

UCLA

UCLA Previously Published Works

Title

A qualitative analysis describing attrition from bariatric surgery to identify strategies for improving retention in patients who desire treatment.

Permalink

<https://escholarship.org/uc/item/1jb6j9q5>

Journal

Surgical Endoscopy, 37(8)

Authors

Delaney, Lia
Alimi, Yewande
Jafri, Sara
et al.

Publication Date

2023-08-01

DOI

10.1007/s00464-023-10030-z

Peer reviewed



A qualitative analysis describing attrition from bariatric surgery to identify strategies for improving retention in patients who desire treatment

Grace F. Chao^{1,2,3} · Kerry Lindquist⁴ · Crystal A. Vitous⁴ · Dante A. Tolentino⁵ · Lia Delaney⁴ · Yewande Alimi⁶ · Sara M. Jafri⁴ · Dana A. Telem^{4,7}

Received: 21 January 2023 / Accepted: 12 March 2023

© The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature 2023

Abstract

Background Among patients who express interest in bariatric surgery, dropout rates from bariatric surgery programs are reported as high as 60%. There is a lack of understanding how we can better support patients to obtain treatment of this serious chronic disease.

Methods Semi-structured interviews with individuals who dropped out of bariatric surgery programs from three clinical sites were conducted. Transcripts were iteratively analyzed to understand patterns clustering around codes. We mapped these codes to domains of the Theoretical Domains Framework (TDF) which will serve as the basis of future theory-based interventions.

Results Twenty patients who self-identified as 60% female and 85% as non-Hispanic White were included. The results clustered around codes of “perceptions of bariatric surgery,” “reasons for not undergoing surgery,” and “[factors for re-considering surgery](#).” Major drivers of attrition were burden of pre-operative workup requirements, stigma against bariatric surgery, fear of surgery, and anticipated regret. The number and time for requirements led patients to lose their initial optimism about improving health. Perceptions regarding being seen as weak for choosing bariatric surgery, fear of surgery itself, and possible regret over surgery grew as time passed. These drivers mapped to four TDF domains: environmental context and resources, social role and identity, emotion, and beliefs about consequences, respectively.

Conclusions This study uses the TDF to identify areas of greatest concern for patients to be used for intervention design. This is the first step in understanding how we best support patients who express interest in bariatric surgery achieve their goals and live healthier lives.

Keywords Uptake bariatric surgery · Patient retention

✉ Grace F. Chao
grace.f.chao@yale.edu

¹ National Clinician Scholars Program at the Institute for Healthcare Policy and Innovation, University of Michigan, Ann Arbor, MI, USA

² Veterans Affairs Ann Arbor, Ann Arbor, MI, USA

³ Department of Surgery, Yale School of Medicine, PO Box 208062, New Haven, CT, USA

⁴ Center for Healthcare Outcomes and Policy, University of Michigan, Ann Arbor, MI, USA

⁵ School of Nursing, University of California Los Angeles, Los Angeles, CA, USA

⁶ Department of Surgery, Georgetown University Medical Center, Washington, DC, USA

⁷ Department of Surgery, University of Michigan, Ann Arbor, MI, USA

Of the over 33 million individuals eligible for bariatric surgery in the United States, less than 1% of eligible patients yearly complete surgery [1, 2]. Utilization of this life-altering intervention is inadequate. Perhaps more alarming is that among patients who express interest in this therapy and engage with bariatric centers, the dropout rate of eligible surgical candidates has been reported as high as 60% [3–5]. There is a lack of understanding how the healthcare system can better support patients to obtain treatment of this serious chronic disease.

A number of factors for this high attrition rate have been proposed such as inadequate or lack of insurance coverage and the high burden of pre-surgical requirements. With regard to insurance coverage, studies using quantitative methods have shown that increased cost-sharing decreases bariatric surgery uptake [6, 7]. Gasoyan et al. found that insurance type

(private insurance [8], preferred provider organization plans [9], and fee-for-services-plans [9]) increases bariatric surgery utilization as well [8]. However, health insurance coverage is unlikely to be significant enough as an independent reason for attrition [5, 10]. Even in countries with universal healthcare, the attrition rate is approximately 50% [11]. For pre-surgical requirements, both the number and type of pre-surgical requirements (e.g., requiring months of medically supervised weight loss [9], be accompanied by a support person during clinic visits [3], cardiology evaluation [12]) have been shown to be significantly associated with attrition from bariatric surgery programs. However, the nuances of how these proposed factors as well as other not yet identified factors work together to cause dropout remains unknown. Additionally, prior research focuses on insurance variables or comorbidity burden which are largely non-modifiable.

In order to identify strategies to reduce this attrition, we need a better understanding of the factors that contribute to patients' decisions to drop out of the bariatric surgery process. In this context, we utilize a qualitative approach to understand the experiences of patients who started the process leading to bariatric surgery but chose not to complete surgery. We learn from patients themselves to inform nuanced, multifaceted, theory-informed strategies to promote completion of bariatric surgery.

Materials and methods

Study design

We identified patients from three clinical sites who had dropped out of bariatric surgery programs. These clinical sites represented a suburban community center, a suburban academic center, and an urban academic center. The study protocol was approved by the University of Michigan Institutional Review Board (HUMID#00171265). Verbal informed consent was obtained from all participants of the study prior to their interview. The study is reported according to the Consolidated Criteria for Reporting Qualitative Studies (COREQ) guidelines [13] (Supplement 1).

