The Influence of Emotion and Contextual Factors on Problematic Eating Behavior in Bariatric Patients 1 to 5 Years after Surgery: an Experience Sampling Study

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Abstract

Introduction Surgery is the most effective treatment for morbid obesity, to lose weight and reduce the associated comorbidities. Despite the effectiveness of bariatric surgery, post-bariatric patients are not always able to maintain the essential behavioral change and may gain weight as a result. An important aspect in behavior change is altering problematic eating behavior. Patients may show problematic eating behaviors when they experience negative emotions, as well as when they are in a certain environment or doing certain activities.

Objective There is a widespread agreement across research that there is a relationship between emotion, environmental factors, and eating behavior in the obese population. The current study aims to learn more about this association in post-bariatric patients. Besides that, this study aims to examine multiple eating behaviors. It is crucial to understand the factors that drive poor eating behavior after bariatric surgery in order to decrease or avoid problematic eating behavior and weight regain.

Method In this Experience Sampling Study (ESM) post-bariatric patients 1 to 5 year after surgery (N = 5) recorded their emotions, environmental factors, and problematic eating behaviors at 6 stratified semirandom intervals daily for a time period of two weeks through the use of a smartphone application. At the start, the demographic data were collected once. For the analyses, a linear mixed model was used with a random intercept.

Results The results do not support the hypothesis that emotions (stress, sadness, boredom, and relaxedness) and contextual factors (being at home and watching TV) influence eating behavior (craving, binge eating, grazing and dietary relapse) in post-bariatric patients ($p > .05$). Problematic eating behavior occurred barely. Dietary relapse happened 5.20 (SD = 2.77) times, grazing happened 2.2 (SD = 2.68) times and binge eating 0.4 (SD = 0,55) times during the study period of 14 days.

Conclusion Analysis of the data showed that there was no relationship between emotions, contextual factors, and problematic eating behaviors. The participants barely showed problematic eating behavior, which might be explained by attending follow-up care. Future research should focus on higher compliance to the ESM study and a bigger study sample.

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Introduction

Obesity and Treatments

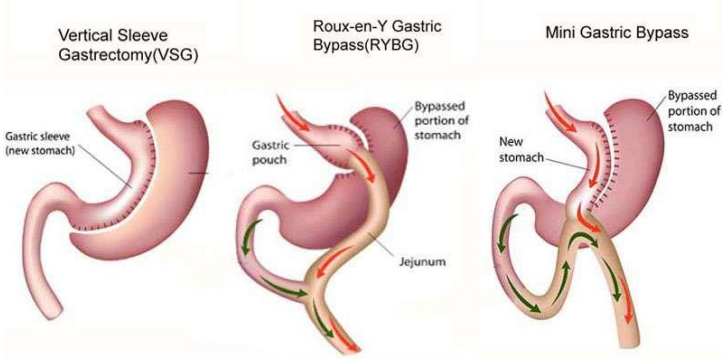
The prevalence of overweight and obesity has been dramatically increasing over the years, and obesity has become a worldwide epidemic. In 2016, more than 1.9 billion adults aged 18 years and older were overweight, and 650 million of these adults suffered from obesity (1). In the Netherlands more than 50 percent of the population has overweight or obesity (2). Obesity is a disease that involves an excessive amount of body fat, caused by gaining more energy than the body is losing via the metabolic system and physical activity (3). The Body Mass Index (BMI) is used to categorize obesity. Overweight is defined as a BMI of 25 kg/m^2 or higher, obesity as a BMI of 30 kg/m^2 or higher and severe obesity as a BMI of 40kg/m^2 or higher. Obesity is caused by multiple factors, like genetic factors, diet, metabolism, physical activity, and the influence of the social environment (4). Overweight and obesity comes with a range of serious health problems, chronic diseases, and comorbidities, like type 2 diabetes, hypertension, gastrointestinal disorders, types of cancer, dyslipidemia, sleep apnea and cardiovascular diseases (5). Obese patients have an increased risk of mortality and morbidity, compared to patients with a healthy weight (6,7). Body weight reductions of even 5 to 10% are related with a considerable reduction in chronic disease risk factors (4). Therefore, treatment of obesity is a crucial step to lose weight and reduce obesity-related comorbidities (8).

Various non-surgical treatments help with effective weight loss, but often patients regain 90 to 95% of their weight within two years after these treatments (5,9). The first-line therapy for obesity begins with dietary therapy and the restriction of calories. In addition to creating a calorie deficit, exercise plays an essential role in reducing fat storage and is a commonly used strategy to treat obese patients (6). Pharmacotherapy is suggested for patients who have medical risks or

chronic diseases because of their obesity, as well as for weight management. Surgery is indicated when the lifestyle interventions and other treatment options have not proven effective. To be eligible for surgery, patients must be classified with severe or morbid obesity (BMI>40kg/m ^{2}) or severe obesity (BMI>35kg/m ^{2}) with related comorbidities. In the Netherlands, the following surgeries are performed, namely: Roux-en-Y gastric bypass surgery, mini gastric bypass surgery and a gastric sleeve surgery (see figure 1) (10). Most patients lose about 70 to 80 percent of their overweight body weight after a bariatric bypass surgery and 60 percent of their overweight after a gastric sleeve surgery (11). Currently, bariatric surgery is the most effective method of long-term weight loss in obese patients (12). An effective bariatric surgery outcome is one that achieves a loss of 50 to 70% of excess weight or a reduction of 20 to 30% of the patient's baseline weight, or a BMI below 35 kg/m ^{2} (13,14). Surgical treatment can increase weight loss, improve the quality of the patients' life, achieve proper control or potentially remission the comorbidities related to obesity and increases life expectancy (10,15). However, not all patients experience optimal weight outcomes and the additional health benefits of bariatric surgery (16).

Figure 1

Bariatric surgeries performed in the Netherlands



Note. Chaudhary, U. *(https://medmonks.com/knowledge/types-bariatric-surgery-weight-loss-management)*

Weight Regain Post-Bariatric Surgery

Despite the success of surgery for bariatric patients, post-bariatric patients are not always able to maintain the required behavioral change and may acquire weight regain as a result. Weight regain happens in approximately 20 to 40% percent of the patients after bariatric surgery (14,17,18) . Losing weight is easy during the first couple of months or years because it is anatomically not possible to eat regular portions shortly after surgery. However, as the weight stabilizes after 12 to 24 months, patients experience more difficulties with weight maintenance because they can eat more and the risk of weight gain increases (19–21). The success of bariatric surgery and prevention of weight regain depends on the patient's commitment to certain behavioral changes. To fully benefit from the acquired surgical weight loss and prevent weight regain, patients need to learn how to deal with emotions, stressful situations, new exercise patterns, environmental control, nutritional optimization and decrease the reliance on food to cope with emotions (22). To achieve acquired surgical weight loss and maintain this after bariatric surgery patients receive help from health care professionals during their post-operative follow-up care in changing eating habits and what is needed to change them for a lasting weight regain (23). Weight regain can lead to recurrence of obesity related comorbidities and can reduce the quality of life of the patient (24). Besides that, weight regain also causes recurring costs that are associated with weight regain and the treatment of persistent obesity and the costs of obesity associated conditions (25).

Factors That Have an Influence on Weight Regain Post-Bariatric Surgery

There are multiple factors that have an influence on weight regain after bariatric surgery, for example: hormonal and metabolic disbalance, physical inactivity, problematic eating behavior and the environment. However, identifying these factors remain difficult due to the

complex nature and variety of mechanism and characteristics of the patients that influence bariatric surgery (26). First, hormonal, and metabolic disbalance is one of these influences and is caused by anatomical exclusion of the forestomach during the surgery which leads to hormonal changes, which lead to weight maintenance on the short-term. Furthermore, due to lower stomach capacity after the surgery, decreased appetite, and greater satiety, caused by the hormonal and metabolic changes discussed above, bariatric surgery reduces calorie intake in the immediate postoperative term (27). However, after 1 to 2 years, calorie intake increases due to stomach growth and adaptive changes in gut and adipocyte hormone levels such as ghrelin and leptin. Which can lead to weight regain in the longer-term (28). Second, eating behavior is implicated in weight regain after surgery. Calorie intake and diet non-adherence gradually increases in some patients, contributing to weight regain. Other patients continue with their pre-surgical eating patterns, this can lead to difficulties with weight maintenance and consequently weight regain. Besides that, problematic eating disorders can play a significant role in weight regain (29,30). The likelihood of weight regain following bariatric surgery has been linked to problematic eating behaviors such as grazing and binge eating disorder, night eating syndrome, postsurgical eating avoidance disorder, craving, and eating disorders not otherwise defined (31). Third, physical inactivity is associated with weight regain after bariatric surgery (32). Although most of the patients increase their activity, some remain inactive. Studies show that some patients are even less active after surgery than they were before the surgery (33). Fourth, mental health influences weight regain. Psychological factors may affect weight regain by decreasing motivation or preventing compliance with food, physical exercise, and other weight-loss-maintaining activities (34). Moreover, some patients use food to cope with their mental health or with emotions and then get entangled in certain eating behaviors. Last, the environment the

individuals are in, also plays a significant role in eating behavior. For example, distractions that interfere with eating and self-control (e.g., watching television, conversing with others at the table) may also contribute to greater consumption of unhealthy meals, through suppression of taste perception. It is widely established in the literature that social interactions increase calorie intake (i.e., eating more in the presence of others) (35).

