A quality improvement project to improve treatment of severe hypertriglyceridemia in veterans

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ABSTRACT

Background: Severe hypertriglyceridemia (sHTG) is associated with an increased risk of acute pancreatitis. Prompt recognition and treatment of sHTG is key for prevention of acute pancreatitis and its associated life-threatening complications.

Local problem: Patients with sHTG at a primary care clinic within the Veterans Affairs Eastern Colorado Health Care System were receiving suboptimal treatment that did not align with evidence-based guidelines.

Methods: We initiated a quality improvement (QI) project to improve the management of sHTG in an outpatient primary care clinic. Veterans with a triglyceride level between 500 and 1,500 mg/dl were included in the project.

Interventions: Project interventions included provider education, patient education, and targeted electronic consultations (e-consults) with treatment recommendations. The primary outcome was to decrease the percentage of patients with triglycerides ≥500 mg/dl by 25%. The secondary outcome was to decrease the mean triglyceride level of the patient population by 15%.

Results: Education on evaluation and treatment of sHTG was given to 100% (n = 21) of primary care clinicians. Overall, 72.8% (95% CI [62.6–81.6%]) of patients (n = 67) received appropriate written education materials, and 72.8% (95% CI [62.6–81.6%]) of patients (n = 67) received a targeted e-consult. The percentage of patients with sHTG decreased by 47%. Average triglyceride level decreased from 651 to 483 mg/dl (25.8% decrease).

Conclusion: A multipronged QI project consisting of provider education, patient education, and targeted e-consults resulted in decreased triglyceride levels and improved access to specialist expertise. Clinical implications include decreased prevalence of sHTG and risk of acute pancreatitis among patients in the project.

Keywords: Acute pancreatitis; e-consult; lipids; quality improvement; severe hypertriglyceridemia; triglycerides.

Journal of the American Association of Nurse Practitioners 36 (2024) 719–727, © 2024 American Association of Nurse Practitioners

DOI# 10.1097/JXX.0000000000001017

Introduction

Hypertriglyceridemia (HTG), defined as a triglyceride level of 150 mg/dl or greater, is the most common form of hyperlipidemia and affects more than 30% of US adults (Hernandez et al., 2021; Simha, 2020). Severe HTG, defined as a triglyceride level of 500 mg/dl or above, has an estimated prevalence of 2.5% (Esparza et al., 2019). Severe HTG is a significant risk factor for acute pancreatitis and accounts for an estimated 10% of cases (Grundy et al., 2019; Hernandez et al., 2021). Although persistent triglyceride elevations of 175 mg/dl and above are also a risk factor for cardiovascular disease, this project's focus was severe elevations in triglyceride levels and their relation to acute pancreatitis (Grundy et al., 2019). Hypertriglyceridemia-induced acute pancreatitis can lead to multisystem organ failure, pancreatic necrosis, renal failure, and death (Kiss et al., 2018; Sue et al., 2017). Timely diagnosis, evaluation, and treatment of severe hypertriglyceridemia (sHTG) is crucial because the risk of developing acute pancreatitis commensurately intensifies as triglyceride levels increase (Hernandez et al., 2021; Yang & McNabb-Baltar, 2020). Acute pancreatitis due to undertreatment of sHTG is linked with higher health care costs (Meng et al., 2019; Yan et al., 2020).

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Received: *6 December 2023; revised: 21 February 2024; accepted 6 March 2024*

Problem description

At the local level, sHTG affects hundreds of patients at the Rocky Mountain Regional Veterans Affairs Medical Center (RMR VAMC). Baseline data gathered by chart review

before project initiation found that more than one-third (35%) of these patients were receiving treatment that did not align with evidence-based guidelines, which recommend pharmacologic treatment in addition to diet and lifestyle modifications for adults with sHTG (Grundy et al., 2019; Newman et al., 2020).

Several areas for improvement in the treatment of sHTG in veterans at RMR VAMC were identified based on chart reviews conducted before the project started. Primary care providers (PCPs) were often unaware of patients' triglyceride levels or the significance of those levels, as evidenced by lack of documentation in the electronic medical record (EMR), and subsequently failed to address the problem or initiate treatment. In other cases, PCPs recognized the diagnosis of sHTG but did not implement treatment in accordance with evidence-based guidelines, presumably because of lack of appropriate knowledge. Lastly, increased patient education on optimization of lifestyle factors, which is essential to decreasing triglyceride levels, was needed (Simha, 2020).

