Health Behaviors and Wellbeing among those “LIVING” with Metastatic Cancer in the Deep South

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Abstract

Background: Approximately 5 million Americans are living with metastatic cancer. Metastatic cancer survivors (MCS) are at risk for poor health behaviors, which may negatively influence wellbeing.

Methods: Using a modified Dillman's method, 542 MCS were mailed a survey querying physical and mental health (PROMIS® measures), health behaviors, and supportive care interest. Returned surveys were double-key entered into REDCap®. Data were analyzed using SPSS.

Results: Two hundred and seventy-seven surveys were returned (51% response). Respondents (51% female; 88% Caucasian; 12% African-American; Mage=65 years; Msurvivorship=38 months; 23% female cancers, 23% melanoma, 21% gastrointestinal, 15% genitourinary, 12% pulmonary, and 6% other) reported low daily fruit and vegetable (F&V) intake (M=4.1) and weekly minutes of moderate-to-vigorous physical activity (PA) (M=41.9), with 66% of respondents having overweight or obesity. While mean scores for physical (M=43.6) and mental (M=47.7) health were considered "good," scores in the "fair" to "poor" ranges were observed (40% physical; 23% mental). MCS meeting PA (>150 min per week) and dietary (>5 daily servings of F&V) guidelines reported better physical (p=.003; p=.056) and mental (p=.033, p=.549) health respectively, compared to MCS who were not. While current supportive care use was low (12%), future interest was high (57%), with greatest interest for nutrition (46%), MCS support group (38%), and gardening (31%).

Conclusions: Our findings suggest that engaging in regular PA and consuming more F&Vs may enhance physical and mental health among MCS. Future research may explore supportive care approaches with high interest, to aid MCS in improving key health behaviors.

Introduction

Metastatic cancer survivors (MCS) are a significant and growing, high-risk, underserved population. There are more than 16 million cancer survivors in the United States (U.S.), of which 10–30% are living with metastatic cancer [1, 2]. The growing number of MCS is likely due to improvements in early detection and treatment, resulting in Americans surviving their initial cancer and potentially developing metastatic disease at a future date [1–3]. MCS are at an increased risk for poor health behaviors (e.g., diets low in fruits and vegetables and physical inactivity) and psychosocial distress, which may negatively influence treatment adherence, decision-making, relationships with health care providers, and quality-of-life [4, 5]. While treatments for metastatic cancer have increased survival time, especially among metastatic breast, prostate and colorectal cancer survivors who may live 2–5 years with metastatic disease [1, 2, 6], longer survival time necessitates an increased need for services and research on how to improve health behaviors, physical and mental wellbeing, and the quality of survival [7–9]. Yet, few investigators are addressing the needs of this unique, underserved patient population. Specific aims of this cross-sectional survey study were to explore current health behaviors, supportive care use and interest, and wellbeing among a diverse group of MCS, and to examine differences in responses by cancer site (i.e., female cancers, genitourinary, gastrointestinal, pulmonary, melanoma, and other).

Methods

We conducted a cross-sectional mail survey study among a census of O'Neal Comprehensive Cancer Center at the University of Alabama at Birmingham (UAB) patients diagnosed with non-hematologic metastatic cancer. The study protocol received approval from the UAB Institutional Review Board. Participant consent was implied through voluntary completion of the study survey.

Participants

Adult (≥ 21 years) MCS were identified via the UAB Cancer Registry and I2B2 (Informatics for Integrating Biology and the Bedside), resulting in an initial listing of 2,508 MCS. I2B2 is an NIH-funded National Center for Biomedical Computing (NCBC) developed to leverage existing data for research cohort discovery [10]. To prevent unnecessary burden on potential participants
and their families, the electronic medical record (EMR) was reviewed and online obituary searches were conducted, revealing 1,900 ineligible cases (1,486 deceased; 304 no metastatic disease; 86 hospice care; 15 no mailing address, 9 < 21 years of age). Physician approval to contact was obtained from treating oncologists for 579 potential participants. See Fig. 1 for Consort Diagram.

Procedures

The mailed survey was conducted using a modified Dillman-tailored design approach [11]. A pre-notice letter was sent to patients to inform them that they soon would receive a survey to be completed and offered an opt-out option. Five days later, a paper survey and cover letter, along with a postage paid pre-addressed return envelope, were mailed. A postcard was sent one week later that expressed thanks to individuals if they had returned a survey and if not, to prompt them to please do so. Three weeks after the postcard, if no survey had been received, a replacement survey was sent. A thank-you letter and a $2 book of stamps (token of appreciation) were sent to MCS who completed surveys. Surveys were posted between March and August 2019, and completed surveys were received until September 2019. Returned surveys were reviewed for completeness. If incomplete, a member of the study team immediately followed-up with respondent via telephone. Data were double-key entered into REDCap (Research Electronic Data Capture), a secure web-based software platform designed to support data capture for research studies [12, 13].

Study Survey

The 8-page survey was comprised of validated and widely-used scales and subscales, including PROMIS® (Patient-Reported Outcomes Measurement Information System) Measures [14]. Short form-measures were selected to reduce participant burden. Colorful headers and large font were used to engage participants and enhance response rates [11, 15].

Demographic and Cancer-related Data. Self-reported demographic and cancer-related health data included education, marital status, employment status, income, household size, smoking status, alcohol consumption, body weight and height, and cancer treatment status. EMR verified demographic and cancer-related data included age, gender, race, date of metastasis, and primary cancer site.

