The General Self-Efficacy Scale in a population planned for bariatric surgery in Sweden: a psychometric evaluation study

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ABSTRACT

Objectives This study psychometrically evaluated General Self-Efficacy (GSE) Scale in patients planned for bariatric surgery in Sweden.

Design A cross-sectional psychometric study. The psychometric evaluation was guided by the COnsensus-based Standards for the selection of health status Measurement Instruments checklist for health-related reported-patient outcomes.

Setting Three bariatric centres in Sweden.

Participants Adult patients: 18 years old scheduled for primary bariatric surgery (with sleeve gastrectomy or Roux-en-Y gastric bypass).

Primary and secondary measures Psychometric properties of the GSE.

Results In total, 704 patients were included in the analysis. Mean values for GSE items were 2.9–3.4 and the mean GSE sum score was 31.4 (SD 4.7). There were no floor or ceiling effects. Cronbach’s alpha was 0.89. Men reported a higher mean GSE than did women, that is, 31.2 (SD 4.8) for women versus 32.1 (SD 4.3) for men, p=0.03. Correlation coefficients were weak or negligible: GSE and mental component summary score of 36-item Short Form Health Survey (SF-36)/RAND 36, r=0.18 (p<0.00); GSE and physical component summary score of SF-36/RAND 36, r=0.07 (p=0.138); GSE and obesity-related problem scale r=−0.15 (p=0.001) and GSE and level of education, r=0.04 (p=0.35). Confirmatory factor analysis indicated one-factor construct with a satisfactory goodness of fit, that is, Comparative Fit Index=0.927, root mean square error of approximation=0.092 and standardised root mean square residual=0.045. The factor GSE explained almost half or over half of the variance of each item (0.45–0.75, p-values<0.001).

Conclusions The GSE scale is a valid and reliable scale that can be used to assess general self-efficacy in patients undergoing bariatric surgery.

BACKGROUND

Obesity has increased in recent decades and is currently a global health issue. Obesity is associated with increased risk of comorbid diseases, such as cardiovascular diseases, diabetes and cancer and consequently also higher mortality. Bariatric surgery is the most effective treatment for obesity that has produced long-term weight loss, decreased comorbidities and decreased mortality. Due to the surgery itself and to achieve sustainable weight loss after bariatric surgery, patients must make several lifestyle changes. These include learning new eating habits, such as eating regularly, eating more vegetables, fruits and proteins, eating smaller portions, not eating quickly and not eating a high-carbohydrate diet, as it increases the risk of dumping syndrome. Changes in physical activity are also important and increased physical activity can improve outcomes after surgery.

One factor that can be important for lifestyle change is self-efficacy. Self-efficacy theory stems from social cognitive theory and concerns one’s beliefs in one’s capacity to organise and execute actions to achieve certain goals. Self-efficacy is linked to self-care, self-management and lifestyle change, factors important for the patient after bariatric surgery. Self-efficacy affects the entire process of lifestyle change, from considering adopting a new behaviour, maintaining motivation and continuing the new behaviour over time, to handling possible setbacks. Earlier studies have reported that self-efficacy is a predictor of weight loss and...
of greater weight loss in persons with obesity undergoing non-operative weight-loss interventions.\textsuperscript{12,13}

