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Health Change Awareness and Its Association With Weight Loss Following Bariatric Surgery

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Objective: Patients' ability to judge health change over time has important clinical implications for treatment, but is understudied in longitudinal contexts with meaningful health change. We assess patients' awareness of health change for 5 years following bariatric surgery, and its association with weight loss. ***Method:*** Participants were part of the Longitudinal Assessment of Bariatric Surgery ($N = 2{,}027$). Perceived health change for each year was assessed by comparing it to self-reports of health on the SF-36 health survey. Participants were categorized as concordant when perceived and actual self-reported health change corresponded, and as discordant when they did not correspond. ***Results:*** Year-to-year concordance between perceived and actual self-reported health change occurred less than 50% of the time. Discordance between perceived and actual health was associated with weight loss following surgery. Discordant-positive participants who perceived their health change as more positive than was warranted lost more weight post-surgery and thus had lower body mass index scores than concordant participants. Conversely, discordant-negative participants who perceived their health as worse than what was warranted lost less weight post-surgery and thus had higher body mass index scores. ***Conclusions:*** These results suggest that recollection of past health is generally poor and can be biased by salient factors during recall. Clinicians are advised to use caution when retrospective judgments of health are utilized.

Keywords: recall bias, response shift, metacognition, bariatric surgery, health change

Supplemental materials: https://doi.org/10.1037/hea0001279.supp

Patient perceptions of changes to their own health are an important aspect of overall health understanding. Attitudes and beliefs about disease and health trajectories are associated with health outcomes and behaviors (Levy & Myers, 2004; Petrie & Weinman, 2012; Sargent-Cox et al., 2012). Research also indicates that subjective patient perceptions of their health relate to objective medical outcomes (Diener et al., 2017; Khan & Butler, 2022). Questions that require patients to recall the progression of a disease, or to perceive changes in health over time, are common in physical examinations and in documenting health histories (Mansen & Gabiola, 2015; Tierney & Henderson, 2005). The pervasiveness of these types of questions suggests that many health practitioners and researchers view people as capable of accurately reporting these changes. Yet in order to accurately assess health change over time, patients must first accurately recollect their health status from a specified previous point in time, then compare it to their present state.

In the current research, we assess patients' awareness of health change by determining the concordance between their perceptions of change over time, and self-reports of health over multiple time periods. We also examine the relationship between this concordance measure and amount of weight loss following bariatric surgery, which is the primary health outcome following this surgery. The accuracy of health change perceptions could influence important clinical decisions. For example, if a patient erroneously believes their health has improved following a medical or behavioral health

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The LABS-2 study (NCT00465829) is registered at https://www.clinicaltrials.gov/. Access to the data is available by request from the National Institute of Diabetes and Digestive and Kidney Diseases Central Data Repository (https://repository.niddk.nih.gov/studies/labs/). LABS-2 funding from NIDDK grant U01 DK066557 (Data Coordinating Center) and U01-DK66555 to OHSU. Financial support to James Mitchell: NIDDK grants U01 DK 072493, R01 DK 80020, and R01 DK 112585. The authors claim no conflicts of interest. This project can be accessed at: https://osf.io/87eq9/. The authors thank Aaron Yarlas and Brian Lakey for helpful comments.

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treatment, they may be more likely to persist with an ineffective treatment. Conversely, if a patient incorrectly assumes their health has deteriorated, they may withdraw from a potentially effective course of treatment. In both cases, health practitioners could also be misled about the effectiveness of medical or behavioral treatments if patients are not able to accurately report changes from before the beginning of the treatment.