Emotion and Problematic Eating Behavior

Not being able to cope with emotions can cause problematic eating behavior (36). It is believed that individuals exhibit different behaviors to control their emotions, an important regulator for this is consuming food (37). Individuals change food choice and quantity as a regulator to cope with emotions. Increasing the amount of food an individual ingests as a response to negative emotions is seen as a coping technique that temporarily reduces the negative emotion (38). It is commonly acknowledged that human eating behavior alters in response to variations in emotional arousal (anxiety, anger, joy, depression, sadness and other emotions). However, generalizations regarding these associations are difficult since the relationship between eating and mood varies during the day and depends on the individual's qualities and the unique emotional state (39). To capture the real depth and complexity of emotions, it is necessary to distinguish between distinct positive and negative feelings (40). Early research has been done on emotion and its influence on eating behavior, however, at that time the influences of different emotions were hardly considered and have been studied primarily as positive or negative affect (41,42). Besides that, it is unknown when emotions cause increased, reduced, or unchanged eating, as well as what the primary triggers of variations in food intake are (43). There are several emotions that can all have a different influence on problematic eating behavior, this is discussed in the next paragraphs.

Feeling stressed and Binge Eating

Binge eating is described in the Diagnostic and Statistical Manual of Mental Disorders (DSM), 5th edition as overeating, and is characterized by frequent eating episodes where the individual eats a massive amount of food in a short period of time (44). Binge eating disorder is the most common problematic eating behavior in the bariatric population and occurs in 29% of the post-bariatric patients (30). Individuals binge eat in reaction to both negative emotions, like stress, and the availability of food-related signals in the environment. Stress is known as a cause of obesity and binge eating disorder. Multiple studies suggest that individuals begin binge eating when they face stress or emotional stimulation, either to divert from that emotional state, or as a coping technique against the unpleasant feelings (45,46). Stress can cause certain eating behaviors, depending on the type of stressor or the personal characteristics of the patient, stress can cause either reduced or increased food intake (47). Individual differences in increases in negative mood in response to stressors are significantly related to greater food consumption and a lesser likelihood of controlled eating (48). Another study indicates that women are more likely to eat sweet and fatty foods when stressed (49,50). Multiple studies did research on stress and binge eating or overeating. However, no real-life data has yet been collected on post-bariatric patients.

Feeling Sad and Grazing

Grazing is the repeated consumption of smaller amounts of food over an extended period with an accompanying sense of a lack of control over this eating. Grazing has been increasingly recognized as an important eating behavior associated with obesity (51). For this target audience (1 to 5 years post-bariatric surgery) it is physically more achievable than massive binges due to the restricting impact of bariatric surgery (29). Stress, boredom, and mental discomfort are

common triggers for grazing, which is exacerbated by "mindless eating" while watching television, surfing the internet, or attending social activities. A meta-analysis study found that the prevalence of grazing was 17 to 47%, while the prevalence of weight regain was 47% in patients who graze and the latter is related with considerably less weight loss following surgery or higher weight regain at longer term follow-up (18,52). In both men and women, external (a heightened proclivity to consume in reaction to environmental signals, such as the sight or scent of food) and emotional eating were found to be positively linked with grazing (53,54). According to research, grazing may represent individuals' attempts to manage unfavorable emotional states. The existing research implies that grazing may be a clinically relevant form of overeating related to binge eating, weight gain, and poor treatment success for obesity (55). Despite the fact that grazing has been identified as a high-risk behavior for weight gain, it has gotten little attention in research studies (52). Most of the research available consists out of quantitative method. For example a quantitative study shows that the participants found themselves grazing as a distraction from the current emotional mood they were in at that moment (56).

Feeling Relaxed and Craving

Craving food is the uncontrollable desire for specific food items, especially sweet and savory foods. Post-bariatric patients call craving ‘head hunger.’ Food cravings occur commonly after post-bariatric surgery and are predictors of dietary relapse and weight regain. A quasi-prospective study found that only 10% of the post-bariatric patients did not experience craving (57). Post-bariatric patients experienced cravings when they were at home or around others, cravings were not connected to a negative feeling or hunger (58). Only a few studies have looked at how changes in food cravings following surgery affect post-operative weight reduction, even though food cravings have been linked to weight return in non-bariatric patients (59). In addition,

bariatric surgery itself makes it harder to satisfy desires by eating the craved food, but it is unclear how long this constraint will last (58). Positive emotions like happiness or relaxation have not yet been researched in the post-bariatric population; craving has only been studied in connection to negative feelings thus far (60).

Feeling Bored and Dietary Relapse

Dietary relapse is defined as a return to former eating and exercise habits, which is often accompanied with considerable weight regain. It is common for individuals who lost weight to slip back into old behaviors and their weight slowly increases. In this study we talk about lapses, this means that there is a short and small slip in weight loss efforts (e.g. a single setback, a mistake) (61). Another negative emotion that has not been often examined but may also be an important contributor to emotional eating, is boredom (62). Recent studies imply that, unlike some other negative emotions, eating in reaction to boredom may be a meaningful-regulation response, unlike other negative emotions. Research shows that the feelings of loneliness and boredom show an increase in eating, although there is not much of difference between individuals with obese and normal weight. It was expected that obese individuals will eat more food if presented with a boring assignment rather than an exciting job. Especially the frequency of eating is higher in bored obese patients, in comparison to the non-obese (63). Additionally, another study found that bariatric patients acknowledged eating more frequently while bored than when feeling other negative emotions, implying that therapies focused on combating boredom may be crucial to post-surgical success (64). A behavioral diary study concluded that when individuals experienced boredom they would eat more and food with a greater energy intake, as well as more fat and carbohydrates (65). Another research found that higher food consumption and higher craving was reported during boredom (66). Multiple studies conclude

that boredom causes problematic eating behavior, however the specific eating behavior ‘dietary relapse’ is not yet studied in post-bariatric patients 1 to 5 years after surgery (67)

Contextual Factors and Eating Behavior

As stated before, there are multiple factors that have an influence on eating behavior. Contextual factors are characteristics of the environment that influence the behavior. Overweight and obesity are significantly influenced by the environment (68). There is no complete understanding of contextual factors associated with obesity and weight regain or weight maintenance. There has been little consideration given into whether contextual factors like location and the presence of other individuals, can predict weight loss success by influencing postoperative behavioral compliance (69). The following characteristics are considered contextual factors in this study: situational factors (activities) and location type (68).

Situational factors

Previous research has shown that situational factors can stimulate desires and behaviors even when an individual wishes to eat or drink less (70). Distractions that impair one's focus on eating and ability to self-monitor intake (e.g., television viewing, conversing with dining companions) can lead to increased palatable food consumption (35). Besides that, when participants are working or engaging in other activities, this would take the place of eating and can result in less inappropriate eating. An interview study did research on situational and social factors that influence eating behavior in overweight individuals. Dietary relapses tended to occur in this population during certain activities, such as socializing, relaxing, and working (71). In addition, an Ecological Momentary Assessment (EMA) study, studying young adults showed that eating occasions commonly occurred while being alone, actively consuming food a less positive coping response that increased risk of dietary relapse (39,72). Problematic eating

behavior in situational factors has been studied in different populations but remains unexplored in the post-bariatric population. Therefore, this is explored further in this study.

Location type

The physical environment influences eating through affecting food access and availability as well as perceived norms about eating practices (73). Food is everywhere, and the majority of what is offered is unhealthy. People's eating habits might be influenced by their environment. This can eventually lead to people being overweight (74). Besides that, the amount to which people are enticed to make unhealthy food choices is determined by environmental variables such as food availability and "internal" ones such as how people make food decisions (74). A prospective study showed that individuals were binge eating more than 50% of the time when they were eating in restaurants (75). Besides that, an ESM study concluded that participants made more unhealthy food choices when eating out-of-home and caused dietary relapse (76). An experimental study showed that overweight men ate more calories when dining in a restaurant than at home (77). On the contrarily, a quasi-prospective study, concluded that 62% of craving occurred when post-bariatric patients were at home (58). Another EMA study, showed that being in a location where food is likely to be present (at home) increased the risk of dietary relapse (72). Studies show that individuals eat more when eating out, however this has not been studied yet in the post-bariatric population. Besides that, there is also little to be found about problematic eating behavior when bariatric patients eat at home (50).

Objective of the Current Study

Among different studies, there is thus a general consensus that there is a relationship between emotion, contextual factors and eating behavior in the obese population (68). The existing studies on this topic are mainly done by review, interview or experiment studies, this

can give error and bias. Besides that, existing studies give contrasting findings in the relation between emotion, contextual factors and eating behavior. In addition, little research has been done on these factors in post-bariatric patients. Due to significant variation in study methods of assessing eating behavior, types of problematic eating behavior measured and time of postoperative follow-up, it is unclear if emotional eating behavior is affected after bariatric surgery (78). Currently, there is a lack of ecological data and longitudinal data on these factors. Ecological data is data gathered by following patients in their daily lives, which makes the study more ecological valid (46).

The current study is conducted to better understand the relationship between emotions, contextual factors and problematic eating behavior in post-bariatric patients. It is critical to understand the factors that influence problematic eating behavior following bariatric surgery so that problematic eating behavior can be reduced or avoided. To examine this, the Experience Sampling Method (ESM) method is used. ESM is a study design that could overcome some of the described limitations in previous studies. This method can be used to monitor the feelings and behavior of patients after bariatric surgery and collects ecological data (79). The use of ESM removes many sources of bias and also capitalizes external validity (80). In addition, it also has been shown that ESM can be a valuable tool for research on eating disorders (81).

The following hypotheses have been formulated, which can be answered by means of the data from the ESM study.

Hypothesis 1 – When post-bariatric patients feel stressed, they are more likely to binge eat in comparison to post-bariatric patients who do not feel stressed.

Hypothesis 2 – When post-bariatric patients feel sad, they are more likely to graze.

Hypothesis 3 – Post-bariatric patients who feel relaxed, will have less craving for specific food in comparison to post-bariatric patients who do not feel relaxed.

