

Improving Access to Evidence-Based Lifestyle Interventions for People with Gestational
Diabetes Mellitus in a Multi-Specialty Clinic: A Quality Improvement Project

Jennifer A. Ham

Oregon Health & Science University

Abstract

Background

A physician-owned, women's health specialty outpatient clinic lacked the resources and expertise to offer lifestyle interventions treatments for people diagnosed with gestational diabetes mellitus. The global aim of this quality improvement project was to improve the capacity and expertise of the health care team to deliver best practices to women diagnosed with GDM. The process began with an abnormal glucose test qualifying for the diagnosis of GDM and ended at the six weeks postpartum visit. The quality improvement initiative was conducted in a microsystem that consisted of fourteen providers and twenty nursing or support staff. Providers consisted of physicians, nurse practitioners and certified nurse-midwives and support staff participants were certified nurse assistants, registered nurses or licensed practical nurses.

Methods

Institute for Healthcare Improvement's Plan-Do-Study-Act Worksheet was used to guide rapid test of change over thirteen weeks. The Knowledge to Action conceptual framework was used to drive local healthcare delivery changes informed by synthesized knowledge. Through a literature review, this QI project synthesized knowledge on GDM best practices and previous attempts by health care systems to close the evidence practice gap. This information was then used to design a more effective health care approach. A lifestyle interventions practice toolkit was developed, informed by literature review, evidence-based guidelines and local relevant prevalence data. Five weeks of baseline data was analyzed.

Intervention

A quality improvement team was developed within the specialty outpatient clinic. The lifestyle interventions practice toolkit was shared between the specialty healthcare participants and patients within one week of gestational diabetes diagnosis. The percentage of charts that

demonstrated lifestyle interventions education for the treatment of gestational diabetes within one week of diagnosis was collected weekly and plotted on a run chart. The run chart data and Plan-Do-Study-Act Worksheet was used to inform the quality improvement team at monthly meetings.

Results

The results of this quality improvement project showed that a practice toolkit was effective to elevate an outpatient women's health specialty's capacity to offer gestational diabetes mellitus best practices. Baseline data median score was 23.27% and after implementation of the quality improvement team and gestational diabetes mellitus toolkit, health care system delivery of best practices rose to as high as 52.54% within twelve weeks. Future successes would require allegiance to the quality improvement process as best practices and healthcare delivery mechanisms continuously evolve.

Introduction

Problem Description

Type 2 diabetes mellitus (T2DM) is a local and global problem, as this syndrome is projected to affect 1 in 3 Americans by 2050 (Drozd & Thorlton, 2017). People with gestational diabetes mellitus (GDM) face seven times increased risk for the development of T2DM compared to women without GDM history and failure to provide adequate access to lifestyle counseling increases this risk (Oza-Frank, Ko, Wapner, Rodgers, Bouchard, Conrey, 2014).

The three principles to lifestyle interventions for the treatment of GDM are personal glucose surveillance, the addition of exercise, and the institution of diet changes (American College of Obstetricians and Gynecologists, 2017). Lifestyle interventions may be adequate to

control glucose in as many as 70-85% of women diagnosed with GDM (American Diabetes Association, 2018), yet providers looking to offer best practice to women with GDM may not have the capacity, confidence or expertise to realize change in their local clinical environments (Wilkinson, O'Brien, McCray, Harvey, 2019). Evidence-based guidelines from The American College of Obstetricians and Gynecologists (ACOG), American Association of Diabetes Educators (AADE), Centers for Disease Control and Prevention (CDC) and American Diabetes Association (ADA) recommend lifestyle interventions as first-line interventions for the treatment of GDM. Providers and staff can seize the opportunity to introduce exercise and healthy habits in the prenatal window as pregnant women diagnosed with GDM are typically very motivated as this diagnosis can be a precursor to T2DM (Wang, Guelfi, Hui-Xia, 2016).

Available Knowledge

Most Effective Treatments for GDM

Lifestyle interventions for the treatment of GDM are described as diet and exercise modifications with personal glucose surveillance (ACOG, 2018). Although the evidence is unclear as to which specific diet or type of exercises are superior in pregnancy for the management of GDM, level 1 Cochrane systematic reviews of randomized controlled trials (RCTs) demonstrate clear evidence that the combination of personal glucose surveillance, diet improvements and regular exercise improve maternal and fetal health when compared to pharmaceutical prescriptions.

When compared to alternative GDM treatments such as insulin, exercise alone, diet alone or oral pharmaceutical therapy, a systematic review of literature showed that the combination of glucose surveillance, exercise and diet change were the only treatments that showed any benefit to maternal fetal health without associated harm and the specific advantage was in the reduced

number of large for gestational age newborns (Brown, Alwan, West, Brown, McKinlay, Farrar, et al., 2017). A systematic review examined randomized controlled studies (RCT) on the effect of lifestyle interventions with and without pharmacologic intervention and although there was high variation in the diet and exercise prescriptions, the results showed that lifestyle interventions alone were effective in overall reduced risk for depression, increased achievement of postpartum weight goals, decreased large for gestational age (LGA) newborns and decreased neonatal adiposity (Brown, Alwan, West, Brown, McKinlay, Farrar, et al., 2017). The evidence that lifestyle interventions improve maternal-fetal health without the introduction of harm is so compelling that evidence-based guidelines (EBG) released from ACOG, AADE, ADA, and CDC recommend lifestyle interventions as first line treatment for GDM. The same lifestyle habits recommended to manage GDM also reduce the risk for DM 2 when utilized following pregnancy.