Self-efficacy is often measured in relation to specific tasks or domains, for example, eating self-efficacy\textsuperscript{14} or exercise self-efficacy.\textsuperscript{15} It can also be considered a more general construct applying to a person’s sense of competence to handle and cope more broadly, in various situations. A scale capturing such a construct is the General Self-Efficacy Scale (GSE)\textsuperscript{16} developed by Jerusalem and Schwartz in 1979. The original version of GSE was in German and comprised 20 items, which were reduced to 10 items in 1981. The items are rated on a four-point scale, that is, 1=not at all true, 2=hardly true, 3=moderately true and 4=exactly true, and possible sum scores range from 10 to 40, with lower scores indicating lower self-efficacy.\textsuperscript{17} GSE has been translated into more than 28 languages and evaluated for cross-cultural differences, validity and reliability.\textsuperscript{16,17} GSE is described as having a unidimensional structure.\textsuperscript{17,18} GSE was evaluated in a group of persons with morbid obesity and found to be valid, reliable and unidimensional.\textsuperscript{19} The Swedish version of GSE was found to be reliable in group of stroke survivors\textsuperscript{20} and valid in a general population, confirming the unidimensionality of the construct.\textsuperscript{21} Associations with GSE and several variables have been reported in previous studies. Health-Related Quality of Life (HRQoL) correlates positively with GSE in patients recovering from myocardial infarction,\textsuperscript{22} patients with chronic obstructive pulmonary disease\textsuperscript{23} and patients undergoing bariatric surgery.\textsuperscript{24} There are indications that there is an association between higher GSE and higher level of education.\textsuperscript{25,26} This is supported by the theory that persons with higher self-efficacy beliefs consider more options in education and career.\textsuperscript{10} Men seem to report higher GSE compared with women,\textsuperscript{21,22,25} although some studies have not found any difference between men and women.\textsuperscript{17} Gender differences can be related stereotype gender expectations.\textsuperscript{10,10}

The psychometric evaluation of instruments used in clinical trials is crucial because outcomes guide decisions and treatments.\textsuperscript{27} It has been suggested that using non-validated instruments in trials may bias results.\textsuperscript{28} Lifestyle changes are central after undergoing bariatric surgery, and self-efficacy is one factor that can influence lifestyle changes. To the best of our knowledge, GSE has not been psychometrically evaluated in a group of patients undergoing bariatric surgery. The aim of this study was therefore to psychometrically evaluate the GSE Scale in patients planned for bariatric surgery in Sweden.

METHODS

This psychometric study was conducted as part of a multicentre prospective, longitudinal, mixed-methods study. The overall aim of the main trial was to evaluate self-efficacy and health literacy in a population undergoing bariatric surgery and their impact on postoperative outcomes and complications.\textsuperscript{29}

Participants and procedure

The study followed the ethical principles described in the WMA Declaration of Helsinki and was approved by the Regional Ethical Review Board in Uppsala, Sweden (no. 2018/256). Data were collected at three bariatric centres in Sweden between October 2018 and November 2020. The three centres were a university hospital clinic, a non-profit private hospital clinic and a district hospital clinic. All centres are considered to be mid-volume to high-volume centres and are located in different parts of Sweden. Inclusion criteria were adult patients ≥18 years, being scheduled for primary bariatric surgery (Roux-en-Y gastric bypass or sleeve gastrectomy) and ability to understand spoken and written Swedish.\textsuperscript{29}

Participants were informed of the study by a research nurse or surgeon during a preoperative visit. All were informed that it was voluntary to participate in the study. The preoperative visit was separate from the scheduled surgery and gave patients time to reflect over the study and if they wanted to participate. Written information was provided together with the appointment for the surgery and again at arrival at the bariatric centre if the patient had lost or for some reason did not receive the information. Written informed consent was obtained before surgery, and participants completed the GSE questionnaire and study-specific questions concerning level of education. Preoperatively, participants also completed two health literacy questionnaires (10 items in total, results reported elsewhere\textsuperscript{26}) and provided data for the Scandinavian Obesity Surgery Registry (SORReg). The SORReg is a national quality and research registry including virtually all patients receiving bariatric surgery in Sweden. The data in SORReg are continuously validated, revealing high data validity.\textsuperscript{21} Data generated from the SORReg registry for this psychometric study were weight, Body Mass Index (BMI), age, sex, the HRQoL 36-Item Short Form Health Survey (SF-36)/RAND36 and the obesity-related problem (OP) scale.