In addition to standard medical exams, some common health assessment instruments require patients to recall the onset, frequency, and duration of symptoms associated with a number of conditions. Two of these assessments are the world mental health composite international diagnostic interview (WMH-CIDI; Robins et al., 1981) and the national survey on drug use and health (NSDUH; Substance Abuse and Mental Health Services Administration, 2018). Despite the use of health change assessments in medical contexts, their accuracy remains unclear and can be questioned by research in other domains. Studies examining recall of beliefs (Wolfe & Williams, 2018), attitudes and behaviors (Ross, 1989), emotions (Levine et al., 2009), and happiness (Prati & Senik, 2022) all indicate that people's recall of previous states can be poor, and is likely biased by one's current state. In health contexts, some studies demonstrate recall error at an individual level with multiple measurements (Safer & Keuler, 2002; Visser et al., 2013). Population-based studies (Coughlin, 1990), or studies in which initial patient knowledge is unclear (Piontek et al., 2020), can also provide valuable demonstrations of recall error. Researchers from the field of epidemiological psychiatry have quantified recall error by comparing statistical models that estimate prevalence rates from recall items versus measures that are independent of memory. Using the recall questions on the WMH-CIDI (Kruijshaar et al., 2005) and NSDUH (Tam et al., 2020) showed that memory-based estimates of the prevalence of major depressive disorder were much lower than known prevalence rates. Thus, recall error may pose a serious problem in estimating prevalence rates of a variety of physical and mental health conditions (e.g., Takayanagi et al., 2014). To date, few studies have adequately documented recall accuracy as it relates to health change, and even fewer have done so over multiple time points following profound health change.

Health Change Awareness Among Bariatric Surgery Patients

Research on health change assessment is limited because in most contexts, people do not experience significant health changes over the course of a year (Choi, 2003). However, the Longitudinal Assessment of Bariatric Surgery (LABS-2; Belle et al., 2013; Courcoulas et al., 2018) assessed health at multiple time points among patients who experienced dramatic health changes. Using data from LABS-2, we address the following questions:

1. How accurate is memory for health change? To address this question, two measures from LABS-2 are combined into a single measure we refer to as *concordance*. First, patient perceptions of their current health compared to health 1 year previous require patients to utilize memory of past health. Second, yearly ratings of current health provide a measure of actual self-reported health change for each year. Both measures are subjective ratings of health, which are important as outcome measures in themselves (Khan & Butler, 2022), and extensively validated in terms of correspondence with objective measures (Maruish, 2011). Perceived and actual self-reported change can only be in concordance with each other when patients can recall past health states with reasonable accuracy. The LABS-2 data set is ideally suited to address this question because bariatric surgery patients experience health changes following surgery. LABS-2 participants lost 34% of body weight within the first year following Roux-en-Y gastric bypass, and 14% following laparoscopic adjustable gastric banding (Courcoulas et al., 2018). Participants also experienced significant decreases in rates of diabetes and hypertension (Courcoulas et al., 2018).
2. Is concordance between perceived and self-reported health change stable among individuals? In other words, is concordance the product of fairly stable individual differences or influenced by the situational context in which the judgment is made?
3. Is *awareness* of health change related to health outcomes? Current health assessments relate to health outcomes (Khan & Butler, 2022), and perceived health changes relate to reported health behaviors (Levy & Myers, 2004). But to understand the clinical usefulness of perceived health change measures, it is important to assess the relationship between the accuracy of change perceptions and objective health outcomes. We know of no research that addresses this question in a health context. We address this question by examining the relationship between concordance status and weight loss as reflected in change in body mass index following bariatric surgery in LABS-2.

Method

The study and analysis plan were not preregistered. The LABS-2 study (NCT00465829) is registered at https://www.clinicaltrials.gov/. Access to the data is available by request through the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) Central Data Repository (https://repository.niddk.nih.gov/studies/labs/). Significance was assessed at $p < .05$. Data analysis was conducted in JMP 15.1 and SAS 9.4. This project can be accessed at: https://osf.io/87eq9/.

