



Article

“You Can’t Manage What You Can’t Measure”: Perspectives of Transplant Recipients on Two Lifestyle Interventions for Weight Management

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Abstract: Previous research suggests that effective lifestyle interventions for solid organ transplant (SOT) recipients must be tailored to address the unique life circumstances of this population. As few studies have investigated this design consideration, this study aimed to explore the perspectives and experiences of SOT recipients after completing a Group Lifestyle Balance™ [GLB]-based intervention incorporating either (a) standard population-based nutrition guidance or (b) nutrigenomics-based nutrition guidance. All active participants in the Nutrigenomics, Overweight/Obesity, and Weight Management-Transplant (NOW-Tx) pilot study were invited to participate. Data were collected through focus groups and individual interviews. Ninety-five percent (n = 18) of the NOW-Tx pilot study participants enrolled in the current study: 15 participated in 3 focus groups; 3 were interviewed individually. Three themes were common to both intervention groups: (1) the post-transplant experience; (2) beneficial program components; (3) suggestions for improvement. A unique theme was identified for the nutrigenomics-based intervention, comprising the sub-themes of intervention-specific advantages, challenges, and problem-solving. The readily available and adaptable GLB curriculum demonstrated both feasibility and acceptability and was aligned with participants’ needs and existing health self-management skills. The addition of nutrigenomics-based guidance to the GLB curriculum may enhance motivation for behaviour change in this patient population.



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1. Introduction

Lifestyle interventions developed specifically for solid organ transplant (SOT) recipients represent a promising means of enhancing long-term health outcomes in this population [1–3]. These interventions are often designed to have an impact on diet and/or physical activity patterns, and increasingly involve cognitive behavioural therapy components such as goal-setting, self-monitoring, and problem-solving [4,5]. In SOT recipients, excess weight gain and obesity are associated with adverse outcomes including cardiovascular disease, graft failure, and increased mortality [6–8], and are consequently recognised as important considerations in the design of lifestyle interventions for these patients [6,9,10]. Although recent research suggests that effective lifestyle interventions for weight management in SOT recipients must be tailored to the unique physical and psychosocial requirements of this population [11–15], evidence on how to best meet these needs in delivering post-transplant lifestyle advice is scarce.

The Group Lifestyle Balance™ (GLB) program is an evidence-based lifestyle intervention that facilitates behavioural changes supporting a healthy dietary pattern, physical activity, and weight loss in participants [16,17]. It is an updated and group-based version

of the extensively studied Diabetes Prevention Program (DPP) [17]. The DPP has been translated to a wide variety of settings where it demonstrates overall effectiveness for clinically meaningful weight loss (4–5%) after 9 months or more of follow up [18], as well as improvements in cardiometabolic health [19] and diet quality [20] of participants. The DPP/GLB curriculum integrates multiple behavioural therapy strategies (such as self-monitoring, goal setting, and reinforcement management) [21] that are recommended to assist individuals in achieving health behaviour goals [4,5]. Although the GLB program resources are freely available and are adaptable under a Creative Commons licence [22], and have been successfully modified to meet the needs of different populations [23], to our knowledge they have not yet been studied in lifestyle interventions for SOT recipients.

Researchers have hypothesised that GLB program outcomes could be enhanced by adding nutrigenomics-based lifestyle guidance to the standard intervention [24]. The science of nutrigenomics allows the personalisation of lifestyle guidance based on an individual's genotype. For example, variants in the PPAR γ 2 gene have been shown in some studies to interact with fat intake to affect weight loss, such that low-fat diets are associated with greater weight loss for certain gene variants [25]. Currently, the impact of providing nutrigenomics-based guidance for weight management in SOT recipients is unknown.

The considerations above guided the development of the transplant arm of the Nutrigenomics, Overweight/Obesity and Weight Management trial (NOW-Tx) clinical intervention pilot study (U.S. National Library of Medicine Clinical Trials Registry: NCT03015012). The NOW-Tx study was a randomised controlled clinical trial, designed to compare the impact of two GLB-based lifestyle interventions on dietary patterns and weight management outcomes in SOT (heart, kidney, liver, and lung) recipients. The two interventions differed only in the lifestyle (nutrition and physical activity) guidance provided, either a) standard population-based guidance, or b) personalised, nutrigenomics-based guidance.

Lifestyle interventions such as those used in the NOW-Tx study are considered “complex interventions” [26] and the use of qualitative research methods is recommended to investigate the many factors that affect the acceptability, implementation, and transferability of such interventions [27,28]. Furthermore, qualitative studies are limited in the transplantation literature, but they can make unique contributions to clinical practice and policy [29,30] and can help to address issues pertinent to the crucial element of patient-centredness in transplantation healthcare [31,32].