SF-36/RAND36 consists of 36 items grouped into eight scales: physical functioning (PF), role-physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role-emotional (RE) and mental health (MH). The eight scales are also summarised into two summary scores: PF, RP, BP and GH constitute the physical component summary score (PCS) and MH, RE, SF and VT the mental component summary score (MCS). The scales and summary scores produce scores of 0–100, with higher scores indicating higher HRQoL.\textsuperscript{32–34} The OP scale is a HRQoL instrument measuring psychosocial functioning, developed for patients with obesity. Scores are summarised into a total score between 0 and 100, where a lower score indicates a better psychosocial functioning.\textsuperscript{35}

Psychometric evaluation and statistical analysis

The psychometric evaluation was guided by the COnsensus-based Standards for the selection of health status Measurement Instruments (COSMIN) checklist for
health-related patient reported outcomes. The sample size of 700 participants was estimated for the main trial (described in detail in the published protocol), and not for the psychometric evaluation. For psychometric evaluations of instruments comprising 10 items, such as GSE, a sample size of 700 participants is considered very good.

Floor and ceiling effects
Floor and ceiling effects are present if >15% of the participants report the lowest or highest score on the scale.

Internal consistency
Internal consistency was calculated using Cronbach’s alpha and inter-item and item–total correlations. For Cronbach’s alpha, a value of 0.70–0.90 was considered good internal consistency. Inter-item correlations of 0.2–0.5 were considered weak. Inter-item correlations >0.7 indicate that deleting one item should be considered, since higher values imply that multiple items measure the same thing. Furthermore, item–total correlations below 0.3 also indicate that item deletion may be warranted.

Construct validity
Construct validity includes both hypothesis testing and structural validity.

Hypothesis testing
Hypothesis testing was guided by earlier studies by Brink et al., Bonsaksen et al., Löve et al., and Nickel et al. Our a priori hypotheses were that there would be: (a) significant GSE differences between the sexes, with men expected to have higher GSE scores than women; (b) weak to moderate positive correlations between GSE and MSC; (c) weak positive correlations between GSE and PCS; (d) negative correlations between GSE and OP scale and (e) negligible to weak positive correlations between GSE and education level. Sex differences in GSE scores were analysed using the independent t-test. Correlations were analysed using Pearson’s r for associations between GSE and MCS, PCS or OP scale. Spearman’s rho was used to analyse associations between GSE and education level. Correlations<0.10 were considered negligible, 0.10–0.39 weak, 0.40–0.69 moderate and ≥0.70 strong or very strong.

Structural validity
The structural validity of the GSE scale was confirmed using confirmatory factor analysis (CFA). We assumed a one-factor model, as observed in previous studies, for example, by Scholz et al. For CFA, the following model-fit criteria were used to evaluate the fit of the hypothetical model: Comparative Fit Index (CFI)>0.90, root mean square error of approximation (RMSEA)<0.08 and standardised root mean square residual (SRMR)<0.08. Before running the CFA, we investigated the presence of outliers, 28 of which were identified using the squared Mahalanobis distance; CFA was conducted after removing the outliers. In addition, an exploratory factor analysis (EFA) was conducted to present a scree plot and the percentage variance accounted by a one-factor model.

Descriptive data are presented as frequencies and percentages for nominal data and as means and SDs for continuous data. Guided by earlier studies, GSE was treated as a continuous variable (eg, Bonsaksen et al.). GSE sum scores were dichotomised into low GSE≤30 and high GSE>31. Education levels were sorted into four categories: elementary school, upper secondary school, other education (ie, higher vocational training) and higher education (ie, first, second, or third cycle). Missing items were deleted from the analysis. A p-value<0.05 was considered statistically significant. IBM SPSS Statistics 27 was used for all analyses except CFA and EFA. CFA and EFA were processed and analysed using the lavaan package, 0.6–3, in the R statistical programming language.