LABS-2 is a longitudinal assessment of bariatric surgical outcomes collected from 10 hospitals at six clinical surgical centers. Participants ($N = 2,467$) were recruited from 2006 through 2009. Data were collected at baseline and annually through year 8, though participation dropped off after year 5. All participants completed written informed consent and Institutional Review Board approval was obtained at each center. Participants who filled out an SF-36 survey at baseline and at least two consecutive years during the first 5 years of follow-up were included ($N = 2,027$). There were 1,283 participants with complete data across the 5 years of follow-up who were included in the final model about BMI. A sensitivity analysis was conducted on participants who were included/excluded from the BMI model based on missing data, and differences were minimal enough to assume representativeness.

Measures

Body Mass Index

Patient weight was obtained within 30 days pre-surgery, and at annual follow-up visits. BMI is calculated as weight (in kilograms) divided by height (in meters squared).

The Short-Form Health Survey (SF-36) and Concordance

The 36-item Short-Form Health Survey (SF-36; Maruish, 2011) is a widely used self-report measure of overall patient health and well-being. Perceived health change is assessed with the health transition item "Compared to 1 year ago, how would you rate your health in general now?" This question has five ordinal response options: (a) Much better now than 1 year ago, (b) Somewhat better now than 1 year ago, (c) About the same as 1 year ago, (d) Somewhat worse now than 1 year ago, and (e) Much worse now than 1 year ago. The health transition item is the only item that does not contribute to a composite score. Responses to the other items on the SF-36 are combined to provide composite scores which reflect self-reported current health status. The Physical Composite Score (PCS) is normed for the general US population to have a mean of 50 and a standard deviation of 10, with higher scores indicating better physical health status. Reliability and criterion validity for the SF-36 are reported in a number of publications, including among populations with severe obesity (e.g., Karlsen et al., 2011; Maruish, 2011; Ware et al., 1994). Estimates across studies demonstrate strong internal consistency ($\alpha > .80$) and 3-month test–retest reliability ($\alpha > .88$, Maruish, 2011). Criterion validity of the PCS is illustrated by strong correlations ($r > .60$) with physical functioning, pain (negative), and patients' perception of their current health (Ware et al., 1994). It is also negatively correlated with health measures over a 4-month period, including BMI ($r = -.25$), frequency of chronic medical conditions ($r = -.55$), and outpatient visits ($r = -.39$; Maruish, 2011).

Our measure of participants' recollection accuracy of their past health is the concordance for each year between the SF-36 health transition item (perceived change), and the difference between the current and previous year's PCS (actual self-reported health change). Year-over-year PCS differences are interpreted using the concept of clinically meaningful change, which includes the criteria that a change is consciously detectable by the patient. In a review of 33 studies investigating various measures of self-reported quality of life, including the SF-36, Norman et al. (2003, 2004) found that 0.5 standard deviations (a moderate effect size, as interpreted by Cohen, 1988) represent "a threshold of important change." This threshold showed strong correspondence with measures indicating meaningful health change estimated with a variety of objective measures. To determine the threshold for clinically meaningful change in PCS scores from 1 year to the next, we calculated the weighted half standard deviation of all visits (Weighted half $SD = 5.36$). For each response to the health transition item on the SF-36, we calculated the PCS change score range that would be concordant based on the one-half SD threshold. Table 1 shows the SF-36 score ranges that delineate between concordance and discordance. To illustrate this contrast, consider two participants: The first participant had a PCS of 38.5 pre-surgery and 50.5 at year 1 (change score difference = +12.00) and chose "much better" on the health transition item. Since this PCS difference exceeds the threshold of important change (>10.72) they are concordant. The second patient had a PCS of 47.5 at year 2 and 46 at year 3 (change score difference = −1.5) but perceived their health as "somewhat worse." The PCS change of −1.5 is below the threshold of meaningful change and therefore should be undetectable to the patient, making the perceived change discordant.