Health Behaviors

Data on respondents’ health behaviors and physical and psychosocial wellbeing are presented in Table 3. Overall, 66% of MCS were overweight or obese; however, there were significant cancer group differences with only 38% of pulmonary MCS’ having overweight or obesity. PA levels across cancer groups were low, with a mere 14% meeting established guidelines (i.e., engaging in ≥ 150 min of moderate-to-vigorous PA per/week). MCS meeting PA guidelines reported experiencing significantly better physical (48 vs 43; p = .003, d = .567) and mental (51 vs 47; p = .033, d = .404) health. Controlling for age, gender, race, time since diagnosis, treatment status, BMI, pain, and fatigue, meeting PA guidelines significantly predicted MCS physical (B = 5.190; p < 0.001) and mental (B = 4.158; p = 0.004) health. As for F&V intake, overall MCS reported consuming and average of 4 servings per day, with only 35% meeting the guidelines of ≥ 5 daily servings per day. While not statistically significant, MCS meeting dietary guidelines reported experiencing better physical (45 vs 43; p = .056, d = .244) and mental (48 vs 47; p = .549, d = .077) health. Alcohol (31%) and tobacco (10%) use were reported. Alcohol consumption averaged five drinks a week; however, heavier consumption (15–40 drinks a week) was reported. While only 10% reported being current smokers, half of the respondents had a history of smoking, with pulmonary MCS reporting the highest incidence of smoking (20.6% current smokers; 79.4% ever smokers).
| Variables                          | All (N = 277) | Cancer Types                                                                 |
|-----------------------------------|---------------|------------------------------------------------------------------------------|
|                                   | % (n)         | Female (n = 64) | Genitourinary (n = 40) | Gastrointestinal (n = 58) | Pulmonary (n = 34) | Melanoma (n = 64) | Other (n = 17) |
| Body Mass Index Mean (SD) Range   | 27.8 (5.59)   | 28.5 (6.21)     | 28.9 (5.35)            | 27.5 (5.16)               | 24.5 (3.75)        | 28.5 (5.58)       | 27.8 (6.21)   |
| Cancer Types                      |               | % (n)           | % (n)                  | % (n)                     | % (n)              | % (n)             | % (n)          |
| Female (n = 64)                   |               | 14–50           | 14–50                  | 20–40                     | 19–47              | 17–36            | 21–50         |
| Genitourinary (n = 40)            |               | 14–50           | 14–50                  | 20–40                     | 19–47              | 17–36            | 21–50         |
| Gastrointestinal (n = 58)         |               | 14–50           | 14–50                  | 20–40                     | 19–47              | 17–36            | 21–50         |
| Pulmonary (n = 34)                |               | 14–50           | 14–50                  | 20–40                     | 19–47              | 17–36            | 21–50         |
| Melanoma (n = 64)                 |               | 14–50           | 14–50                  | 20–40                     | 19–47              | 17–36            | 21–50         |
| Other (n = 17)                    |               | 14–50           | 14–50                  | 20–40                     | 19–47              | 17–36            | 21–50         |
| % Overweight or Obese            | 65.7% (182)   | 65.6% (42)      | 77.5% (31)            | 67.2% (39)                | 38.2% (13)         | 73.4% (47)       | 58.8% (10)    |
| Smoking Status                   |               |                 |                       |                           |                    |                  |               |
| Current Smoker (n = 128)          | 10.1% (28)    | 7.8% (5)        | 10% (4)                | 5.2% (3)                  | 20.6% (7)          | 10.9% (7)        | 11.8% (2)     |
| Ever Smoker (n = 140)             | 50.5% (140)   | 26.6% (17)      | 62.5% (25)            | 46.6% (27)                | 79.4% (27)         | 54.7% (35)       | 52.9% (9)     |
| Never Smoker (n = 137)            | 49.5% (137)   | 73.4% (47)      | 37.5% (15)            | 53.4% (31)                | 20.6% (7)          | 45.3% (29)       | 47.1% (8)     |
| Uses Alcohol                     | 31.4% (87)    | 26.6% (17)      | 22.5% (31)            | 34.5% (20)                | 35.3% (12)         | 32.8% (21)       | 47.1% (8)     |
| # of drinks per week Mean (SD)    | 4.8 (6.11)    | 4.0 (6.01)      | 2.6 (3.22)            | 5.9 (8.65)                | 3.7 (3.73)         | 5.2 (5.32)       | 6.1 (6.52)    |
| Range                            | 1–40          | 1–25            | 1–10                  | 1–40                      | 1–14              | 1–20            | 1–20          |
| Fruit/Vegetable Intake daily servings Mean (SD) Range | 4.1 (1.5) | 4.0 (1.57) | 4.1 (1.44) | 4.0 (1.65) | 4.2 (1.59) | 4.0 (1.46) | 4.7 (0.77) | .731a |

*Kruskal Wallis test

*Chi-Square test

*Fisher Exact Test
| Variables                              | All (N = 277) | Cancer Types                              |  |  |  |  |  |  |  |  |  |  |
|----------------------------------------|---------------|-------------------------------------------|---|---|---|---|---|---|---|---|---|---|
|                                        | % (n)         | Female (n = 64)                            | % (n) | Genitourinary (n = 40) | % (n) | Gastrointestinal (n = 58) | % (n) | Pulmonary (n = 34) | % (n) | Melanoma (n = 64) | % (n) | Other (n = 17) | % (n) | P value |
| Percent meeting dietary guidelines     | 35% (97)      | 39.1% (25)                                | 27.5% (11) | 32.8% (19) | 41.2% (14) | 34.4% (22) | 35.3% (6) | .826 b |
| ≥ 5 daily servings                     |               |                                          |                                       |                                       |                                       |                                       |     |
| Physical Activity^f                    |               |                                          |                                       |                                       |                                       |                                       |     |
| minutes per week                       |               |                                          |                                       |                                       |                                       |                                       |     |
| Moderate to Vigorous (MVPA)            | 41.9 (58.81)  | 25.9 (46.15)                              | 36.7 (54.56) | 54.8 (65.59) | 30.6 (52.05) | 50.0 (61.20) | 62.9 (75.17) | .064 a |
| Mean (SD)                              | 0-185         | 0-175                                     | 0-185 | 0-180 | 0-150 | 0-180 | 0-180 |     |
| Range                                  |               |                                          |                                       |                                       |                                       |                                       |     |
| Mild                                   | 48.8 (54.48)  | 46.3 (47.84)                              | 59.0 (65.68) | 50.9 (50.09) | 36.5 (43.81) | 53.1 (62.38) | 36.2 (51.04) | .725 a |
| Mean (SD)                              | 0-180         | 0-180                                     | 0-180 | 0-150 | 0-140 | 0-180 | 0-180 |     |
| Range                                  |               |                                          |                                       |                                       |                                       |                                       |     |
| Percent meeting physical activity      | 14.1% (39)    | 6.3% (4)                                  | 10% (4) | 20.7% (12) | 8.8% (3) | 17.2% (11) | 29.4% (5) | .063 a |
| guidelines                             |               |                                          |                                       |                                       |                                       |                                       |     |
| ≥ 150 min MVPA per week                |               |                                          |                                       |                                       |                                       |                                       |     |
| Physical Health^g                      | 43.6 (12.08)  | 43.3 (9.12)                               | 42.6 (8.24) | 45.5 (8.77) | 42.5 (8.50) | 45.4 (8.64) | 46.1 (9.59) | .521 a |
| Mean (SD)                              | 17–68         | 20–68                                     | 24–58 | 29–68 | 25–58 | 26–62 | 34–68 |     |
| Range                                  |               |                                          |                                       |                                       |                                       |                                       |     |
| Excellent: >58                         | 3.2% (9)      | 4.7% (3)                                  | 0                                  | 3.4% (2) | 0   | 3.1% (2) | 11.8% (2) |     |
| Very Good: 51–58                       | 15.5% (43)    | 10.9% (7)                                 | 12.5% (5) | 12.1% (7) | 17.6% (6) | 25% (16)  | 11.8% (2) |     |
| Good: 42–50                            | 37.9% (105)   | 37.5% (24)                                | 50% (20) | 36.2% (21) | 35.3% (12) | 32.8% (21) | 41.2% (7) |     |
| Fair: 35–41                            | 28.5% (79)    | 34.4% (22)                                | 17.5% (7) | 34.5% (20) | 29.4% (10) | 26.6% (17) | 17.6% (3) |     |
| Poor: <35                              | 14.8% (41)    | 12.5% (8)                                 | 20% (8)  | 13.8% (8) | 17.6% (6) | 12.5% (8) | 17.6% (3) |     |