To develop an understanding of factors relevant to developing a larger-scale follow-up to the NOW-Tx study, it is important to understand the acceptability and implementation of the two lifestyle interventions. The current qualitative study explores the perspectives and experiences of SOT recipients after completing a GLB-based lifestyle intervention incorporating either population-based or nutrigenomics-based lifestyle guidance in the NOW-Tx pilot study, with a specific focus on the nutrition component of the guidance.

2. Materials and Methods

2.1. Study Setting and Design

This qualitative study was a component of the NOW-Tx clinical intervention pilot study conducted between 2 February 2018 and 21 September 2019 at Brescia University College in London, Ontario, Canada. The NOW-Tx study compared two lifestyle interventions modified from the Group Lifestyle Balance™ (GLB) [16] program.

Both interventions provided recommendations for calories, protein, total fat, saturated fat, total unsaturated fat, monounsaturated fat, polyunsaturated fat, meal/snack timing, and physical activity. However, in the population-based (TxGLB) intervention the nutrition recommendations were derived from population-based guidance, and in the nutrigenomics-based (TxGLB + Ngx) intervention, they were personalised through the provision of a summary report of DNA-based recommendations. A sample table for each set of recommendations has been published previously [24].

The two interventions of the quantitative NOW-Tx pilot study were delivered to four groups of 4–6 participants each over the course of 12 months (two groups randomised to the population-based TxGLB intervention, and two groups randomised to the DNA-based TxGLB + Ngx intervention). Start times for each group were staggered by 2 months, with the first group beginning the 12-month intervention in February 2018 and the fourth group beginning in September 2018. Each randomised group participated in four in-person group sessions: first at the start of the intervention, and then at the 3-, 6- and 12-month timepoints. At the end of every in-person session, each participant was provided with a 15-min one-on-one lifestyle counselling session with a Registered Dietitian (RD). Between the group sessions, curriculum content was provided online.

The guiding methodology for this qualitative study was interpretive description [33,34], which incorporates principles of constructivism and naturalistic inquiry, and is oriented towards “capturing themes and patterns within subjective perceptions and generating an interpretive description capable of informing clinical understanding” [33]. This study is reported according to the Consolidated Criteria for Reporting Qualitative Research (COREQ) [35].

This study was approved by the Health Sciences Research Ethics Board at Western University, Ontario, Canada (108511).

2.2. Participant Recruitment and Selection

Participants were recipients of kidney, heart, liver or lung transplant from two transplant centres in southern Ontario, who met the following inclusion criteria: Adults ≥ 18 years, non-pregnant, non-lactating, BMI ≥ 25 kg/m², ≥ 1 -year post-transplant, medically stable (not being treated for transplant rejection or infection), have access to a computer with email or a telephone at least one day per week, and English speaking. Individuals who were unwilling to undergo genetic testing, unable to provide consent, and/or who were seeing another healthcare provider for weight loss advice outside of this study were excluded. The NOW-Tx study was publicised to potential participants through the Canadian Transplant Association and The Trillium Gift of Life Network.

Sampling for the qualitative study was purposive, in that all 19 active participants in the quantitative NOW-Tx pilot study were invited to participate by the Lead Research Coordinator (CB) before the study's 12-month timepoint. All consenting participants received a \$10 CAD grocery store gift card.

2.3. Data Collection

Data were collected using semi-structured focus groups and individual interviews. Focus groups were conducted with pre-existing NOW-Tx intervention groups at the final 12-month timepoint. Individual interviews were offered to participants unable to attend focus groups.

All focus groups and individual interviews were conducted by the first author (SA), a graduate student in Nutrition and Dietetics and a certified teacher registered with the Ontario College of Teachers, who is experienced in adult education and the facilitation of small group discussions. All interviews took place in a private classroom at Brescia University College in London, Ontario, Canada. During the focus groups, three trained student research assistants recorded field notes, non-verbal communications, and other pertinent observations [36].

The semi-structured interview guide (Supplementary File S1) was developed by four of the co-authors [JEM, JRH, JIM, SA] and drew on their individual backgrounds in the nutrition care of SOT recipients (JEM), qualitative research methods (JIM, JRH), and facilitation of group interactions among adults of diverse backgrounds (SA). The open-ended questions served as a starting point for all discussions and were followed up with a variety of probes to explore participants' perspectives. Further information about the development of the interview guide is provided in Supplementary File S1.