Table 1
Concordance Criteria for Perceived Health Change Versus SF-36 Physical Composite Score Change

Perceived health change (SF-36)	Criteria for concordance	Range in SF-36 PCS difference
Much better	≥+1 *SD*	≥10.72
Somewhat better	+1 to +0.5 *SD*	10.71 to 5.37
About the same	±0.5 *SD*	5.36 to −5.36
Somewhat worse	−0.5 to −1 *SD*	−5.37 to −10.71
Much worse	≤−1 *SD*	≤−10.72

Note. SF-36 = 36-item Short-Form Health Survey; PCS = Physical Composite Score.

Three potential categories of concordance were calculated in each year 1 through 5:

Concordant: The participant has a perceived change that is within the specified range of their actual self-reported change.

Discordant-positive: The participant perceives themself to have a *positive* health change to a greater extent than is warranted based on their actual self-reported health change.

Discordant-negative: The participant perceives themself to have a *negative* health change to a greater extent than is warranted based on their actual self-reported health change.

Comorbidity and Other Measures

Patient status was determined at each visit for the presence or absence of diabetes, hyperlipidemia, hypertension, and dyslipidemia according to the protocol described in Belle et al. (2013). The Beck Depression Inventory-1 is a standardized assessment of depressive symptoms over the past week (Beck et al., 1988), and was administered at each visit. Due to the nature of the study, the weight loss BDI-1 item was not scored. In standard scoring for the BDI-1, raw scores are translated into categories none, mild, moderate, and severe. For cancer diagnosis, participants responded to the question "Since bariatric surgery, have you been told by a medical professional that you have cancer?" Changes in memory were self-reported with the question "In the last 12 months, have you noticed a definite change in your memory?" Surgical revisions or reversals were coded as re-operation. 400-m walk time was assessed with a corridor walk.

Results

Baseline demographic and clinical characteristics for all LABS-2 participants are reported in Table 2. The results address three primary questions: (a) What is the concordance between perceived and actual self-reported health change? (b) Is concordance stable among participants across the 5 years of the study? (c) To what extent is concordance or discordance associated with body mass index as a proxy for weight loss since surgery, and physical health outcomes? Since the primary measure of interest in the LABS-2 study was BMI, concordance status was used to predict this outcome while controlling for other important LABS-2 outcomes.

Table 2
Patient Demographic and Clinical Characteristics Prior to Bariatric Surgery

Study characteristic	*N* or median/ mean	% or IQR/95% CI
Participants at each visit		
Year 1	1,732	85%
Year 2	1,434	70%
Year 3	1,316	65%
Year 4	1,286	63%
Year 5	1,318	65%
Mean age at surgery (years)	2,027	46 [46, 47]
Gender (female)	1,540	79%
Race		
White	1,759	88%
Black	192	10%
Other	55	3%
Median weight (kg)	2,027	128 [115, 147]
Median BMI	2,027	46 [42, 51]
Surgical procedure		
Roux-en-Y bypass	1,417	70%
Laparoscopic adjustable band	509	25%
Mean SF-36 Physical Composite		
Score	1,911	39 [38, 39]
Diabetes	993	49%
Hypertension	1,341	68%
Dyslipidemia	1,288	68%
Hyperlipidemia	636	39%
Median 400-m walking time (min)	1,406	6 [6, 7]
Median Beck Depression Inventory		
Score	1,975	8 [4, 13]
Cancer diagnosis	115	6%
Reported memory issues	235	21%

Note. Medians reported with IQR, means reported with 95% confidence intervals, and counts reported with percent. BMI = body mass index; SF-36 = 36-item Short-Form Health Survey; IQR = interquartile range; CI = confidence interval.

