



Patient Access, Utilization, and Perceptions of Neighborhood and Built Environment Resources

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Abstract

Purpose There is a critical need to explore bariatric patients' perceptions of existing neighborhood and built environment resources and supports to assist with postoperative behavior change and weight loss maintenance. The objective of this study was to survey postoperative patients to determine neighborhood food retail, fitness facility, and options for outdoor activity access, utilization, satisfaction, and perceptions of resources.

Materials and Methods A convenience sample of postoperative patients from a single academic surgical center in the USA ($N=44$) completed an online survey about access, utilization, satisfaction, and safety for food retail, fitness facility, and outdoor activity options in their neighborhoods. Analysis included descriptives (frequency, percent, Chi-square), and independent samples t tests and ANOVA determined differences based on race, insurance status, geographic location, and receipt of governmental assistance programs. Open-ended questions were analyzed using summative content analysis.

Results Patients reported the highest access to lower-cost national food retailers and fitness facilities. The most prevalent challenge in finding food products to meet patients' goals was financial (39%). Patients' top suggestions for fitness facilities included training staff/facilities (59%) and trainers (35%) in postoperative patient care and exercise. The highest access for outdoor activity options was for walking/running trails, city/metro parks, and sidewalks. Significant differences in access, utilization, and safety were found based on geographic location, receipt of at least one assistant program, and race.

Conclusion The development of targeted resources may benefit patients in non-suburban areas and who receive governmental assistant programs to increase safety of outdoor options and access to lower-cost food retailers and to increase utilization of lower-cost fitness facilities.

Keywords Resources · Neighborhood · Built environment · Social determinants of health · Support · Bariatric surgery

Key Points

1. Patients reported the highest access to lower-cost national food retailers and fitness facilities.
2. The most prevalent challenge in finding food products to meet patients' goals was financial. Patients' top suggestions for fitness facilities included training staff/facilities and trainers in postoperative patient care and exercise.
3. Patients who received at least one governmental assistance program reported lower access to a discount grocer, lower satisfaction of wholesale retailers with bulk products, and less safety when using city and metro parks.
4. Patients in rural and urban areas reported increased safety concerns for using sidewalks, lower utilization of community-based wellness centers, and less access to bulk discounted food retailers.

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Introduction

Despite the established efficacy of bariatric surgery for long-term weight loss and comorbidity resolution [1–5], there are health inequity trends [6] in which patients identifying as racial/ethnic minorities and from economically disadvantaged backgrounds have poorer postoperative outcomes [7–10]. Specifically, Black/African American patients experience increased major postoperative complications, 30-day readmissions, re-intervention, reoperation, mortality, less weight loss, and lower attendance rates compared to non-Black/African American patients [7, 11–14]. Patients of low socioeconomic status (i.e., lower income, receiving governmental social assistance, etc.) are also at increased risk of postoperative complications [8], and patients with lower income and living in larger urban cities have less

postoperative weight loss [9, 10]. Geographic location (i.e., urban, rural, suburban), however, is also not associated with postoperative weight loss [15, 16]. These racial and economic disparities merit exploration into neighborhood and built environment determinants to better understand how to achieve health equity in patient outcomes following bariatric surgery.

The social determinants of health (SDOH) as applied to bariatric surgery are the environmental conditions (economic stability, education, health care, neighborhood and built environment, and community) [17, 18] that affect patients' healthy choices, behavior change, and maintenance of weight loss following bariatric surgery. Promoting healthy behaviors to patients who live in environments inconsistent with their lifestyle and weight loss goals will most likely not eliminate disparities in postoperative outcomes. For example, postoperative patients who cannot find, or have limited access to, healthy foods are less likely to have the options to make healthy dietary choices. Similarly, patients who do not have access to safe places to exercise outdoors or that are unable to afford fitness facility memberships are less likely to exercise. In either case, patients will likely continue to struggle with behavior change and weight loss. Instead, improvements to conditions in neighborhoods and built environments in which patients live can in turn reduce disparities. Yet, little research has assessed the SDOH among bariatric surgery patients beyond routine electronic health record demographics (i.e., race/ethnicity, insurance, income, and education). In the limited work focused on neighborhood and built environment, patients reported their postoperative weight loss was challenged by (1) lack of access to and high cost of healthy foods; (2) lack of sidewalks, walking and bike trails, and fitness facilities; and (3) engaging in safe outdoor exercise [19]. Patients also identified difficulty accessing nutrition/dietary services in their communities [20] and limited community programs as a barrier to physical activity [21]. However, in other work, neighborhood and built environment factors like walkability, geographic location, and socioeconomic deprivation did not affect patients' postoperative behaviors or weight loss outcomes [22, 23].