Focus group and individual interviews lasted between 30 and 45 min. All interviews were audio-recorded and transcribed verbatim in an anonymised format using F4transkript software, version 7 (Dr. Dresing & Pehl GmbH, Marburg, Germany). Transcripts were reviewed for accuracy and imported into QSR International's NVivo 12 Pro for Windows, version 12. Data management in NVivo was guided by the work of Woolf and Silver [37].

2.4. Data Analysis

Consistent with interpretive description methodology [33,34], data analysis occurred concurrently with data collection. SA reviewed each transcript before the next data collection so that later interviews could incorporate insights on developing concepts. Analytic memos [38] were recorded throughout the data analysis process and were managed using the NVivo software.

Using a constant comparative method, paper copies of transcripts were hand coded line-by-line using the process of inductive thematic analysis [39,40] as explicated in the context of nutrition and dietetics research [41]. After independently analysing three transcripts, three authors (JEM, JIM, SA) reached a consensus through discussion on the coding scheme. The coding scheme was then systematically applied to all focus group and individual interview data by SA.

3. Results

3.1. Participants

Eighteen out of 19 invited NOW-Tx pilot study participants (95%) agreed to be in the current qualitative study; 15 in three focus groups and three in individual interviews. Sixty-one percent of the participants were female; the mean age in years (\pm SD) was 51.1 ± 9.1 and mean BMI in kg/m^2 (\pm SD) was 30.3 ± 5.0 .

3.2. Themes and Sub-Themes

Four overarching themes were identified, each with one or more subthemes. Three themes were common to both intervention groups: (1) the post-transplant experience; (2) beneficial program components; and (3) suggestions for improvement (Table 1). One theme was unique to the nutrigenomics-based group: (4) unique aspects of nutrigenomics-based guidance (Table 2). Representative quotes are presented for each theme/sub-theme and identified by the method of data collection (focus group or interview) and participant number (e.g., FG, P12; INT, P18).

Table 1. Themes and sub-themes in both intervention groups (Tx-GLB and Tx-GLB + Ngx) ¹.

Themes	Sub-Themes
1. The post-transplant experience	1A. Limited access to nutrition guidance 1B. Existing health self-management skills 1C. Physical and psychosocial health factors 1D. Connection to other transplant recipients
2. Beneficial program components	2A. Nutrition knowledge development 2B. Clear goals and reinforcement; Self-monitoring guidance 2C. Peer support
3. Suggestions for improvement	Varied suggestions

¹ Tx-GLB (population-based guidance); Tx-GLB + Ngx (nutrigenomics-based guidance).

Table 2. Theme and sub-themes unique to Tx-GLB + Ngx¹ intervention group.

Themes	Sub-Themes
4. Unique aspects of nutrigenomics-based guidance	4A. Advantages: Personalization 4B. Challenges: Implementing recommendations 4C. Problem-solving: Learning trajectory

¹ Nutrigenomics-based guidance.

3.2.1. Themes in Both Intervention Groups

Theme 1—The Post-Transplant Experience

Perspectives on the experience of being a SOT recipient, and the new awareness that accompanied this experience, were integrated by participants into their responses to all interview questions, including those questions that did not ask about these subjects specifically.

Sub-theme 1A—Limited access to nutrition guidance

Almost all participants described receiving minimal dietary guidance post-transplant from healthcare providers.

The day after the surgery, I was told I can eat and drink anything I wanted. Not as much as I wanted, but anything I wanted, so I went from an extremely restrictive to completely non-restrictive [diet], with no conversations with any dietitians or nutritionists afterwards. It was never felt a need for that. (FG, P12)

And then [after] transplanting, ok what now? They say, “Eat a square meal”, well—what does that really mean? (FG, P1)

Two of these participants suggested that the limited guidance they received contributed to undesired post-transplant weight gain.

I was underweight at the time and, you know, got told “Well, you can gain weight” and then I just had a heyday because “Yeah, woohoo, first time in my life I can gain weight.” And I took it to heart and I—boy, did I gain weight. (FG, P1)

Others suggested that more guidance in the early post-transplant period would have been helpful.

I was given a food calendar and that was about it. And I had wanted more. (FG, P11)

I wish I had been followed more closely so that someone could give me help on what to eat so that I could gain weight—but healthy. (FG, P1)

However, in contrast to this perspective, one participant indicated that readiness for nutrition guidance could vary, depending on individual health circumstances.