^aKruskal Wallis test

^bChi-Square test

^cFisher Exact Test
| Variables          | All (N = 277) | Cancer Types | Female (n = 64) | Genitourinary (n = 40) | Gastrointestinal (n = 58) | Pulmonary (n = 34) | Melanoma (n = 64) | Other (n = 17) | P value |
|-------------------|---------------|--------------|----------------|------------------------|---------------------------|-------------------|------------------|----------------|---------|
| Mental Health     |               |              |                |                        |                           |                   |                  |                |         |
| Mean (SD)         | 47.7 (9.30)   | 48.2 (9.39)  | 48.2          | 42.7 (8.77)            | 46.6 (8.61)               | 49.3 (9.75)       | 48.8 (11.38)    | .241^a        |         |
| Range             |               |              |                |                        |                           |                   |                  |                |         |
| Excellent: >56    | 16.6% (46)    | 17.2% (11)   | 15%          | 10.3% (6)              | 11.8% (4)                 | 23.4% (15)        | 23.5% (4)       | .381^c        |         |
| Very Good: 49–56  | 26.0% (72)    | 25% (16)     | 37.5%        | 22.4% (13)             | 26.5% (9)                 | 26.6% (17)        | 11.8% (2)       |               |         |
| Good: 41–48       | 33.9% (94)    | 35.9% (23)   | 27.5%        | 36.2% (21)             | 32.4% (11)                | 31% (20)          | 47.1% (8)       |               |         |
| Fair: 29–40       | 21.7% (60)    | 20.3% (13)   | 17.5%        | 29.3% (17)             | 29.4% (10)                | 17.2% (11)        | 11.8% (2)       |               |         |
| Poor: <29         | 1.8% (5)      | 1.6% (1)     | 2.5%         | 1.7% (1)               | 0                         | 1.6% (1)          | 5.9% (1)        |               |         |
| Overall Health    |               |              |                |                        |                           |                   |                  |                | .703^c   |
| Excellent         | 3.2% (9)      | 3.1% (2)     | 0             | 3.4% (2)               | 2.9% (1)                  | 3.1% (2)          | 11.8% (2)       |               |         |
| Very Good         | 19.9% (55)    | 18.8% (12)   | 17.5%        | 17.2% (10)             | 17.6% (6)                 | 26.6% (17)        | 17.6% (3)       |               |         |
| Good              | 42.6% (118)   | 45.3% (29)   | 52.5%        | 37.9% (22)             | 29.4% (10)                | 45.3% (29)        | 41.2% (7)       |               |         |
| Fair              | 26% (72)      | 21.9% (14)   | 22.5%        | 31% (10)               | 32.4% (11)                | 23.4% (15)        | 29.4% (5)       |               |         |
| Poor              | 8.3% (23)     | 10.9% (7)    | 7.5%         | 10.3% (6)              | 17.6% (6)                 | 1.6% (1)          | 0               |               |         |

^aKruskal Wallis test

^bChi-Square test

^cFisher Exact Test
| Variables | All (N = 277) | Cancer Types | | | | P value |
|-----------|--------------|--------------|--------------|--------------|--------------|--------------|
|           | % (n) | Female (n = 64) | % (n) | Genitourinary (n = 40) | % (n) | Gastrointestinal (n = 58) | % (n) | Pulmonary (n = 34) | % (n) | Melanoma (n = 64) | % (n) | Other (n = 17) | % (n) |
| Excellent | 10.1% (28) | 7.8% (5) | 10% (4) | 6.9% (4) | 2.9% (1) | 17.2% (11) | | 17.6% (3) |
| Very Good | 26.4% (73) | 26.6% (17) | 27.5% (11) | 22.4% (13) | 23.5% (8) | 29.7% (19) | | 29.4% (5) |
| Good | 42.6% (118) | 45.3% (29) | 37.5% (15) | 50% (29) | 41.2% (14) | 39.1% (25) | | 35.3% (6) |
| Fair | 17.3% (48) | 18.8% (12) | 20% (8) | 15.5% (9) | 23.5% (8) | 12.5% (8) | | 17.6% (3) |
| Poor | 3.6% (10) | 1.6% (1) | 5% (2) | 5.2% (3) | 8.8% (3) | 1.6% (1) | | 0 |
| Pain | | | | | | | | | | | | | | |
| 0 (worst imaginable) | 0.4% (1) | 0 | 0 | 1.7% (1) | 0 | 0 | | 0 |
| 7–9 | 10.1% (28) | 9.4% (6) | 17.5% (7) | 6.9% (4) | 11.8% (4) | 9.4% (6) | | 5.9% (1) |
| 4–6 | 23.1% (64) | 21.9% (14) | 47.5% (19) | 43.1% (25) | 35.3% (12) | 37.5% (24) | | 23.5% (4) |
| 1–3 | 42.2% (117) | 45.3% (29) | 15% (6) | 17.3% (10) | 35.3% (12) | 31.3% (20) | | 47.1% (8) |
| 0 (none) | 24.2% (67) | 23.4% (15) | | | | | | | | | | | | | |
| Fatigue | | | | | | | | | | | | | | |
| Very Severe | 10.8% (30) | 12.5% (8) | 15% (6) | 17.2% (10) | 5.9% (2) | 4.7% (3) | | 5.9% (1) |
| Severe | 29.6% (82) | 21.9% (14) | 25% (10) | 31% (18) | 38.2% (13) | 29.7% (19) | | 47.1% (8) |
| Moderate | 34.7% (96) | 34.4% (22) | 22.5% (9) | 13.8% (8) | 20.6% (7) | 25% (16) | | 29.4% (5) |
| Mild | 20.2% (56) | 21.9% (14) | 0 | 5.2% (3) | 0 | 3.1% (2) | | 11.8% (2) |
| None | 4.7% (13) | 4.7% (6) | | | | | | | | | | | | | |
| Anxiety | | | | | | | | | | | | | | |
| Mean (SD) | 49.3 (10.13) | 48.5 (10.12) | 49.6 (9.37) | 51.8 (11.19) | 49.8 (9.01) | 48.1 (9.59) | | 47.1 (11.79) |
| Range | 37–79 | 37–72 | 37–79 | 37–79 | 37–66 | 37–72 | | 37–72 |