To work towards achieving health equity in postoperative outcomes for bariatric surgery patients, there is a critical need to explore patients' perceptions of existing neighborhood and built environment determinants and patients' perceptions of resources and supports to assist with postoperative behavior change and weight loss maintenance. The objective of this study was to conduct a survey of postoperative bariatric patients from a single academic surgical center to determine neighborhood and built environment food retail, fitness facility, and options for outdoor activity access, utilization, satisfaction, and perceptions of resources. Between group differences based on race, insurance status, geographic location (rural, urban, suburban), and

governmental social assistance were also assessed. Based on prior evidence, it was hypothesized that patients who identified as a racial/ethnic minority, with public insurance, from an urban geographic area, and received some form of governmental assistance would report less access, utilization, closeness to home, satisfaction, and safety with food retailers, fitness facilities, and options for outdoor activities.

Materials and Methods

Patients and Procedures

A survey was conducted at the Ohio State University Comprehensive Center for Medical Weight Management, Metabolic and Bariatric Surgery of the postoperative bariatric patient population using Qualtrics Survey Software. All patients in the center's postoperative support group email listserv were invited to participate. The listserv contained approximately 200 emails of postoperative patients who received the invitation to participate and survey link. There was no way to determine whether email addresses on the listserv were active and/or currently in use. The listserv is consistently added to by administrators at the center. The survey was available from March to April 2021, with two reminder emails sent. Fifty-four participants completed some of the survey; conservatively, if all email addresses were valid, this is a 27% response rate. Of the 54 participants, 44 provided responses for the questions about neighborhood and built environment food retail, fitness facility, and outdoor activity options, making the final analytic sample $N=44$. The survey assessed access to specific food retailers and fitness facilities by name in order to determine if close to home access options were different for specific retailers (i.e., Walmart or Target, Planet Fitness, or Lifetime Fitness) based on urban, suburban, and rural residence and SDOH factors. These retailers and facilities appear by name in the methods and results, but in the discussion are referred to in general terms (i.e., low-cost food retail store). The study was approved by the Ohio State University Institutional Review Board (#2020B0439).

Measures

Demographics Patients were asked to complete age, race/ethnicity, sex, insurance, education, income, employment, and relationship status, clinical factors (surgical procedure, length of time since surgery, T2D status, current height/weight, and highest weight, and number of moves since surgery), and additional economic factors not found in the electronic health record (home ownership, main mode of transportation, religious/spiritual service attendance, geographic location, food insecurity, [24] and use of governmental

social assistance programs). Height and current and highest weight were used to calculate current BMI, highest BMI, and Δ BMI (highest — current).

Food Retail Questions The survey included prior utilized items [25] about neighborhood and built environment options for food retail, fitness facilities, and outdoor activity options. The local food retail purchasing options included pharmacy, farmer’s market, convenience store, grocery store, Walmart, Target, Sam’s Club or Costco, Whole Foods or Trader Joe’s, and Aldi’s. For each option, participants were asked to respond with their perceived access (yes, no), closeness to home (1–5, 5 + miles), frequency of utilization (weekly, monthly), and satisfaction (very satisfied = 1, somewhat satisfied = 2, neutral = 3, somewhat dissatisfied = 4, very dissatisfied = 5). There were three open-ended questions about suggestions for food retail options, including “What are the greatest challenges with finding products that are adherent with your postoperative dietary requirements and goals?”, “What are specific products that are difficult to find?”, and “What suggestions do you have about how to make products more available that are congruent with your dietary requirements and goals?”.

Fitness Facility Questions The local fitness facilities options included Lifetime Fitness, Gold’s Gym, Planet Fitness, CrossFit, Orange Theory, Pure Barre, yoga options, pilates options, Snap Fitness, and YMCA. For each option, patients completed the same questions as the food retail stores. There was one open-ended question that asked “How do you think fitness facilities could better meet your postoperative activity needs?”.

Outdoor Activity Questions The outdoor activity options included sidewalks, bike lanes, walking/running trails, city or metro parks, and open green space. For each option, patients completed the same questions about perceived access, closeness to home, utilization, and also perception of safety (yes, no). The survey concluded with an open-ended question about additional resources “What other resources would you like to see in your community to help you maintain a healthy lifestyle after surgery?”.

Analysis

Analysis included descriptive statistics (frequencies, percent) for the food retail, fitness facility, and outdoor activity options access, utilization, closeness to home, satisfaction, and safety. Bi-variate statistics (independent samples *t* tests, Chi-square, one-way ANOVA) assessed between-group differences in access, utilization, closeness to home, satisfaction, and safety for the top five food retail, fitness facility, and outdoor activity options based

on race, insurance status (public, private), geographic location (urban, rural, suburban), and use of at least one governmental social assistance program (yes, no). For race, there were only six participants who identified as Black/African American; in bivariate analyses, race was dichotomized as White ($n = 36$) and non-White (Black/African American, multiracial/other; $n = 7$). Additionally, given the small group of non-White patients, Fisher’s exact test was used to confirm Chi-square results and the nonparametric Mann–Whitney *U* test was conducted to confirm independent samples *t* test analysis when race was included as a grouping variable. Analysis was conducted using SPSS version 27 (IBM Corp., Armonk, NY, USA). Significance was set at $p < 0.05$.