Concordance and Discordance

Figure 1 shows responses to the SF-36 health transition item. Concordance by perceived health change is shown in Figure 2. Table S1 in the online supplemental materials shows full descriptive data for concordance by perceived change in overall health for each of the 5 years of follow-up included in this study, along with the actual change in SF-36 PCS. Several data points and trends are noteworthy. First, participants perceive large positive health changes in the first year after surgery. By year 3, perceptions of health change stabilize such that approximately 50% of participants perceive their health as "about the same" as 1 year ago. The others perceive a mix of improved and worsening health. Second, the overall concordance rate in year 0 to year 1 is 50%. In all other years, less than 50% of participants have a perceived health change that is concordant with their actual self-reported health change. Third, for those who are not in concordance, between 32% and 62% are discordant-positive in any given year. But 10%–22% are discordant-negative, suggesting a large degree of variability in concordance status.

Figure 1
Percent of Participants Reporting Each Level of Perceived Health Change From Year to Year

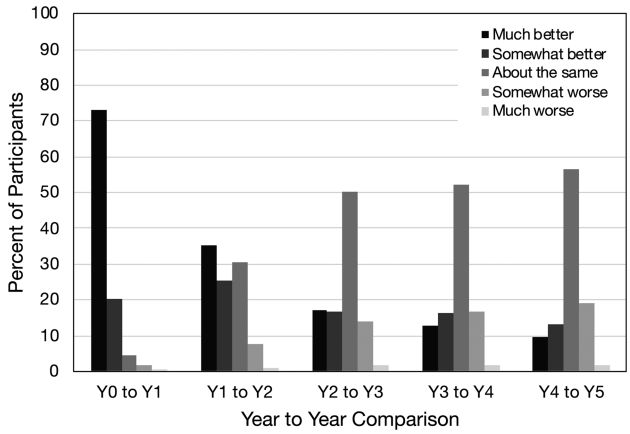
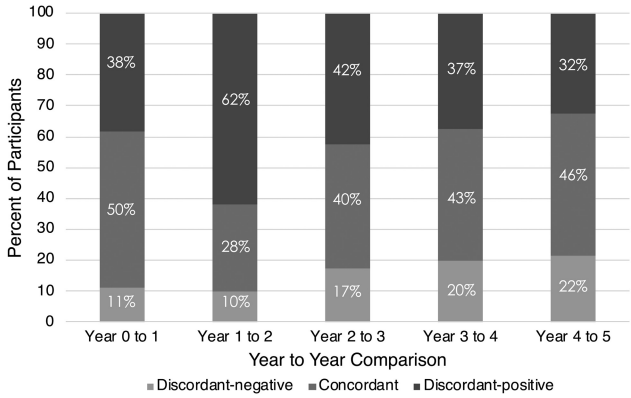


Figure 2
Percent of Participants in Each Concordance Category From Year to Year



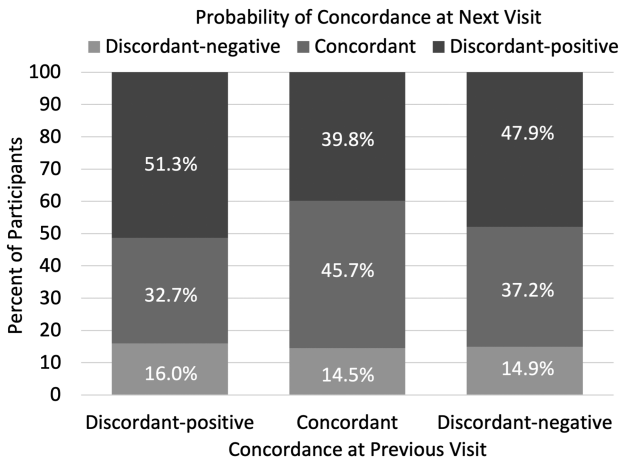
Note. Discordant-negative = perceived health change was worse than their SF-36 change score implied. Concordant = perceived health change and SF-36 change scores were aligned. Discordant-positive = perceived health change was better than their SF-36 change score implied. SF-36 = 36-item Short-Form Health Survey.