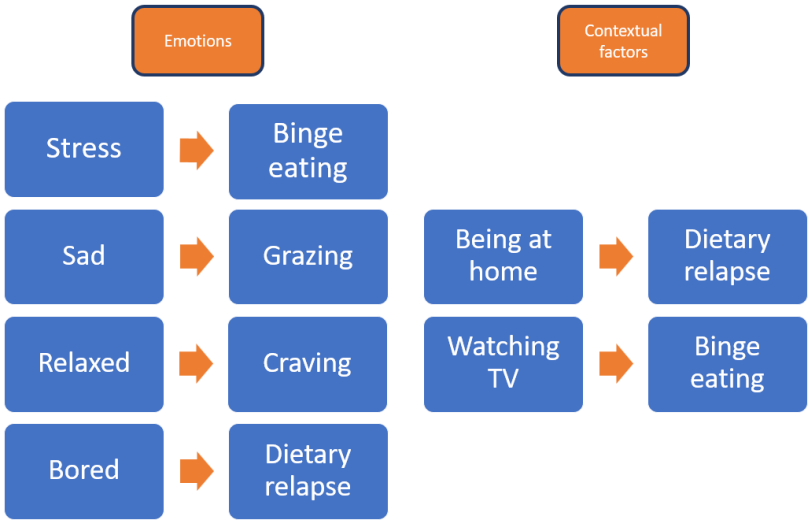
Hypothesis 4 – Post-bariatric patients who are bored, consume more food that is likely to be negative to their weight than post-bariatric patients who are not bored.

Hypothesis 5 – Post-bariatric patients who are at home, are more likely to consume food that is negative for their weight than post-bariatric patients who eat outside of the house.

Hypothesis 6 – Post-bariatric who are watching television, are more likely to overeat in comparison to patients who do not watch television.

Figure 1

Visualization of the hypotheses



Setting and treatment

Follow-up care is crucial to maintain the outcome of bariatric surgery. However, each hospital has different follow-up care and treatment for obesity. This current study was done at ZGT. This hospital has a dedicated obesity center where patients are treated by a

multidisciplinary team. The following paragraphs tell more about the treatment and follow-up care (at ZGT).

Post-Operative Care

To reduce the likelihood of weight regain or to keep managing comorbidities that are related to obesity, patients should receive proper follow-up care. A multidisciplinary team comprising a dietician, physiotherapist and psychologist should offer treatment to help patients through the adjustment to life after bariatric surgery and may prevent weight regain (82). Eating patterns and physical activity habits need to be permanently modified to lose weight and keep it off. Therefore, longitudinal follow-up care is important preferably for at least 5 years post-bariatric surgery (83).

Adherence to post-bariatric follow-up care is poor. A systematic review study showed that less than 3% of the bariatric studies included more than 80% of long-term follow-up (84,85). Inadequate adherence to follow-up treatment has been identified as a factor in the development of problems following bariatric surgery, for example weight regain, dietary relapse and nutritional deficiencies (86). Patients' health suffers as a result of missed medical appointments. Missing visits might result in a delayed identification of difficulties, the loss of a support network, and a lack of reinforcement to adhere to the treatment plan (87).

Current Treatment at ZGT

Yearly approximately 12.000 patients undergo bariatric surgery in the Netherlands, 600 of which in Ziekenhuis Groep Twente (ZGT) Hengelo and Almelo (88). ZGT currently has three surgical treatment for patients with obesity. The patient must meet a few criteria before they are screened and thus can be admitted to surgery. The first condition is that the BMI must be

between 35 and 40 kg/m^2 with one obesity-related comorbidity or minimal 40 kg/m^2. The second condition is that the patient is willing to participate in the post-surgery counseling program and to change eating habits and exercise patterns under the guidance of a dietician and physical therapist. The third condition is that the patient is older than 18 years old. The last condition is that the patients already suffer from obesity for five years and tried multiple times to lose weight, without success (89). When the patient meets the criteria, the patient is screened. During a multidisciplinary consultation, the most appropriate treatment is discussed with the obesity nurse, the surgeon, the medical psychologist and the dietician. Before the surgery the patients are screened again and have a personal conversation with the surgeon or obesity nurse about the bariatric surgery. Before the surgery the patients have a mandatory group meeting led by the dietician and physical therapist. The surgery will take place approximately four weeks after this group meeting (90).

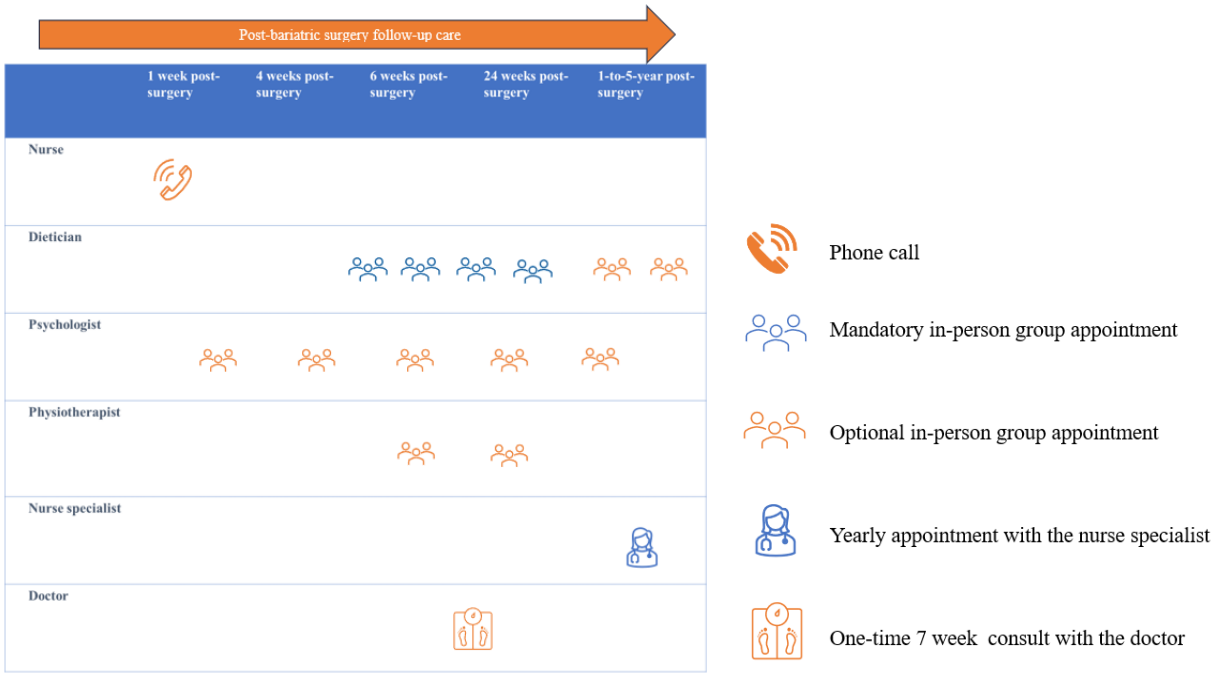
Post-Operative Care at ZGT

Strengthening adherence to lifestyle changes and maintenance of weight loss after bariatric surgery often requires regular contact with an obesity management center and lifetime follow-up (91). At ZGT Hengelo patients receive follow up care one week post-bariatric surgery. Group meetings are organized after bariatric surgery and take place until around a year and a half after the surgery. The follow-up care at ZGT is multidisciplinary. First, the nurse calls the patient one week post-bariatric surgery to plan the follow-up care appointments and to ask how the patient is doing. Second, a dietician provides four mandatory group meeting were the patient is educated about proteins and vitamins (92). The guidance of the dietician is mainly for learning different eating patterns. The patient will gain insight into their eating habits and what it takes to change them for long lasting weight loss. Besides that, the patients receive tools to deal with

stressful situations and learn coping strategies to handle emotions, by not indulging in problematic eating behavior (23). Third, the psychologist hosts five optional group meetings about eating habits, coping with stress, motivation and relapse prevention. Fourth, the physiotherapist has two meetings where patients learn the guidelines of physical activity and get training on fitness equipment (92). Fifth, the patient has a telephone consultation with the surgeon 7 weeks after surgery for evaluation. Lastly, the patient has a yearly consult with the nurse specialist, where general questions are asked about the patients, eating behavior, physical activity, protein, vitamins and complications. Besides that, patients receive laboratory tests during the consultation with the nurse specialist to examine the deficiencies of vitamins and minerals. Furthermore, the follow-up care program from the hospital is transferred to the general practitioner after 5 years (92). The follow-up care program is visualized in figure 2.

Figure 2

Follow-up care post-bariatric surgery until 5 years after surgery



Method

Participants and Setting

This two week longitudinal study was carried out at the Ziekenhuis Groep Twente (ZGT) Hengelo. In this research there was a specific target group: patients who had bariatric surgery one to five years after the surgery. Purposive sampling was used to gain participants for the study. The inclusion criterium for the participants in this study was: (I) the patients had bariatric surgery between 2017 and 2021. The exclusion criteria for this study were: (i) involvement in a diet or intervention program or behavioral treatment after bariatric surgery that is outside the scope of regular care after bariatric surgery, (ii) insufficient command of the Dutch spoken and written language, (iii) not capable to fill in the self-reports during the day time and (iv) not in possession of a smartphone that supports the ESM application.

Design and Procedure

Before this longitudinal study started, the study protocol obtained approval of the BMS ethics committee of the University of Twente (#220552) and the local medical ethics committee of the hospital (registration number 2020-48). In addition, informed consent was acquired from the participants before any study-related activities were started.

The recruitment of participants began during yearly one-on-one consults with the physician assistant at the ZGT hospital eligible patients were informed about the study and have been asked to participate in the study. During these consults patients received a flyer (see appendix A) with a QR code. The QR led to the information about the study and informed consent in the program ‘Qualtrics’. Furthermore, participants filled in their demographics in the Qualtrics program (see appendix B). After the patients received the flyer they had one week to

think about whether they would want to participate. Patients who had not signed up for the study were called to motivate them to still join the study.