Open-ended questions were coded using summative content analysis [26]. The first and third author independently coded all questions and triangulated the fourth author as a verification strategy. For each question, similar codes were grouped into categories, and the number of participant responses represented in each category and percent was reported. Only categories with at least 10% representation of participant responses to each question were reported. Within each category, the total number of codes was reported. Because a participant may have reported multiple codes within one category, the code total either equaled or exceeded the category total (i.e., number of participants represented). Representative quotations are provided.

Results

Demographics

Patient clinical demographics and economic factors are provided in Table 1. Patients primarily identified as White (84%), female (93%), married (67%), privately insured (68%), with at least an associate’s degree (74%), household income > 40 K (70%), and an average age of 49. On average, patients had surgery 3 years ago (range 0–20 years), 65.1% had Roux-en-Y gastric bypass surgery, 26% received a T2D diagnosis, and patient Δ BMI was 14.78. Forty-eight percent of patients were employed full time, 26% were identified as having food insecurity, 50% received at least one government social assistance program, 42% did not own their home, 45% did not attend any religious services, and nearly all patients (96%) used their personal vehicle as their main mode of transportation. The majority of patients are identified as the primary household food purchaser (93%) and preparer (89%). Patients were divided in geographic area between rural (32%), suburban (39%), and urban (29%). Thirty percent of patients experienced at least one residential move since their surgery.

Table 1 Patient clinical demographic and economic factors (N=44)

Clinical demographics	N (%); Mean ±SD, range	Economic factors	N (%); Mean ±SD, range
<i>Race/ethnicity</i>		<i>Food insecurity (n=43)</i>	
White	36 (83.7)	Often/sometimes	11 (25.6)
Non-White	7 (16.3)	Never	32 (74.4)
<i>Biological Sex</i>		<i>Received governmental assistance programs (n=44)</i>	
Male	3 (7.0)	Yes, 1 program	14 (31.8)
Female	40 (93.0)	Yes, > 1 program	8 (18.2)
<i>Age</i>	49.2 ± 11.4, 24–71	No programs	22 (50.0)
<i>Insurance type</i>		<i>*Specific government assistance programs (selected all received)</i>	
Employer provided	30 (68.2)	SNAP/EBT	8 (18.2)
Medicare or Medicaid	11 (25.0)	School lunch program	7 (15.9)
Others	3 (6.8)	Medicaid	10 (22.7)
<i>Marital status</i>		Unemployment benefits	8 (18.2)
Married or cohabitating	29 (67.4)	Others	6 (13.6)
Single	14 (32.6)	<i>Religious/spiritual attendance (n=42)</i>	
<i>Completed Education</i>		Weekly	9 (21.4)
High school	11 (25.6)	Monthly/several times per year	10 (23.8)
Associate degree	9 (20.9)	Once a year	4 (9.5)
Bachelor's degree	8 (18.6)	No attendance	19 (45.2)
Master's degree or higher	15 (34.9)	<i>Home ownership (n=43)</i>	
<i>Annual household income</i>		Own	25 (58.1)
< 40 K	13 (30.2)	Rent	10 (23.3)
40–59 K	6 (14.0)	Others	8 (18.6)
60–99 K	16 (37.2)	<i>Main mode of transportation</i>	
100 K or more	8 (18.6)	Personal vehicle	42 (95.5)
<i>Procedure</i>		Family members Vehicle	2 (4.5)
Roux-en-Y gastric bypass	28 (65.1)	Others (public, ride share, taxi, etc.)	0 (0.0)
Sleeve gastrectomy	15 (34.9)	<i>Employment (n=33)</i>	
<i>Time since surgery (years)</i>	2.94 ± 4.25, 0–20	Full time	26 (48.1)
<i>Current weight (n=42)</i>	213.33 ± 43.69, 149–315	Part time/retired	7 (13.0)
<i>Highest weight (n=42)</i>	305.59 ± 69.12, 165–576	Disability	6 (11.1)
<i>Current BMI (n=42)</i>	34.70 ± 8.02, 22.89–62.40	Others	4 (7.4)
<i>Highest BMI (n=42)</i>	49.48 ± 9.09, 29.23–71.99	<i>Geographic area</i>	
Δ BMI (n=42)	14.78 ± 8.95, –3.54, 35.74	Rural	14 (31.8)
<i>Ever received a type 2 diabetes diagnosis</i>		Suburban	17 (38.6)
Yes	11 (25.6)	Urban	13 (29.5)
No	32 (74.4)	<i>Primary food purchaser</i>	
<i>Number of children in the home</i>	.52 ± .83, 0–3	Yes	41 (93.2)
<i>Number of adults in the home</i>	1.21 ± .99, 0–4	No	3 (6.8)
<i>Residential changes since surgery</i>		<i>Primary food preparer</i>	
One move	7 (15.9)	Yes	39 (88.6)
More than one move	6 (13.6)	No	5 (11.4)
No moves	31 (70.5)		

*Note: This number adds up to more than the Sample size, since participants could select more than one program. Each program percent is out of 44