Evidence Practice Gap

Despite guiding professional organization recommendations to first treat women with GDM through lifestyle interventions, health care teams are challenged by limited resources and the increased intensity of patient access (Rasekaba, Furler, Young, Liew, Gray, Blackberry & Kim, 2018). Attempts to close the evidence-practice gap include a variety of strategies. One such strategy is the use of daily feedback through electronic applications via patient smart phone. Use of this intervention resulted in increased patient compliance and decreased insulin utilization (Miremberg, Ben-Ari, Betzer, Raphaeli, Gasnier, Barda, Bar, et al., 2018). Another similar approach utilizing technology introduced an adjunct to usual care called TeleGDM, which is the use of a web-based patient-controlled personal health record for GDM data sharing between

patients and clinicians. A randomized controlled trial found that use of TeleGDM was associated with improved glucose control (Rasekaba, et al., 2018).

Another strategy included the use of a toolkit, designed for both health care teams and patient use. Although there is not robust research on the topic, it appears that lack of patient resources, social support and intensified treatments for women diagnosed with GDM may result in increased patient stress (Kopec, Ogonowski, Rahman, Miazgowski, 2015). A quality improvement (QI) initiative in Ohio demonstrated that GDM toolkits can be helpful for both providers and patients when seeking improvement for postpartum glucose surveillance and showed that a toolkit composed of English and Spanish educational materials written at a 4th-5th grade reading level more than doubled the patient adherence to evidence based guidelines (Shellhaas, Conrey, Crane, Lorenz, Wapner, Oza-Frank, Bouchard, 2016). The National Diabetes Education Program, sponsored by the National Institute of Health (NIH), developed an online practice toolkit for patients and providers that has demonstrated moderate effectiveness in the prevention of DM 2 in high risk individuals through increased patient adoption of knowledge and behaviors (Devchand, Sheehan, Gallivan, Tuncer, Nicols, 2017). The National Diabetes Education Program developed this online toolkit to be “accessible, culturally tailored, engaging, contain high-impact information, and be delivered at an appropriate readability level” (Devchand, et al., 2017, p. 515). The Partnership to Improve Diabetes Education (PRIDE) toolkit has been shown to be effective to increase diabetes knowledge for self management and support in people with low literacy and numeracy and this toolkit can be used by all members of the multidisciplinary team (Wolff, Chambers, Bumol, White, Gregory, Davis, et al., 2016). The PRIDE toolkit is tailored using a reading grade level of five and is available in both English and Spanish.

Lastly, the integration of a dietician into regular prenatal visits to close the evidence-practice gap increased the number of women who received best practice in an Australian QI implementation project; however, the organization was unable to sustain this service change because of the added demands beyond usual clinical care (Wilkinson, McCray, Beckmann, McIntyre, 2016).

Multiethnic Disparities

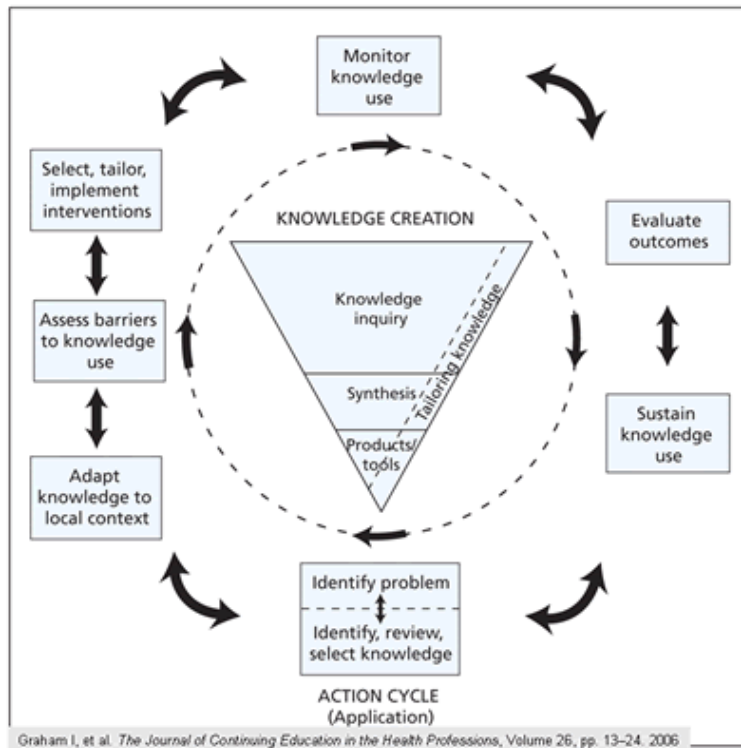
Women of color are disproportionately affected by GDM and although evidence is limited, there is concern that ethnically diverse women with GDM face additional challenges in the assimilation of treatments for lifestyle interventions. In the evaluation of care to a California state multiethnic cohort, Hispanic women with gestational diabetes had higher emergency department utilization. These women specifically expressed that they experienced distress with the way the GDM diagnosis was delivered in that there was insufficient emotional and psychosocial support offered by providers (Singh, Soyoltulga, Fong, Billimek, 2018). The creation of a “one size fits all” treatment plan is a common approach and may further marginalize high risk women with ethnic descent in western societies, highlighting the specific challenges with the individualization of medical nutrition therapy and instructions for insulin use (Yuen & Wong, 2015). Ability to empower patients to make behavior change, belief in the importance of chosen interventions and shared connections with Latinx patients are provider-driven enabling factors for Latina women in the implementation of lifestyle interventions to prevent diabetes (Gubrium, Leckenby, Harvey, Marcus, Rosal, Chasan-Taber, 2019).