Study population

Participants were recruited using purposive sampling. We reached out via phone to participants who dropped out of the bariatric surgery programs from December 2017 to January 2019. Attrition was defined as persons who initiated the process of bariatric surgery (attending an initial evaluation visit in clinic) but did not complete bariatric surgery. Patients dropped out of the process anywhere along the continuum from after the initial evaluation up to scheduling a surgical date (e.g., after the initial evaluation, after participating for

months, after scheduling a surgery date). We reached out to 31 patients by phone and met our goal of 20 participants (64.5% response rate). We excluded patients who did not meet NIH criteria for surgery or were deemed not to be a surgical candidate by the multidisciplinary board. Our final group of participants was diverse with respect to gender (60% Female) and age (35% < 45 years; 50% 45–65 years; 5% > 65 years; 10% No Answer). Of our participants, 85% self-identified as “White,” 10% as “Black,” and 5% as “Mixed Race.” With regard to self-reported BMI, 10% had a BMI of < 35 kg/m², 15% of 35–40 kg/m², 60% of 40 kg/m² or greater, and 15% did not answer their height and weight.

The Theoretical Domains Framework and interview guide

We used the Theoretical Domains Framework to develop our semi-structured interview guide and then to analyze patient responses in a systematic manner to identify behavioral change techniques. The Theoretical Domains Framework is a robust implementation science framework that applies organizational theory towards behavioral change [14–16]. The framework integrates 35 theoretical models of human behavior change into 14 domains. These 14 domains are (1) knowledge; (2) skills; (3) social or professional role and identity; (4) beliefs about capabilities; (5) optimism; (6) beliefs about consequences; (7) reinforcement; (8) intentions; (9) goals; (10) memory, attention, and decision processes; (11) environmental context; (12) social influences; (13) emotion; and (14) behavioral regulation [16]. Each of these domains includes constructs which in turn map to specific behavioral change techniques (Fig. 1). The TDF has been used extensively in healthcare to identify behavioral change practices to increase physical activity [17, 18], to improve smoking cessation rates [19], to increase cohesion between provider practice and guidelines [14, 20, 21], and to minimize trainee prescribing errors [22]. We chose this framework because this is an individual-facing framework that links to behavior change techniques. We use the consensus guidelines proposed by Atkins et al. in applying the Theoretical Domains Framework [23].

Data collection

Interviews were conducted May 2020–March 2021 via phone due to COVID-19 social distancing measures. Reasons for non-participation were not elicited. Of the 31 patients we reached by phone, 20 patients (65%) agreed to participate. Independent interviews were conducted by 5 authors (G.F.C., K.L., L.D., Y.A., and S.M.J.), two surgical health services researchers, two health services research assistants, and a medical student. Interviews began with the question, “What first brought you to be interested in