Post-transplant, it took a long time for me to recover because I had a lot of additional issues—yeah, it took a long time to get used to that. So I’m at 4 ½, 5 years post-transplant. It was, ok, this is where I’m at, I’ve got a good handle on what I can and can’t do, and so now I’m kind of back into working on the other stuff. (INT, P18)

Sub-theme 1B—Existing health self-management skills

Participants described extensive experience with health self-management skills, which were developed during both the pre- and post-transplant periods.

For example, the pre-transplant diet was described as being “very restricted” (FG, P10), thus necessitating careful long-term monitoring of various nutrition parameters, in some cases for up to 8 years (“protein because of the liver, fat because of the gallbladder, and carbs because of my type 2 diabetes. So I really had to watch what I ate.”) (FG, P8).

Health self-management also required adaptability, for example when dietary recommendations were changed after transplant surgery.

Post-transplant, first recommendations are, you know, load up on protein, ‘cause you have to heal. And you’re like, “but wait a sec, I am conditioned not to do that”. (FG, P10)

Health self-management skills were also applied during the recovery from the pre-transplant state, culminating in a need to “get balanced”.

Well, before your transplant you're pretty much down to nothing, you know, as far as your health and your strength. And then, you know, you're building yourself back after your transplant, so it was—I think I built too far. So then it was like, ok now I need to get balanced. (FG, P9)

Participants also described various other aspects of post-transplant health self-management, including adherence to medication regimens and post-transplant medical testing.

Sub-theme 1C—Physical and psychosocial health factors

Participants described their unique health considerations as transplant recipients. They noted side effects of post-transplant medications that “are going to play with your appetite” (FG, P4), or that could cause other challenges.

But I think it's kind of hard too, because [transplant recipients] are on a lot of medications. And a lot of medications are making you sick to your stomach. (INT, P17)

Participants also expressed an enhanced need for a healthy dietary pattern to maintain the health of the transplanted organ.

I think we're kind of unique individuals and diet is a very important part of our lives, especially being post-transplant patients. I have to watch it more than maybe the average person, just so that you know, my organ will last longer and I will be healthier. (FG, P12)

I know that I need to be healthy as a transplant recipient so that I can live for a long time and keep my—like, the healthy body is important for a healthy heart which is my transplant type. (INT, P16)

One participant in an individual interview noted unique psychosocial circumstances post-transplant.

What I hear from all of my heart transplant friends is that it's really hard to find a new normal. And people outside of our circle think, “Oh, you've got a new heart, you're fine.” Like, “What's wrong?”, you know what I mean? And they don't understand the amount of medications or—all of my transplant friends that I had five years ago, they've all had something major: rejection, now one has cancer, one had a bleed to the brain, one had lost her colon. I mean it's all—so it's a lot—to me it's a lot of psychological stuff. (INT, P17)

This participant also mentioned the possibility of effects of the transplant experience on family members.

And then of course our spouses too. Like, I think there's a lot of spouses that have PTSD [post-traumatic stress disorder] and stuff like that, I truly believe that, because it's a change for them as well. (INT, P17)

Sub-theme 1D—The importance of connection to other transplant recipients

Participants expressed a strong sense of connection to other SOT recipients. This manifested in a variety of ways, one of which was the expression of interest in supporting other recipients by participating in research such as the NOW-Tx pilot study.

In terms of motivation to participate, I echo everybody's sentiments, but I would also add that I wanted to, knowing this was a new study, just help to the benefit of the transplant community as well. (FG, P10)

The importance of connection to other SOT recipients was also evidenced by participants describing close involvement in various organizations such as the Canadian Transplant Association and the Canadian Transplant Games, as well as participation in social media groups for SOT recipients.

In reference to opportunities to share knowledge among SOT recipients, a participant who was involved in organizing peer support groups at her transplant centre stated, “I just think that if we could have a bunch of us—we empower each other.” (INT, P17)

Theme 2—Beneficial Program Components

Sub-theme 2A—Nutrition knowledge development

Participants indicated that knowledge development, both via the program's nutrition curriculum and through having access to a Registered Dietitian, was beneficial for a variety of reasons, including the trustworthiness of the information in contrast to popular media sources.

You know, this is science, it does work. And you know, if you listen to the news every day you get a different diet tip every day and most of it's garbage and doesn't apply to you. This is my plan, it applies only to me. And if I follow it, it'll work. (FG, P2)

The guidance about energy intake and diet composition was also valued. As expressed by one participant, "I realized in the year in this study that calorie counting isn't everything, it's the proportion of each different [nutrient]—of the proteins and the fats" (FG, P12). This participant noted that this information "helped me sort of realign my strategy towards diet and lifestyle, you know?" (FG, P12).