Stability of Concordance

To determine the stability of concordance status among individuals across years, concordance status from year-to-year was examined. Concordance stability was measured in multiple ways. Across 5 years, we tabulated the number of times each participant changed concordance status compared to the previous year. Each participant can change statuses between zero and five times. Out of 2,027 participants, the percent of participants experiencing each number of changes were: 0 = 14%, 1 = 26%, 2 = 24%, 3 = 20%, 4 = 12%, 5 = 4%. In evaluating the consistency of a participant's ability to assess the change in their physical health (consistently concordant or discordant), we used Fleiss' Kappa to assess consistency of concordance across years. Kappa was 0.06, 95% CI [0.04 to 0.08], which is considered poor, suggesting that participants inconsistently assessed the change in their physical health from year to year. Finally, Figure 3 shows the probability of each concordance status for the next visit given the concordance status at the previous visit. As seen, regardless of the concordance status in a given year, there is a less than 50% chance of being concordant the next year.

Figure 3

Probability of Concordance Status at Follow-Up Visit Given Concordance Status at Previous Visit



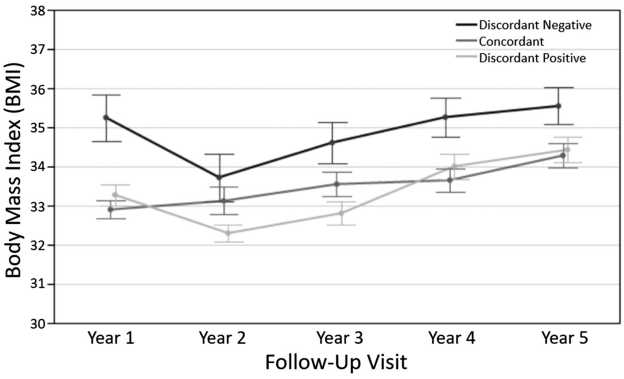
Overall, these results show little evidence of consistency among participants.

Concordance and Health Outcomes

The primary research interest in the LABS-2 study was weight loss following bariatric surgery. BMI by concordance status is reported in Figure 4 and Table S2 in the online supplemental materials. Table S2 in the online supplemental materials also shows the association between concordance status and other patient demographic and clinical variables of interest. As seen in Table S2 in the online supplemental materials, BMI and weight are related to concordance status for all years (p-values $< .05$). Concordance status was not consistently associated with 400 m walk time, age at surgery, sex, diabetes, hyperlipidemia, hypertension, or dyslipidemia.

Figure 4

Mean Body Mass Index and Concordance From Year to Year



Note. Error bars are 95% confidence intervals. Discordant negative = perceived health change was worse than their SF-36 score implied. Concordant = perceived health change and SF-36 scores were aligned. Discordant positive = perceived health change was better than their SF-36 score implied. Median BMI at baseline was 46. SF-36 = 36-item Short-Form Health Survey.

To examine the association between concordance and BMI after controlling for critical health outcomes, mixed-effects linear regression with robust standard errors clustered on participants within visits was used. Results are shown in Table 3. In this model, discordant-positive participants had lower BMI than concordant participants ($p = .004$), while discordant-negative participants had higher BMI than concordant participants ($p = .047$). Furthermore, these results show a greater difference between discordant-positive and concordant participants than for discordant-negative and concordant participants. Surgery type was the largest predictor of BMI ($p < .001$), as previously reported (Courcoulas et al., 2018).

Discussion

Following bariatric surgery, participants displayed low concordance between perceived changes in their health and actual changes in self-reported health. This poor concordance indicates that people often do not have an accurate memory of their previous health. Discordance occurred in both positive and negative directions; sometimes participants perceived change as being more positive than was warranted, while other times, the change was more negative than was warranted. Moreover, concordance status from 1 year to the next was highly variable within participants. The variability in concordance suggests that judgments of past health are influenced by situational factors rather than stable biases. The most notable and important result was that both BMI and weight change following bariatric surgery were associated with concordance status. Specifically, overly positive or negative perceptions of health change showed significantly different BMI scores relative to concordant participants.