Patient and public involvement
Patients and/or the public were not involved in the design, conduct, reporting, or dissemination plans of this research.

RESULTS
In total, 704 patients were included in this psychometric evaluation. Most were female (74.4%) and most had upper secondary school as their highest education (52.6%). Characteristics of the sample are presented in table 1. Two questionnaires were unit non-responders and 21 questionnaires were missing responses for one to four items. A total of 681 participants (96.7%) completed all GSE items (table 2), and of them 487 (71.5%) completed all the items in SF-36/RAND-36 and 509 (74.7%) completed the OP scale.

The mean values for GSE items were 2.9–3.4 and the mean GSE sum score was 31.4 (SD 4.7) (table 2).
mean GSE sum score was 31.2 (SD 4.8) for female versus 32.1 (SD 4.3) for male; 39.9% (n=272/681) of participants reported low and 60.1% (n=409/681) high GSE sum scores.

Floor and ceiling effects
No one reported the lowest possible GSE sum score of 10, whereas 20 participants (2.9%) reported the highest possible GSE sum score of 40. Consequently, there were no floor or ceiling effects. The distribution of sum scores was skewed towards higher scores.

Internal consistency
Cronbach’s alpha was 0.89 and excluding any of the items did not increase Cronbach’s alpha (range 0.87–0.89 if deleting an item). Inter-item correlations were 0.27–0.60 (table 3) and item–total correlations were 0.44–0.68.

Construct validity
Hypothesis testing
Male reported a higher mean GSE sum score than did female, that is, 32.1 (SD 4.3) versus 31.2 (SD 4.8) (p=0.03). Correlation coefficients were weak or negligible: GSE and MCS r=0.18 (p<0.00), GSE and PCS r=0.07 (p=0.138), GSE and OP scale r=−0.15 (p=0.001) and GSE and education level, rho=0.04 (p=0.35).

Structural validity
Figure 1 shows the path diagram as well as the factor loadings estimated using the maximum likelihood estimation method. The global fit statistics were as follows: CFI=0.927, RMSEA=0.092 and SRMR=0.045. The model shown in figure 1 has a satisfactory goodness of fit, except that the RMSEA is slightly greater than 0.08. The factor GSE explained almost half or more than half of the

### Table 2 The General Self-Efficacy Scale, n=704

| GSE item                                                                 | Responders, N | Mean (SD) | Min–max |
|-------------------------------------------------------------------------|---------------|-----------|---------|
| 1. I can always manage to solve difficult problems if I try hard enough. | 702           | 3.4 (0.6) | 1–4     |
| 2. If someone opposes me, I can find the means and ways to get what I want. | 700           | 3.3 (0.6) | 1–4     |
| 3. It is easy for me to stick to my aims and accomplish my goals.        | 700           | 3.1 (0.7) | 1–4     |
| 4. I am confident that I could deal efficiently with unexpected events.  | 699           | 2.9 (0.7) | 1–4     |
| 5. Thanks to my resourcefulness, I know how to handle unforeseen situations. | 697           | 3.1 (0.7) | 1–4     |
| 6. I can solve most problems if I invest the necessary effort.           | 700           | 3.1 (0.8) | 1–4     |
| 7. I can remain calm when facing difficulties because I can rely on my coping abilities. | 697           | 3.3 (0.7) | 1–4     |
| 8. When I am confronted with a problem, I can usually find several solutions. | 698           | 3.2 (0.7) | 1–4     |
| 9. If I am in trouble, I can usually think of a solution.                | 700           | 3.0 (0.6) | 1–4     |
| 10. I can usually handle whatever comes my way.                         | 700           | 3.2 (0.7) | 1–4     |
| Sum score.                                                              | 681           | 31.4 (4.7) | 15–40  |

Item responses ranged between 1=not at all true and 4=exactly true. Possible sum scores were 10–40, with lower scores indicating lower general self-efficacy. GSE, General Self-Efficacy Scale.