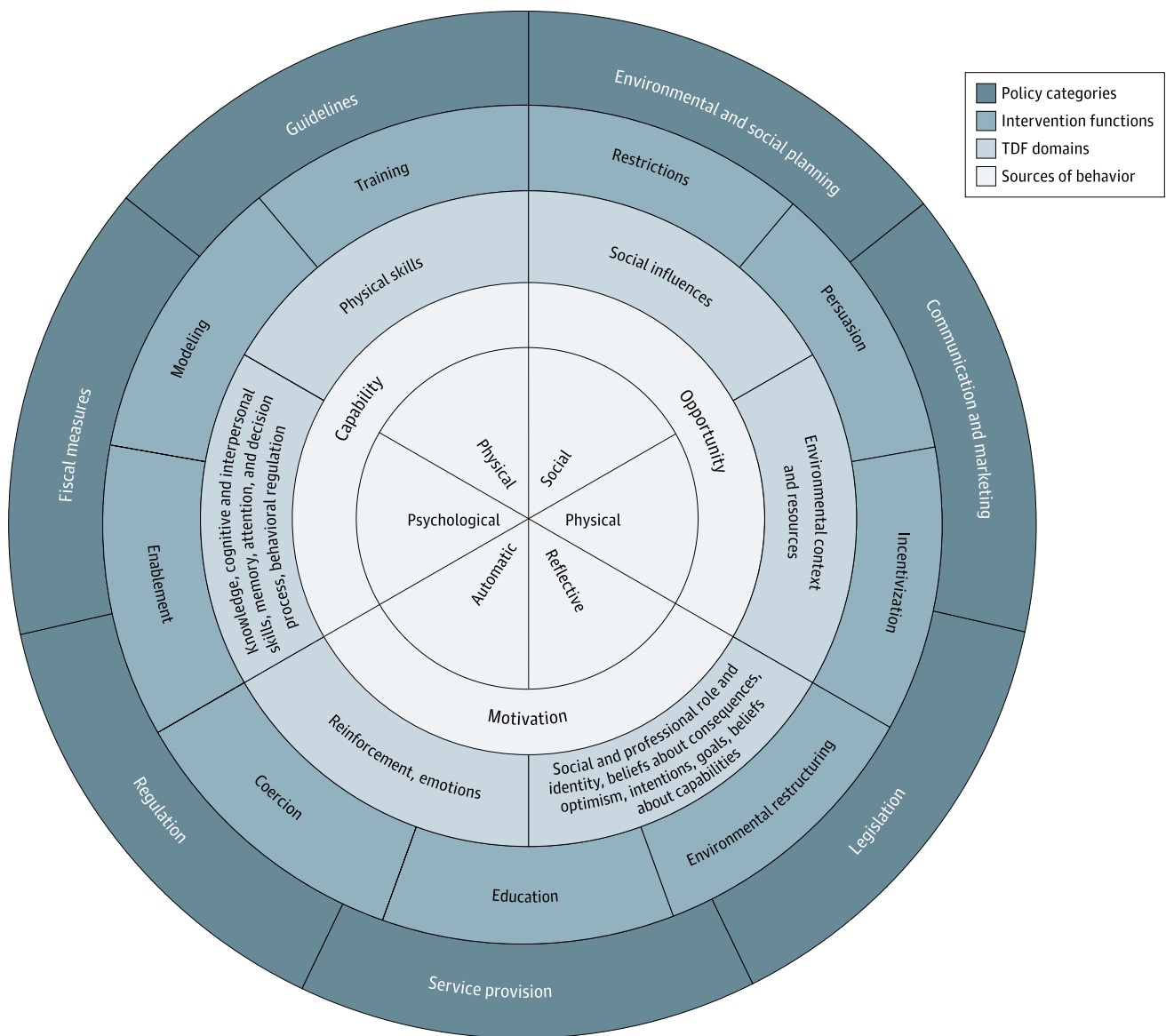


Fig. 1 Behavior Wheel [21]

bariatric surgery?” The participants then guided the rest of the conversation. The interview guide was designed to probe further into topics the participants brought up themselves. All participants were also asked “Can you tell me about the process of getting ready for bariatric surgery?”, “Was there something about the bariatric surgery process that confused or frustrated you?”, and “What would convince you to get bariatric surgery in the future?” Demographic information was asked at the conclusion of the interview. The full interview guide with cross-walked linking questions is available in Appendix Table 6.

Interviews lasted 20 to 50 min and were digitally recorded, transcribed verbatim, and de-identified. Transcripts were not returned to participants for review. Field

notes, observations about each interview, were included in analysis. One participant did not consent to be recorded but did allow for field notes from the interview to be used for the study.

Data analysis

Coding was approached through an iterative, inductive process. Three members of the team (G.F.C., K.L., and L.D.) independently reviewed transcripts to identify an initial set of codes. The codes were further refined with the senior author, an implementation science expert (D.A.Te.). Next, three transcripts were independently coded by two of the team members (G.F.C. and K.L.) blinded to each other’s

work. The coders met iteratively to discuss discrepancies and refine the codebook. The rest of the interviews were coded by one of the two coders. Once all data were coded, the entire research team met to discuss patterns and “issues around which codes cluster,” [24] reach consensus, and map codes to TDF domains. To increase validity, we selected a research team representing diverse professional fields (anthropology, implementation science, nursing, public health, and surgery). All transcribed interviews were coded using NVivo 12.6.1 (QSR International, 2020), a computer-assisted qualitative data analysis software.

Results

Of study participants, 40% identified as men and 60% as women with an average age of 46.7 years (SD 10.7) and average BMI of 44.8 kg/m² (SD 8.7). Participants in our study were predominantly non-Hispanic White (85%). Results for this study focus on three codes: “perceptions of bariatric surgery,” “reasons for not undergoing surgery,” and “[factors for re-considering surgery](#).” Fourteen of the twenty participants stated they would re-consider surgery sometime in the future. There are still 18 other codes to review for analysis in future studies.

Key themes that emerged were (1) burden of pre-operative workup, (2) stigma against bariatric surgery, (3) fear of surgery, and (4) anticipated regret which organized into four TDF domains: environmental context and resources, social role and identity, emotion, and beliefs about consequences. Exemplar quotations are included below and in tables.

Burden of pre-operative workup: environmental context and resources

Participants cited the long pre-operative workup time and number of requirements as a major barrier to their completing bariatric surgery, mapping to the TDF domain of Environmental Context and Resources (Table 1). Some even believed their insurance company purposely prolonged the process to discourage them from getting bariatric surgery. One participant shared that she was so disappointed after being told she had to wait three months after quitting smoking and then a few more weeks between other appointments that:

I even considered the whole Mexico thing too...I can quit smoking for two weeks and, you know, get the surgery, and you have the surgery. You can't smoke again after the surgery, so I don't understand why the waiting. It just like brings you that more time to fail, you know what I mean? (Participant 11, White Female)

This participant was even willing to consider going to another country for surgery. Her response was emblematic of the discouragement many participants felt over the long wait times. While two participants cited inability to take off work as a reason why the visits were burdensome, overall participants described the burden as the number of and the time between pre-operative workup appointments and tests.

The longer the pre-operative wait time, the greater the loss of optimism for patients as well. When asked why participants decided to initiate the bariatric surgery process, almost all cited specific health concerns (e.g. diabetes, cardiovascular health) and a desire to lose weight after failures of non-operative methods. However, not all participants decided to proceed past the initial information session or one or two appointments. We found that participants who decided to proceed further cited a sense of hope that they could do something to improve their life. These participants referred to bariatric surgery as a “light at the end of the tunnel” (Participant 7, Black Female) or “some saving thing for my life” (Participant 13, White Male). Many expressed optimism that bariatric surgery would lead to personal physical health benefits of decreased obesity-related conditions as well as the emotional and social benefits of bariatric surgery such as being able to travel more easily or participate in social events. This optimism that initially propelled patients to attend subsequent appointments and evaluations was diminished by the long wait times.

There were certain aspects of the pre-operative workup that participants found informative and that sustained their interest in pursuing bariatric surgery. As one participant shared, “Well, one of the positive things was the openness of everything. There was nothing that they were trying to hide like in regards to like the surgery and the after-effects” (Participant 14, White Female). Most participants described the initial information session and group classes as beneficial to their understanding of their health and spoke positively about them.