Rationale

Conceptual Framework

The KTA framework utilizes new knowledge to inform the action cycle that can be applied to a local clinical problem and this concept is illustrated in Figure 1. The Knowledge

Figure 1



The Knowledge to Action Framework. From Graham I, Logan J, Harrison M, Strauss S, Tetroe J, Caswell W, Robinson N: Lost in knowledge translation: time for a map? *The Journal of Continuing Education in the Health Professions* 2006, 26, p. 19

to Action (KTA) Framework has been successfully used to drive system wide change through advancement of provider knowledge and behavior change specifically towards the adoption of best practices for diabetes treatment (Yu, Lillie, Mascarenhas-Johnson, Gall, Straus, 2018). Knowledge synthesized from evidence-based guidelines, quality improvement efforts in the practice area of gestational diabetes mellitus, relevant county and state prevalence data and microsystem organizational quality gaps were used to inform healthcare delivery changes.

Science of Improvement

The Institute for Healthcare Improvement (IHI) Plan-Do-Study-Act (PDSA) Worksheet is part of IHI's QI Essentials Toolkit which was designed to assist healthcare teams through the "methodology of learning" (Institute for Healthcare Improvement, 2017). The toolkit contained ten organizational tools and templates to guide healthcare improvement change. The PDSA Worksheet Act step 4 summarizes the healthcare delivery modifications through an adapt, adopt or abandon decision process.

Practice Toolkit

Toolkits have been described as "the bundling of a combination of educational materials including templates, instruction sheets, literature reviews, videos, and posters, presented in a variety of formats (Barac, Stein, Bruce & Barwick, 2014, p. 3). Toolkits have been used to inform and improve health behaviors for diverse audiences, including health practitioners, patients, community and health organizations, policy makers, and for the public" (Barac, Stein, Bruce, & Barwick, 2014, p.3).

Specific Aims

The global aim of this QI project was to improve the capacity and expertise of the health care team to deliver best practices to women diagnosed with GDM. The process began with an abnormal glucose test qualifying for the diagnosis of GDM and ended at the six week postpartum visit. Within 3 months, 75% of reviewed GDM charts would show documentation that the health care team provided education to the patient on the three tenets of lifestyle interventions within 1 week of GDM diagnosis.

Methods

Context

This project took place in a physician-owned, women's health specialty outpatient microsystem, which was part of a macrosystem multi-specialty group practice that consisted of eighty providers among four locations located in Marion County, Oregon. Most recent county and state prevalence data, available from 2015, showed that 10% of all pregnancies were affected by GDM and this disproportionately affected 17% of Latinx pregnancies (Oregon Health Authority, 2015).

The microsystem functioned as a professional team composed of obstetrician-gynecologists, certified nurse-midwives, nurse practitioners, certified medical aides (CMA), registered nurses (RN), licensed practical nurses (LPN), a nurse manager and patient scheduling specialists. The environment was fast paced and prenatal care appointments were scheduled for 15-minutes each. Communication patterns between staff that concerned microsystem processes occurred through monthly meetings and transmission of information about patient care was primarily through the use of EHR EPIC encounters and notes. There were approximately sixty people with GDM served by the specialty microsystem clinic at any given time and a range of three to five new GDM diagnoses each week.

Intervention

Practice Toolkit

A GDM lifestyle interventions toolkit was created that contained selected information from evidence-based guidelines on the three tenets of lifestyle interventions: personal glucose surveillance, safe exercise in pregnancy and GDM diet modifications (see Appendix). This information was contained in a manila folder and these kits were labeled as either English or Spanish. The lifestyle interventions GDM toolkit was reviewed between the support staff and person diagnosed with GDM within one week of diagnosis through a separate

follow up visit. Once diagnosed with GDM by a provider, the support staff notified the patient of the diagnosis, ordered a referral to a hospital-based dietician, sent an order to the pharmacy for glucometer and testing supplies and then transferred the encounter to the triage RN to schedule a follow up visit with the patient. The person with GDM was encouraged to bring her glucometer and supplies to the follow up visit. The follow up visit was shared between both CMA and RN staff, to accommodate patient-specific educational needs pertinent to proper use of glucose testing equipment and lifestyle education materials. Spanish fluent team members conducted follow up visits when Spanish language was preferred by the patient.

