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Adherence to Medical Appointments Among Patients Undergoing Bariatric Surgery: Do Health Literacy, Health Numeracy, and Cognitive Functioning Play a Role?

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Methods

Patients and Procedure

All patients included in this study ($N=210$) underwent a laparoscopic Roux-en-Y gastric bypass or sleeve gastrectomy from 2016 to 2018 and completed a pre-surgical psychosocial evaluation. As part of this retrospective chart review study, demographic information, health literacy (ability to use health information for decision-making), health numeracy (ability to use health-related numerical information), cognitive functioning, and adherence to medical appointments were extracted from patients' electronic medical records. Health literacy was measured using the Rapid Estimate of Adult Literacy in Medicine and Rapid Estimate of Adult Literacy in Medicine-Short Form, with a reading level below 9th grade indicative of limited health literacy [1]. The Brief Medical Numbers Test was used as a measure of health

numeracy, using a cutoff of $<4/4$ items correct to indicate limited health numeracy [2]. Lastly, the Montreal Cognitive Assessment was used to assess cognitive functioning, with a cutoff score <26 to denote lower levels of cognitive functioning [3]. All health care appointments in the 2 years prior to a patient's bariatric surgery were tallied, including the number of canceled, "no-showed," and missed appointments (i.e., a sum of no-showed and canceled appointments). Post-surgery, the number of canceled, no-showed, and missed bariatric-only health care appointments were tallied within 1 year of patients' surgery date. Percentages were calculated for the total number of missed and completed appointments both pre- and post-surgery. Approval was obtained by the institutional review board, and informed consent was waived because the study is retrospective.

Analyses

Descriptive analyses were conducted on the demographic data. Independent samples t -tests were conducted to examine whether age was associated with health literacy, health numeracy, and cognitive functioning. Independent samples t -tests were then conducted to examine associations between health literacy and cognitive functioning with appointment adherence, and an ANCOVA was used to examine association between health numeracy and appointment adherence, controlling for age. One-tailed tests were considered significant at $p < 0.05$, given a priori hypotheses that appointment non-adherence would be higher among those with lower levels of health literacy, health numeracy, and cognitive functioning. This study is an extension of previous research on adherence to medical appointments using same sample by examining factors which may explain poorer adherence [4].

Key Points

- Pre-surgical appointment attendance is linked with cognitive level and health numeracy
- Missing post-surgery bariatric appointments is related to health literacy
- Total appointment attendance is associated with cognitive level and health numeracy

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Results

The majority of patients were female (84.8%) and underwent sleeve gastrectomy (74.6%). Patients primarily identified as either White (49%) or Black (42.4%). Additional demographics are reported in Table 1 of the previous publication on which this study is based [4]. Approximately 13.3% ($n = 28$), 21.4% ($n = 45$), and 37.6% ($n = 79$) of the sample had limited health literacy, limited health numeracy, and lower cognitive functioning, respectively. Age was significantly related to health numeracy, such that those with inadequate health numeracy were older ($M = 48.8, SD = 10.1$ vs. $M = 45.3, SD = 10.1$), $t(208) = 2.1, p = 0.02$, and thus, age was controlled for in subsequent analyses. Age was not significantly related to health literacy or cognitive functioning ($p > 0.05$).

In the 2-year pre-surgery, those with lower cognitive functioning and limited health numeracy had a higher percentage of no-show appointments than those with adequate functioning in these domains (see Table 1). Additionally, those with lower cognitive functioning had a higher percentage of missed medical appointments. In the year following surgery, those with limited health literacy had a higher percentage of missed bariatric appointments compared to those with adequate health literacy. The percentage of total no-show appointments was higher among those with limited health numeracy and lower cognitive functioning; those with lower cognitive functioning also had a higher percentage of total missed appointments.

Conclusion

Adherence to health care treatment, including attending health care appointments, is an important factor associated with health outcomes [5]. Previous research showed that lower levels of adherence to medical appointments were associated with poorer weight loss [4]. Findings from the present study suggest that, prior to bariatric surgery, lower cognitive functioning is linked with not attending (“no-showing” or missing) scheduled health care appointments, while health numeracy is linked with no-showing only. After bariatric surgery, health literacy was the only variable related to missed bariatric appointments. When examined across the total number of pre- and post-surgery appointments, similar findings were observed as pre-surgery, with cognitive functioning and health numeracy being associated with appointment attendance.

The findings regarding cognitive functioning and appointment attendance may be explained by obesity-linked deficits in memory and executive functioning [6];

Table 1 Adherence to medical appointments by cognitive functioning, health literacy, and health numeracy levels

	Adequate cognitive functioning <i>M% (SD%)</i>	Lower cognitive functioning <i>M% (SD%)</i>	<i>t</i>	<i>p</i>	Adequate health literacy <i>M% (SD%)</i>	Limited health literacy <i>M% (SD%)</i>	<i>t</i>	<i>p</i>	Adequate health numeracy <i>M% (SD%)</i>	Limited health numeracy <i>M% (SD%)</i>	<i>F*</i>	<i>df</i>	<i>p</i>
Percentage pre-surgical no show appointments	4.5% (7.0%)	6.4% (8.3%)	1.7	.04	5.1% (7.5%)	5.4% (8.0%)	.18	.43	4.7% (7.3%)	6.9% (8.3%)	4.84	1,207	.03
Percentage pre-surgical missed appointments	20.1% (15.1%)	24.6% (15.0%)	1.8	.04	22.2% (15.0%)	22.4% (15.2%)	.05	.48	21.5% (14.9%)	25.1% (15.5%)	2.31	1,207	.13
Percentage no show post-surgical appointments	5.3% (12.4%)	8.1% (17.0%)	1.2	.11	6.1% (14.1%)	7.8% (15.7%)	.56	.29	5.6% (12.7%)	9.2% (18.9%)	3.48	1,202	.06
Percentage missed post-surgical appointments	23.6% (24.0%)	24.3% (24.7%)	.18	.43	22.8% (24.1%)	31.0% (23.1%)	.75	.05	23.9% (23.9%)	23.8% (24.8%)	.15	1,202	.70
Percentage total no show appointments	4.8% (6.8%)	6.8% (8.5%)	1.8	.04	5.5% (7.4%)	5.6% (8.2%)	.28	.48	5.0% (7.1%)	7.1% (8.7%)	5.83	1,206	.02
Percentage total missed appointments	22.1% (14.0%)	26.3% (13.2%)	2.1	.02	23.6% (13.8%)	24.0% (14.2%)	.93	.48	23.0% (13.6%)	26.0% (14.7%)	2.59	1,202	.11

* ANCOVA controlling for age; bolded text denotes significance at $p < .05$

such deficits have the potential to impair the planning and logistics (i.e., scheduling and transportation) necessary to attend appointments. Although cognitive deficits may help explain lower attendance rates, other research has shown poorer weight loss outcomes among individuals with lower health literacy who undergo bariatric surgery [7, 8]; therefore, it is also possible that those with literacy or cognitive deficits may avoid attending follow-up appointments because of their weight loss outcomes [9]. Future research would benefit from examining whether interventions targeted at those with lower cognitive abilities are associated with commensurate improvements in appointment adherence, weight loss, and health outcomes.

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. For this type of study, formal consent is not required.

Conflict of Interest The authors declare no competing interests.

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