A review of the literature and identification of deficits in treatment at the RMR VAMC uncovered an opportunity for improvement in quality of care for patients with sHTG. Educating providers on best practice guidelines, teaching patients about their diagnoses, and implementing a targeted endocrine electronic consultation helped promote positive changes in treatment strategies and improve patient outcomes.

Available knowledge

The available literature underscores the importance of the relationship between sHTG and risk of acute pancreatitis, as well as the value of treatment of sHTG. Multiple studies demonstrate that sHTG is associated with risk of acute pancreatitis (Meng et al., 2019; Song et al., 2021; Zhang et al., 2019). The study by Zhang et al. (2019) found that clinical outcomes, including persistent organ failure and mortality, worsened significantly in accordance with increasing triglyceride levels. It is clear from these results that patients with sHTG are at amplified risk of acute pancreatitis, and that lowering triglyceride levels can lead to reduction of severity of pancreatitis. Another study by Meng et al. (2019) similarly concluded that the rate of persistent organ failure in acute pancreatitis was proportional to the triglyceride elevation. These findings substantiate the value of appropriate treatment of sHTG and the potential consequences of overlooking this lipid abnormality.

Prompt recognition and early treatment of sHTG is key for prevention of acute pancreatitis and its associated life-threatening complications. The potential damage of failing to address sHTG is demonstrated in a systematic review and meta-analysis by Kiss et al. (2018). Their results revealed that HTG worsens the course and severity of acute pancreatitis, which is significant because severe acute pancreatitis carries a mortality rate of 20–40% (Boxhoorn et al., 2020; Schepers et al., 2019; Shuanglian et al., 2023). A related study by Sue et al. (2017) assessed clinical outcomes in patients hospitalized for acute pancreatitis and found an association between HTG and risk of multisystem organ failure. The authors ascertained that 59.5% of patients hospitalized with acute pancreatitis who had triglyceride levels >500 mg/dl had very high triglyceride levels in the year preceding their hospitalization. These discoveries illustrate that improved treatment of sHTG in the outpatient setting has the potential to decrease the incidence of acute pancreatitis and its related complications.

Guidance from specialists can be helpful for PCPs but is often unavailable in rural locations. This can lead to delays in treatment because of long wait times. Electronic consultations (e-consults) address both issues by providing a way for PCPs to receive virtual recommendations from specialists after posing a patient-specific question. Timely guidance from specialists on metabolic disorders such as sHTG can be delivered by electronic consultations (e-consults), which enable rapid access to specialists. In one Veterans Health Administration (VHA) study comparing e-consult and traditional consults, use of e-consults decreased response time from specialists from an average of 34.4 days to just 2.4 days (Wachter et al., 2019). Within the VHA, e-consults are used widely, and in certain situations, they may substitute for in-person visits and save transportation costs for both patients and the larger health care system (Saxon et al., 2021). "Targeted" e-consults use the EMR to identify patients who would benefit from specialist expertise instead of relying on a traditional consult request from the patient's primary care team (Judson et al., 2022; Wachter et al., 2019).

The impact of rapid problem recognition and response by specialists is illustrated by Park et al. (2018), who implemented a quality improvement (QI) project using targeted e-consults. Their project resulted in improved clinical outcomes of recovery from acute kidney injury (AKI) and decreased likelihood of an unnoticed AKI event. These findings showcase the utility and versatility of e-consults. E-consults foster more timely access to specialty care and allow specialists to provide guidance to PCPs for issues that may otherwise have gone undertreated or untreated.

Rationale

Imogene King's Theory of Goal Attainment was used as a theoretical framework to develop and guide this project. According to King's theory, patients and nurses should mutually agree on goals and then work to achieve them through a transaction process (King, 1981). King's theory aligns with this project because there is a substantial lifestyle component that must be addressed when

treating sHTG. If a patient does not understand the goal or significance of treatment, it is unlikely that treatment will be completely successful. King's model shaped this project's aims and interventions through its emphasis on shared goals and the use of feedback to revise and improve patient care.