Other guidance that was considered helpful included dietary balance and portion size information.

I really like—from this 12-month study that we're part of—is to gain knowledge and I really like the visual plate of the food placement part [GLB "MyPlate" lesson]. (FG, P3)

Knowledge development was also valued in that it reinforced self-assessment of dietary patterns:

I thought I ate healthy before. And then this kind of highlighted some areas that I could get better at, which over last year, according to all this I have done well with. (FG, P14)

Sub-theme 2B—Clear goals, reinforcement, and self-monitoring

Participants identified program benefits that were related to having clear goals for energy and macronutrient intake.

I find you can't manage what you can't measure, and you know, this sheet that you've given us is, it's a road map, it tells us what to do. And if you follow it, and you measure your food, and stick to it, it will work, and that's what I found out over the last year. (FG, P2)

Reinforcement for goal-related activities was also noted as being beneficial and was manifested in various forms, such as encouragement from the program facilitator or peers, or self-evaluation of goal achievement at group meetings.

Self-monitoring of dietary intake, as encouraged by the GLB curriculum, was also considered beneficial. While some participants used paper and pencil methods to record dietary intake, others found it helpful to use a mobile application (e.g., MyFitnessPal) for self-monitoring of intake.

In the beginning, the first month I think, I didn't use the app. And it was like, oh my goodness, the—you know, figuring out everything was a little daunting, right? Because for me, looking everything up, had that added—you know, it took longer to read, it took longer to find, it took longer to do. And then when I decided to try the app, it was like, "Ah, this is so much easier." (INT, P18)

Sub-theme 2C—Peer support

The group-based format of the GLB program was perceived as providing multiple benefits. As one participant noted, "We were like a support group" (FG, P6), in that group members encouraged each other during setbacks, and provided accountability for goal-related activities. The social interaction provided by the group was also seen as an incentive for attending group sessions.

I did look forward to it, I did look forward to coming. For sure. Because we all got along really well. So that was a good thing, the group thing was good. (FG, P1)

One group of participants also used social media for communicating between sessions:

[Participant FG, P6] started a Facebook page It was nice because we could chat with each other and say, "Hey, I found this recipe and it keys in to what we just learned." (FG, P1)

Theme 3—Suggestions for Improvement

A third theme comprised participants' varied suggestions for program improvements. These included suggestions for additional components such as more frequent meetings or more detailed menu plans. One participant, who had previously referred to the unique psychosocial circumstances of SOT recipients, suggested that "If anything, I think there should have been more information on what to do when you're dealing with the psychological piece." (INT, P17)

3.2.2. Theme Unique to the Nutrigenomics-Based Intervention (Tx-GLB + Ngx)

Participants allocated to the Tx-GLB + Ngx intervention contributed perspectives and experiences unique to this intervention, representing a single theme comprised of three sub-themes.

Theme 4—Unique Aspects of Nutrigenomics-Based Recommendations

Subtheme 4A—Advantages: Personalization

The personalization of nutrition recommendations, when compared to population-based advice, was generally perceived as an advantage by participants in the nutrigenomics group.

It's personalized, which is a big advantage. So it tells you—as opposed to the standard recommendations for the general population—the idea with this is that it's got an advantage specifically for me. (INT, P16)

In addition, participants stated that the nutrigenomics-based advice was helpful in that it permitted a focus on specific aspects of dietary intake. Participants with a PPAR γ 2 gene variant linked to lower body fat percentage with diets high in monounsaturated fats described effects on their motivation to make certain dietary changes.

I always knew an avocado was good for you, but seeing that I have an enhanced response to those kinds of fats—now I have a push to put that into my diet, that extra— (FG, P7)

. . . and I've done the same with the exact same food too, yeah, for sure. (FG, P10)

Similarly, a participant with a variant of the ACE gene (associated with greater risk of high blood pressure with higher dietary sodium intake) [42] noted that "finding that I had an elevated risk for sodium" (FG, P8) reinforced the importance of continuing with his current strategies to limit dietary sodium and that this information "just sort of put an emphasis on, yeah, I was doing good and I've still got to do good because of what the study found with the sodium." (FG, P8)

Additionally, participants with another gene variant (MC4R, associated with a greater likelihood of eating frequently between meals) [43] noted increased self-compassion.