*aKruskal Wallis test

*bChi-Square test

*cFisher Exact Test
| Variables       | All (N = 277) | Cancer Types                                      | Female (n = 64) | Genitourinary (n = 40) | Gastrointestinal (n = 58) | Pulmonary (n = 34) | Melanoma (n = 64) | Other (n = 17) | P value |
|-----------------|---------------|--------------------------------------------------|----------------|-----------------------|--------------------------|----------------|----------------|---------------|---------|
| Normal: <55     | 67.5% (187)   | 71.9% (46)                                       | 77.5% (31)     | 53.4% (31)            | 67.6% (23)               | 70.3% (45)      | 64.7% (11)    |               |         |
| Mild: 55–60     | 18.4% (51)    | 15.6% (10)                                       | 10% (31)       | 25.9% (15)            | 17.6% (6)                | 18.8% (12)      | 23.5% (4)     |               | .250a   |
| Moderate: 61–70 | 11.6% (32)    | 9.4% (6)                                         | 10% (4)        | 17.2% (10)            | 14.7% (5)                | 9.4% (6)        | 5.9% (1)      |               |         |
| Severe: >70     | 2.5% (7)      | 3.1% (2)                                         | 2.5% (1)       | 3.4% (2)              | 0                        | 1.6% (1)        | 5.9% (1)      |               |         |
| Depression      | Mean (SD)     | Range                                            |                |                       |                          |                |                |               |         |
| Normal: <55     | 74.7% (207)   | 81.3% (52)                                       | 75% (30)       | 60.3% (35)            | 61.8% (21)               | 85.9% (55)      | 82.4% (14)    |               |         |
| Mild: 55–60     | 17.7% (49)    | 14.1% (9)                                        | 17.5% (7)      | 24.1% (14)            | 32.4% (11)               | 10.9% (7)       | 5.9% (1)      |               |         |
| Moderate: 61–70 | 5.8% (16)     | 3.1% (2)                                         | 5% (2)         | 13.8% (8)             | 2.9% (1)                 | 3.1% (2)        | 5.9% (1)      |               |         |
| Severe: >70     | 1.8% (5)      | 1.6% (1)                                         | 2.5% (1)       | 1.7% (1)              | 2.9% (1)                 | 0               | 5.9% (1)      |               |         |
| Social Isolation| Mean (SD)     | Range                                            |                |                       |                          |                |                |               | .576a   |
| Normal: <55     | 86.6% (240)   | 87.5% (56)                                       | 90% (36)       | 77.6% (45)            | 88.2% (30)               | 92.2% (59)      | 82.4% (14)    |               |         |
| Mild: 55–60     | 8.3% (23)     | 7.8% (5)                                         | 7.5% (3)       | 17.2% (10)            | 5.9% (2)                 | 3.1% (2)        | 5.9% (1)      |               |         |
| Moderate: 61–70 | 5.1% (14)     | 4.7% (3)                                         | 2.5% (1)       | 5.2% (3)              | 5.9% (2)                 | 4.7% (3)        | 11.8% (2)     |               |         |
| Severe: >70     | 0             | 0                                                | 0              | 0                     | 0                        | 0               | 0             |               | 0       |

*aKruskal Wallis test

*bChi-Square test

*cFisher Exact Test
| Variables          | All (N = 277) % (n) | Cancer Types               | P value |
|--------------------|---------------------|----------------------------|---------|
|                    | Female (n = 64) % (n) | Genitourinary (n = 40) % (n) | Gastrointestinal (n = 58) % (n) | Pulmonary (n = 34) % (n) | Melanoma (n = 64) % (n) | Other (n = 17) % (n) |         |
| Emotional Support  | 55.9 (8.47) 55.5 (7.80) 56.0 (9.12) | 35–63 35–63 38–63 | 55.4 (8.05) 38–63 | 55.7 (9.06) 33–63 | 56.5 (9.02) 32–63 | 57.0 (8.37) 37–63 | .846<sup>a</sup> |
| Mean (SD)          | 32–63 37–63 35–63 | 56–63 35–63 38–63 | 55–63 33–63 | 55–63 32–63 | 57–63 32–63 | 57–63 37–63 |

Range

| Very High: >70 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| High: 61–70    | 45.5% (126) 37.5% (24) 50% (20) | 39.7% (23) | 44.1% (15) | 54.7% (35) | 52.9% (9) |
| Average: 41–60 | 48.7% (135) 59.4% (38) 42.5% (17) | 56.9% (33) | 47.1% (16) | 37.5% (24) | 41.2% (7) |
| Low: 30–40     | 5.8% (16) 3.1% (2) 7.5% (3) | 3.4% (2) | 8.8% (3) | 7.8% (5) | 5.9% (1) |
| Very Low:<30   | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Meaning and Purpose | 55.5 (10.19) 56.4 (10.28) 55.1 (10.67) | 29–68 31–68 | 52.8 (10.20) 31–68 | 54.9 (10.82) 32–68 | 57.0 (9.25) 35–68 | 57.9 (10.10) 39–68 | .251<sup>a</sup> |
| Mean (SD) Range | 29–68 32–68 29–68 | 31–68 31–68 | 32–68 35–68 | 32–68 35–68 | 39–68 |
| Very High: >70 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| High: 61–70    | 34.7% (96) 35.9% (23) 37.5% (15) | 22.4% (13) | 38.2% (13) | 37.5% (24) | 47.1% (8) |
| Average: 41–60 | 54.2% (150) 53.1% (34) 52.5% (21) | 60.3% (35) | 50.0% (17) | 56.3% (36) | 41.2% (7) |