Microsystem QI Team

A QI team was recruited through a volunteer sign up sheet and consisted of two providers, six support nursing staff and the nurse manager. There were three Spanish fluent QI team members. A process map outlining how to integrate the GDM lifestyle interventions toolkit as an adjunct to usual care was created by the QI team. The QI team conducted monthly meetings, which immediately followed a usual support staff meeting. The goal of each meeting was to complete the IHI PDSA Worksheet and review process performance measures.

Study of the Intervention and Measures

Between 12/1/2019 and 3/20/2020 the microsystem EHR team provided patient records with a 2019-2020 open active pregnancy episode and with gestational diabetes in the problem list. The qualifying records singled out from EHR were reviewed weekly by a single QI team member and the proportion of records showing receipt of lifestyle interventions treatment for GDM within one week of diagnosis against the total number of patients in the microsystem with GDM were calculated. This percentage was charted on a run chart and this proportion was reviewed as a performance measure by the QI team. Once monthly, the microsystem QI team

used IHI's PDSA Worksheet to compare the specific aims against the data performance measure, test the change in the way information was delivered, qualitatively discuss data, barriers and achievements and then decided to adopt, adapt or abandon the new changes (Institute for Healthcare Improvement, 2017).

Run Chart

The first five weeks of baseline data percentages were collected prior to the implementation of the toolkit and these data points were used to create the median line. The run chart contained the quality indicator as a percentage of patients who received access to lifestyle interventions within 1 week on the x-axis while the y-axis contained the time as a weekly Friday date. The run chart was created through the Google Sheets program. In addition to the median line, annotations to the run chart were added to include the start date of the intervention, each monthly QI team meeting and when COVID 19 healthcare restrictions began. The run chart allowed the GDM QI task team to view improvement over time and also provided information as to whether the change could be sustained which was superior to analyses that might have only used summary statistics (Perla, Provost & Murray, 2011, p. 47).

Costs

Costs included hourly staff wages for attendance at two meetings lasting 15 minutes each and these costs were approved by and covered by the practice. It costed approximately \$0.80 per toolkit for copy paper and for fifty ADA brochures. Information copied was copyright free and available to the public for consumer use.

Analysis

Run Chart

The proportion of records that showed GDM lifestyle treatments for people diagnosed with GDM within one week of diagnosis was calculated for baseline data from 11/25/2019 to 1/3/2020 and then the project of improvement was measured from 1/10/2020 through 3/20/2020. This weekly proportionate data was plotted on the run chart for quantitative measure and then the run chart was analyzed for common cause variation. The baseline data collected did not show evidence of runs, trends, shifts or astronomical data points, so the median was calculated and “frozen” for use in the chart (Perla, Provost & Murray, 2011). Following the thirteen week rapid test of change, the run chart was analyzed for runs, trends, shifts and astronomical data points. Monthly, the QI team reviewed the run chart and used the data points as their performance measure.

Ethical Considerations

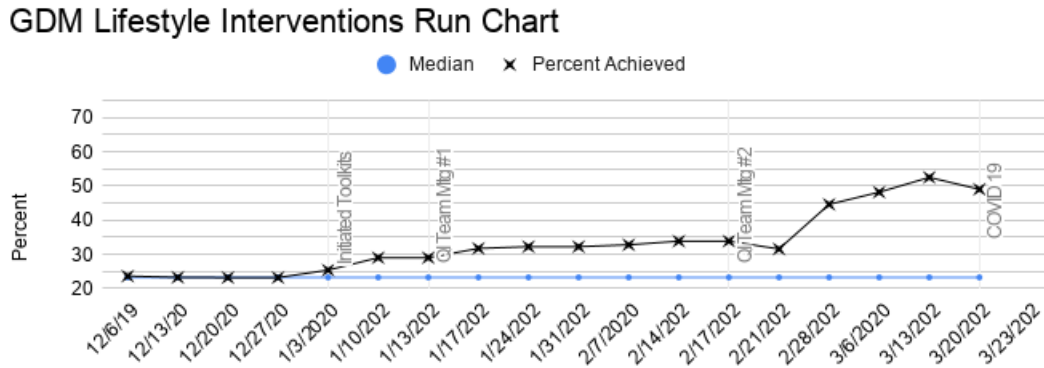
This project was submitted to the Oregon Health & Science University Institutional Review Board (IRB) for assessment and it was determined not to be human research. Minimal risk to patients was anticipated as the final data will be presented as a numerical proportion without protected health information and this was generated from a list collected by the clinic EHR team. Data plotted and analyzed did not include patient identifiers. No conflicts of interest were identified.

Results

Run Chart

Five baseline data points were generated before the onset of the toolkit distribution and these proportions were used to generate a median line. The median line was calculated as 23.27 from the data points 23.214, 23.214, 23.27, 23.64, 25.40 which showed a stable process. Figure 2 demonstrates the eighteen weeks of data percentages over time.

Figure 2



There were seventeen data points not on the median line and there were three runs. Using the Tables for Testing Randomness of Grouping in a Sequence of Alternatives developed by Swed & Eisenhart (1943), this would be “too few” runs which makes common cause variation unlikely (Perla, Provost & Murray, 2011). There was one shift which also developed into a trend and it started on 1/10/2020. This trend was broken by a slight dip in the data point on 2/21/2020. There were no astronomical data points.