This eating between meals that we talked about. I know—I always want to snack! And when I read that—when I first read that, I went "Ah! It's not my fault." And now I recognize that, and I embrace it, and I just make better choices, and I think I'm a little easier on myself. (FG, P7)

Subtheme 4B—Challenges: Understanding/implementing recommendations

Participants reported that the amount of information provided in the nutrigenomics-based recommendations initially presented a challenge to implementation:

All of a sudden, I had this whole big list of things that I had to look at, and it was hard for me. And especially because I'm a person who likes to get things right, then it was a lot of work. And so initially it was—like, I was dedicating a lot of time every day to trying to figure out how I was going to do things. (INT, P16)

When I started, I had to just focus on one or two. Because if I focussed on all of these things, I got really overwhelmed. So I had to pick a couple. (FG, P7)

Implementing the recommendations also took time and work.

What I've realized is it is hard work, I mean just understanding it, you know—between all the fats and the balance that, you know, your calories have to be divided into this percentage, this percentage, this percentage . . . you do have to take time, cutting vegetables and having all that fresh, whole food, it does take time. But that's the commitment. (FG, P9)

These challenges meant that the time to “kind of really get comfortable with it, and to have to think about it a little less” (INT, P18) was variable, ranging from at least one month, to about 6–7 months.

Subtheme 4C—Problem-solving: Learning trajectory

The challenges of understanding and implementing the nutrigenomics-based recommendations prompted a series of problem-solving activities.

The first strategy involved a self-training process for estimating food quantities and nutrient content. Participants described using a self-monitoring app (“I tracked for six months, like, every day” [INT, P16]) to develop confidence in understanding their intake.

I started trusting myself and I would—I could eyeball my cup of cereal, and I was pretty good at eyeballing it. So that was the first step. And then over the course of the six months, you kind of figure out what foods have—you know, something that's going to be high in protein. (INT, P16)

I was doing it regularly for probably like 4 months or so, actually—so I was pretty impressed with myself. And then I got to know kind of like what to expect, and then if something new came in, then I would check it maybe? (FG, P7)

A second strategy involved the development of daily routines and eating patterns facilitating the implementation of the dietary recommendations.

I have 4 or 5 kind of “go-to” lunches that I don't have to think about, don't have to worry about—I can just go “Yeah, that's a good one, ok” and off I go. (INT, P18)

Ultimately the process resulted in habits that were perceived as beneficial and that were worthwhile maintaining.

And then I just decided, I feel better, my day's better, I last longer without snacking, I just feel better by doing this. And then I just—so I've done it for the whole year. (FG, P7)

4. Discussion

The participants in this study contributed insights that have multiple implications for the design and implementation of lifestyle interventions for weight management for SOT recipients. The first three themes were common to both intervention groups and appear to be interrelated (Figure 1). The unique circumstances of the post-transplant experience (sub-themes of Theme 1) are linked to Tx-GLB program components that participants identified as beneficial (sub-themes of Theme 2). These linkages suggest that the modified GLB program was effective both in meeting participants' needs (e.g., for credible nutrition guidance and peer support) and in integrating and building on participants' existing skills (e.g., skills in health self-management).

Furthermore, the theme of “Suggestions for Improvement” (Theme 3) indicates a potential benefit to engaging patients in program development, and to using flexible, responsive program designs that can promptly address the circumstances, needs, and interests of individuals as they arise.

Although the study participants expressed a strong interest in credible long-term post-transplant dietary guidance from qualified healthcare professionals, they did not have access to the information they sought. Although we report on SOT recipients in Ontario (Canada), other studies have revealed similar healthcare gaps in the USA [15], Ireland [44],

and the UK [45]. The reasons for these gaps are beyond the scope of the current study but are worthy of attention from health organization leaders and policymakers seeking to improve outcomes for the steadily increasing number of SOT recipients worldwide.

Several aspects of the modified GLB program provided in both interventions (Tx-GLB and Tx-GLB + Ngx) appear to have addressed the gap participants identified between their nutrition information needs and the services generally available to them. First, the curriculum provided comprehensive, evidence-based dietary guidance to promote healthy eating patterns and weight management, through information about nutrition labels, portion sizes, ultra-processed foods, nutrient density, and other topics. Second, the program provided access to a nutrition professional (the RD-facilitator) through group sessions, email correspondence, and quarterly one-on-one sessions. Third, the program allowed personalization of recommendations, based either solely on phenotype (e.g., individualised energy needs estimations in the TxGLB intervention) or further personalised through the provision of nutrigenomics-based guidance (TxGLB + Ngx).