Stigma against bariatric surgery: social role and identity

With regard to the TDF domain of Social Role and Identity, participants in this waiting time began to think more about what it would mean to be a person who had undergone bariatric surgery which was guided by stigma against bariatric surgery (Table 2). They began to focus on how to undergo bariatric surgery would be to admit loss of control over their life. Participants' view of bariatric surgery changed from perceptions of it mostly as a helpful tool to achieve health to something people who were weak used as “a crutch” (Participant 13, White Male) rather than taking control of their own lives. Thus, many stated that they dropped out of the program because they would rather try to lose weight through diet and

Table 1 Burden of pre-operative workup

TDF domain	Construct	Exemplar quotations
Environmental Context and Resources: Any circumstance of a person's situation that discourages or encourages the development of adaptive behavior	Barriers and Facilitators	<p>I know what kind of body mass I carry. I don't want to say that I felt like I looked as dire as a lot of the other people that were there, but, certainly, still, at 5'9", 450 pounds, it's absolutely way too big. So I thought that was going to be, you know, my salvation or whatever, some saving thing for my life and house and all that. So, you know, I was all gung-ho for it... There was all this pump up. I was all excited. You know, I waited three weeks to see this guy, waited two weeks to go to this orientation, waited a couple more weeks, or whatever, for the evaluation, and then three weeks later, punch in the face... Maybe you'll make it, maybe you won't. (13, White Male)</p> <p>I mean, I'm 51 years old. I've struggled since I was in the third grade with my weight. My whole life, I've been up and down... You know, everything is just kind of, I just feel like that's my only hope... But I feel like, I don't know if it's the insurance companies that want it to be prolonged this long to be able to get the surgery, but I feel like it needs to be faster for people. I mean, you know, not skipping over anything health-wise. I want, you know, I still want to be, make sure I'm good to go. But I just feel like if it could be a little bit faster for people, that I feel like that would be a good thing. (11, White Female)</p> <p>On the positive, you know, end of it, there were lots of joy. You know, like, wow, there's finally something that will be able to help someone that's in my current situation... So it is, finding out about all these steps, I think, was a big part of probably why I personally decided not to kind of go through with the process because it just, that part was very overwhelming, like the, everything that you had to do beforehand before it's actually get to the point of having the surgery. (7, Black Female)</p> <p>Yeah, it's not an overnight. I went thinking it was going to be did like the next week and everybody. And he said, no, you got to go through a process. It was like about six months of preparation to get to that point... because that was a lot of my time. (5, Mixed Race Female)</p> <p>Yeah. I feel like having too much time to think about it gives me more time to question what I'm doing... I guess lots of, all the doctor's appointments and meetings you had to go to, and that's basically what deterred me was the commitment of having to travel so much constantly at that time in my life... really it was the months' worth of doctor's appointments. (20, White Female)</p> <p>I'd love to be able to... get moving so that I can, you know, walk and wipe and everything easier because getting fat sucks... Yeah. I had a couple of different friends and acquaintances who have had the surgery, and it seems to have drastically improved their life, their health, their ability to move around, ride on an airplane, all of that stuff. (17, White Male)</p>

Table 2 Stigma of bariatric surgery

TDF domain	Construct	Exemplar quotations
Social Role and Identity: a coherent set of behaviors and displayed personal qualities of an individual in a social setting	Social Identity	<p>So, I mean, masculinity is about self-control so, self-control is even more of a virtue, or at least a desirable quality for masculinity. And rugged individualism and the Marlboro Man, I mean, you know, there's, we have all these cultural archetypes around these things. And so the idea that to be a man means to lean on other people, whether they're men or women, to get your [stuff] together is stigmatizing. (1, White Male)</p> <p>I just don't think that it's accepted within the Black community at least. Because it's seen as kind of giving up on yourself. Like, well, you know, I talked to my mom about it, and she was like, well, why can't you just do it on your own? So it's really seen as kind of like shortcut. (7, Black Female)</p> <p>Yeah, it's a safety net. You know, in a sense, if you can't control yourself, you can always do this. (12, White Male)</p> <p>Meaning my husband really didn't want me doing it. I knew if I did do it, he would be all right with it, and he would be there for me, but I know he would've hung it over my head that I, quote, took an easy way out instead of fighting for it and that kind of thing. (14, White Female)</p> <p>You decide you want to make a change in how you eat, you know what I'm saying, how you sleep. That has a lot to do with it, everything, you know, how your body digests food...It's like, okay, I can make some steps, you know what I'm saying, besides getting the surgery, to help me, which is helping me out. (10, White Male)</p>

exercise which they viewed as activities more under their personal control and responsibility compared to bariatric surgery.

Fear of surgery: emotion

Individuals discussed how their fear of surgical procedures which they had prior to starting the bariatric surgery process contributed to their decision not to pursue surgery, mapping to the TDF domain of Emotion (Table 3). Surgery was seen as invasive, potentially dangerous, and irreversible. One participant shared: "I want to place the emphasis on drastic because I feel like the procedure itself is, is a very drastic procedure...hey, like instead of trying to work at this on my own, I'm going to give up and sacrifice my body in the process." (Participant 7, Black Female). Bariatric surgery was seen putting one's body in danger.

Anticipated regret: beliefs about consequences

Lastly, participants stated they were afraid they would regret undergoing bariatric surgery, contributing to their decision to drop out of the process (Table 4). Because the pre-operative process, surgery itself, and post-operative recovery required substantial work to be put in by patients, many worried that they would regret undergoing bariatric surgery and this work would have been done in vain. Participants described this anticipated regret as related to three factors: possible weight regain, further physical disfigurement, and possible worsening of health.