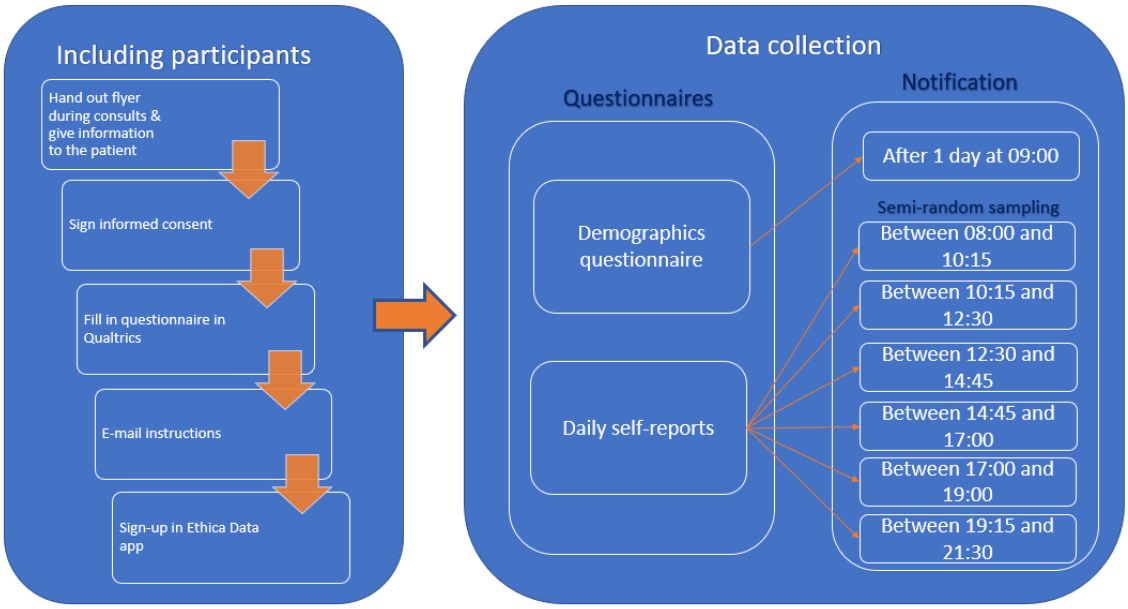
Patients were informed by phone or email about the use of the application: Ethica Data. In addition, patients received a manual through email (see appendix C) with information about installing the app, setting notifications for the ESM study and making an account for the Ethica Data app. If necessary, the patient was helped to install the app. Before starting the study, patients got a notification in the Ethica Data app that by starting the study they agree to participate. On the first day after signing up, all participants received the demographics questionnaire (see appendix D) in the Ethica Data app. The combination of both questionnaires (Ethica Data app and Qualtrics), ensures linking the patients to the correct data in the study. Through the Ethica Data app, participants completed daily self-reports. For the self-reports a semi-random sampling scheme was used, where assessments are randomly generated within multiple predefined time intervals. In the next 14 days, they received the questionnaire 6 times a day from 08:00 in the morning until 21:30 in the evening. The choice of 14 days of data collection is in line with other studies that use ESM, studies that use several measurements per day should last between 3 days and 3 weeks (93). Participants were asked to fill in the questionnaire as soon as possible after receiving the notification from the Ethica Data app. When the self-report was not filled in, in a time slot of 5 minutes, the participant received a one-time reminder notification to increase the compliance. The self-reports remain available for 15 minutes after the notification. The complete measurement design is visualized in Figure 3.

On day three of using the Ethica Data app the participants were called to ask if they had any questions or needed help. After one week the participants were called to check if everything went smoothly and if there were any problems. Besides that, during the phone call they were

motivated to keep up the good work and continue the study for one more week. Participants were notified by WhatsApp after 1 day of uncompleted self-reports and were contacted by phone after three days of missed self-reports to encourage them to continue. Lack of response was shown by percentages in the 'Session statistics' in Ethica Data working environment. Throughout the entire study, participants could ask for help from the lead researcher (R.t.H.) through email and phone. This information could be found on the flyer the participants received.

Figure 3

Design of the ESM study from inclusion to data collection



Note: modified from Schleich (2022).

Measures and Materials

This study required several programs in order to be executed effectively. The following demographic data were asked in the questionnaire through the Ethica Data app and Qualtrics (Appendix B and appendix D): gender (man/woman), age, height (cm), type of surgery (gastric bypass/mini gastric bypass/gastric sleeve), first, second or third surgery, time after surgery (date), weight before surgery (kg), weight at the moment of the study (kg).

Participants used the phone application: Ethica data (Ethica Data, Toronto, ON, Canada), to complete self-reports. This phone application was available for Android and iOS/Apple users and was freely available in the App Store. The Ethica Data application can also be used offline, which makes it usable in every context. The self-reports completed in the Ethica Data app exist out of 14 questions (see appendix E), the variables are related to emotions, contextual factors and eating behavior. The entire self-report approximately takes 2 minutes to fill in.

Emotion. Emotions were assessed in question 1 to 7. To measure the positive emotions, participants were asked " How 'happy' or 'relaxed' do you feel right now?". For the negative emotions, the same question with the adjectives anxious, stress, sad, bored, and tired were asked. These questions were conducted by means of the Visual Analogue Scale (VAS), ranging from 0 to 10.

Contextual factors. Contextual factors were assessed in questions 8 to 10 contained questions about contextual factors. For these questions multiple answers were possible. Examples of these questions included in the self-report are: 'Where am I?' or 'What am I doing?'.

Eating behavior. Lastly questions 11 to 14 contained questions about eating behavior. Question 15 used a VAS scale ,ranging from 0 to 10, to indicate how strong a desire was for a particular food item. Questions 16 to 18 only contained closed questions. Examples of these questions included in the self-reports are; 'Have you consumed an unusually large amount of unhealthy food in the last 60 minutes?' and 'In the past 60 minutes, have you eaten and/or drunk anything that is likely to have a negative influence on your weight'.

During the data collection, an Excel file was maintained with anonymized data on the data collection and the patients. Information in the Excel file exists of: the start date and end date

of the study per participant, date of explaining the app Ethica Data, days where the questionnaires were not filled in, email address and phone number.

Analysis

The data from the Ethica Data app was analyzed with IBM SPSS Statistics 27. After that, the data was visualized by making graphs using Excel for Microsoft. First, descriptive statistics were calculated to summarize means, standard deviations, and percentages based on the demographics of the individuals. Linear mixed modelling (LMM) with a random intercept was used to test all hypothesis. For each model, the time variable (14 days) was used as repeated measurement and the participants' EthicaDataID was set as subject variable. To answer the last two hypotheses, two new variables were made. First, for the variable 'where are you' a new variable was made for 'being at home'. Second, for the variable 'what are you doing' a new variable was made to measure 'watching television', using 0 as not watching tv and using 1 as watching TV. To fit the random effects models that is described above, LMM uses maximum likelihood estimation (MLE). Participants whom did not meet the response rate of 33.3% were excluded from this study (94). The level of significance for rejecting the null hypothesis will be less than 0,05 in this research.

Results

Compliance and Demographics

A total of 32 patients were invited to participate in the ESM study, eventually 7 participants started the Ethica Data app and filled in the self-reports. Eventually, 2 participants were excluded from the data sets due to their low completion rates (<33.3%). Out of 390 possible ESM self-reports, participants responded to a total of 196 self-reports, resulting in a compliance of 50.3 %. All the participants included in the study were women (M = 48, SD = 11.31). Of the

five participants, one had undergone a gastric bypass surgery, the other four had undergone a mini gastric bypass surgery. None of the participants had a gastric sleeve surgery. The time after surgery was between one and five years (*M* = 2.2, *SD* = 1.79) Furthermore, the mean BMI before surgery was 40.7 (*SD* = 1.68) and the current mean BMI was 23.8 (*SD* = 3.40) (see appendix F).

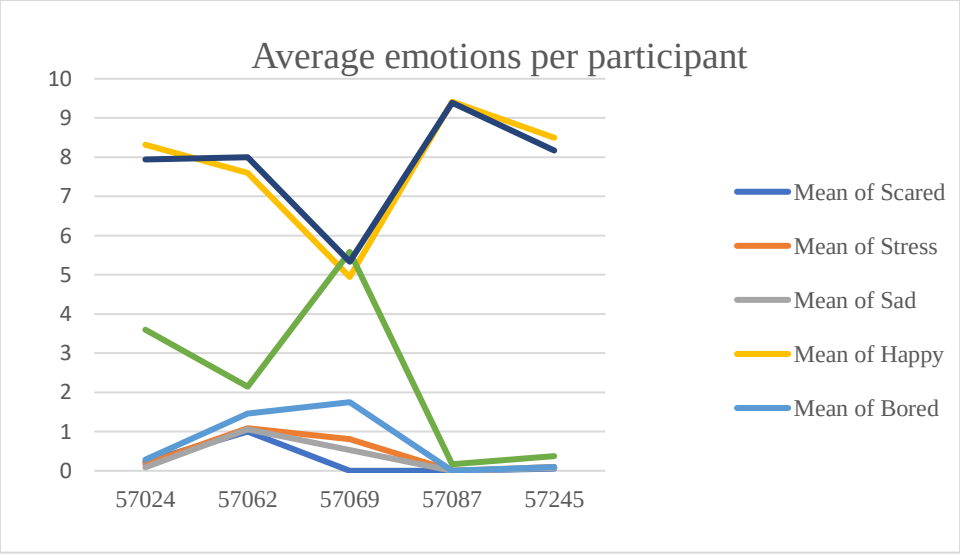
Descriptive Statistics

Emotions

The participants showed some variation in positive emotions and little variation in negative emotions. On average the sample group showed higher positive emotions (relaxed and happy) than negative emotions (angry, scared, sad, stressed, bored and tired). The mean score feeling happy was 7.82 (*SD* = 2.06) and the mean score of feeling relaxed was 7.80 (*SD* = 2.36). Furthermore, the mean of feeling scared was .23 (*SD* = .71), feeling stressed had a mean of .40 (*SD* = .90) and feeling sad had a mean of .32 (*SD* = .71). Besides that feeling bored was not common in this sample group, with a mean of .66 (*SD* = 1.02). The mean of feeling tired was 2.18 (*SD* = 2.49). These average emotions per participant are shown in figure 4.