In conjunction with King's Theory of Goal Attainment, Everett Rogers' Diffusion of Innovations Change Theory was used to guide project interventions. Rogers' (2003) model outlines a five-step process for planned change: knowledge, persuasion, decision, implementation, and confirmation or continuation. Rogers' model was used to guide the QI process and ensure project interventions were carefully researched, discussed, and evaluated among the project team before they were implemented.

Specific aims

The aims of this QI project included (1) decreasing the percentage of patients with sHTG at a primary care clinic by 25% and (2) decreasing the aggregate mean triglyceride level of patients in this clinic by 15%.

Methods

Context

The project setting was an outpatient primary care clinic within the RMR VAMC—a tertiary teaching hospital in Aurora, Colorado. The clinic is comprised of 18 medical doctors and three nurse practitioners (NPs) and serves military veterans receiving care for chronic and acute health conditions. Specialty care is housed in the same facility. All clinicians use the same EMR system for notes, medication orders, imaging, and laboratory results.

Patients seen at the RMR VAMC primary care clinic from January 2020 through December 2020 who had a triglyceride level between 500 and 1,500 mg/dl were deemed eligible for project inclusion. This triglyceride range was chosen because patients with levels above 1,500 mg/dl require rapid evaluation and intervention, which was not the focus of this project. Patients who were pregnant or pursuing pregnancy were excluded from project eligibility.

The project was conducted from January 2021 to December 2021, during which time the COVID-19 pandemic persisted. Implementation of interventions began in April 2021 and continued for 6 months.

Interventions

1. Provider Education

Two 1-hr educational sessions about the project background, goals, and planned interventions, as well as provider-focused education on diagnosis and management of sHTG, were conducted by an endocrine NP, an endocrine attending physician, and a pharmacist with expertise in lipids. This was followed by a second educational presentation to PCPs on the importance of early recognition of sHTG, identification of primary and secondary causes of sHTG, and therapies available for treatment.

2. Patient Education

The project team mailed educational materials to patients with sHTG. Materials included a letter explaining the intention of the correspondence and a colorful one-page document, published by the National Lipid Association (2014). This document included information on triglycerides, including ways to lower triglyceride levels and make healthy lifestyle changes.

3. Targeted E-Consults

An e-consult template was created that summarized the importance of treatment of sHTG and the treatment options recommended by evidence-based clinical practice guidelines. Each e-consult was tailored to the patient by including the most recent laboratory tests and any triglyceride-lowering drugs already being prescribed. E-consults were added to charts monthly in waves of 5–10 patients, and the template was revised after each wave based on feedback from PCPs or other knowledge gained from the small cycle of change. Patient charts were randomly selected and reviewed monthly to determine whether the PCP acknowledged receipt of the e-consult and whether any action was taken based on e-consult recommendations, such as ordering new laboratory tests or medications. The intervention was deemed to be effective in the short term if the PCP acknowledged receipt of the e-consult or acted on the recommendations. Long-term effectiveness was determined by changes in patients' triglyceride levels in accordance with the project's outcome measures and goals.

Study of the interventions

Data collection began 3 months before project implementation and continued for 6 additional months while the interventions were performed. Interventions followed the Institute for Health Improvement's (2021) Plan-Do-Study-Act (PDSA) methodology, which involves planning the intervention, implementing the intervention, analyzing the effect of the intervention, and deciding which revisions are needed to the intervention based on the results of the cycle.

The impact of the interventions was assessed by tracking changes in project measures using run charts, control charts, and comparison of statistical data from month to month. To determine whether the outcomes were due to the interventions, pre-project data were used

as a baseline for comparison to data collected during and after implementation of the interventions.

Measures

Two outcome measures were used to assess achievement of the project goals:

1. Decrease the percentage of patients at RMR VAMC primary care clinic with triglyceride levels between 500 and 1,500 mg/dl by 25% by the project end date.
2. Decrease the mean triglyceride level of patients at RMR VAMC primary care clinic with triglyceride levels between 500 and 1,500 mg/dl by 15% by the project end date.

These outcome measures were chosen based on evidence that early identification and treatment of sHTG is crucial for prevention of acute pancreatitis (Yang & McNabb-Baltar, 2020). Data for outcome measures were tracked using an EMR report created by a VA-appointed data analyst.