A few trends are noteworthy over the 5 years of the study period. The first year following surgery revealed dramatic perceptions of improved health, in alignment with the substantial weight loss at that point (Courcoulas et al., 2018). The relatively high incidence of concordance may be due to the distinctiveness of the perceived health change judgment, given that 1 year earlier was pre-surgery. Year 2 shows the highest incidence of discordant-positive responses and the lowest incidence of concordance. Data in Table S1 in the online supplemental materials suggest that this pattern is due to a larger than warranted number of positive perceptions of health change at year 2, but little change in PCS. One possible explanation is that at year 2, patients' pre-surgery health was still salient and swayed their perception of health change. For years three through five, perceived health change was "about the same" for roughly half the patients, yet concordance still remained below 50%. This lack of within-person stability in concordance indicates that even as patients' weight stabilizes, their perception of change still fails to match their actual self-reports of health over time.

The current work builds on previous research in a few ways. The results are based on a large longitudinal sample with a population who experience health changes that are far greater than a typical sample. Existing research on awareness of change typically utilizes two measures over a time span of weeks to a few months. Population-based studies, such as those on major depressive disorder (Kruijshaar et al., 2005; Tam et al, 2020), address memory for past health over long time spans. But they do not afford examination of individual variation across time or association with other health outcomes. Studies that examine awareness of health change at an individual level (Safer & Keuler, 2002; Visser et al., 2013) are valuable.

Table 3
Multivariable Regression Estimating BMI Based on Select Participant Characteristics

Covariate	Association with BMI	Estimated change in BMI	*p*
Age at surgery (per +1 year)	−	−0.03	.11
Sex (female)	−	−1.91	.007
400 m walking time (per +1 min)	+	+0.60	.004
Diabetes (yes vs. no)	+	+1.31	.02
Hyperlipidemia (yes vs. no)	−	−1.06	.045
Hypertension (yes vs. no)	+	+1.46	.01
Concordance (dis-neg vs. con)	+	+0.30	.047
Concordance (dis-pos vs. con)	−	−0.42	.004
Surgery (LAGB vs. RYGB)	+	+5.83	<.001
Surgery (other vs. RYGB)	+	+4.04	.01
Dyslipidemia (yes vs. no)	+	+0.35	.36
BDI (mild vs. none)	+	+0.34	.26
BDI (moderate vs. none)	+	+0.39	.30
BDI (severe vs. none)	−	−0.20	.70
Cancer diagnosis (yes vs. no)	+	+0.37	.64
Reported memory issues (yes vs. no)	+	+0.13	.37
Re-operation (yes vs. no)	+	+0.82	.33

Note. Full model $N = 1{,}283$. "+" indicates that the covariate was associated with increases in BMI; "−" indicates that the covariate was associated with decreases in BMI. BDI = Beck Depression Inventory. Surgery (Other) includes banded gastric bypass, biliopancreatic diversion with switch, and sleeve gastrectomy. LAGB = laparoscopic adjusted gastric band; RYGB = Roux-en-Y gastric bypass; con = concordant; dis-neg = discordant-negative; dis-pos = discordant-positive. BMI = body mass index.

However, the current combination of large initial health change followed by stabilization across years is unique among studies of awareness of change. Changing health during the study period is essential in order to establish that memory for past health cannot be merely guessed based on an assumption of no change (Ross, 1989). Finally, the SF-36 is a well-studied and highly used self-report measure, which lends validity to both measures of perceived change and actual change in self-reported health.

The current work also represents the first evidence (to our knowledge) of an association between memory bias and health outcomes. It is established that self-reports of health relate to health outcomes. In fact, use of the SF-36 in the current research relies on this association. Evidence also suggests that patients' perceptions of health change are associated with and can potentially determine health outcomes (Levy & Myers, 2004; Petrie & Weinman, 2012; Sargent-Cox et al., 2012). The current research provides further evidence that patient perceptions of health change can be related to health outcomes. Moreover, this work is the first to demonstrate the divergent influence of positive and negative discordance in health change biases on the important health outcome of weight.