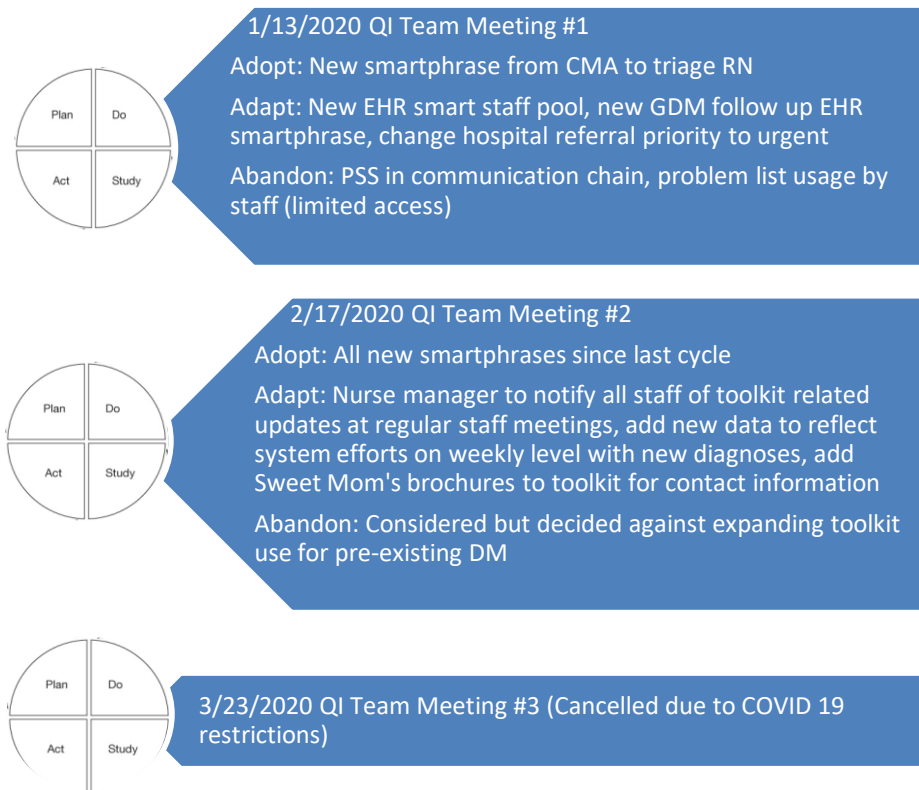
The goal to reach 75% of all patients in the clinic diagnosed with GDM was missed. This goal was initially developed as an estimate and from the broad perspective that a change was needed in the care for the population of people diagnosed with GDM in the microsystem.

QI Team Meetings

COVID 19 healthcare restrictions shortened the projected quality improvement initiative by one week and by one QI team meeting. QI team meetings, structured by IHI’s PDSA Worksheet, were essential to the process of change. Following the first QI team meeting, a jump in the quality indicator from 29.03% to 33.87% resulted. Shortly following the second QI team meeting, a dramatic increase in performance to 66.67% from 33.87% was observed. Figure 3 shows a brief summary of results from the PDSA Act step each month.

Figure 3

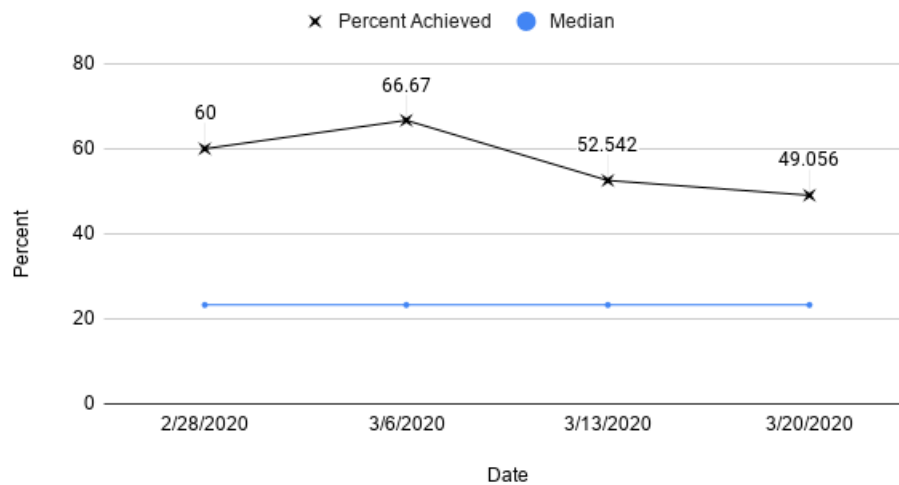
Summary of PDSA Act Step 4: Act and Adopt, Adapt and Abandon Decisions



In the second monthly QI team meeting, the QI team wanted to know more about how the microsystem had performed in the past week with new GDM diagnoses. The slow upward trend by a percentage point or two didn't capture the system's most recent progress. The decision was made to capture additional data on how many new weekly diagnoses there were and how many of those patients received GDM lifestyle interventions treatment. The denominator became the total number of patients newly diagnosed for the week and the numerator was how many patients received GDM lifestyle interventions with seven days of the diagnosis. Figure 4 illustrates the additional data used to evaluate the process.