### Table 3 Inter-item correlation matrix

|        | GSE 1 | GSE 2 | GSE 3 | GSE 4 | GSE 5 | GSE 6 | GSE 7 | GSE 8 | GSE 9 | GSE 10 |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| GSE 1  | 1.000 | 0.556 | 0.295 | 0.388 | 0.416 | 0.398 | 0.380 | 0.456 | 0.431 | 0.412  |
| GSE 2  | 0.556 | 1.000 | 0.395 | 0.405 | 0.430 | 0.416 | 0.397 | 0.489 | 0.492 | 0.487  |
| GSE 3  | 0.295 | 0.395 | 1.000 | 0.363 | 0.273 | 0.340 | 0.283 | 0.309 | 0.327 | 0.306  |
| GSE 4  | 0.388 | 0.405 | 0.363 | 1.000 | 0.600 | 0.482 | 0.337 | 0.439 | 0.515 | 0.498  |
| GSE 5  | 0.416 | 0.430 | 0.273 | 0.600 | 1.000 | 0.551 | 0.426 | 0.510 | 0.485 | 0.475  |
| GSE 6  | 0.398 | 0.416 | 0.340 | 0.482 | 0.551 | 1.000 | 0.436 | 0.480 | 0.502 | 0.518  |
| GSE 7  | 0.380 | 0.397 | 0.283 | 0.337 | 0.426 | 0.436 | 1.000 | 0.588 | 0.426 | 0.440  |
| GSE 8  | 0.456 | 0.489 | 0.309 | 0.439 | 0.510 | 0.480 | 0.588 | 1.000 | 0.535 | 0.485  |
| GSE 9  | 0.431 | 0.492 | 0.327 | 0.515 | 0.485 | 0.502 | 0.426 | 0.535 | 1.000 | 0.536  |
| GSE 10 | 0.412 | 0.487 | 0.306 | 0.498 | 0.475 | 0.518 | 0.440 | 0.485 | 0.536 | 1.000  |

GSE, General Self-Efficacy Scale.
variance in each item, that is, 0.45–0.75 (p-values<0.001). The factor loadings, which measured the correlations between specific items and the GSE factor, ranged from 0.50 to 0.74 (p-values<0.001).

The EFA revealed one factor which explains 45% of the variance. The scree plot obtained is shown in figure 2.

DISCUSSION
This psychometric evaluation showed that GSE is a reliable and valid scale to use in patients with severe obesity, planned to undergo bariatric surgery in Sweden. Taken together, the psychometric evaluation obtained results similar to those of earlier studies conducted in several countries and contexts.

The response rate was high, with 96.7% of participants completing all GSE items, so GSE can be considered a feasible scale that can be distributed in the preoperative period before bariatric surgery. Mean GSE sum score in our study was 31.4, which shows that most participants scored towards the higher values. It can be argued that patients overestimate their self-efficacy which is always a possible limitation in self-assessed instruments. On the other hand, a slight skewness towards higher scores is consistent with earlier evaluations of GSE, and a
suggested cut-off point is GSE sum score 30 that indicates that higher values are to be expected. The lack of floor or ceiling effects was similar to results for a general Norwegian population and for Swedish stroke survivors, 2.8% and 0.3%25 and 8.8% and 0% of whom reported the highest and lowest possible scores, respectively.26

Internal consistency was high, and Cronbach’s alpha was 0.89, in line with recommended values of 0.75–0.90.37 This is also in line with or slightly lower than earlier reported Cronbach’s alpha coefficients for GSE of 0.94,9, 0.93,16 0.91,21 0.9022 and 0.75–0.91 (in Scholz et al, a study of 25 countries7).