<sup>a</sup>Kruskal Wallis test

<sup>b</sup>Chi-Square test

<sup>c</sup>Fisher Exact Test
| Variables | All (N = 277) | Cancer Types |  |  |  |  |  |  |  |  |  |  |
|-----------|--------------|--------------|---|---|---|---|---|---|---|---|---|---|
|           | % (n)        | Female (n = 64) | Genitourinary (n = 40) | Gastrointestinal (n = 58) | Pulmonary (n = 34) | Melanoma (n = 64) | Other (n = 17) |
|           | % (n)        | % (n)        | % (n)        | % (n)        | % (n)        | % (n)        | % (n)        |
| Low: 30–40| 10.8% (30)   | 10.9% (7)    | 7.5% (3)     | 17.2% (10)   | 11.8% (4)    | 6.3% (4)     | 11.8% (2)    |
| Very Low:<30| 0.4% (1)    | 0            | 2.5% (1)     | 0            | 0           | 0            | 0            |

\(^a\)Kruskal Wallis test

\(^b\)Chi-Square test

\(^c\)Fisher Exact Test

### Statistical Analyses

Data were analyzed using SPSS V-26. The significance level was set at 0.05 and was not corrected for multiple comparisons. Descriptive statistics were conducted for the sample characteristics. Frequencies and percentages were used to describe all categorical variables. Means and SDs were generated for scores on all continuous variables. Preliminary analyses were conducted to examine whether there were any group differences between survey responders and non-responders (e.g., time since diagnosis, cancer type, age, gender, race) using independent sample t-tests or Pearson’s chi-square tests when appropriate. Among responders, differences between cancer types were tested using chi-square, Kruskal–Wallis, or Fisher exact tests. Multiple regression analyses were used to explore associations between health behaviors and physical and mental health.

### Results

The potential evaluable sample comprised 542 MCS (Fig. 1). Most were Caucasian (79%) and the distribution among cancer types was 23% gastrointestinal, 22% female cancers, 19% melanoma, 15% genitourinary, 13% pulmonary, and 8% other. A 51% response rate was achieved overall. Non-responder analyses (Table 1) revealed significant differences in age, race, and time since metastatic diagnosis. Responders (n = 277) tended to be older, Caucasian, and living longer with metastatic disease. There were no significant differences in gender, cancer type, or residence (rural vs urban).
| Variables                                    | Total (N = 542) | Responders (n = 277) | Non-Responders (n = 265) | Difference |
|----------------------------------------------|-----------------|----------------------|--------------------------|------------|
|                                              | Mean (SD)       | n (%)                | Mean (SD)                | n (%)      | P          |
| Age (years)                                 | 61.5 (12.95)    | 65.1 (12.28)         | 57.9 (12.62)             | <.001<sup>a</sup> |
|                                             | 25–93           | 25–90                | 25–93                    |            |
| Time since metastatic diagnosis (months)    | 31.8 (24.94)    | 36.6 (30.06)         | 26.7 (16.74)             | <.001<sup>a</sup> |
|                                             | 3-189           | 3-189                | 4–88                     |            |
| Cancer Type                                 |                 |                      |                          | 0.132<sup>b</sup> |
| Female Cancers                              | 119 (22%)       | 64 (23.1%)           | 55 (20.8%)               |            |
| Genitourinary                               | 83 (15.3%)      | 40 (14.4%)           | 43 (16.2%)               |            |
| Gastrointestinal                            | 125 (23.1%)     | 57 (20.6%)           | 68 (25.7%)               |            |
| Pulmonary                                   | 70 (12.9%)      | 34 (12.3%)           | 36 (13.6%)               |            |
| Melanoma                                     | 103 (19%)       | 64 (23.1%)           | 39 (14.7%)               |            |
| Other                                        | 42 (7.7%)       | 18 (6.5%)            | 24 (9.1%)                |            |
| Gender                                       |                 |                      |                          | 0.871<sup>b</sup> |
| Female                                       | 276 (50.9%)     | 142 (51.3%)          | 134 (50.6%)              |            |
| Male                                         | 266 (49.1%)     | 135 (48.7%)          | 131 (49.4%)              |            |
| Race                                         |                 |                      |                          | <.001<sup>b</sup> |
| African-American                            | 116 (21.4%)     | 32 (11.6%)           | 84 (31.7%)               |            |

<sup>a</sup>Kruskal Wallis test

<sup>b</sup>Chi-Square test
### Variables

| Variables               | Total (N = 542) | Responders (n = 277) | Non-Responders (n = 265) | Difference |
|-------------------------|-----------------|-----------------------|--------------------------|------------|
|                         | Mean (SD)       | n (%)                 | Mean (SD)                | n (%)      | P          |
|                         | Range           |                       | Range                    |            |            |
| Caucasian               |                 |                       |                          |            |            |
|                         | 426 (78.6%)     | 245 (88.4%)           | 181 (68.3%)              |            |            |
| Rural Residence         |                 |                       |                          | 0.093b     |            |
| Yes                     | 249 (45.9%)     | 137 (49.5%)           | 112 (42.3%)              |            |            |
| No                      | 293 (54.1%)     | 140 (50.5%)           | 153 (57.7%)              |            |            |

\(^a^\text{Kruskal Wallis test}\)

\(^b^\text{Chi-Square test}\)