The first area of anticipated regret was undergoing weight loss and then regaining weight afterwards. The main marker of success after bariatric surgery for participants was weight loss. Thus, some participants felt that it would be disappointing if they had put in all of the work to go through with bariatric surgery and then regained the weight. For some participants, this was a theoretical concern while others cited individuals they met at group sessions or family members, friends, or acquaintances who had undergone bariatric surgery and then regained weight.

The second area of anticipated regret was future physical disfigurement. Some physical changes with bariatric surgery, both those that were visible outwardly and those that were inside the body, were considered undesirable for participants. One participant noted:

Is it worse to look obese, or worse to look like you were once obese and have all this skin hanging around. I mean, obviously skin hanging around, to me, seems more disgusting. (Participant 1, White Male)

As he described, some physical changes that might occur after bariatric surgery like loose skin further discouraged participants from undergoing bariatric surgery. Internal disfigurement was also a concern for some participants. One

Table 3 Fear of surgery

TDF domain	Construct	Exemplar quotations
Emotion: A complex reaction pattern, involving experiential, behavioral, and physiological elements, by which the individual attempts to deal with a personally significant matter or event	Fear	<p>I just, because something like that is important because any time you have surgery, you know, that is, that could be like threatening. And, you know, I take it extremely serious because who wants to just get cut on? (4, White Female)</p> <p>And for me, I viewed surgery as a last resort for something like this, and I had not explored every single option that I could...And again, it's one of those where it's an irreversible process. So I, that's a little daunting to me, I guess. (6, White Male)</p> <p>I felt like this is, it was, you know, it's a drastic operation. You know, it's a drastic step and I felt like, you know, I just hadn't exhausted other avenues yet. (16, White Female)</p> <p>There's like informational meetings, and then you had to have support group meetings. And with my insurance to cover it, I had to go to the doctor every month for six months straight...I had to go have an echocardiogram done or something... [It] was just all seemed very overwhelming. That, plus with the fear of going under the knife. (20, White Female)</p>

participant even described this as having a “Frankenstein-ish kind of body once you’re done...going under a scalpel and getting your body kind of chopped up to be a certain way” (Participant 7, Black Female). These images of a disfigured future self were a major barrier for some patients to undergo surgery.

Finally, some participants were concerned about complications with their physical health after bariatric surgery. This included anticipated regret getting bariatric surgery regarding general post-surgical concerns, dietary concerns, and others. Dietary concerns included needing to rely on supplements or liquids for the rest of their lives or gastrointestinal symptoms such as dumping syndrome. Other concerns included too many disruptions to metabolism and needing to postpone childbearing.

Factors for re-considering surgery

There were fourteen participants who stated that they would consider surgery in the future. Overall, half of participants cited worsening of weight gain or other obesity-related comorbidity as a potential driver to reconsider surgery. All participants’ reasons for reconsidering surgery are summarized in Table 5.

Discussion

Our study is the first to use a qualitative analysis method to understand the nuances in why patients decided to drop out of bariatric surgery programs. Because of the length of time and the number of requirements prior to surgery, patients became discouraged from continuing the process. The burden of pre-operative requirements led patients to lose their initial optimism about bariatric surgery improving their health. Their perceptions regarding being seen as weak for choosing bariatric surgery, fear of surgery itself, and possible regret over having had surgery also grew as more time passed between their initial evaluation and a future surgical date. By mapping these themes onto the Theoretical Domains Framework, we can begin to identify theory-based interventions.

Our data add to the existing literature on pre-operative attrition from bariatric surgery programs by illuminating the most important reasons for dropping out of bariatric surgery programs according to patients themselves. In a study by Sadhasivam et al. where patients’ charts were reviewed, approximately 20% of eligible patients’ assigned reason for not completing surgery was “patient decision.” [5] Our study is the first to begin to characterize the factors most important to patient decisionmaking. Our findings also align with prior quantitative work by Gasoyan, Alvarez, and Love et al. which found that certain pre-operative requirements were

Table 4 Anticipated Regret

TDF domain	Construct	Exemplar quotations
Beliefs About Consequences: acceptance of the truth, reality, or validity about outcomes of a behavior in a given situation	Anticipated Regret	<p>But the fact is the maintaining part, you know what I'm saying. I just seen like three or four people that have done it. And one person, they have like kind of like complications now, and it's over like seven, eight months, more than that probably, and they're starting to have complications. And I seen a lot of people gain more weight, you know what I'm saying, than they, they lost weight, and then they gained more weight than they had before. I just seen that. And I'm like, you know, I'm just noticing some things. I don't know if I'd be able to, you know, do that or what. (10, White Male)</p> <p>Well, I've heard, I heard that a lot of people who have the surgery, they are successful at losing the weight, but they end up gaining it back. And I heard quite a few of that. And I have a cousin who had the surgery, and she kept it off for, I'd say, about a good six years. But now she has gained her weight back. And I was just looking at it like, to be honest, that it's a waste of time because if I'm going to have a surgery like that, I don't want to be able to gain it back. It's like, often, it's just, it's just wasting time. So that was my conclusion about it. Why have it when I could gain it right back? (4, White Female)</p> <p>And then another thing is after I thought about it, I was like, I don't really want my body altered like that, you know what I'm saying. You never know what kind of complications it might cause down the line or whatever like that. I know a few people, some people are doing well, and then I know people that's having complications and stuff like that. But you never can tell what can happen. (10, White Male)</p> <p>If it's a supplement, you're still relying on a supplement that you'd have to take for the rest of your life, which is not a big, you know, don't get me wrong. I mean, you're going to have some things that you have to adjust to and, you know, things that you have to change, well, which is better than nothing...I think, you know, you're going to, if you wanted to pursue it, you would have to make those adjustments. And, you know, it would be worth it to you in the long run? (9, White Female)</p> <p>Because they like, one of the...remember, but in the later part of it, it talked about not having kids within like, I think the first two years of having the surgery or something similar to that, and I, you know, I plan on having children, I don't know when. But kind of like when I heard that part, I was like, okay...do, you know, you need all of the nutrients and everything necessary in order to grow a baby. And at that time that's not going to be, you know, the best. Your hair's falling out because you're not eating as much as you used to. And then there was the sugar dumps, and I was like, oh, lord. I really don't need to deal with that at that time. (15, Black Female)</p>