Three process measures were designed to assess project progress:

1. 90% of PCPs would receive education on new guidelines and recommended treatment for sHTG.
2. 50% of patients with sHTG would receive written education on the significance of sHTG and triglyceride-lowering strategies. This measure was hindered by inefficiency and cost associated with printing and mailing informational materials.
3. 75% of patients with sHTG would receive a targeted endocrine e-consult with treatment recommendations. This measure was chosen based on evidence that e-consults can decrease wait time for specialty care and lead to improved patient outcomes (Park et al., 2018; Wachter et al., 2019).

Process measures were tracked by team members and reviewed monthly for completeness and accuracy.

The project team used a balancing measure to gauge whether the interventions were creating unintended consequences. Because the team anticipated an increased volume of referrals to endocrinology specialty care, a balancing measure of endocrinology clinic wait time for new patient visits was chosen, with a goal that wait time would not increase. Data for this measure were tracked with an organizational wait-time tool.

Analysis

Data were collected monthly for both outcome measures. The first outcome measure was analyzed with a run chart—a graph of data over time—by using the Institute for Health Improvement [IHI] (2021) methods for identifying meaningful signals of change. The second outcome measure was analyzed using a paired *t*-test to compare the difference between pre-project and post-project aggregate mean triglyceride levels. The *t*-test was chosen to enhance project rigor and assess whether improvements in triglyceride levels could be attributed to the project interventions. Patients who were identified in the baseline data but did not have a new lipid panel drawn after project implementation were excluded from the paired *t*-test, resulting in a *t*-test sample size of 56 patients. The *t*-test has 79% power to detect a 15% decrease in mean triglyceride level based on the starting mean of 651 mg/dl with an SD of 185, sample size of 56 patients, and type I error rate of 5%. The second outcome measure was also tracked with a run chart to assess changes over time and demonstrate the effects of time as a variable. Data points were added monthly to each run chart for a total of 10 data points per chart. A moderate effect size was anticipated for both outcome measures based on published studies with similar methods.

Data were collected monthly for each process measure. Process measures were analyzed using descriptive statistics by comparing post-intervention percentages and corresponding confidence intervals (CIs) to each process measure goal. The balancing measure was analyzed with a control chart using IHI methods for identifying process stability and variation. Data for this measure were collected and added to the control chart every two weeks for a total of 16 data points.

Ethical considerations

This QI project was designed with the intent of improving practice within the RMR primary care clinic and with the expectation that participants would be positively impacted by the interventions. It was approved as QI by the VA Research Office within the Eastern Colorado Health Care System and the University of Colorado College of Nursing. The project did not involve human participants research, and patient consent was not required. All eligible patients were included in the project. Ethical consideration was given to participants' privacy. Data were stored in a secure Microsoft Excel file and de-identified for all analyses.

Results

A total of 92 patients met criteria for project inclusion (**Table 1**). Patients were 96% male, mean age of 52.7 years, 72.8% White, and 33.7% had diabetes. At baseline, mean triglyceride level was 651 mg/dl ± 185 mg/dl, and only 12% were prescribed a fibrate, 17% were prescribed fish oil, and 34% were prescribed a high-intensity statin.

With the implementation of interventions, the outcome measure of the percentage of patients at RMR VAMC primary care clinic with triglyceride levels between 500 and 1,500 mg/dl decreased by 47% (from 92 patients to 49 patients; **Figure 1**). Unfortunately, only 56 of the 92 patients (61.5%) had laboratory tests repeated after the interventions

Table 1. Baseline characteristics

Variable	Total Cohort	Cohort With Repeat Laboratory Tests
N	92	56
Age (years)[a]	52.7 ± 13.4	53.8 ± 12.9
Male sex, *N* (%)	88 (96)	54 (96)
Race, *N* (%)		
White	67 (72.8)	44 (78.6)
Black	7 (7.6)	4 (7.1)
Asian	6 (6.5)	3 (5.4)
American Indian	3 (3.3)	2 (3.6)
Pacific islander	2 (2.2)	0 (0)
Unknown	7 (7.6)	3 (5.4)
BMI (kg/m^2)[a]	31.5 ± 4.7	32.0 ± 4.8
Hemoglobin A1C (%)[a]	6.6 ± 1.9	6.7 ± 1.9
Diagnosis of diabetes mellitus, *N* (%)	31 (33.7)	21 (37.5)
Lipid levels		
Total cholesterol (mg/dl)[a]	229 ± 59	229 ± 53
LDL-C (mg/dl)[a]	113 ± 39	109 ± 39
HDL-C (mg/dl)[a]	33 ± 8	32 ± 8
Triglyceride (mg/dl)[a]	651 ± 185	669 ± 214
Lipid-lowering therapy, *N* (%)		
No therapy	32 (35)	19 (34)
Single drug	47 (51)	28 (50)
Combination therapy with two drugs	12 (13)	8 (14)
Combination therapy with three drugs	1 (1)	1 (2)
Lipid-lowering drugs, *N* (%)		
Fibrate	11 (12)	7 (13)
Omega 3 fatty acid	16 (17)	10 (18)
Ezetimibe	1 (1)	1 (2)
Statins	46 (50)	29 (52)
High intensity	31 (34)	21 (38)
Moderate intensity	12 (13)	6 (11)
Low intensity	3 (3)	2 (4)