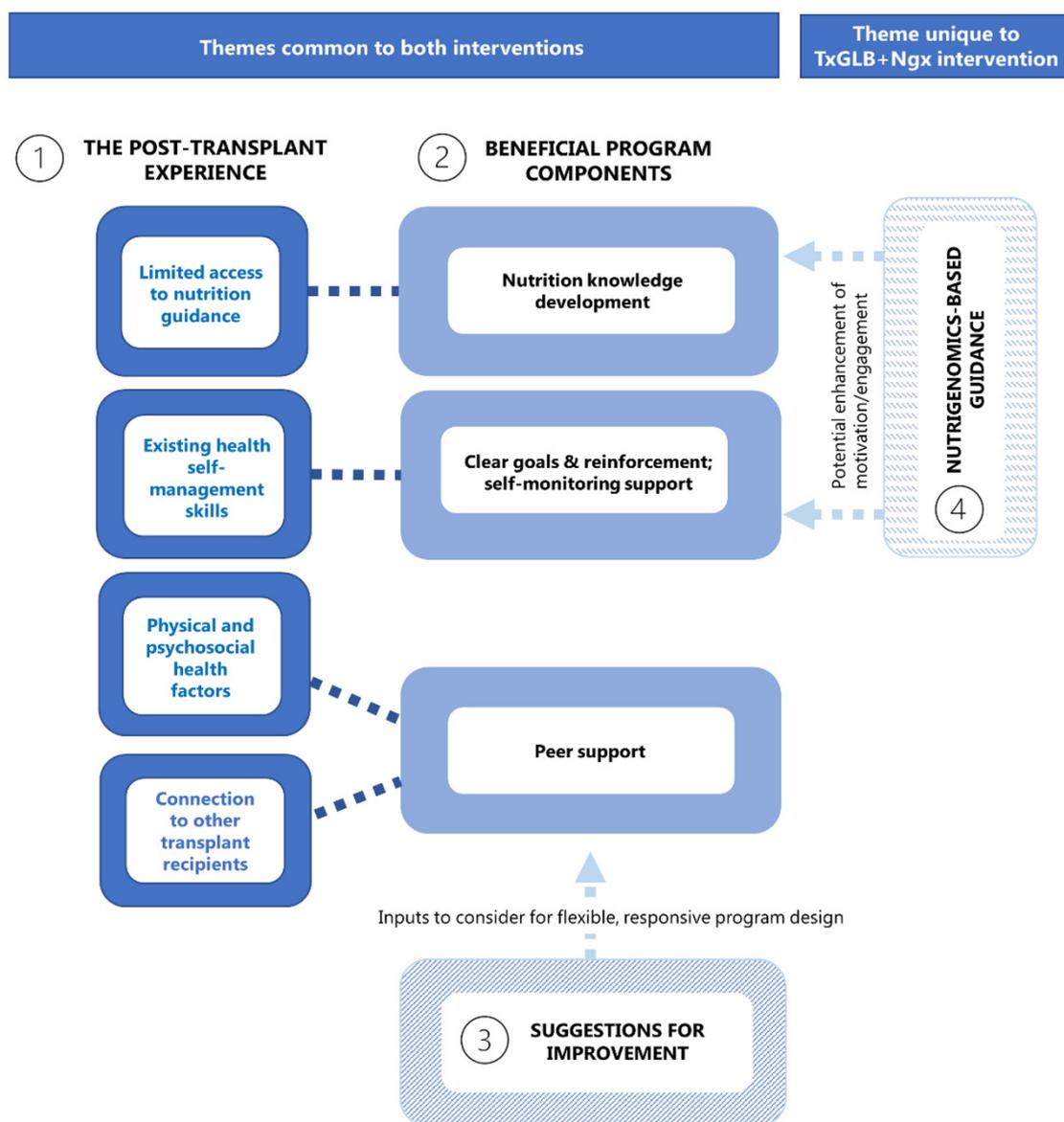


Figure 1. Interrelationships between themes and sub-themes for both intervention groups (Tx-GLB and Tx-GLB + Ngx).