Figure 4

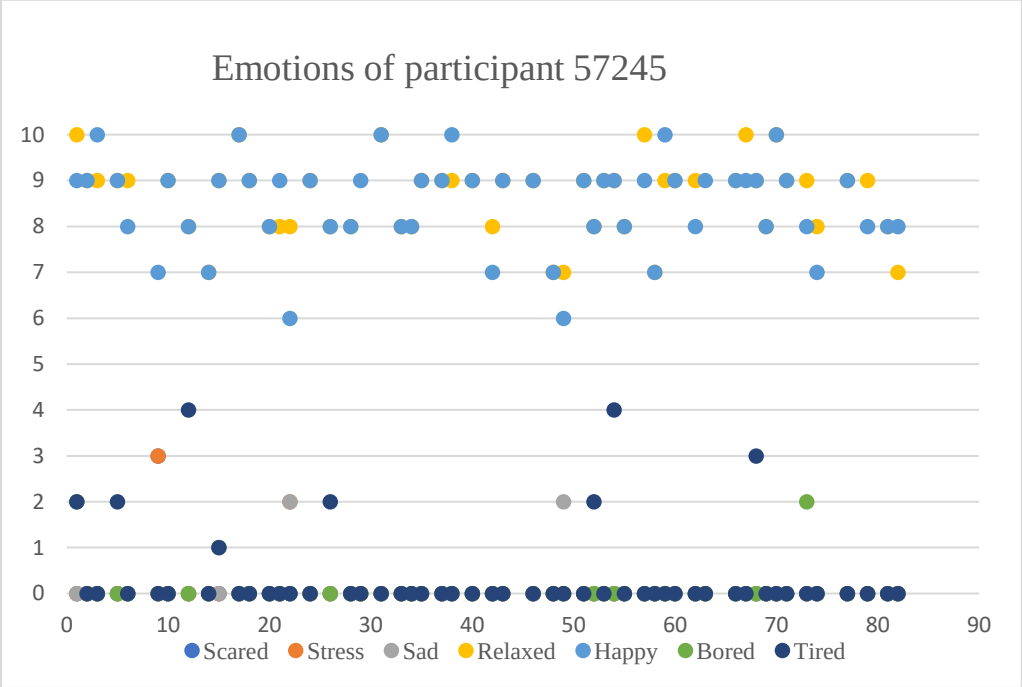
Average emotions per participant on a VAS-scale from 0 to 10 in 14 days



When looking at the emotion of participants separately, they show some variability in emotions as seen in both figure 5 and 6. For the plots of individual cases, first participant 57245 was plotted, positive emotions are always relatively high and negative emotions are relatively low within this participants. This participant shows not much variability in feeling sad and feeling tired. Furthermore, the participant did never feel scared or anxious.

Figure 5

Emotions of participant 57245

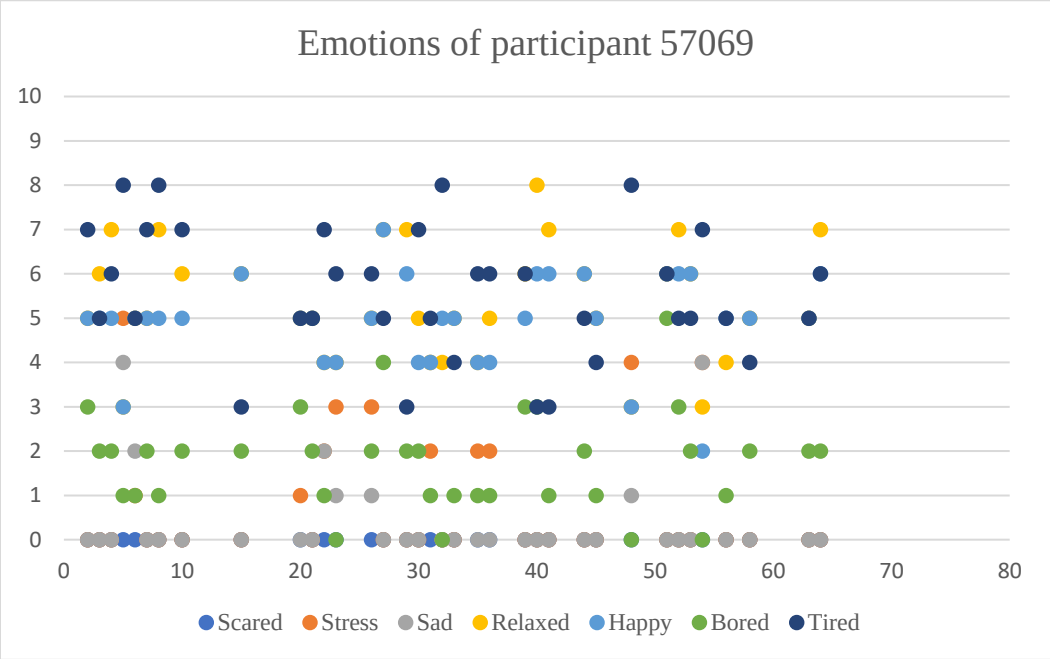


Second, participant 57069 shows quite some variability in emotions where positive emotions are relatively low in comparison to participant 57245 (see figure 5). However, the participant rarely felt sad or scared. What is remarkable about this participant is the high variability in feeling tired and feeling bored. Concluding, the emotions happy, relaxed and feeling tired show relatively high variabilities between participants. On the other hand, feeling

scared, sad or bored show low variabilities between participants. Emotions of the other participants can be found in appendix H.

Figure 6

Emotions of participant 57069



Contextual factors

The contextual factors 'being at home' stood out the most. Of the 196 filled-in self-reports, the location of the participants was home most of the time (59.1%). Watching television occurred most of the time (15.8%), second relaxing (14.7%) and third working (14.2%) The activity that was the least prevalent among participants was exercising (0.5%).

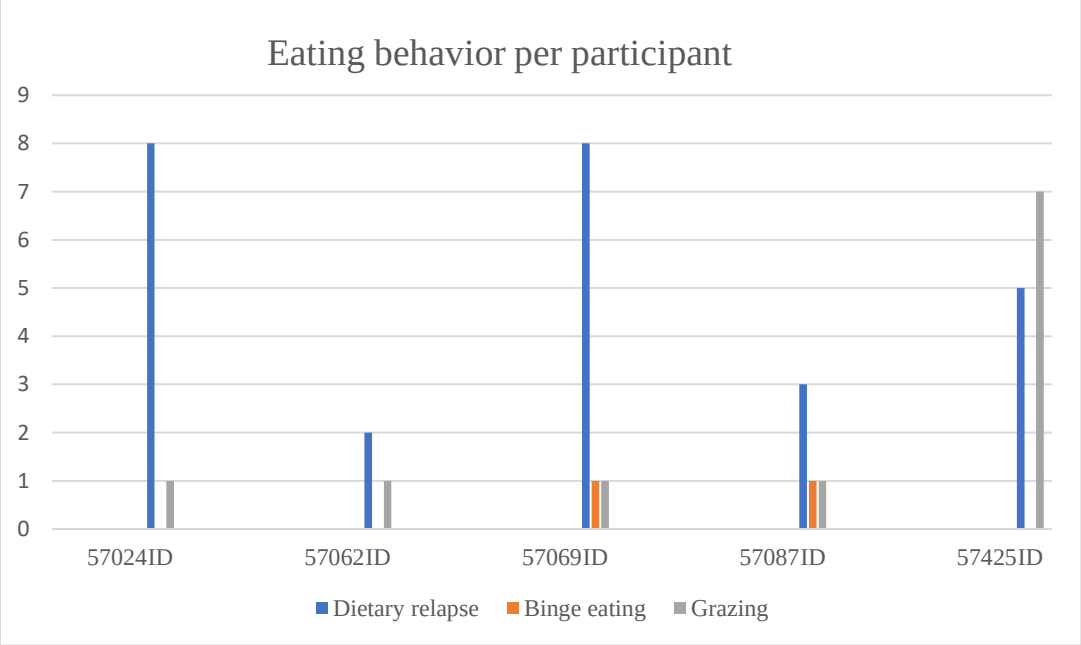
Eating behavior

In total of the 196 filled in self-reports, 39 problematic eating behaviors were reported. Dietary relapse occurred most often, then grazing and lastly binge eating. On an average dietary

relapse happened 5.20 (*SD* = 2.77) times, grazing happened 2.2 (*SD* = 2.68) times and binge eating 0.4 (*SD* = 0.55) times during the study period of 14 days. As figure 7 shows, binge eating did not happen in all participants. There was not a lot of variability between craving within the participants (M = 0.78, *SD* = 0.56), they scored on an average between 0 and 3 on the VAS-scale, this is not shown in a graph.

Figure 7

Count of Eating behaviors per participant in 14 days



Explorative statistics

For the individual cases, participant 57024 experienced dietary relapse 4 out of the 8 times when being at home and scoring the highest score (10 on a VAS-scale) on feeling happy and feeling relaxed. The same counts for participant 57425, who experienced dietary relapse 4 out of the 5 times when being at home and feeling happy and relaxed (scores between 8 and 10). For this participant dietary relapse and grazing occurred at the same time. Participant 57069, who

experienced dietary relapse 6 out of the 8 times when being at home. Binge eating occurred only in participant 57069 and 57087, it occurred simultaneously when the participants had a dietary relapse. All participants experienced grazing one or more times, this problematic eating behavior occurred for all the participants when being at home and experiencing dietary relapse at the same time.