Figure 4

GDM Lifestyle Interventions Newly Diagnosed Run Chart



Each week, two to five patients were newly diagnosed within the clinic. When the patient did not receive timely lifestyle interventions for the treatment of GDM, the misses were examined. The only observation that contributed to the decline in performance between 3/13/2020 and 3/20/2020 data points was that the new work flow was not followed when patients were unconventionally diagnosed with GDM. Unconventional diagnosis included patients who had a history of GDM and preferred to forego the three hour glucose tolerance test and instead assume GDM after a single elevated 1 hour glucose tolerance test. This data and process evaluation would have been included in the third QI team meeting had it not been canceled by COVID 19 restrictions.

Even though providers were invited to the microsystem QI team meetings and two had originally volunteered to participate, only one provider aside from the quality improvement leader, attended a meeting and this occurred once. Once the provider part of the team became aware of the system's low rate of lifestyle interventions treatment education for patients diagnosed with GDM compared to community standards, there was an initial interest in closing the evidence-practice gap which did not materialize into a presence for the process. Provider

contribution was limited to the leadership decision on whether or not the interventions should be sustained.

COVID 19

The project was restricted at the end by the-COVID-19 pandemic, which challenged all levels of health care systems to control and prevent transmission of the virus (Adhikari, 2020). Efforts to control the spread of Coronavirus-19 included “big isolation and big disinfection,” (Adhikari, 2020) and organizations were summoned to assist with these measures to prevent transmission. Video consultations, a form of telemedicine, were prioritized in both the United States and the United Kingdom in efforts to maintain public quarantine (Ohannessian, 2020). This project relied upon an in-person follow up visit within the clinic which was abruptly halted on 3/13/2020 to align with public health guidelines to reduce COVID-19 exposure risk. In response, providers asked for the GDM lifestyle interventions toolkit to be reviewed with patients by one of the QI team members, who is a level 1 diabetes educator via telemedicine. Practice implications for the future of this toolkit include the possible conversion of the GDM toolkit to an electronic format that could be more person-centered and delivered without an in-person visit to those who prefer technological access.

Discussion

Summary and Interpretation

This project was a combination of a practice toolkit, informed by synthesized knowledge, and a new QI team with monthly meetings structured around IHI’s PDSA Worksheet. This intervention was low cost and projected costs did not differ from actual costs. Data was more meaningful to the QI team when it reflected the immediate changes the organization desired to see, in contrast to the global or specific project long term aims. With performance data feeding

the QI team's action, the KTA framework was realized. Although the specific aim was missed, significant improvement in the delivery of GDM lifestyle interventions treatment was observed within a few months. Success for this quality improvement project was partially dependent on the degree of penetration of the new knowledge within the established microsystem communication patterns. Where there was not an adequate process before, this QI team and GDM lifestyle interventions toolkit became the new norm and based on improvement in the evidence practice gap, leadership recommended that the new process be sustained.

Although this GDM lifestyle interventions toolkit is unique, success with an improvement in the evidence practice gap was achieved with the use of a practice toolkit which was demonstrated in available knowledge. Limited studies also showed promise with web-based applications that link health care providers to the personal health records created by patients with GDM. With an increased focus on technological health care delivery mechanisms since COVID 19, research on how novel applications can link health care teams to people with GDM will inform future QI efforts. Future considerations would be to alter the GDM lifestyle interventions toolkit so that delivery could be conducted through telemedicine by the members of the prenatal health care team. An offer to conduct the follow up visit through technology would enhance the person-centered approach to health care delivery.

The GDM lifestyle interventions practice toolkit was designed for people who were fluent in English or Spanish, which was specific to this microsystem's context. Additional information is needed about resources in other languages.

Based on the upward trajectory of project data from baseline and the jump in improvements that followed QI meetings, this process likely needed more time to achieve the change in clinic population that was desired. More information is needed to learn about which

aspects of GDM lifestyle interventions quality improvement that would best engage prenatal providers. As the environment of health care is ever-changing, the ability of the staff to sustain the quality improvement process, rather than the changed work flow itself, would be a predictor of project success. Additional investigation as to how much the GDM practice toolkit increased expertise of the healthcare delivery team could also be explored.

It is possible that the COVID-19 public quarantine will permanently change health care delivery in the United States such that telemedicine will become a typical delivery mechanism. The success of telemedicine in the future depends on the resolution to challenges in reimbursement which have recently become thrust into the spotlight (Ohannessian, 2020). To meet the telemedicine demands, the GDM lifestyle interventions toolkit could be converted to an evidence-based electronic format and reimbursed by telemedicine standards.

Conclusions

A rapid test of change showed improvement in the lifestyle treatments for people with GDM evidence practice gap. Although the arbitrary goal of 75% over 3 months time was missed, a significant improvement in the provision of best practices was realized. The run chart trend suggested that the goal would have been met following additional QI team meetings. The combination of a specialty quality improvement team that utilized the IHI's PDSA worksheet and the integration of a practice toolkit showed promise and could be tested in other practices. Although COVID 19 shortened the project, the restrictions imposed to minimize virus spread opened up opportunities to convert this project to a format that could be delivered through telemedicine. The project could be improved upon through expansion of the practice toolkit material to meet language needs other than English or Spanish.

