowledge, competence, and performance to reduce therapeutic inertia and ultimately contribute to improved patient health outcomes can be effectively delivered virtually.

DUALITY OF INTEREST

All three authors are affiliated with the Primary Care Education Consortium, a for-profit medical education company. S.A.B. serves on both an advisory board and a speakers bureau for Abbott Diabetes, AstraZeneca, Bayer, Boehringer Ingelheim, Novo Nordisk, and Sanofi. He serves on a speakers bureau for Lilly and on an advisory board for Xeris. No other potential conflicts of interest relevant to this article were reported.

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AUTHOR CONTRIBUTIONS

N.A.W. collected and analyzed data from past CRS Diabetes programs and provided comments to the draft article. S.A.B. reviewed the data, edited the manuscript, and contributed to the discussion. G.A.S. reviewed and interpreted data from past CRS Diabetes programs, prepared a draft of the article, and revised the draft based on comments from the other authors. S.A.B. is the guarantor of this work and, as such, had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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