Results of the Hypothesis

There was no overall significant association when running a LMM analysis between emotion, contextual factors and eating behavior (> p 0.05). Relevant statistics can be found in table 1. The first four hypotheses examined the relationship between emotion and problematic eating behavior. First, LMM analyses showed no significant association between post-bariatric patients feeling stressed and the likeliness to overeat in comparison to post-bariatric patients who do not feel stressed. Second, results showed no significant association between post-bariatric patients feeling sad and the likeliness to graze in comparison to post-bariatric patients who are not feeling sad. Third, results showed no significant association between post-bariatric patients who feel relaxed and the likeliness to have cravings in comparison to post-bariatric patients who do not feel relaxed. Last, results showed no significant association between post-bariatric patients who feel bored and the likeliness to have a dietary relapse in comparison to post-bariatric patients who are not bored. The last two hypotheses examined the relationship between contextual factors and eating behavior. The LMM analysis showed no significant association between post-bariatric patients who are at home and the likeliness to consume food that is negative for their health, in comparison to post-bariatric patients who are not at home. Furthermore, the analysis showed that there was no significant association between post-bariatric

patients who are watching television and the likeliness to overeat, in comparison to post-bariatric patients who are not watching television.

Table 1

Summary of all the hypotheses

Hypothesis	Estimate (*B*)	Standard Error (*SE*)	df	t	P-value	CI Lower - 95	CI Upper - 95
1 – Feeling stressed and binge eating	-.005	.008	193	-.627	.531	-.021	.011
2 – Feeling sad and grazing	.001	.024	97.041	. 032	.975	-.048	.049
3 – Feeling relaxed and craving	-.010	.055	152.500	-1.79	.858	-.118	.099
4 – Feeling bored and dietary relapse	-.024	.027	34.310	-.860	.396	-.079	.032
5 – Being at home and dietary relapse	.033	.050	195	.659	.511	-.065	.130
6 – Watching television and binge eating	-.011	.029	195	-.380	.704	-.068	.046

Note: df Degrees of freedom *CI* Confidence interval of unstandardized estimates

Discussion

The present study employed experience sampling procedures to examine the influence of emotion and contextual factors that followed problematic eating behavior in post-bariatric patients. For 14 days the participants filled in 6 self-reports per day during their normal daily life's. This study is one of very few that includes a time horizon of 1 to 5 years and assessed multiple problematic eating behaviors (67). Although we expected to observe an association between emotions (stress, sadness, boredom, and relaxedness) and contextual factors (being at home and watching TV) were not associated with reports of problematic eating behavior (craving, binge eating, grazing and dietary relapse) in post-bariatric patients.

Main findings

The main findings were as follows. First, there was no association between problematic eating when experiencing certain emotions or problematic eating behavior when in different locations or doing specific activities. These findings stand in line with a quasi-prospective study that studied post-bariatric patients and compared them to obese and overweight individuals. This study showed that a negative mood did not lead to problematic eating, especially not craving food (58). Another study found that stress scores improved post-bariatric surgery and that patients were better equipped to cope with emotions. The latter resulted in indulging less in problematic eating behavior (95). A long-term follow-up study concluded that there is no association between lifestyle, behavioral factors, eating behavior and success in long-term weight-loss (24). However, the finding of the present study contradicts earlier findings that suggest an association between emotions and contextual factors on one hand and eating behaviors on the other hand (72,96,97). Speculative, these differences may have arisen because the participants predominantly showed positive emotions (Appendix H). In obese individuals,

bariatric surgery is related with a considerable decrease in the prevalence and severity of depressed and anxious symptoms. Because of enhanced self-image and a reduction in comorbidities, post-bariatric patients reported more positive emotions (98). Besides that, weight loss contributes to improved quality of life, confidence, and happiness (99). According to studies, patients who experience negative feelings are more prone to displaying problematic eating behaviors (50).

Second, the participants in this ESM study barely showed problematic eating behaviors. An EMA study examining overweight dieters were four times more likely to show problematic eating behavior in comparison to the participants in the current study (100,101). Barely observing problematic eating behaviors may be explained by the fact that the participants in this study all followed the post-bariatric follow-up care appointments. Participants in this study showed up at all follow up appointment except for two participants who did miss one (of 4 meetings) obliged meeting with the dietician. Besides that all participants followed their yearly consults with the nurse specialist. Potential explanations for no significant association between emotion, location and problematic eating behavior in the current study may be, that follow-up care post-bariatric surgery plays an important role in long term weight maintenance and dietary habits. Most post-bariatric patients will have received comprehensive nutritional and psycho-behavioral examination, education, and support prior to surgery and during the first few months following surgery, including techniques to modify eating habit. This may reinforce their efforts to avoid food consumption in reaction to their emotions, through developing coping strategies to deal with emotion (78). Previous study has connected follow-up care attendance to better dietary compliance, which results into better weight loss outcomes after bariatric surgery (85,102). As a

result, follow-up care is crucial for optimizing clinical and psychosocial outcomes after bariatric surgery.

Strengths and limitations

One of the strengths of this study is that ESM has been applied to eating behavior. The use of ESM is appropriate for examining eating behavior in post-bariatric patients (103). Besides that, this is one of the few studies in the post-bariatric population that uses ESM and, even one of the first to examine emotion, eating behavior, and contextual factors measured through ESM. Naturalistic circumstances are created by capturing information while individuals go about their daily activities, and this appears to be very relevant in terms of eating behavior (50). Another strength is that the current study measured over 14 days and used a semi-random sampling scheme (104). The duration of this study is lengthy compared to other studies examining eating behavior in post-bariatric patients (100). This is a mixture between fixed and random sampling, which results in to a high ecological validity. This allowed the study to capture variations throughout days, weeks and also limits retrospective bias (105). Apart from that, the seemingly unpredictable nature of the signals reduce response biases and expectancy effects. Another strength of the current study is that it measures one to five years after bariatric surgery to also cover the time when weight is stabilized after one to two years post-bariatric surgery (19). Furthermore, multiple types of problematic eating behavior were assessed in this study (craving, binge eating, grazing and dietary relapse). Other studies often focus on one type of problematic eating behavior, like binge eating (35).

Next to the strengths of the study, the current study also has certain limitations. First, because of the limited sample size and characteristics of the sample size (female between the age of 40 and 60) these findings should be regarded with caution, because they limit the

generalizability. These findings should be replicated in a larger, more representative population in future study. The study of larger and representative samples should also allow for an estimation of influences of factors such as eating habits, gender, age, ethnical background type of bariatric surgery. These factors could have an influence on the outcomes of the hypotheses, for example: anatomical changes in different surgical types, may make it anatomically impossible to show problematic eating behavior (106). Second, a post-hoc power study revealed a 16.9% power (see appendix G). A low power like this, increases the possibility that a statistically (non-)significant discovery is a false positive (107). Third, ESM studies are intensive longitudinal, due to participants multiple responses per day over a period of days or even week. Therefore ESM studies have a high burden on participants. On the other hand, patients are inclined to miss assessments as a response to their current mood, which could also lead to selection bias. Fourth, there was no pre-bariatric surgery group or an overweight group to compare the outcomes and ensures the internal validity of the study. Finally, all the ESM measurements included ratings of eating behavior, which were measured by self-reports and were intrinsically subjective. There were no measures of precise food intake, precluding calculation of calories and energy intake. Without objective measurements of energy intake, it cannot be determined whether the observations of eating behavior during the ESM study are representative of problematic eating behavior. Besides that, no pre-used questionnaires were used. By this means the results could not be compared, this makes the study less reliable.

Future research

For future studies, it might be important to start the study with a bigger sample to make the average values more accurate. Participants must be motivated to continue completing the self-reports, therefore redesigning the study could increase the compliance among the

participants. To further elaborate on this, compliance could be increased by using a fixed sampling scheme. This allows participants to plan their day work around the scheduled assessment periods, which may boost compliance rates but at the expense of decreased ecological validity (108). Besides that, sampling could be linked to habitual behaviors, for example after eating moments (108). This would decrease the cognitive burden for the participants. Furthermore, fewer self-reports per day with higher time intervals between the self-reports would increase compliance (108). Another possibility to increase compliance is to use incentives, like a fixed compensation or personalized/visualized feedback (109). According to research, ESM-based self-monitoring and feedback can effectiveness of internal control by increasing the capacity to employ natural rewards (110,111).

Implications for Practice

The results of this study yield several clinical implications. First, these data suggest that emotion and environment are not associated with problematic eating behavior. Based on what is known in the literature, I would not make any major adjustments to the clinic, however if based on my research I would recommend to stop examining emotion and environment when measuring problematic eating behavior in an ESM study in post-bariatric patients. However, this recommendation should be followed with caution unless multiple larger studies show the same results. The current study did show some problematic eating behaviors, however none of the factors in this study had an association with these eating moments. Based on literature, other factors that are interesting to measure in an ESM study that may influence eating behavior in post-bariatric patients include: social support, self-monitoring, social economics, culture and self-confidence (112).

Second, ESM is a useful tool for capturing the personal circumstance individuals are experiencing. As seen in figure 4, participants experience on an average different emotions. Figure 7 shows that participants also differ in the amount of problematic eating behaviors they show. Therefore, it is important in post-bariatric patients to provide them with personalized care tailored to the patient's emotions and eating behaviors. Since problematic eating behavior is multi-factorial and there is variation from patient to patient post-bariatric surgery (113–115). Personal care can prevent relapses and help weight maintenance post-bariatric surgery. For example, personalized weight feedback post-bariatric surgery, can result in modest long-term weight loss (116). Besides that, personal feedback can increase compliance in ESM studies, because the information is relevant and interesting for the patient (117).