As the risk for T2DM increases throughout the globe, importance could be placed on the precursory warning of the GDM diagnosis as a way to ultimately reduce the progression of this disease. Just as the United States issued early mandates for social distancing to “flatten the curve,” or reduce the risk for future costs and strain to the medical system (Villas-Boas, et al., 2020) related to COVID-19, early interventions for the treatment of GDM may halt or slow the disease process over the human lifespan towards the more costly T2DM diagnosis.

References

- Adhikari, S., Meng, S., Wu, Y., Mao, Y., Ye, R., Wang, Q., Sun, C., Sylvia, S., Rozelle, S., Raat, H., Zhou, H. (2020). Epidemiology, causes, clinical manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the early outbreak period: a scoping review. *Infectious Diseases of Poverty*, 9(29). DOI <https://doi-org.liboff.ohsu.edu/10.1186/s40249-020-00646-x>
- American College of Obstetricians and Gynecologists (2018). *ACOG practice bulletin: Gestational Diabetes Mellitus*. Washington, DC: The College.
- American Diabetes Association (2017). Management of diabetes in pregnancy. *Diabetes Care*, 40(Suppl. 1), S114-119. DOI: 10.2337/dc17-S016.
- Barac, R., Stein, S., Bruce, B., Barwick, M. (2014). Scoping review of toolkits as a knowledge translation strategy in health. *BMC Medical Informatics and Decision Making*, 14(121). doi:10.1186/s12911-014-0121-7
- Brown, J., Alwan, N., West, J., Brown, S., McKinlay, C., Farrar, D., . . . Crowther, C. (2017). Lifestyle interventions for the treatment of women with gestational diabetes. *Cochrane Database of Systematic Reviews 2017*, 5. DOI: 10.1002/14651858.CD011970.pub2.
- Carolan-Olah, M., Duarte-Gardea, M., Lechuga, J., Salinas-Lopez, S. (2017). The experience of gestational diabetes mellitus (GDM) among Hispanic women in U.S. border region. *Sexual & Reproductive Healthcare*, 12, 16-23. <http://dx.doi.org/10.1016/j.srhc.2016.11.003>.
- Devchand, R., Sheehan, P., Gallivan, J., Tuncer, D., Nicols, C. (2017). Assessment of a National Diabetes Education Program diabetes prevention toolkit: The D2d experience. *American Association of Nurse Practitioners*, 514-520. doi:10.1002/2327-6924.12499

- Drozd, S., Thorlton, J. (2017). Diabetes self-management education: The art and science of disease management. In Cornell, S., Halstenson, C., Miller, D. (Eds.). *The art and science of diabetes self-management education desk reference* (4th Ed.)(3-28). Chicago, Illinois: American Association of Diabetes Educators.
- Field, B., Booth, A., Ilott, I., Gerrish, K. (2014). Using the Knowledge to Action Framework in practice: a citation analysis and systematic review. *Implementation Science*, 9(172). Retrieved from <https://implementationscience.biomedcentral.com/articles/10.1186/s13012-014-0172-2>
- Ghaffari, F., Rahnavard, Z., Salsali, M., Parvisi, S. (2016). The confusion of mothers with gestational diabetes mellitus due to the multidimensionality of healthcare and therapeutic care: A serious threat to mother and fetus's health. *Obstetrics and Gynaecology Cases*, 3(4).
- Gubrium, A., Leckenby, D., Harvey, M., Marcus, B., Rosal, M., Chasan-Taber, L. (2019). Perspectives of health educators and interviewers in a randomized controlled trial of postpartum diabetes prevention program for Latinas: A qualitative assessment. *BMC Health Services Research*, 19(357).
- Institute for Healthcare Improvement (2017). *QI Essentials Toolkit: PDSA Worksheet*. Retrieved from <http://www.ihl.org/resources/Pages/Tools/Quality-Improvement-Essentials-Toolkit.aspx>
- Kopec, J., Ogonowski, J., Rahman, M., Miazgowski, T. (2015). Patient-reported outcomes in women with gestational diabetes: A longitudinal study. *International Journal of Behavioral Medicine*, 22, 206-213.
- Miremberg, H., Ben-Ari, T., Betzer, T., Raphaeli, H., Gasnier, R., Barda, G. . . . Weiner, E.