The behavioural components of the modified GLB program (subtheme 2B) were also identified as beneficial by participants, who described having extensive experience in

health self-management due to pre-transplant dietary restrictions and post-transplant medication regimes. These are well-known self-management experiences among SOT recipients [14,46], and suggest a strong foundation of transferable skills for post-transplant weight management through lifestyle interventions. These health self-management skills may contribute to participants' endorsement of the clear goals and self-monitoring guidance provided in the modified GLB program, as these skills are familiar to participants and have been met with success in the past. This is supported by the work of Hickman et al., who noted that liver transplant recipients desired "tailored, personalised health care, with practical guidance to help them self-manage diet and exercise" [13]. Castle et al. [45] also reported that kidney transplant recipients valued goal setting and the self-monitoring of progress in an online lifestyle intervention. The investigation of behavioural therapies relevant to SOT recipients merits further attention, to determine the full range of strategies that are best aligned with their needs and interests. This work could be guided by the CALO-RE taxonomy of behaviour change techniques (BCTs) [47], which includes the BCTs identified as beneficial by our participants.

The value of peer support among SOT recipients is strongly evident in this study and corroborates the findings of other qualitative researchers [13,14,45,48]. Taken together, these findings indicate that the provision of peer support should be given special consideration in designing lifestyle interventions for this patient population. Challenges related to participants' dispersed geographical distribution and other factors could be addressed through promising new telehealth strategies, as reported by several studies [2,45,48,49].

Finally, we suggest that nutrigenomics-based recommendations, offered in the context of a structured lifestyle intervention, may be well suited to the needs and interests of SOT recipients (Figure 1). Furthermore, this unique guidance has the potential to enhance motivation and engagement through several mechanisms as outlined below.

The perspectives of participants in this study who received nutrigenomics-based nutrition guidance demonstrated unique characteristics. Participants responded positively to guidance for gene variants linked to sodium intake, resting metabolism, and frequency of eating between meals, and indicated that this information motivated enhanced efforts to meet dietary recommendations. This corroborates findings from a recent pragmatic trial in a general population showing greater long-term dietary change and/or adherence (e.g., for total fat and saturated fat intake) with nutrigenomics-based advice compared to population-based advice [50].

The nutrigenomics-based recommendations also initially presented distinct challenges. Participants reported that these challenges catalysed an individual learning trajectory which was often aided using a mobile application for tracking dietary intake. The development of self-efficacy took between one and seven months for the participants in this study. Based on these findings, we suggest that practitioners incorporating nutrigenomics-based guidance into their lifestyle counselling may find it beneficial to inform patients of a possible "learning curve" for implementing such guidance and to provide strategies to facilitate learning.

The detailed discussion by participants in the nutrigenomics-based group about the initial challenges to implementing their nutrition recommendations, and their motivation to learn new skills and ultimately achieve self-efficacy, suggest an enhanced level of interest in and engagement with the nutrigenomics-based dietary guidance compared to population-based guidance. This is not surprising, given that population-based guidance is already familiar to most Canadians, in contrast to nutrigenomics-based guidance which is relatively novel. This increased engagement could play a role in facilitating behaviour change by providing an effective external motivator for behaviour initiation, a mechanism proposed in a systematic review of qualitative studies of weight management programs [51]. This merits further investigation in clinical trials of nutrigenomics-based nutrition guidance in SOT recipients.

It is important to note, however, that the initially increased implementation challenges noted with the nutrigenomics-based guidance suggest that this intervention could

be excessively burdensome to some SOT recipients, such as those experiencing acute transplantation-related physical or psychosocial health difficulties, or those with other challenges and priorities. It is therefore crucial for clinicians considering lifestyle interventions for SOT recipients to be sensitive to the current circumstances and needs of their patients and to utilise flexible designs that allow acknowledgement of and tailoring to individual needs within a group program.

This study has employed rigorous qualitative methods to facilitate the assessment of the transferability [32] of the findings to other settings. Several factors relevant to the transferability assessment should be noted. The participants in this study were self-selected and thus were potentially more motivated and more able to engage with a lifestyle intervention than a broader population of SOT recipients might be. There is also a possibility of recall bias in the data, as the participants discussed experiences that spanned the course of the entire study (over 12 months). The data reflect the perspectives of an Ontario-based (Canadian) transplant population whose experiences may differ from those of SOT recipients in other healthcare systems. Future qualitative investigations of lifestyle interventions for SOT recipients spanning different jurisdictions would be valuable to provide further guidance for program developers.

5. Conclusions

Group-based lifestyle interventions for weight management based on the readily available and adaptable Group Lifestyle Balance™ (GLB) curriculum appear to be both acceptable to SOT recipients and in alignment with SOT recipients' needs and existing health self-management skills. The addition of nutrigenomics-based guidance to the GLB curriculum offers a potentially valuable means of enhancing motivation for behaviour change in this specialised population desiring clear, actionable and highly personalised dietary guidance for weight management.

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