SD standard deviation; K 1000; BMI body mass index; Δ change

Food Retail Stores

Table 2 displays patient responses to neighborhood food retail, fitness facility, and outdoor activity options. Food retail stores (Table 2 part A) with the highest access were grocery stores (95%), Walmart (75%), Costco/Sam's Club (58%), Aldi's (41%), and convenience stores (33%). The locations closest to home (within 5 miles) were convenience stores (83%), grocery stores (77%), pharmacies (71%), Aldi's (63%), and Walmart (58%). The highest weekly utilized stores were grocery stores (69%), Walmart (27%), Aldi's (22%), farmer's markets (17%), and Target (15%). Satisfaction was highest for grocery stores (1.57 ± 0.90), farmer's markets (2.15 ± 0.99), Costco/Sam's Club (2.15 ± 0.96), Walmart (2.21 ± 1.10), and Trader Joe's/Whole Foods (2.24 ± 0.96). There was a significant difference in Walmart utilization based on geographical location ($X^2(2) = 6.65, p = 0.036$), in which suburban patients had higher utilization (42.4%) than urban (24.2%) or rural (33.3%) patients. There was a significant difference in Aldi's access based on receiving at least one governmental assistance program(s) ($X^2(1) = 4.61, p = 0.032$); patients who received at least one program (27.8%) had lower access to Aldi's compared to patients who did not receive any assistance programs (65.4%). Patients who received at least one program (2.48 ± 0.93) also had lower satisfaction of Sam's Club/Costco compared to patients who did not receive any assistance programs ($1.80 \pm 0.89; t(39) = 2.37, p = 0.023$). There were significant differences based on race for grocery store ($t(35) = -4.28, p < 0.001$) and Whole Foods/Trader Joe's ($t(34) = -2.35, p = 0.025$) satisfaction, in which non-White patients reported higher satisfaction ($1.00 \pm 0.00; 1.50 \pm 0.84$) than White patients ($1.69 \pm 0.95; 2.43 \pm 0.90$). Given the small distribution of non-White patients, results were also confirmed with nonparametric Mann Whitney *U* test (grocery store $U = 66.50, p = 0.024$; Whole Foods/Trader Joe's $U = 41.00, p = 0.026$).

Responses to the open-ended survey questions are in Table 3. The most prevalent challenge that patients reported in finding food products to meet their goals ($N = 44$; Table 3 part A) was financial (39%), which included the price and costs of healthy foods and foods adhering to a postoperative diet, and finding items of lower prices (i.e., sale). For example one patient reported, "Many foods adherent with my requirements and goals are expensive." The second most prevalent challenges were difficulty finding specific healthy foods (27%, i.e., fruits/vegetables, low or free/sugar/carb products, specialty items) and specific store challenges (27%) including finding stores that had a variety of items, rather than one brand or flavor, and availability and in-stock items. Another patient noted, "Availability/selection can be challenging a times (especially when items go on sale)."

Challenges with finding premade and convenience healthy meals were also noted (11%).

Patients noted that specific products that were difficult to find ($N = 43$; Table 3 part B) included protein products (47%) such as shakes/drinks/powers, meat, yogurt, bars/chips, and general protein-rich snack items. For example, a patient reported "Protein shakes that I like in stock. Typically, I find one and its out, no matter where I go." Patients also reported difficulty finding low or free sugar/carb/sodium products (33%) and fruits and vegetables (16%). Patient suggestions ($N = 39$; Table 3 part C) included providing a variety of resources (41%) including lists of foods to use when shopping or preparing meals, lists of stores that carry foods congruent with a postoperative diet, lists of recipes, available cooking demos, free samples, and having these items available on a website or mobile app. One patient suggested, "Maybe make a list of stores and several items from each store that meeting our dietary requirements to give people ideas on what to purchase... that are in our area." Patients noted educational (18%) needs including reading food labels and engaging in grocery store tours. Patients also suggested additional needed services (13%) like in-home meal/food delivery and meal planning services specific to postoperative dietary requirements. For example, one patient mentioned, "It would be great if someone created a bariatric meal service that has premade meals in correct portions and had variation." Finally, patients provided suggestions with financial challenges (13%) such as coupons and cheaper prices for healthy options.

Fitness Facilities

Fitness facilities (Table 2 part B) with the highest access were Planet Fitness (80%), YMCA (74%), Lifetime Fitness (52%), yoga options (45%), and Orange Theory (30%). Locations closest to home were Planet Fitness (58%), YMCA (49%), yoga options (46%), Snap Fitness (38%), and Lifetime Fitness (36%) and CrossFit (36%). The highest weekly utilized facilities included YMCA (56%), Planet Fitness (50%), Lifetime Fitness (33%), pilates options (11%), and CrossFit (11%). Satisfaction was highest for YMCA (2.48 ± 0.85), yoga options (2.77 ± 0.53), Lifetime Fitness (2.82 ± 0.72), Orange Theory (2.89 ± 0.46), and Pure Barre (2.94 ± 0.24). There was a significant difference based on geographic location ($X^2(2) = 7.03, p = 0.030$) for utilization of YMCAs, with suburban patients reporting higher utilization (50%) compared to rural (37.5%) and urban (12.5%) patients. There was also a significant difference for access to a YMCA based on receiving at least one governmental assistance program ($X^2(1) = 6.43, p = 0.011$), where patients who received at least one program (62.5%) reported higher access to a YMCA compared to those patients who did not receive any assistance programs (37.5%).