- (2018). The impact of daily smartphone-based feedback system among women with gestational diabetes on compliance, glycemic control, satisfaction and pregnancy outcome: A randomized controlled trial. *American Journal of Obstetrics & Gynecology*, 218, 453.e1-7.
- Ohannessian, R., Duong, T., Odone, A. (2020). Global telemedicine implementation and integration within health systems to fight the COVID-19 pandemic: A call to action. *JMIR Public Health Surveillance*, 6(2), e18810. DOI 10.2196/18810
- Oregon Health Authority (2015). Oregon Diabetes Report: A Report on the Burden of Diabetes and Progress on the 2009 Strategic Plan to Slow the Rate of Diabetes. Retrieved from <https://www.oregon.gov/blind/Documents/OregonDiabetesReport.pdf>
- Oza-Frank, Ko, J., Wapner, A., Rodgers, L., Bouchard, J., Conrey, E. (2014). Improving care for women with a history of gestational diabetes: A provider perspective. *Maternal and Child Health Journal*, 18, 1683-1690.
- Perla, R., Provost, L., Murray, S. (2011). The run chart: a simple analytical tool for learning from variation in healthcare processes. *BMJ Quality & Safety*, 20, 46-51.
- Rasekaba, T., Furler, J., Young, D., Liew, D., Gray, K., Blackberry, I. . . . Lim, W. (2018). Using technology to support care for gestational diabetes mellitus: Quantitative outcomes of an exploratory randomized control trial of adjunct telemedicine for gestational diabetes mellitus (TeleGDM). *Diabetes Research and Clinical Practice*, 142, 276-285.
- Villas-Boas, S. B, Sears, J., Villas-Boas, M., & Villas-Boas, V. (2020). Are We #StayingHome to Flatten the Curve? *UC Berkeley: Department of Agricultural and Resource Economics*. Retrieved from <https://escholarship.org/uc/item/5h97n884>
- Shellhaas, C., Conrey, E., Crane, D., Lorenz, A., Wapner, A., Oza-Frank, R. . . . Bouchard, J. (2016). The Ohio gestational diabetes postpartum care learning collaborative:

- Development of a quality improvement initiative to improve systems of care for women.
- Singh, H., Soyoltulga, K., Fong, T., Billimek, J. (2018). Delivery outcomes, emergency room visits and psychological aspects of gestational diabetes. *The Diabetes EDUCATOR*, 44(5), 465-474.
- Maternal and Child Health Journal*, 20, S71-S80. DOI 10.1007/s10995-016-2170-2.
- Swed, F.S., Eisenhart, C.(1943). Tables for testing randomness of grouping in a sequence of alternatives. *The Annals of Mathematical Statistics* 14:66–87.
- Wang, C., Guelfi, K., Yang, H. (2016). Exercise and its role in gestational diabetes mellitus. *Chronic Diseases and Translational Medicine*, 208-214.
- <http://dx.doi.org/10.1016/j.cdtm.2016.11.006>
- White, K., Dudley-Brown, S., Terhaar, M. (2016). *Translation of Evidence into Nursing and Health Care* (2nd ed.). New York: Springer Publishing Company.
- Wilkinson, S., McCray, S., Beckmann, M., McIntyre, H. (2016). Evaluation of a process of implementation of a gestational diabetes nutrition model of care into practice. *Nutrition & Dietetics*, 73, 329-335. DOI: 10.1111/1747-0080.12233.
- Wilkinson, S., O'Brien, M., McCray, S., Harvey, D. (2019). Implementing a best-practice model of gestational diabetes mellitus care in dietetics: A qualitative study. *BMC Health Services Research*, 19(122). <https://doi.org/10.1186/s12913-019-3947-y>.
- Wolff, K., Chambers, L., Bumol, S., White, R., Gregory, B., Davis, D., Rothman, R. (2016). The PRIDE (Partnership to Improve Diabetes Education) Toolkit: Development and Evaluation of Novel Literacy and Culturally Sensitive Diabetes Education Materials. *The Diabetes EDUCATOR*, 42(1), 23-33.
- Yu, C., Lillie, E., Mascarenhas-Johnson, A., Gall, C., Straus, C. (2018). Impact of the Canadian

Diabetes Association guideline dissemination strategy on clinician knowledge and behavior change outcomes. *Diabetes and Research Clinical Practice*, 314-323.

<http://dx.doi.org.liboff.ohsu.edu/10.1016/j.diabres.2018.02.041>

Yuen, L., Wong, V. (2015). Gestational diabetes mellitus: Challenges for different ethnic groups. *World Journal of Diabetes*, 6(8), 1024-1032.

Appendix

List of GDM Lifestyle Interventions Toolkit Contents

Glucose Log with glucose value targets	Clinic Generated	English & Spanish
Web-based interactive Choose Your Plate tool https://www.choosemyplate.gov/eathealthy/start-simple-myplate https://www.choosemyplate.gov/browse-by-audience/view-all-audiences/multiple-languages/multilanguage-spanish	United States Department of Agriculture	English & Spanish
Choose Your Foods, Plan Your Meals, 2 nd Ed. English: ISBN: 978-0-88091-044-6 Spanish: Item #: 5617-06	American Diabetes Association & Academy of Nutrition and Dietetics	English & Spanish
Salem Health “Sweet Moms” Brochure (Registered Dietician/Diabetes Educator)	Salem Health	English & Spanish
Exercise in Pregnancy Volume 59, Number 4	American College of Nurse Midwives	English
KRAMES gestational diabetes booklet #11949	StayWell	English & Spanish
Instructions for how to share glucose values with health care team	Clinic Generated	English & Spanish
Exercise in Pregnancy 2017 SP 119	American College of Obstetricians and Gynecologists	Spanish