Lastly, When using ESM as personalized care, compliance and adherence first should be increased. Therefore, caution needs to be taken into how many self-reports an individual needs to fill in. To increase the compliance three or four self-reports daily is enough to capture emotions, contextual factors and problematic eating behavior (80). Moreover, to reduce the load and mental burden of the self-reports, compliance can be increased by tying it to routines. For example, sending self-reports daily after standard eating moments. Besides that, the self-report needs to contain personalized questions, since patients differ in post-bariatric problems (118). ESM used in follow-up care could help patients with self-monitoring and self-insight of their progress, self-insight ensures initiation of change in behavior (110). For health professionals the development and needs of patients post-bariatric surgery is informative. This would make it easier for specialists to determine whether or not patients required their assistance, and professionals could then assist patients sooner before relapses or weight regain occurred (92). Besides that, ESM allows for the development of insight into earlier implicit patterns of thinking, experience, and

behavior. As a result rapid personalized feedback is available (110). Finally, when sensitive feedback data is accessible in real time, personalized meetings with the dietician, psychologist or physiotherapist could be initiated more easily. ESM can show personalized trajectories of symptoms, show disruptions and patterns of environmental reactivity. This personalized data can assist in shared decision-making and prediction in clinical practice (110). What should be measured in the ESM study is different for each patient, therefore, it is important to include different measurement factors (emotion, physical activity, sleep, environment, social support et cetera) as long as the self-report does not contain more than 30 items (110).

Conclusion

The current study is the first one know aimed to explore the association between emotion, contextual factors and problematic eating behavior among patients who had bariatric surgery 1 to 5 years ago. This association is measured by doing an ESM study, where the participants filled in 6 self-reports per day over a time period of 14 days. By analyzing the data through LMM there was no association found between emotions (stress, sadness, boredom, and relaxedness) and contextual factors (being at home and watching TV), and on the other hand eating behavior (craving, binge eating, grazing and dietary relapse) in post-bariatric patients. However, the results are not generalizable due to a small sample consisting solely of wo men. Besides that, participants in this study barely showed problematic eating behavior, which may come from attending follow-up care.

References

1. Obesity and overweight [Internet]. [cited 2022 May 27]. Available from: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight
2. Meer volwassenen met ernstig overgewicht tevreden met gewicht [Internet]. [cited 2022 Mar 8]. Available from: https://www.cbs.nl/nl-nl/nieuws/2021/34/meer-volwassenen-met-ernstig-overgewicht-tevreden-met-gewicht
3. Obesity - Symptoms and causes - Mayo Clinic [Internet]. [cited 2022 Oct 25]. Available from: https://www.mayoclinic.org/diseases-conditions/obesity/symptoms-causes/syc-20375742
4. Jebb S. Obesity: causes and consequences. Women's Health Medicine. 2004 Nov 1;1(1):38–41.
5. de Mutsert R, den Heijer M, Rabelink TJ, Smit JWA, Romijn JA, Jukema JW, et al. The Netherlands epidemiology of obesity (NEO) study: Study design and data collection. Eur J Epidemiol [Internet]. 2013 Jun 11 [cited 2022 Mar 8];28(6):513–23. Available from: https://link.springer.com/article/10.1007/s10654-013-9801-3
6. Nammi S, Koka S, Chinnala KM, Boini KM. Obesity: An overview on its current perspectives and treatment options. Nutr J [Internet]. 2004 Apr 14 [cited 2022 Mar 9];3(1):1–8. Available from: https://nutritionj.biomedcentral.com/articles/10.1186/1475-2891-3-3
7. VanItallie TB, Lew EA. In Search of Optimal Weights for U.S. Men and Women. Obesity Treatment [Internet]. 1995 [cited 2022 Sep 9];1–20. Available from: https://link.springer.com/chapter/10.1007/978-1-4615-1901-0_1
8. Ryan DH, Yockey SR. Weight Loss and Improvement in Comorbidity: Differences at 5%, 10%, 15%, and Over. Curr Obes Rep [Internet]. 2017 Jun 1 [cited 2022 Apr 21];6(2):187. Available from: /pmc/articles/PMC5497590/
9. Byrne SM. Psychological aspects of weight maintenance and relapse in obesity.
10. de Luca M, Angrisani L, Himpens J, Busetto L, Scopinaro N, Weiner R, et al. Indications for Surgery for Obesity and Weight-Related Diseases: Position Statements from the International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO). Obes Surg [Internet]. 2016 Aug 1 [cited 2022 Mar 15];26(8):1659. Available from: /pmc/articles/PMC6037181/
11. Subramaniam K, Low WY, Lau PC, Chin KF, Chinna K, Kosai NR, et al. Eating Behaviour Predicts Weight Loss Six Months after Bariatric Surgery: A Longitudinal Study. Nutrients [Internet]. 2018 Nov 2 [cited 2022 Oct 30];10(11). Available from: /pmc/articles/PMC6266615/
12. Cristina Lins BASTOS E, Maria Wanderley Gusmão BARBOSA E, Moreira Silva SORIANO G, Amorim dos SANTOS E, Mary Lima VASCONCELOS S, Cristina Lins Bastos E. DETERMINANTS OF WEIGHT REGAIN AFTER BARIATRIC SURGERY Fatores determinantes do reganho ponderal no pós-operatório de cirurgia bariátrica. ABCD Arq Bras Cir Dig Original Article. 2013;26(1):26–32.
13. Alfadda AA, Al-Naami MY, Masood A, Elawad R, Isnani A, Ahamed SS, et al. Clinical Medicine Long-Term Weight Outcomes after Bariatric Surgery: A Single Center Saudi Arabian Cohort Experience. 2021; Available from: https://doi.org/10.3390/jcm10214922
14. Cadena-Obando D, Ramírez-Rentería C, Ferreira-Hermosillo A, Albarrán-Sanchez A, Sosa-Eroza E, Molina-Ayala M, et al. Are there really any predictive factors for a successful weight loss after bariatric surgery? BMC Endocr Disord [Internet]. 2020 Feb 5 [cited 2022 May 27];20(1):1–8. Available from: https://bmcendocrdisord.biomedcentral.com/articles/10.1186/s12902-020-0499-4

15. Baheeg M, Tag El-Din M, Labib MF, Elgohary SA, Hasan A. Long-term durability of weight loss after bariatric surgery; a retrospective study. International Journal of Surgery Open. 2021 Jan 1;28:37–40.

16. Cadena-Obando D, Ramírez-Rentería C, Ferreira-Hermosillo A, Albarrán-Sanchez A, Sosa-Eroza E, Molina-Ayala M, et al. Are there really any predictive factors for a successful weight loss after bariatric surgery? BMC Endocr Disord [Internet]. 2020 Feb 5 [cited 2022 Nov 29];20(1):1–8. Available from: https://bmcendocrdisord.biomedcentral.com/articles/10.1186/s12902-020-0499-4

17. Christensen BJ, Schmidt JB, Nielsen MS, Tækker L, Holm L, Lunn S, et al. Patient profiling for success after weight loss surgery (GO Bypass study): An interdisciplinary study protocol. Contemp Clin Trials Commun. 2018 Jun 1;10:121–30.

18. Ansari W el, Elhag W. Weight Regain and Insufficient Weight Loss After Bariatric Surgery: Definitions, Prevalence, Mechanisms, Predictors, Prevention and Management Strategies, and Knowledge Gaps-a Scoping Review. Available from: https://doi.org/10.1007/s11695-020-05160-5

19. Bryant EJ, Malik MS, Whitford-Bartle T, Waters GM. The effects of bariatric surgery on psychological aspects of eating behaviour and food intake in humans. Appetite. 2020 Jul 1;150.

20. Oliveira Magro D, Geloneze B, Delfini R, Contini Pareja B, Callejas F, Carlos Pareja J. Long-term Weight Regain after Gastric Bypass: A 5-year Prospective Study.

21. Liebl L, Barnason S, Brage Hudson D. Awakening: a qualitative study on maintaining weight loss after bariatric surgery. J Clin Nurs [Internet]. 2016 Apr 1 [cited 2022 Feb 14];25(7–8):951–61. Available from: https://onlinelibrary.wiley.com/doi/full/10.1111/jocn.13129

22. Bauchowitz AU, Gonder-Frederick LA, Olbrisch ME, Azarbad L, Ryee MY, Woodson M, et al. Psychosocial evaluation of bariatric surgery candidates: a survey of present practices. Psychosom Med [Internet]. 2005 Sep [cited 2022 Sep 8];67(5):825–32. Available from: https://pubmed.ncbi.nlm.nih.gov/16204445/

23. Behandeling [Internet]. [cited 2022 Feb 14]. Available from: https://www.zgt.nl/aandoening-en-behandeling/onze-specialismen/obesitascentrum/behandeling/

24. Athanasiadis DI, Martin A, Kapsampelis P, Monfared S, Stefanidis D. Factors associated with weight regain post-bariatric surgery: a systematic review. Surg Endosc. 2021 Aug 1;35(8):4069–84.

25. Karmali S, Brar B, Shi X, Sharma AM, de Gara C, Birch DW. Weight recidivism post-bariatric surgery: A systematic review. Obes Surg [Internet]. 2013 Nov 1 [cited 2022 Mar 8];23(11):1922–33. Available from: https://link.springer.com/article/10.1007/s11695-013-1070-4

26. de Vries L. OBESITY RELAPSE AFTER BARIATRIC SURGERY. 2017;

27. Kushner RF, Sorensen KW. Prevention of Weight Regain Following Bariatric Surgery.

28. Shah M, Simha V, Garg A. REVIEW: Long-Term Impact of Bariatric Surgery on Body Weight, Comorbidities, and Nutritional Status. 2006 [cited 2022 Dec 18]; Available from: http://www.