Table 5 Reasons to Reconsider Bariatric Surgery

		Participant would re-consider bariatric surgery if he/she
Participant 1	White Male	Regained weight
Participant 4	White Female	Had a different surgical procedure or post-operative support that would ensure maintained weight loss
Participant 5	Mixed Race Female	Considered her family history of diabetes and stroke more
Participant 6	White Male	Had worsening diabetes
Participant 10	White Male	Had a major health risk
Participant 11	White Female	Can quit smoking
Participant 12	White Male	Had worsening diabetes
Participant 13	White Male	Regained weight
Participant 14	White Female	Had her husband's support
Participant 15	Black Female	Had fewer family responsibilities
Participant 16	White Female	Had fewer pre-operative requirements
Participant 17	White Male	Did not have to complete the sleep study. He was unable to keep the monitoring leads on for the duration of the study multiple times
Participant 18	White Male	Had worsening cardiac health
Participant 20	White Female	Had a shorter pre-operative workup time

significantly associated with dropout from bariatric surgery programs, especially months of medically supervised weight loss [9], additional psychological evaluations [3], longer diet requirement [12], and advanced laboratory testing [12].

By using the Theoretical Domains Framework, we can map these important determinants of attrition from bariatric surgery from patients in our study to theory-based interventions [25]. We can use this framework to identify sources of behavior and intervention functions to target in the future. Given the importance of shorter wait times to completion of surgery and that the median wait time from 2006 to 2016 increased from 86 to 159 days [26], reducing wait times should be a priority for future interventions to decrease attrition. One way we can reduce pre-operative requirements is through advocating for reduced pre-operative requirements. Other proposed pragmatic strategies to decrease the time to surgery involve restructuring how care is delivered. For example, telehealth uptake due to the COVID-19 pandemic increased significantly among surgical practices [27] and could be leveraged to minimize the burden of pre-operative visits for patients who choose this option. Practices of different specialties can also coordinate visits and laboratory testing for bariatric surgical patients to be on the same day or within a few days of one another.

Patients' anticipated regret warrants special consideration. While we understand the legitimacy of concerns about body and life after bariatric surgery that contributed to patients deciding not to pursue surgery, we were struck by how patients connected these concerns affecting their decision to the lengthy time from their initial enthusiasm for bariatric surgery. Thus, we believe our findings represent the burden of pre-operative requirements working against patients' desire to undergo bariatric surgery rather

than these concerns being of major concern at the beginning of their workup process. Moving forward, interventions will need to distinguish between whether patient concerns are due to long waiting time or represent fundamental beliefs that would lead to decisional regret after bariatric surgery. Prior work by Wee et al. have shown that individuals who underwent Roux-en-Y gastric bypass have low rates of decisional regret ranging from 2.2% at post-operative year 1 to 5.1% at post-operative year 4 [28], but decisional regret in future intervention studies will be vital.

Our study has several limitations. First, the majority of our patients self-identified as White. Thus, it is unknown whether these findings are equally relevant to our Black, Hispanic, and Asian American Pacific Islander patients. However, a strength in the diversity of our sample is that while most studies in bariatric surgery include predominantly women, ours shares the voices of a significant number of men. Additionally, there remains a lack of formal guidance on how to apply the TDF in healthcare settings [23]. Thus, research with and interventions designed from the TDF requires expert guidance from an implementation science expert. Lastly, all of our participants were recruited from Southeastern Michigan. Their experiences with Michigan bariatric surgery practices may not be generalizable to other settings.

This study addresses the barriers and facilitators for patients being able to achieve their goal of bariatric surgery. Using the Theoretical Domains Framework, we identified areas of greatest concern for patients that can be used for future intervention design. This is the first step in understanding how we best support our patients who express interest in bariatric surgery achieve their goals and live healthier lives.

Appendix 1

See Table 6.

Table 6 Semi-structured interview developed from the theoretical domains framework