Table 2 Patient response to local neighborhood food retail, fitness facility, and outdoor activity options

	N	Availability n (%)		Closeness to home n (%)		Utilization n (%)		Satisfaction n, Mean ± SD	
		Yes	No	1–5 miles	> 5 miles	Weekly	Monthly	1 = very satisfied; 5 = very dissatisfied	
A. Food retail									
Convenience store	43	14 (32.6)	29 (67.4)	34 (82.9)	7 (17.1)	2 (14.3)	12 (85.7)	40, 3.38 ± 1.19	
Grocery store	44	42 (95.5)	2 (4.5)	33 (76.7)	10 (23.3)	29 (69.0)	13 (31.0)	44, 1.57 ± .90	
Pharmacy	43	10 (23.3)	33 (76.7)	30 (71.4)	12 (28.6)	0 (0.0)	10 (100.0)	38, 3.03 ± 1.13	
¹ Aldi's	43	18 (40.9)	26 (59.1)	27 (62.8)	16 (37.2)	4 (22.2)	14 (77.8)	41, 2.39 ± 1.07	
² Walmart	44	33 (75.0)	11 (25.0)	25 (58.1)	18 (41.9)	9 (27.3)	24 (72.7)	43, 2.21 ± 1.10	
³ Target	43	13 (30.2)	30 (68.9)	18 (41.9)	25 (58.1)	2 (15.4)	11 (84.6)	41, 2.49 ± 1.05	
Farmer's market	43	6 (14.0)	37 (86.0)	12 (31.6)	26 (68.4)	1 (16.7)	5 (83.3)	39, 2.15 ± .99	
⁴ Costco/Sam's Club	43	25 (58.1)	18 (41.9)	10 (22.7)	34 (77.3)	3 (12.0)	22 (88.0)	41, 2.15 ± .96	
⁵ Trader Joe's/Whole Foods	43	12 (27.9)	31 (72.1)	4 (10.3)	35 (89.7)	1 (8.3)	11 (91.7)	37, 2.24 ± .96	
B. Fitness facilities									
⁶ Planet Fitness	44	35 (79.5)	9 (20.5)	21 (58.3)	15 (41.7)	8 (50.0)	8 (50.0)	28, 3.00 ± 1.07	
⁷ YMCA	43	32 (74.4)	11 (25.6)	16 (48.5)	17 (51.5)	9 (56.3)	7 (43.8)	31, 2.48 ± .85	
⁸ Lifetime Fitness	44	23 (52.3)	21 (47.7)	11 (35.5)	20 (64.5)	4 (33.3)	8 (66.7)	28, 2.82 ± .72	
Yoga options	40	18 (45.0)	22 (55.0)	12 (46.2)	14 (53.8)	1 (11.1)	8 (88.9)	22, 2.77 ± .53	
⁹ Orange Theory	40	12 (30.0)	28 (70.0)	8 (32.0)	17 (68.0)	0 (0.0)	8 (100.0)	19, 2.89 ± .46	
Pilates options	40	11 (27.5)	29 (72.5)	7 (33.3)	14 (66.7)	1 (12.5)	7 (87.5)	18, 3.00 ± .00	
¹⁰ CrossFit	39	11 (28.2)	28 (71.8)	9 (36.0)	16 (64.0)	1 (12.5)	7 (87.5)	20, 3.00 ± .00	
¹¹ Gold's Gym	40	9 (22.5)	31 (77.5)	4 (18.2)	18 (81.8)	0 (0.0)	8 (100.0)	20, 3.00 ± .00	
¹² Snap Fitness	38	8 (21.1)	30 (78.9)	9 (37.5)	15 (62.5)	0 (0.0)	8 (100.0)	18, 3.00 ± .00	
¹³ Pure Barre	39	5 (12.8)	34 (87.2)	4 (21.1)	15 (79.9)	0 (0.0)	8 (100.0)	18, 2.94 ± .24	
C. Outdoor activity options									
								Safety n (%)	
								Yes	No
Walking/running trails	44	37 (84.1)	7 (15.9)	29 (72.5)	11 (27.5)	14 (53.8)	12 (46.2)	28 (73.7)	10 (26.3)
City/metro parks	44	37 (84.1)	7 (15.9)	24 (60.0)	16 (40.0)	12 (41.4)	17 (58.6)	32 (84.2)	6 (15.8)
Sidewalks	44	36 (81.8)	8 (18.2)	34 (85.0)	6 (15.0)	20 (58.8)	14 (41.2)	33 (89.2)	4 (10.8)
Green space	43	32 (74.4)	11 (25.6)	28 (71.8)	11 (28.2)	10 (37.0)	17 (63.0)	30 (83.3)	6 (16.7)
Bike lanes	43	27 (62.8)	16 (37.2)	21 (55.3)	17 (44.7)	2 (9.5)	19 (90.5)	18 (50.0)	18 (50.0)