Note: BMI, body mass index; N = number of patients.
[a]*Mean ± SD.*

were implemented. The lack of laboratory data means that 36 patients were assumed to have had no change. The inclusion of these patients in the percentage change calculation may have falsely elevated the result of 47%.

When the patients without repeat laboratory tests were excluded and only the 56 patients who had repeat laboratory tests drawn over the course of the project were considered, the percentage of patients with triglyceride

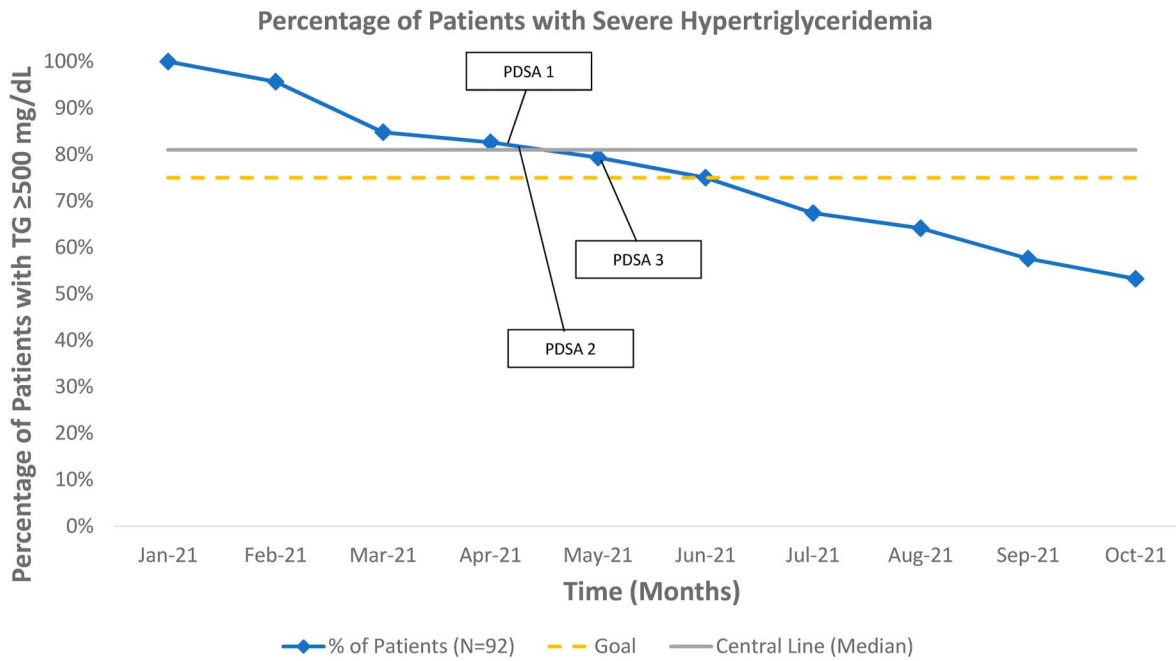

Figure 1. Percentage of patients with severe hypertriglyceridemia in the project cohort. *N*, number of patients; TG, triglycerides; PDSA, Plan-Do-Study-Act.

levels between 500 and 1,500 mg/dl decreased by 77% (from 56 patients to 13 patients). There were signals of non-random patterns within the run chart, including a shift immediately after PDSA cycle two and a trend of all data points decreasing after project initiation per the IHI run chart rules (2021).