Clinical Implications

Questions about a patient's health history, or change over time, are common in documenting patient history (Mansen & Gabiola, 2015; Tierney & Henderson, 2005), and are frequently included in health assessment questionnaires used in both clinical and research applications. The current results suggest that health practitioners should attempt to rely less on retrospective judgments of health, given that they may be biased. Treatment decisions could be based on unintentionally inaccurate judgments if they rely on questions such as "are you feeling better than the last time you were here?" or "does the medication seem to be helping?" Ideally, patient progress should be evaluated through multiple assessments of health at the moment. We recognize that self-reports of past health or disease trajectory are often unavoidable, particularly when a patient presents themself to a practitioner for the first time. One possible method for improving judgments of perceived health change is context reinstatement, which evidence suggests can improve recall accuracy in eyewitness memory tasks (Hammond et al., 2006). In context reinstatement, witnesses are instructed to mentally put themselves in the context of the crime with as much detail as possible. Once the context is mentally reinstated, then recall begins. Future research could examine whether such a procedure is helpful in a medical context.

Another important implication of this work is illustrated by the association between concordance and BMI. Across years, discordant-positive patients had lower BMI scores than concordant or discordant-negative patients. While the causality of this association is not clear, it is plausible that optimistic memory biases may serve to reinforce patients' motivation and commitment to weight loss. It is also plausible that weight loss or other salient health factors at the time of judgment may bias the recollection of past health. Future research is needed to explore the causal mechanisms behind these results.

Theoretical Interpretation: Memory Fluency and Response Shift

The fluency hypothesis in memory research (Dunlosky & Thiede, 2013; Unkelbach & Greifeneder, 2013) suggests that memories are not accessed directly, but rather reconstructed from information that is salient in the recall context. Other research in health sciences and epidemiology suggests that patient ratings of past health status can be influenced by symptomology in the recall context (Bailis et al., 2003; Choi, 2003). In the context of the LABS-2 study, fluency suggests patients will construct a memory of past health using information that is salient during annual follow-up visits as part of a

weight loss study. In this context, the patient's current weight, health, and cognitions related to their symptomology will influence recall. Fluency in recall can account for the observed inconsistency in concordance because perceptions of health change are tied to salient health-related thoughts, rather than stable characteristics related to personality. Fluency also explains the lack of relationship between concordance and the status of diabetes, hypertension, and dyslipidemia. While these medical outcomes are important, they are less salient than weight in the recall context.

Another plausible interpretation of why patients may have demonstrated poor awareness of health change is related to the phenomenon of *response shift* (Sébille et al., 2021; Visser et al., 2013). This term refers to the possibility that the dimensions on which self-reported health is assessed may change over time. In the current study, response shift could occur if self-reported health was rated according to a different baseline or set of expectations after experiencing significant weight loss. Most response shift studies, however, utilize a recollection method (the "then test") in which accurate recollection of previous health status is assumed. Fluency and response shift are not mutually exclusive accounts, and the current data do not differentiate between them.

Limitations

One limitation of the current research is that the concordance measure is a combination of perceived change and actual self-reported change. Rather than perceived change, assessing recollection of initial self-reported health would provide direct evidence of memory for previous health following health change. Second, the generalizability of the results beyond patients who undergo bariatric surgery is unclear. The weight loss experienced in the LABS-2 sample affords a strong test of our hypotheses. However, the combination of being affected with the disease of obesity and willingness to engage in surgical intervention distinguish our sample from the general population. We do not have reason to believe that memory processes are different in this population. However, it is conceivable that the same weight loss that we consider a strength in terms of health change makes the LABS-2 population unique in factors like expectancy for health change that could influence judgments. Finally, our measure of concordance is based on two subjective assessments of health. Future studies of health change awareness should measure objective change, and require patients to recollect objective health measures.

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