TDF Domain	TDF Constructs	Examples	Prompts
Knowledge	Knowledge of condition/ scientific rationale	Knowledge of the health out- comes after bariatric surgery	What did you know about bariatric surgery prior to the first consultation?
	Procedural knowledge	Knowledge of pre-operative workup and requirements	Can you tell me about the process of getting bari- atric surgery?
	Knowledge of task environ- ment	Knowledge of patient's role on the day of surgery	Where, if you did, did you look for more infor- mation about bariatric surgery? What kinds of things did you learn?
		Knowledge of the operating room and hospital Knowledge of post-operative care	Was there anything surprising that you learned?
Skills	Skills	Feels equipped to speak to pro- viders about surgical concerns	When you went to speak to the surgeon, what was that interaction like?
	Skills development		
	Competence	Feels equipped to make lifestyle changes required post-opera- tively	Can you tell me something your providers did that made you feel like you could or could not ask them questions?
	Ability		
	Interpersonal skills		
	Practice	Was able to demonstrate healthy lifestyle choices pre-operatively	Can you describe in a typical day when you were considering bariatric surgery? What kinds of activities do you do throughout the day?
Social/Professional Role and Identity	Professional identity	Has social support that will be intact during the surgical process	Can you tell me a little about yourself? What is your family like? What are your friends like?
	Social identity		
	Identity		
	Group identity	Feels agency over own health	What do you typically do during the day / What kinds of work do you do?
	Leadership	Sees self as a part of the health- care team in decision-making	How would you rate your overall health? Who helps to take care of your health?
Beliefs about capabilities	Organizational commit- ment	Sees healthcare providers as supportive of mission for health change	
	Self-confidence	Believes that change in health status is possible	Can you tell me what kinds of benefits you might get from surgery?
	Self-esteem		
	Empowerment	Sees self as the main driver of health change	What kinds of barriers do you think you would face?
Optimism	Professional confidence		
	Optimism	Sees self as optimistic/pessimistic person	Do you think that bariatric surgery is likely to help you reach your health goals? Why or why not?
	Pessimism		
	Unrealistic optimism	Is optimistic/pessimistic about the effect of bariatric surgery on health	
Beliefs about conse- quences	Identity		
	Outcome expectancies	Understands the effects of habits on overall health	What do you think will happen to your health if you got bariatric surgery? What do you think would happen if you did not?
	Anticipated regret	Understands the consequences of not undergoing bariatric surgery	
Reinforcement	Consequents	Understands the benefits of adhering to medical advice regarding pre-operative, peri- operative, and post-operative activity and behaviors	
	Reinforcement		
	Contingencies		
	Sanctions		
	Rewards	Able to recall a time when life change occurred as a result of decisions made by patient	Can you tell me about a time that you were able to make a meaningful change in your life?
	Incentives		
	Punishment	Identifies motivating factors as one of the types listed in the constructs	

Table 6 (continued)

TDF Domain	TDF Constructs	Examples	Prompts
Intentions	Stability of intentions	Characterizes own resolve	Why did you decide to complete the information session? What brought you in for consultation?
Goals	Goal priority Goal/target setting Action planning Implementation intention	Patient has a plan for eating, physical activity, accountability, social support, post-surgical support Patient has involved others in plan and can identify individuals who are a part of plan	What kinds of support do you think you would need in order to be successful after bariatric surgery? Who would you need to provide support?
Memory, attention, and decision processes	Memory Attention Attention control Decision making Cognitive overload/tiredness	Identifies factors that make it easier/harder to focus on achieving goal of bariatric surgery	What kinds of things distract you from thinking about your health?
Environmental context and resources	Environmental stressors Resources/material resources Organizational culture/climate Salient events/critical incidents Person x environment interaction Barriers and facilitators	Social supports Insurance coverage Cost-sharing consideration Housing Nutrition access Education	How much insurance coverage do you think you have for your bariatric surgery? Do you have somewhere safe to live that you could recover after surgery? Where do you get your food from? Was there something about the bariatric surgery process that confused or frustrated you?
Social influences	Social pressure Social norms Group conformity Power Intergroup conflict Alienation Modelling	Identifies role models who have had bariatric surgery Health status of close relationships Power dynamics between close relationships Possible loss of social support if pursues bariatric surgery	Who is important to you in your life? What did they think about you getting bariatric surgery?
Emotion	Fear Anxiety Affect Stress Depression Positive/negative affect Burn-out	Does not feel discouraged from previous attempts at weight loss Other constructs as listed	Do you feel you may try bariatric surgery at a later date? Why or why not?
Behavioral regulation	Self-monitoring Breaking habit Action planning	Discussion of previous attempts at health changes of any kind	Have you successfully tried to change your diet or exercise habits? Can you tell me what that process was like?

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s00464-023-10030-z>.

Funding No associated funding.

Declarations

Disclosures At the time of this study, Dr. Grace Chao received funding from the Veterans Affairs Center for Clinical Management Research, VA Ann Arbor Healthcare System; this work does not represent the views of the United States government nor the Department of Veterans Affairs. Dr. Dana Telem received funding from AHRQ K08 HS025778-01A1. The work herein was not directly funded by these sources. Ms. Kerry Lindquist, Ms. Crystal Ann Vitous, Dr. Dante Anthony Tolentino, Dr. Lia Delaney, Dr. Yewande Alimi, and Ms. Sara Jafri have no conflicts of interest or financial ties to disclose.

tino, Dr. Lia Delaney, Dr. Yewande Alimi, and Ms. Sara Jafri have no conflicts of interest or financial ties to disclose.

References

1. Ponce J, DeMaria EJ, Nguyen NT, Hutter M, Sudan R, Morton JM (2016) American society for metabolic and bariatric surgery estimation of bariatric surgery procedures in 2015 and surgeon workforce in the United States. *Surg Obes Relat Dis* 12:1637–1639
2. Nguyen NT, Masoomi H, Magno CP, Nguyen XM, Laugenour K, Lane J (2011) Trends in use of bariatric surgery, 2003–2008. *J Am Coll Surg* 213:261–266