The secondary outcome measure of mean triglyceride level of patients at RMR primary care clinic decreased by 26% (from 651 to 483 mg/dl) among all 92 patients, including those whose baseline levels were used because they did not have repeat laboratory tests drawn after project implementation. When the 36 patients without repeat laboratory data were removed from the analysis, there was a 41% decrease in mean triglyceride level (from 669 to 393 mg/dl) in the remaining patients (n = 56). **Figure 2** demonstrates the change in mean triglyceride level over time among project participants. Institute for Health Improvement run chart rules were not applied because the outcome measure was analyzed using a paired t-test. The paired t-test included the 56 patients who had laboratory tests drawn after project implementation. The t-test, depicted in **Table 2**, demonstrated a difference in means that was statistically significant ($p < 0.001$).

The PCP education process measure goal was met by 100% (95% CI [83.9–100%]) of the 21 PCPs attending educational sessions or acknowledging e-consult recommendations on new guidelines and recommended treatment for HTG. The patient education process measure goal was also achieved with 72.8% (95% CI [62.6–81.6%]) of patients (n = 67) receiving appropriate written education materials. The e-consult process measure fell slightly short of the goal because only 72.8% (95% CI [62.6–81.6%]) of patients (n = 67) received a targeted e-consult. The primary reason that an e-consult was not performed was that repeat laboratory tests showed a triglyceride level <500 mg/dl; this occurred for 23 patients within the cohort.

Notably, 30.4% (n = 28) of 92 patients had a lipid-lowering medication prescription change during the intervention. Thirteen patients who were not on any triglyceride-lowering medications at baseline were started on at least one medication, and 15 patients who were on at least one medication at baseline had their therapy intensified with an increase in dose or a prescription for a new medication. Specific medication changes seen were addition of fish oil (n = 12), addition of statin (n = 7), addition of fibrate (n = 6), increase in fish oil dose (n = 3), change in fibrate prescribed (n = 2), and increase in statin dose (n = 1).

The project did not achieve the balancing measure goal. Endocrinology clinic wait time for new patient visits rose to 51 days halfway through project implementation and continued climbing for the duration of the project, despite a lack of increase in endocrinology consultations for lipid disorders. These results are depicted by the control chart in **Figure 3**. The increase in wait time was attributed to turnover among scheduling, staff leading to decreased efficiency and errors in scheduling, and decreased appointment availability because of loss of endocrine providers.

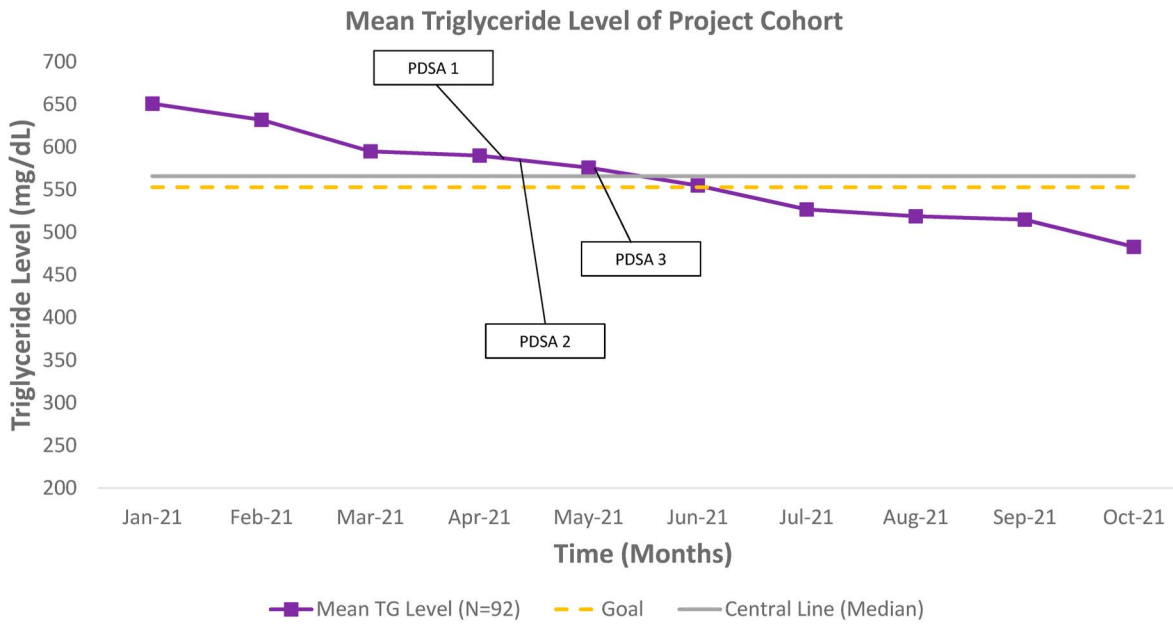

Figure 2. Mean triglyceride level of project cohort. *N*, number of patients; TG, triglycerides; PDSA, Plan-Do-Study-Act.