### Participant Characteristics

Sociodemographic and cancer treatment characteristics of the full respondent sample (N = 277) are provided in Table 2. Overall, MCS were older Caucasians who were married, retired or disabled, and currently receiving cancer treatment. On average MCS had been living with metastatic disease for approximately 3 years. Cancer types consisted of female cancers (n = 64), melanoma (n = 64), gastrointestinal (n = 58), genitourinary (n = 40), pulmonary (n = 34), and other (n = 17). Other cancers consisted of thyroid, sarcoma, and unknown. Significant cancer group differences were observed with regard to age, time since diagnosis, gender, race, marital status, and receiving cancer treatment.
| Variables               | All (N = 277) % (n) | Cancer Types | P value |
|-------------------------|---------------------|--------------|---------|
|                         |                     | Female Cancers (n = 64) % (n) | Genitourinary (n = 40) % (n) | Gastrointestinal (n = 58) % (n) | Pulmonary (n = 34) % (n) | Melanoma (n = 64) % (n) | Other (n = 17) % (n) |
| Age (years)             | 65.1 (12.27)        | 63.3 (11.10) | 66.9 (10.70) | 61.7 (12.12) | 70.5 (9.16) | 66.2 (14.21) | 63.53 (14.48) |
| Mean (SD)               | 25–90               | 34–83        | 37–84        | 32–90        | 52–84       | 25–88        | 3–84          |
| Survivorship (months)   | 37.8 (30.14)        | 31.6 (26.92) | 43.9 (35.52) | 38.3 (30.07) | 24.7 (8.26) | 43.8 (28.25) | 48.8 (48.54) |
| Mean (SD)               | 3-190               | 3-174        | 6-190        | 5-185        | 8-37        | 8-131        | 11–188       |
| Gender                  |                     |              |              |              |            |              | <.001         |
| Female                  | 51.3% (142)         | 100% (64)    | 10% (4)      | 46.6% (27)   | 58.8% (20)  | 29.7% (19)   | 47.1% (8)    |
| Male                    | 48.7% (135)         | 0            | 90% (36)     | 53.4% (31)   | 41.2% (14)  | 70.3% (45)   | 52.9% (9)    |
| Race                    |                     |              |              |              |            |              | .013         |
| African-American        | 11.6 % (32)         | 18.8 % (12)  | 10% (4)      | 15.5% (9)    | 8.8% (3)    | 1.6% (1)     | 11.8% (2)    |
| Caucasian               | 88.4% (245)         | 79.7% (51)   | 90% (36)     | 84.5% (49)   | 91.2% (31)  | 98.4% (63)   | 88.2% (15)   |
| Educational Attainment  |                     |              |              |              |            |              | .672         |
| High school or less     | 32.9% (91)          | 32.8% (21)   | 22.5% (9)    | 34.5% (20)   | 47.1% (16)  | 32.8% (21)   | 23.5% (4)    |
| Some College            | 32.5% (90)          | 31.3% (20)   | 32.5% (13)   | 32.8% (19)   | 23.5% (8)   | 37.5% (24)   | 35.3% (6)    |

*aKruskal Wallis test

*bChi-Square test

*cFisher Exact Test
| Variables                        | All (N = 277) | Cancer Types                                                                 |
|---------------------------------|---------------|--------------------------------------------------------------------------------|
|                                 | % (n)         | Female Cancers (n = 64) % (n)                                                  |
|                                 |               | Genitourinary (n = 40) % (n)                                                   |
|                                 |               | Gastrointestinal (n = 58) % (n)                                                |
|                                 |               | Pulmonary (n = 34) % (n)                                                       |
|                                 |               | Melanoma (n = 64) % (n)                                                        |
|                                 |               | Other (n = 17) % (n)                                                           |
| P value                         |               |                                                                                |
| College Graduate                | 34.7% (96)    | 35.9% (23)                                                                     |
|                                 |               | 45% (18)                                                                       |
|                                 |               | 32.8% (19)                                                                     |
|                                 |               | 29.4% (10)                                                                     |
|                                 |               | 29.7% (19)                                                                     |
|                                 |               | 41.2% (7)                                                                      |
| Marital Status                  |               |                                                                                |
| Married                         | 67.5% (187)   | 56.2% (36)                                                                     |
|                                 |               | 87.5% (35)                                                                     |
|                                 |               | 62.1% (36)                                                                     |
|                                 |               | 58.8% (20)                                                                     |
|                                 |               | 79.7% (51)                                                                     |
|                                 |               | 52.9% (9)                                                                      |
| Divorced or Separated           | 14.1% (39)    | 14.1% (9)                                                                      |
|                                 |               | 10% (4)                                                                        |
|                                 |               | 15.5% (9)                                                                      |
|                                 |               | 14.7% (5)                                                                      |
|                                 |               | 10.9% (7)                                                                      |
|                                 |               | 29.4% (5)                                                                      |
| Widowed                         | 12.3% (34)    | 18.8% (12)                                                                     |
|                                 |               | 2.5% (1)                                                                       |
|                                 |               | 13.8% (8)                                                                      |
|                                 |               | 26.5% (9)                                                                      |
|                                 |               | 6.3% (4)                                                                       |
|                                 |               | 0                                                                              |
| Never Married                   | 6.1% (17)     | 10.9% (7)                                                                      |
|                                 |               | 0                                                                              |
|                                 |               | 8.6% (5)                                                                       |
|                                 |               | 0                                                                              |
|                                 |               | 3.1% (2)                                                                       |
|                                 |               | 17.6% (3)                                                                      |
| Employment Status               |               |                                                                                |
| Employed                        | 28.2% (78)    | 20.3% (13)                                                                     |
|                                 |               | 40% (16)                                                                       |
|                                 |               | 25.9% (15)                                                                     |
|                                 |               | 17.6% (6)                                                                      |
|                                 |               | 34.4% (22)                                                                     |
|                                 |               | 35.3% (6)                                                                      |
| Unemployed                      | 7.2% (20)     | 14.1% (9)                                                                      |
|                                 |               | 0                                                                              |
|                                 |               | 5.1% (3)                                                                       |
|                                 |               | 8.8% (3)                                                                       |
|                                 |               | 4.7% (3)                                                                       |
|                                 |               | 11.8% (2)                                                                      |
| Retired/Disabled                | 64.6% (179)   | 65.6% (42)                                                                     |
|                                 |               | 60% (24)                                                                       |
|                                 |               | 69% (40)                                                                       |
|                                 |               | 73.5% (25)                                                                     |
|                                 |               | 60.9% (39)                                                                     |
|                                 |               | 52.9% (9)                                                                      |
| Household Size                  | 2.2 (1.14)    | 2.2 (1.23)                                                                     |
| Mean (SD)                       |               | 2.5 (1.20)                                                                     |
| Range                           | 1–7           | 1–6                                                                            |
|                                 |               | 2.2 (1.09)                                                                     |
|                                 |               | 2.0 (1.11)                                                                     |
|                                 |               | 2.4 (1.11)                                                                     |
|                                 |               | 1.9 (0.83)                                                                     |
| Household Income                |               |                                                                                |
| Lower: <$40,000                 | 27.1% (75)    | 26.6% (17)                                                                     |
|                                 |               | 22.5% (9)                                                                      |
|                                 |               | 32.8% (19)                                                                     |
|                                 |               | 32.4% (11)                                                                     |
|                                 |               | 21.9% (14)                                                                     |
|                                 |               | 29.4% (5)                                                                      |
| Moderate: $40,000-$60,000       | 17.7% (49)    | 18.8% (12)                                                                     |
|                                 |               | 22.5% (9)                                                                      |
|                                 |               | 12.1% (7)                                                                      |
|                                 |               | 8.8% (3)                                                                       |
|                                 |               | 23.4% (15)                                                                     |
|                                 |               | 17.6% (3)                                                                      |
| Higher: >$60,000                | 35% (97)      | 29.7% (19)                                                                     |
|                                 |               | 37.5% (15)                                                                     |
|                                 |               | 43.1% (25)                                                                     |
|                                 |               | 26.5% (9)                                                                      |
|                                 |               | 35.9% (23)                                                                     |
|                                 |               | 35.3% (6)                                                                      |
| Prefer not to respond           | 20.2% (56)    | 25% (16)                                                                       |
|                                 |               | 17.5% (7)                                                                      |
|                                 |               | 12.1% (7)                                                                      |
|                                 |               | 32.4% (11)                                                                     |
|                                 |               | 18.8% (12)                                                                     |
|                                 |               | 17.6% (3)                                                                      |
| Rural Residence                 |               |                                                                                |
| Yes                             | 49.5% (137)   | 46.9% (30)                                                                     |
|                                 |               | 55% (22)                                                                       |
|                                 |               | 46.6% (27)                                                                     |
|                                 |               | 52.9% (18)                                                                     |
|                                 |               | 50% (32)                                                                       |
|                                 |               | 47.1% (8)                                                                      |