3. Alvarez R, Matusko N, Stricklen AL, Ross R, Buda CM, Varban OA (2018) Factors associated with bariatric surgery utilization among eligible candidates: who drops out? *Surg Obes Relat Dis* 14:1903–1910
4. Jakobsen GS, Hofso D, Roislien J, Sandbu R, Hjeltnes A (2010) Morbidly obese patients—who undergoes bariatric surgery? *Obes Surg* 20:1142–1148
5. Sadhasivam S, Larson CJ, Lambert PJ, Mathiason MA, Kothari SN (2007) Refusals, denials, and patient choice: reasons prospective patients do not undergo bariatric surgery. *Surg Obes Relat Dis* 3:531–535
6. Chhabra KR, Fan Z, Chao GF, Dimick JB, Telem DA (2021) The role of commercial health insurance characteristics in bariatric surgery utilization. *Ann Surg* 273:1150–1156
7. Kim DD, Arterburn DE, Sullivan SD, Basu A (2018) Economic value of greater access to bariatric procedures for patients with severe obesity and diabetes. *Med Care* 56:583–588
8. Gasoyan H, Ibrahim JK, Aaronson WE, Sarwer DB (2021) The role of health insurance characteristics in utilization of bariatric surgery. *Surg Obes Relat Dis* 17:860–868
9. Gasoyan H, Soans R, Ibrahim JK, Aaronson WE, Sarwer DB (2020) Do insurance-mandated precertification criteria and insurance plan type determine the utilization of bariatric surgery among individuals with private insurance? *Med Care* 58:952–957
10. Chhabra KR, Fan Z, Chao GF, Dimick JB, Telem DA (2019) Impact of statewide essential health benefits on utilization of bariatric surgery. *Obes Surg*. <https://doi.org/10.1007/s11695-019-04092-z>
11. Diamant A, Milner J, Cleghorn M, Sockalingam S, Okrainec A, Jackson TD, Quereshy FA (2014) Analysis of patient attrition in a publicly funded bariatric surgery program. *J Am Coll Surg* 219:1047–1055
12. Love KM, Mehaffey JH, Safavian D, Schirmer B, Malin SK, Hallowell PT, Kirby JL (2017) Bariatric surgery insurance requirements independently predict surgery dropout. *Surg Obes Relat Dis* 13:871–876
13. Tong A, Sainsbury P, Craig J (2007) Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health Care* 19:349–357
14. French SD, Green SE, O'Connor DA, McKenzie JE, Francis JJ, Michie S, Buchbinder R, Schattner P, Spike N, Grimshaw JM (2012) Developing theory-informed behaviour change interventions to implement evidence into practice: a systematic approach using the theoretical domains framework. *Implement Sci* 7:38
15. Francis JJ, O'Connor D, Curran J (2012) Theories of behaviour change synthesised into a set of theoretical groupings: introducing a thematic series on the theoretical domains framework. *Implement Sci* 7:35
16. Cane J, O'Connor D, Michie S (2012) Validation of the theoretical domains framework for use in behaviour change and implementation research. *Implement Sci* 7:37
17. Flannery C, McHugh S, Anaba AE, Clifford E, O'Riordan M, Kenny LC, McAuliffe FM, Kearney PM, Byrne M (2018) Enablers and barriers to physical activity in overweight and obese pregnant women: an analysis informed by the theoretical domains framework and COM-B model. *BMC Pregnancy Childbirth* 18:178
18. Quigley A, Baxter L, Keeler L, MacKay-Lyons M (2019) Using the theoretical domains framework to identify barriers and facilitators to exercise among older adults living with HIV. *AIDS Care* 31:163–168
19. Campbell KA, Fergie L, Coleman-Haynes T, Cooper S, Lorenzatto F, Ussher M, Dyas J, Coleman T (2018) Improving behavioural support for smoking cessation in pregnancy: what are the barriers to stopping and which behavior change techniques can influence these? Application of the theoretical domains framework. *Int J Environ Res Public Health*. <https://doi.org/10.3390/ijerph15020359>
20. Lawton R, Heyhoe J, Louch G, Ingleson E, Glidewell L, Willis TA, McEachan RR, Foy R, programme A, (2016) Using the theoretical domains framework (TDF) to understand adherence to multiple evidence-based indicators in primary care: a qualitative study. *Implement Sci* 11:113
21. Vitous CA, Jafri SM, Seven C, Ehlers AP, Englesbe MJ, Dimick J, Telem DA (2020) Exploration of surgeon motivations in management of abdominal wall hernias: a qualitative study. *JAMA Netw Open* 3:e2015916
22. Duncan EM, Francis JJ, Johnston M, Davey P, Maxwell S, McKay GA, McLay J, Ross S, Ryan C, Webb DJ, Bond C (2012) Learning curves, taking instructions, and patient safety: using a theoretical domains framework in an interview study to investigate prescribing errors among trainee doctors. *Implement Sci* 7:86
23. Atkins L, Francis J, Islam R, O'Connor D, Patey A, Ivers N, Foy R, Duncan EM, Colquhoun H, Grimshaw JM, Lawton R, Michie S (2017) A guide to using the theoretical domains framework of behaviour change to investigate implementation problems. *Implement Sci* 12:77
24. Miles MB, Huberman AM, Saldaña J (1994) *Qualitative data analysis: a methods sourcebook*, 3rd edn. Sage, Thousand Oaks
25. Michie S, van Stralen MM, West R (2011) The behaviour change wheel: a new method for characterising and designing behaviour change interventions. *Implement Sci* 6:42
26. Alvarez R, Bonham AJ, Buda CM, Carlin AM, Ghaferi AA, Varban OA (2019) Factors associated with long wait times for bariatric surgery. *Ann Surg* 270:1103–1109
27. Chao GF, Li KY, Zhu Z, McCullough J, Thompson M, Claffin J, Fliegner M, Steppe E, Ryan A, Ellimoottil C (2021) Use of telehealth by surgical specialties during the COVID-19 pandemic. *JAMA Surg*. <https://doi.org/10.1001/jamasurg.2021.0979>
28. Wee CC, Fleishman A, McCarthy AC, Hess DT, Apovian C, Jones DB (2019) Decision regret up to 4 years after gastric bypass and gastric banding. *Obes Surg* 29:1624–1631

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.