Our hypotheses were confirmed, with the exception of a negligible correlation between GSE and PCS. In our study, men reported significantly higher GSE scores than did women, as also reported by Löve et al.21 Bonsaksen et al25 and Brink et al.22 Even though differences between men and woman in our study were significant, the difference of 0.9 may not be clinically significant. Future studies need to investigate minimal important difference45 for the GSE. Earlier reported correlations between GSE, and MCS, PCS and education level were as follows: MCS and GSE, r=0.2522 and r=0.5924 versus r=0.18 in our study; GSE and PCS, r=0.1822 versus r=0.07 in our study and education level, r=0.0925 versus 0.04 in our study. Our correlations were in line with our hypotheses since we did not expect high correlations, yet were lower than those reported in earlier studies.21 22 24–26 Correlations between GSE and OP scale were weak. To the best of our knowledge, correlations between GSE and OP scales have not been described earlier, but they are in line with correlations between GSE and SF-36. This indicates that the above-mentioned variables may not be the most suitable measures of construct validity for hypothesis testing at this scale. Other variables that can be considered in future studies are for example, self-regulation or self-esteem.16

The CFA supported the one-factor solution and indicated a satisfactory goodness of fit, and the value of RMSEA (0.092) is suggestive of a marginal fit.46 And the sizes of the other indices are good as well. RMSEA values slightly higher than 0.08 were also reported in other studies for the general Norwegian population (ie, RMSEA=0.093 and 0.08918) and considered acceptable.

GSE has been psychometrically evaluated in a group of persons with severe obesity using Rasch analysis, resulting in a recommendation to reduce the number of items from 10 to 7. The three items recommended to be deleted were items 1, 2 and 3: (1) I can always manage to solve difficult problems if I try hard enough; (2) If someone opposes me, I can find the means and ways to get what I want and (3) It is easy for me to stick to my aims and accomplish my goals.19 When investigating internal consistency, we found no inter-item correlations over 0.7 and no item–total correlations <0.3 that would indicate that item deletion may be warranted. Also, deleting items did not increase Cronbach’s alpha. Findings similar to ours were described by L Öve et al when investigating GSE in the general Swedish population.21 Furthermore, 10 is a small number of items and constitutes a relatively small scale. Reducing the number of items in an existing valid and reliable scale also reduces the ability to compare GSE between populations. We therefore recommend keeping all 10 GSE items for this study population.

It can be argued that self-efficacy should be measured in relation to specific domains, as self-efficacy differs between different situations.10 In studies of weight management or bariatric surgery, domain-specific scales have been used to investigate changes in specific lifestyle aspects such as exercise (eg, Exercise Self-Efficacy Scale12 15) and eating (eg, Weight Efficacy Lifestyle Questionnaire14 16). In other studies, general self-efficacy was considered more appropriate than domain-specific self-efficacy because general self-efficacy is related to body image, 24 understanding of illness and changes in lifestyle aspects such as diet, eating behaviour19 26 and physical activity.19 26 44 Measuring self-efficacy as a general construct captures a person’s global confidence to handle various stressful situations and a person’s coping abilities, which may be more relevant to multiple lifestyle changes and to possible challenges related to bariatric surgery.

We acknowledge that this study has certain limitations. The GSE version used was in Swedish and we did not include patients who spoke other languages, so we have no knowledge of the psychometric properties for those who are not Swedish speaking. This limits the generalisability of our results. The study was not designed for test–retest analysis, so we have no knowledge of GSE consistency over time. However, results from a qualitative study indicates that self-efficacy seem to increase over time in a sample that underwent bariatric surgery.27

Although our hypotheses were confirmed, there may be other variables that are more strongly correlated with GSE than those considered here, for example, self-regulation or self-esteem.16 These variables were not studied here but could be considered in further studies.

CONCLUSION

The Swedish version of GSE is a valid and reliable scale that can be used to assess general self-efficacy in patients undergoing bariatric surgery in Sweden. Undergoing bariatric surgery involves several lifestyle changes and self-efficacy can play a part in reinforcing them. It can be of importance to assess and strengthen self-efficacy in this group of patients.

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