*aKruskal Wallis test

bChi-Square test

cFisher Exact Test
### Physical And Psychosocial Wellbeing

As for physical and psychosocial wellbeing, no significant differences were observed among the six cancer groups. Most reported some level of fatigue (95%) and pain (76%) in the past week. Ratings of “fair” to “poor” were seen for physical health (40%), mental health (23%), overall health (34%), and QOL (21%). Overall, mean scores for anxiety (M = 49.3), depression (M = 48.2), and social isolation (M = 42.3) fell into the “normal” range. However, clinical symptoms (score ≥ 55) of anxiety (32%) and depression (25%) were observed. MCS’s feelings of meaning and purpose (M = 55.5) and emotional support (M = 55.9) were scored as “average.”

### Supportive Care Use And Interest

Data on respondents’ supportive care use and interest are presented in Table 4. While 33.6% reported ever using supportive care, only 12.3% reported current use. Yet, 57% reported interest in future programs. Greatest interest was seen for nutrition classes (45.6%), metastatic cancer support group (38%), and gardening (31%).

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| Variables | All (N = 277) | Cancer Types |  |  |  |  |  | P value |
|-----------|--------------|--------------|---|---|---|---|---|---------|
|           | % (n)        | Female Cancers | Genitourinary | Gastrointestinal | Pulmonary | Melanoma | Other |
|           | % (n)        | (n = 64)      | (n = 40)      | (n = 58)         | (n = 34)   | (n = 64) | (n = 17) |
| No        | 50.5% (140)  | 53.1% (34)    | 45% (18)      | 53.4% (31)       | 47.1% (16) | 50% (32) | 52.9% (9) |
| Currently Receiving Cancer Treatment | 66.4% (184)  | 78.1% (50)    | 77.5% (31)    | 65.5% (38)       | 73.5% (25) | 51.6% (33) | 41.2% (7) | .003b |
| # of treatment types | 1.3 (0.52)    | 1.3 (0.60)    | 1.1 (0.34)    | 1.3 (0.56)       | 1.1 (0.41) | 1.4 (0.79) |
| Mean (SD) | 1–3          | 1–3           | 1–2           | 1–3              | 1–3        | 1–3       | .168a |
| Range     |              |              |              |                  |            |          |         |
| Current Treatment Types* | Chemotherapy | 49.5% (91)    | 48.4% (31)    | 40% (16)         | 48.3% (28) | 29.4% (10) | 6.3% (4) | .981b |
|           | Radiation    | 15.2% (28)    | 6.3% (4)      | 17.5% (7)        | 6.9% (4)   | 17.6% (6) | 7.8% (5) | .239c |
|           | Immunotherapy| 33.2% (61)    | 10.9% (7)     | 15% (6)          | 12.1% (7)  | 35.3% (12) | 40.6% (26) | .001b |
|           | Hormone Therapy | 23.4% (43) | 35.9% (23)    | 25% (10)        | 5.2% (3)   | 8.8% (3)  | 1.6% (1) | .001b |
|           | Other        | 2.8% (8)      | 3.1% (2)      | 5% (2)           | 1.7% (1)   | 5.9% (2)  | 1.6% (1) | .732c |

*aKruskal Wallis test

bChi-Square test

cFisher Exact Test
Table 4
Supportive Care Use and Interest (N = 277)