SD standard deviation

¹Aldi's: global discount supermarket chain

²Walmart: US-based large discount department store

³Target: US-based large department store

⁴Costco/Sam's Club: US-based membership warehouse stores that offer bulk products

⁵Trader Joe's/Whole Foods: Grocery stores that specialize in gourmet, organic, fresh produce, and specialty diets. Whole Foods is North American and UK-based; Trader Joe's is US-based

⁶Planet Fitness: US-based fitness center

⁷YMCA: Globally available wellness center, with fitness and gym inclusion

⁸Lifetime Fitness: North American-based fitness center and club

⁹Orange Theory: US-based fitness facility specializing in heart-rate based, high intensity interval training group workouts

¹⁰CrossFit: Globally offered, high intensity interval training and strength and conditioning workouts

¹¹Gold's Gym: US-based fitness center

¹²Snap Fitness: Globally offered fitness center

¹³Pure Barre: US-based fitness facility specializing in low-impact/high intensity movements to improve strength and flexibility

Table 3 Open-ended questions about food retail and fitness facilities

A. What are the greatest challenges with finding products that are adherent with your postoperative dietary requirements and goals? (N = 44)		B. What are specific products that are difficult to find? (N = 43)	
Categories, codes	Quotations	Categories, codes	Quotations
Financial challenges	17 (38.6%)	Protein	20 (46.5%)
Price/cost	16	Shakes/drinks/powders	11
			Protein shakes that I like in stock. Typically, I find one and its out no matter where I go
Sale/discounted/generics	3	General/snacks	5
			Protein friendly snacks
Store challenges	12 (27.3%)	Bars/chips	4
In-stock/availability	9	Yogurt	3
Variety/selection	7	Meat	3
			Turkey sausage
Specific healthy foods	12 (27.3%)	Low/free sugar, carb, sodium	14 (32.6%)
(Fresh) Fruit/vegetables	7	Low/sugar free	10
			Sugar free beverages such as Gatorade at reasonable prices
Low/sugar free; low carb	6	Low carb	6
			Low carb pre made meals
Specialty diets	4	Low sodium	3
			Low sodium foods
Premade/frozen; convenience/portioned	5 (11.4%)	Fruits/vegetables	7 (16.3%)
			Fresh vegetables and fruits
None	7 (15.0%)	None	9 (20.9%)
			–
C. What suggestions do you have about how to make products more available that are congruent with your dietary requirements and goals? (N = 39)		D. How do you think fitness facilities could better meet your postoperative activity needs? (N = 34)	
Categories, codes	Quotations	Categories, codes	Quotations
Resources	16 (41.03%)	Facility considerations	20 (58.8%)
List of recipes/cookbook/demos	7	Reduced costs	8
			Gym membership is so expensive for someone who is on a fixed income
List of stores	5	Pool access	5
			Need indoor pool
Free samples	5	Flexibility/adaptability	4
			Times of classes don't fit my schedule very well
Website/mobile app	4	COVID-19 concerns	3
			I'm concerned with covid and these places

Table 3 (continued)

List of foods	3	Offer a downloadable “shopping list” of foods, supplements, etc. In a check-off format to ease getting all the basics	Group classes/workouts	2	Maybe offer exercise classes for post-bariatric patients with a trainer who is knowledgeable about the surgery
Protein focus/options	3	Better selection of protein stuff	Staff-wide/facility training	2	It would be helpful for these facilities to have at least an overview education regarding bariatric surgery & the needs of post-surgery patients
Services	5 (12.8%)		Trainer/coach considerations	12 (35.3%)	
Meal/food delivery	4	A bariatric food site for home delivery besides Amazon	Train the trainer	9	Trainers need to know more about WLS and how to accommodate those who are not as fit or flexible as others
Meal planning	2	It would be great if someone created a bariatric meal service that has pre-made meals in correct portions and had variation	Access	5	Cost friendly personal training plans and trainers
Education	7 (17.9%)		None	5 (14.7%)	–
Dietitian/grocery Tours/engagement	5	Grocery “field trips” with the store nutritionist to suggest items best suited for WLS customers			
Reading food labels	3	Food education and food labels are missing leading			
Finances	5 (12.8%)				
Reduced costs	3	Cheaper prices for the healthy options			
Coupons/discount Services/fund	2	Maybe provide coupons to home meal delivery places that provide pre prepped or ready to go meals			
None	11 (28.2%)	–			

Category *n* = number of total participants in category; Category % = percent of participants out of total; count is for total codes, which may be equal or more than the *n* listed for the category (i.e., a patient had multiple codes within one category)

Patients' suggestions for fitness facility needs ($N=34$; Table 3 part D) included facility considerations (59%) of staff/facility trainings related to postoperative patients exercise, having group fitness classes for postoperative patients, flexibility and adaptability of schedules, access to pools, and reduced costs for memberships and services. One patient mentioned, "Gym membership is so expensive for someone who is on a fixed income." Patients also noted trainer/coach considerations (35%) including a need to "train the trainer" in postoperative care, fitness limitations, and exercises, and overall access to trainers and affordability. For example, a patient noted, "Trainers need to know more about weight loss surgery and how to accommodate those who are not as fit or flexible as others."