Discussion

Summary

The implementation of PCP education, patient education, and targeted e-consults from endocrine specialty clinicians resulted in improved patient outcomes and a statistically significant decrease in mean triglyceride levels. Key findings include improvement in triglyceride levels for 89% of patients who had laboratory tests drawn after implementation of interventions. Project strengths include its alignment with evidence-based practice guidelines for treatment of sHTG and its potential for replication and dissemination to other VHA medical centers (Grundy et al., 2019; Newman et al., 2020).

Interpretation

Project results surpassed expected outcome goals. For the first outcome measure, the 47% decrease in patients with TG levels between 500 and 1,500 mg/dl exceeded the goal of 25%. For the second outcome measure, the 26% decrease in mean triglyceride level exceeded the goal of 15%. The project team was able to reduce the percentage of patients with sHTG and increase prescribing of triglyceride-lowering medications. The project had a positive impact on patients and the health care system, as evidenced by the lack of patient hospitalizations for pancreatitis due to sHTG after implementation of the interventions and the decreased risk of acute pancreatitis among patients because of lower triglyceride levels. Results aligned with findings from other similar QI projects, which have demonstrated improvement in laboratory values such as hemoglobin A1C and serum creatinine after implementation of targeted e-consults or automatic specialty consults (Karslioglu-French et al., 2023; Park et al., 2018).

Process measure results for PCP and patient education aligned with expectations, but the project fell short of achieving the process measure goal that 75% of patients would receive a targeted e-consult. The difference between the actual and anticipated e-consult outcome was due to improvement in triglyceride levels of several patients, which occurred before project team members were able to add a targeted e-consult to the EMRs of these patients. The team decided not to place an e-consult in the EMRs of the 25 patients whose triglyceride levels fell below 500 mg/dl after implementation of the other interventions.

An unintended benefit of the project was a change in pharmacy policy regarding one of the first-line drugs used to treat HTG. As a result of the policy change, a previous authorization request is no longer required when prescribing the drug fenofibrate.

Table 2. Comparison of pre-project and post-project mean triglyceride levels using a paired *t*-test

	Pre-intervention Mean (95% CI)	Post-intervention Mean (95% CI)	Mean Difference (95% CI)	*p* Value
Mean TG level	669 (612–727)	393 (335–450)	277 (193–361)	<.001

Note: CI, confidence interval; TG, triglyceride.