| Variables                              | All (N = 277) % (n) | Cancer Types                                      | P value |
|----------------------------------------|---------------------|---------------------------------------------------|---------|
|                                        |                     | Female (n = 64) % (n) | Genitourinary (n = 40) % (n) | Gastrointestinal (n = 58) % (n) | Pulmonary (n = 34) % (n) | Melanoma (n = 64) % (n) | Other (n = 17) % (n) |
| Supportive Care Use                    |                     |                     |                               |                               |                       |                     |                     |
| Current                                | 12.3% (34)          | 14.1% (9)           | 7.5% (3)                      | 13.8% (8)                      | 14.7% (5)              | 12.5% (8)           | 5.9% (1)            | .885^c |
| Ever                                   | 33.6% (93)          | 42.2% (27)          | 30.0% (12)                    | 34.5% (20)                     | 23.5% (8)              | 34.4% (22)         | 23.5% (4)           | .453^b |
| Future interest                        | 57.0% (158)         | 68.8% (44)          | 50.0% (20)                    | 63.8% (37)                     | 44.1% (15)             | 50.0% (32)         | 58.8% (10)          | .105^b |
| Future Supportive Care Programs of Interest* |                     |                     |                               |                               |                       |                     |                     |
| Nutrition classes                      | 45.6% (72)          | 54.5% (24)          | 30.0% (6)                     | 45.9% (17)                     | 53.3% (8)              | 40.6% (13)         | 40.0% (4)           | .522^b |
| Metastatic Cancer Support Group        | 38.0% (60)          | 43.2% (19)          | 45.0% (9)                     | 32.4% (12)                     | 40.0% (6)              | 28.1% (9)         | 50.0% (5)           | .644^b |
| Gardening                              | 31.0% (49)          | 31.8% (14)          | 15.0% (3)                     | 37.8% (14)                     | 6.7% (1)               | 43.8% (14)         | 30.0% (3)           | .081^b |
| Cooking Classes                        | 25.9% (41)          | 22.7% (10)          | 25.0% (5)                     | 27.0% (10)                     | 26.7% (4)              | 25.0% (8)         | 40.0% (4)           | .933^b |
| Yoga                                   | 20.9% (33)          | 31.8% (14)          | 15% (3)                       | 10.8% (4)                      | 26.7% (4)              | 15.6% (5)         | 30.0% (3)           | .205^c |
| Mediation                              | 19.0% (30)          | 22.7% (10)          | 10% (2)                       | 16.2% (6)                      | 13.3% (2)              | 21.8% (7)         | 3 (30.0%)           | .714^c |
| Art Therapy                            | 19.0% (30)          | 22.7% (10)          | 5% (1)                        | 21.6% (8)                      | 13.3% (2)              | 15.3% (5)         | 40.0% (4)           | .258^c |
| Journaling                             | 1.9% (3)            | 2.3% (1)            | 0                             | 2.7% (1)                       | 0                      | 0                 | 10.0% (1)           | .418^c |
| Other                                  | 16.5% (26)          | 13.6% (6)           | 20.0% (4)                     | 13.5% (5)                      | 33.3% (5)              | 6.3% (2)          | 40.0% (4)           | .069^c |

^aKruskal Wallis test  
^bChi-Square test  
^cFisher Exact Test

Discussion

To the best of our knowledge, this study is the first assessment of lifestyle behaviors among a large and diverse group of MCS. Our findings suggest a prevalence of overweight and obesity, physical inactivity, and inadequate F&V consumption among MCS.
Based on evidence and best clinical practices, the American Cancer Society convened a group of experts in nutrition, physical activity, and cancer survivorship to create nutrition and physical activity guidelines for cancer survivors. These guidelines are intended to provide health care providers with the best possible information with which to help cancer survivors make informed choices about lifestyle habits, including diet and exercise [22]. In these guidelines, MCS are referred to the section 'living with advanced cancer.' However, this section is framed for individuals struggling with weight loss, diminished appetite, and signs and symptoms of malnutrition. In the current study, only 1% of MCS were underweight, with the majority (66%) having overweight or obesity. Obesity is an established risk factor for many malignancies and is associated with worse outcomes in several cancers [23, 24]. However, BMI has also been associated with improved outcomes in some cancers [25–27], a phenomenon dubbed the "obesity paradox" [28]. Nonetheless, it is clear that current nutrition and physical activity guidelines have limited applicability for those living with metastatic cancer, highlighting the need for updated guidelines for this population.

Early evidence suggests that physical activity interventions are not only safe and low cost, but may improve physical and mental wellbeing among MCS [29–34]. Data from CanWalk, a 12-week community-based walking intervention among MCS, show that MCS who walked 30 minutes or more per day reported a higher QOL than those who walked less than 30 minutes per day [31]. Similarly, in the current study, MCS engaging in regular physical activity (≥ 150 min per week) reported experiencing significantly better physical and mental health. Given that MCS may have limited ability, activity preferences should be considered. In a survey among those with metastatic breast cancer, 53% reported a preference for a light intensity activity within their own environment, such as walking or gardening [35, 36]. Data suggest that gardening may improve vegetable consumption, physical activity, body weight status, and QOL among early stage cancer survivors [37–39]. Although findings among early stage cancer survivors cannot necessarily be extrapolated to MCS, it highlights the potential for gardening to enhance survivorship among MCS. Thirty-one percent of MCS in this study reported interest in gardening.

As with all studies, this cross-sectional mailed survey had both strengths and limitations. Strengths included a fairly large sample, representation of multiple primary cancer types, and use of the universally relevant PROMIS® Measures [14]. The primary limitation of the current study relates to potential response bias since our response rate of 51% is at the low end of the limits purported by Dillman as acceptable [11]. Because MCS in this study were all from the Deep South (Alabama, Tennessee, Mississippi, Georgia, and Florida), caution is warranted in generalizing results to those living in other areas of the U.S. Finally, results may be biased by lower survey response rates by survivors who are younger, African-American, and more sentinel to their diagnosis of metastatic disease. Future research should target this population.

**Conclusions**

As treatment options for metastatic disease continue to expand and survivorship is prolonged, it is critical to identify modifiable behaviors to further optimize survivorship among MCS. Our findings suggest that engaging in regular PA and consuming more F&V may improve physical and mental health among those living with metastatic cancer. Future research may explore approaches, such as gardening, which elicit high levels of interest, to aid MCS in improving these key health behaviors.

**Declarations**

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**Availability of Data and Material:** The data for this project are confidential, but may be obtained with a Data Use Agreement with the University of Alabama at Birmingham (UAB). Researchers interested in access to the data may contact the corresponding
author.

**Code Availability:** N/A

**Author Contributions:** Jennifer R. Bail: conceptualization, methodology, funding acquisition, project administration, investigation, data curation, writing - original draft. Sumanth Bail: data curation, visualization, writing - review and editing. Jessica Cagle: data curation, visualization, writing - review and editing. Koriann Tiesi: data curation, visualization, writing - review and editing. Jayla Caffey: data curation, visualization, writing - review and editing. Marie Bakitas: methodology, funding acquisition, writing - review and editing. Wendy Demark-Wahnefried: methodology, funding acquisition, writing - review and editing.

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**Consent to Participate:** An IRB approved study information sheet was mailed along with the study survey (UAB IRB-300002317). Participant consent was implied through voluntary completion of the study survey.

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