Outdoor Activity Options

For outdoor activity options (Table 2 part C), the highest access was for walking/running trails (84%), city/metro parks (84%), sidewalks (82%), green space (74%), and bike lanes (63%). The options closest to home were sidewalks (85%), walking/running trails (73%), green space (72%), city/metro parks (60%), and bike lanes (55%). Patients reported feeling safest using sidewalks (89%), city/metro parks (84%), green space (83%), walking/running trails (74%), and bike lanes (50%). The highest weekly utilized options were sidewalks

(59%), walking/running trails (54%), city/metro parks (41%), green space (37%), and bike lanes (10%). There was a significant difference based on geographic location ($X^2(2)=7.96$, $p=0.019$) for perceived safety when using sidewalks, with suburban (38.9%) patients feeling safer than rural (25.0%) and urban (25.0%) patients. There was also a significant difference for safety when using city or metro parks based on receiving at least one governmental assistance program ($X^2(1)=4.66$, $p=0.031$), where patients who received at least one program felt less safe (100%) utilizing city or metro parks compared to those patients who did not receive any assistance programs (0%).

Additional Resource Development

Additional helpful resources are provided in Table 4 ($N=32$). Thirty-four percent of patients noted additional physical activity resources including sidewalks/walking paths, group meet-ups for exercise, pool access, and gym memberships. Twenty-eight percent of patients mentioned resources for psychosocial/mental health needs such as support groups and mental health services. For example, one patient mentioned, "Support groups not just on campus and online, but in communities around Ohio..." General support (19%) was also noted for facility/program development and "buddy" accountability programs. Close to 16% of patients

Table 4 Open-ended questions about additional resource development and suggestions

What other resources would you like to see in your community to help you maintain a healthy lifestyle after surgery? ($N=32$)		
Categories, codes	<i>n</i> (%)	Quotations
Physical activity	11 (34.4%)	
Exercise meet-up groups	5	"Neighborhood walking/exercise groups"
Sidewalks/walking paths/park equipment	4	"More walking paths"
Pool access	2	"I would love to see an indoor pool"
Memberships	2	"Gym membership would be helpful"
Psychosocial/mental health	9 (28.1%)	
Support group	7	"Support groups not just at OSU campus and online but closer to home like actually in the communities around Ohio. I tend to do better and feel better after an in person support group but I also do not like driving downtown because it gives me high anxiety"
Mental/emotional support	2	"I'd like to see more emotionally supportive services. I was not prepared for the mental & emotional challenges that occurred after surgery and felt very much alone"
Support	6 (18.8%)	
General	4	"Overall support for bariatric patients"
Facilities/programs	2	"More facilities to cater to surgery patients with specialists available"
Network and connect locally	5 (15.6%)	"Connections with local groups/people who have or are in the process of bariatric surgery"
Recipes/restaurants/classes/food retail	5 (15.6%)	"Acceptance at restaurants for smaller healthier portions for us"
None noted	5 (15.6%)	–

Category n =number of total participants in category; Category % =percent of participants out of total; count is for total codes, which may be equal or more than the n listed for the category (i.e., a patient had multiple codes within one category)

noted community/local connections (18%) that they would like to see developed including exercise groups and networking and connecting with postoperative patients. One patient noted, “Connections with local groups/people who have or are in the process of bariatric surgery.” Finally, 16% of patients noted needed dietary resources like promotion of smaller portion sizes at restaurants.

Discussion

This study explored postoperative patients’ perceptions of existing neighborhood and built environment food retail, fitness facility, and outdoor activity options, and challenges and suggestions for resources to aid in a healthy postoperative lifestyle. Patients noted SDOH affecting their ability to make healthy postoperative choices and meet their goals, despite access to some resources in their communities. Hypotheses were partially confirmed, in which patients from urban (and rural) geographic areas and who received at least one governmental assistance program reported less utilization, access, satisfaction, and safety to specific food retailers, fitness facilities, and outdoor activity options. Given that the majority of patients who completed the survey identified as the primary food purchaser and preparer in the household, there is great opportunity partner with patients to learn more about their needs for education and resources in their neighborhoods and communities to work towards their healthy lifestyle and weight loss goals.

Patients reported higher access and closeness to home for lower-cost and more affordable food retail stores (i.e., grocery stores, bulk item, and convenience stores). Even though the majority of patients in the sample had access to a grocer and rated the grocer as satisfactory, economic conditions appeared to play a vital role in access to healthy food. Affordability was noted in patients’ responses to the open-ended questions, in which price/cost was the top challenge experienced by patients when finding food products that fit with their postoperative goals. This is congruent with prior research [19] noting limited access, availability, and the high costs of healthy foods and challenges with engaging in community-based nutrition/dietary services [20]. Future research should focus on methods of connecting patients with local and affordable food retail options and services to assist them with maintaining a health postoperative lifestyle. Methods of connecting patients to resources may include virtual means such as website, mobile app, and social networking sites.