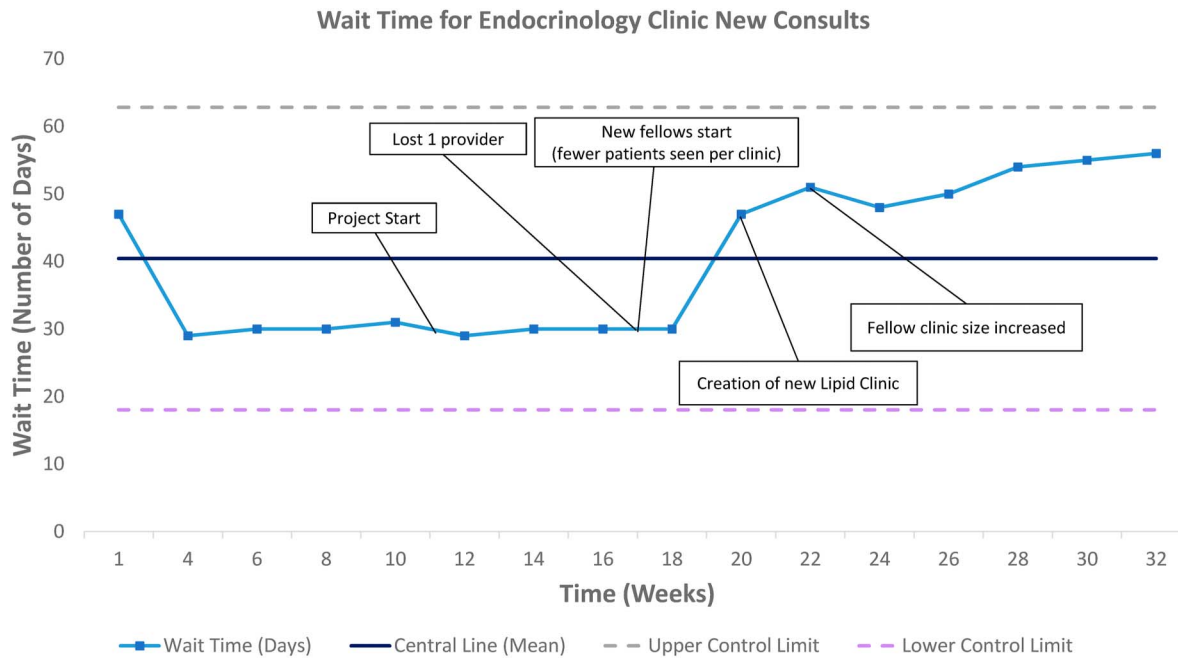

Figure 3. Wait time for endocrinology clinic new consults during project implementation.

Limitations

The project had several limitations. First, the targeted e-consults were not implemented in real time when laboratory tests resulted. Although efforts were made to complete e-consults in a timely manner, a real-time automated e-consult system has the potential to further improve outcomes by decreasing the response time of PCPs for diagnosis and treatment of sHTG. Second, although patient adherence to prescribed lipid-lowering medications likely affected our findings, we did not monitor medication adherence rates. Third, the e-consult intervention may not be generalizable to smaller health care systems that do not include specialty care. Fourth, team members were not able to confirm that written education materials were reviewed and understood by all patients. Last, the COVID-19 pandemic caused many patient visits to be conducted remotely over telehealth. This modality change may have caused patients to be less likely to have laboratory tests drawn.

Conclusions

This project demonstrated that a combination of educational interventions and targeted e-consults can improve the recognition and treatment of sHTG in the outpatient setting. Targeted e-consults can improve patient care by increasing involvement of specialty providers and improving recognition and treatment of sHTG by PCPs. Clinical implications include decreased prevalence of sHTG and possible decreased long-term risk of acute pancreatitis among patients included in the project.

Project findings can be used by primary and specialty care NPs in clinical practice to guide their approach to treatment of sHTG and prevent adverse patient outcomes. This NP-led project can also serve as a model for other NPs who wish to assume a similar leadership role in improving care. Furthermore, it can be replicated by other specialty NPs who want to improve treatment of conditions that are easily overlooked by a non-specialty provider but have severe clinical repercussions if untreated.

The project team worked to make project interventions sustainable. Team members added educational materials to a shared data drive within RMR VAMC and integrated written materials for patient education into the EMR because continuing to mail these resources was not feasible for the long term. Next steps include continued work on e-consult automation and organization of annual educational presentations from endocrine providers to RMR VAMC PCPs.

The project has potential for expansion to other primary care clinics within RMR VAMC. All RMR VAMC clinics use the same EMR, which means that additional clinics can easily be incorporated into the project. If success is demonstrated in other primary care clinics, there is also potential for expansion to other VA medical centers across the country. Further research should test the impact of targeted automatic e-consults on HTG management in a larger cohort of patients because this is an area that has not yet been examined, despite potential mortality risks associated with HTG-induced acute pancreatitis.

For others who may wish to replicate this project, there were several key lessons learned during project implementation. Future project teams should consider PCP

turnover when implementing PCP education and provide an easily accessible way for new PCPs to access educational materials. The potential for improved efficiency with automated targeted e-consults should also be considered because an automated process is efficient, sustainable, and allows for e-consult implementation in real time.

Authors' contributions: *C.R. Wool developed the quality improvement project, implemented all interventions, collected chart data, performed all analyses, wrote the initial manuscript draft, and revised the manuscript for its final submission. K. Shaw provided mentorship by assisting with development and execution of the project and revision of the manuscript. D.R. Saxon assisted with development and implementation of the project interventions and revision of the manuscript. All authors have approved the final article.*

Competing interest: *The authors report no conflicts of interest.*

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