With respect to fitness facilities, the highest accessed and closest to home facilities (chains and yoga options) did not have high reports of utilization and patients’ reported neutral satisfaction. This was likely due to costs associated with memberships, scheduling, and as noted by patients the need

for facility and trainer education to work with postoperative patients. These results underscore a pressing need to develop more robust clinic-to-community collaborations to promote access to, and engagement in, fitness programming that is personalized to the unique needs and challenges experienced by postoperative patients. Prioritizing and developing clinic-to-community pathways to link patients to appropriate fitness resources, developing training materials for facilities and trainers around postoperative fitness and activity considerations, and finding ways to connect patients with discounted memberships and personal training are options to meet the needs described by patients.

Overall patients reported high access and closeness to home for all the outdoor activity options. Utilization rates were lowest for bike lanes, and patients had the highest safety concern about using bike lanes. Challenges with walking/bike trails have been previously reported, as well engaging in safe outdoor activity [17]. In this study, patients suggested the development of additional activity resources including sidewalks/walking paths, and also neighborhood and walking/exercise groups, which may potentially assist with perceptions of safety and higher utilization rates.

There was economic diversity in the sample, with half of participants using at least one governmental social assistance program and divided geographic location. Given that the majority of research assessing SDOH among bariatric surgery patients has relied on data available in the electronic health record, the prevalence of these economic disparities, especially the high rate of receipt of governmental assistance programs, merits exploring ways to assess economic need beyond data in the electronic health record. Patients who received at least one governmental assistance program reported lower access to the discount grocer, lower satisfaction with retailers providing bulk items, and less safety when using city and metro parks. These findings are concerning as these retail stores offer more affordable items and in large quantity.

Also congruent with prior literature on the SDOH, there were significant differences based on geographic location in which patients in rural and urban areas reported increased safety concerns for using sidewalks, lower utilization of community-based fitness centers, and less access to discounted bulk item food retailers. Prior research has noted that rural patients did not have worse postoperative outcomes compared to non-rural patients, and other work noted rural and urban patients had similar outcomes, [17, 18] though prior work has not compared suburban patients with rural and urban patients. While rural and urban patients may have similar outcomes, it may be their outcomes are significantly worse compared to suburban patients, in part due to the lack of resources available to rural and urban patients in their communities. In this study, rural and urban patients reported increased challenges in safety, access, and

utilization of resources to assist with a healthy lifestyle, indicating that targeted resources may need to be developed specifically for non-suburban areas to address existing SDOH.

One aspect that the survey did not specifically assess was support and psychosocial/mental health community-based resources. However, in the open-ended question about future resource development, patients noted the need for close to home support groups and resources for mental health services. Patients also noted the desire for group activities and networking and connecting with other postoperative patients. Given the strong association between mental and physical health outcomes, as food retail, fitness, and activity resources are developed, it will be important to consider how to bring groups of patients together to participate in these resources and ensure their mental health needs can be simultaneously addressed locally. It is also important to locate patients' responses within the context in which they were recruited, from a postoperative support group listserv. All patients who participated in the study were either previously or currently engaged in the center's support group where behavior change, support, and environmental challenges to behavior change are a focus of discussion [27].

Several limitations should be considered in the interpretation of the study results. First, this was a convenience sample obtained from a single postoperative support group listserv. It is not possible to obtain an accurate response rate or to determine if patients who responded were inclined to do so because they have struggled more or less with maintaining a healthy postoperative lifestyle. Although the sample in this study was demographically similar to the sample of patients seen at the center, [28] results are not broadly generalizable. The racial/ethnic homogeneity of the study sample (84% White) is also a limitation, especially given the intersection of race/ethnicity with socioeconomic status and other SDOH. In addition, the food retailers and fitness facilities named in the survey are primarily available in the USA and North America. While the sample size of this study was small ($N=44$) limiting power in bivariate analysis, it was congruent with other studies assessing the neighborhood and build environment resources [16, 19, 20]. Finally, it is possible that there were additional food retail, fitness facility, and outdoor activity options utilized by postoperative patients that were not included in this study.

Conclusions

Overall, postoperative patients reported high access to lower cost and national chain food retail and fitness facility options and high access to outdoor activity options. However, utilization of fitness facilities and outdoor activity options was low. Patients reported financial challenges with finding food products to meet their goals and training fitness facilities and

trainers in appropriate postoperative patient care and exercise. Rural and urban patients reported increased challenges in safety, access, and utilization of resources to assist with a healthy lifestyle. Targeted resources may need to be developed for patients in non-suburban areas and who receive governmental assistant programs to increase safety of outdoor options and access to lower cost food retailers and to increase utilization of lower-cost fitness facilities.

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Declarations

Ethics Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Consent to Participate Informed consent was obtained from all individual participants included in the study.

Conflict of Interest The authors declare no competing interests.

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