29. Pizato N, Botelho PB, Gonçalves VSS, Dutra ES, de Carvalho KMB. Effect of Grazing Behavior on Weight Regain Post-Bariatric Surgery: A Systematic Review. [cited 2022 Nov 11]; Available from: www.mdpi.com/journal/nutrients

30. Meany G, Conceição E, Mitchell JE. Binge Eating, Binge Eating Disorder and Loss of Control Eating: Effects on Weight Outcomes after Bariatric Surgery. 2013;

31. Istfan NW, Lipartia M, Anderson WA, Hess DT, Apovian CM. Approach to the Patient Approach to the Patient: Management of the Post-Bariatric Surgery Patient With Weight Regain The Patient. J Clin

Endocrinol Metab [Internet]. 2021 [cited 2022 Nov 28];106(1):251–63. Available from: https://academic.oup.com/jcem251

32. Coen PM, Goodpaster BH. A role for exercise after bariatric surgery? Diabetes Obes Metab [Internet]. 2016 Jan 1 [cited 2022 Nov 25];18(1):16–23. Available from: https://onlinelibrary.wiley.com/doi/full/10.1111/dom.12545

33. Nielsen MS, Alsaoodi H, Hjorth MF, Sjödin A. Physical Activity, Sedentary Behavior, and Sleep Before and After Bariatric Surgery and Associations with Weight Loss Outcome. [cited 2022 Nov 11]; Available from: https://doi.org/10.1007/s11695-020-04908-3

34. Ansari W el, Elhag W. Weight Regain and Insufficient Weight Loss After Bariatric Surgery: Definitions, Prevalence, Mechanisms, Predictors, Prevention and Management Strategies, and Knowledge Gaps-a Scoping Review. Available from: https://doi.org/10.1007/s11695-020-05160-5

35. Goldschmidt AB, Crosby RD, Cao L, Pearson CM, Utzinger LM, Pacanowski CR, et al. Contextual factors associated with eating in the absence of hunger among adults with obesity. Eat Behav. 2017 Aug 1;26:33–9.

36. Frayn M, Livshits S, Knäuper B. Emotional eating and weight regulation: a qualitative study of compensatory behaviors and concerns. [cited 2022 Nov 25]; Available from: https://doi.org/10.1186/s40337-018-0210-6

37. Greene G, Bennett J, Schwartz-Barcott D. Perceptions of emotional eating behavior. A qualitative study of college students. 2012 [cited 2022 Nov 11]; Available from: http://dx.doi.org/10.1016/j.appet.2012.09.023

38. Wagener AM, Much K. Eating Disorders as Coping Mechanisms. http://dx.doi.org/101080/875682252010486291 [Internet]. 2010 Jul [cited 2022 Nov 25];24(3):203–12. Available from: https://www.tandfonline.com/doi/abs/10.1080/87568225.2010.486291

39. Engel SG, Crosby RD, Thomas G, Bond D, Lavender JM, Mason T, et al. Ecological Momentary Assessment in Eating Disorder and Obesity Research: a Review of the Recent Literature. 2016; Available from: http://retaine.org/

40. Nicholls W, Devonport TJ, Blake M. The association between emotions and eating behaviour in an obese population with binge eating disorder. Obesity Reviews [Internet]. 2016 Jan 1 [cited 2022 Dec 2];17(1):30–42. Available from: https://onlinelibrary.wiley.com/doi/full/10.1111/obr.12329

41. Levitan RD, Davis C. Emotions and Eating Behaviour: Implications for the Current Obesity Epidemic. [cited 2022 Nov 28]; Available from: http://muse.jhu.edu/journals/utq/summary/v079/79.2.levitan.html

42. Smith KE, Mason TB, Crosby RD, Engel SG, Crow SJ, Wonderlich SA, et al. AFFECT, RESTRAINT, AND BINGE EATING 1 State and trait positive and negative affectivity 1 in relation to restraint intention and binge eating among adults with obesity 2 3. 2017;

43. Evers C, Dingemans A, Junghans AF, Boevé A. Feeling bad or feeling good, does emotion affect your consumption of food? A meta-analysis of the experimental evidence. Neurosci Biobehav Rev. 2018 Sep 1;92:195–208.

44. Mccuen-Wurst C, Ruggieri M, Allison KC. Disordered eating and obesity: associations between binge-eating disorder, night-eating syndrome, and weight-related comorbidities. Ann NY Acad Sci.

45. Razzoli M, Pearson C, Crow S, Bartolomucci A. Stress, overeating, and obesity: Insights from human studies and preclinical models. Neurosci Biobehav Rev. 2017 May 1;76:154–62.

46. Masood A, Alsheddi L, Alfayadh L, Bukhari B, Elawad R, Alfadda AA. Dietary and Lifestyle Factors Serve as Predictors of Successful Weight Loss Maintenance Postbariatric Surgery. 2019; Available from: https://doi.org/10.1155/2019/7295978

47. Singh M. Mood, food, and obesity. 2014; Available from: www.frontiersin.org

48. May J, Andrade J, Kavanagh DJ, Hetherington M. Elaborated Intrusion Theory: A Cognitive-Emotional Theory of Food Craving.

49. Hou F, Xu S, Zhao Y, Lu Q, Zhang S, Zu P, et al. Effects of emotional symptoms and life stress on eating behaviors among adolescents. Appetite. 2013 Sep 1;68:63–8.

50. Reichenberger J, Kuppens P, Liedlgruber M, Wilhelm FH, Tiefengrabner M, Ginzinger S, et al. No haste, more taste: An EMA study of the effects of stress, negative and positive emotions on eating behavior. Biol Psychol. 2018 Jan 1;131:54–62.

51. Heriseanu AI, Hay P, Corbit L, Touyz S. Grazing in adults with obesity and eating disorders: A systematic review of associated clinical features and meta-analysis of prevalence. Clin Psychol Rev [Internet]. 2017 Dec 1 [cited 2022 Oct 25];58:16–32. Available from: https://pubmed.ncbi.nlm.nih.gov/28988855/

52. Carter FA, Jansen A. Improving psychological treatment for obesity. Which eating behaviours should we target? q. 2012 [cited 2022 Nov 28]; Available from: http://www.nwcr.ws

53. Lane B, Szabó M. Uncontrolled, Repetitive Eating of Small Amounts of Food or 'Grazing': Development and Evaluation of a New Measure of Atypical Eating. Behaviour Change [Internet]. 2013 [cited 2022 Oct 25];30(2):57–73. Available from: https://www.academia.edu/4668113/Uncontrolled_Repetitive_Eating_of_Small_Amounts_of_Food_or_Grazing_Development_and_Evaluation_of_a_New_Measure_of_Atypical_Eating

54. Hou R, Mogg K, Bradley BP, Moss-Morris R, Peveler R, Roefs A. External eating, impulsivity and attentional bias to food cues. Appetite. 2011 Apr 1;56(2):424–7.

55. Heriseanu AI, Hay P, Corbit L, Touyz S. Relating goal-directed behaviour to grazing in persons with obesity with and without eating disorder features. [cited 2022 Nov 28]; Available from: https://doi.org/10.1186/s40337-020-00324-1

56. Ford T, Lee H, Jeon MSN M. Social Work in Health Care The emotional eating and negative food relationship experiences of obese and overweight adults. 2017; Available from: https://www.tandfonline.com/action/journalInformation?journalCode=wshc20

57. Conceição EM, Utzinger LM, Pisetsky EM. Eating Disorders and Problematic Eating Behaviours Before and After Bariatric Surgery: Characterization, Assessment and Association with Treatment Outcomes. European Eating Disorders Review [Internet]. 2015 Nov 1 [cited 2022 Oct 25];23(6):417–25. Available from: https://onlinelibrary.wiley.com/doi/full/10.1002/erv.2397

58. Guthrie H, Tetley D, Hill AJ. Quasi-prospective, real-life monitoring of food craving post-bariatric surgery: comparison with overweight and normal weight women. Clin Obes. 2014 Jun;4(3):136–42.

59. Janse Van Vuuren MA, Strodl E, White KM, Lockie PD. Emotional food cravings predicts poor short-term weight loss following laparoscopic sleeve gastrectomy. Br J Health Psychol [Internet]. 2018 Sep 1 [cited 2022 Dec 2];23(3):532–43. Available from: https://onlinelibrary.wiley.com/doi/full/10.1111/bjhp.12302

60. Imperatori C, Innamorati M, Tamburello S, Continisio M, Contardi A, Tamburello A, et al. Gender differences in food craving among overweight and obese patients attending low energy diet therapy: A matched case-control study. Eating and Weight Disorders [Internet]. 2013 Sep 2 [cited 2022 Nov 28];18(3):297–303. Available from: https://link.springer.com/article/10.1007/s40519-013-0054-7

61. CDC. ● ● ● ● ● ● ● ● ● ● ● ● ● ● Lifestyle Coach Facilitation Guide: Post-Core Content Overview.

62. (No Title).

63. Abramson EE, Stinson SG. Boredom and eating in obese and non-obese individuals. Addictive Behaviors. 1977 Jan 1;2(4):181–5.

64. Crockett AC, Myhre SK, Rokke PD. Boredom proneness and emotion regulation predict emotional eating. http://dx.doi.org/101177/1359105315573439 [Internet]. 2015 Apr 22 [cited 2022 Sep 20];20(5):670–80. Available from: https://journals.sagepub.com/doi/abs/10.1177/1359105315573439

65. Zentner M, Tapper K, Moynihan AB, van Tilburg WAP, Igou ER, Wisman A, et al. Eaten up by boredom: consuming food to escape awareness of the bored self. 2015; Available from: www.frontiersin.org

66. Dicker-Oren SD, Gelkopf M, Greene T. The dynamic network associations of food craving, restrained eating, hunger and negative emotions. 2022 [cited 2022 May 25]; Available from: https://doi.org/10.1016/j.appet.2022.106019

67. Ballardini D, Pozzi L, Dapporto · E, Gruber C, Tomba E, Ballardini D, et al. Eating Disorders and Bariatric Surgery. Hidden and Lesser-known Disordered Eating Behaviors in Medical and Psychiatric Conditions [Internet]. 2022 [cited 2022 Dec 1];129–45. Available from: https://link.springer.com/chapter/10.1007/978-3-030-81174-7_12

68. The Evidence Repor t.

69. Goldstein SP, Thomas JG, Vithiananthan S, Blackburn GA, Jones DB, Webster J, et al. Multi-sensor ecological momentary assessment of behavioral and psychosocial predictors of weight loss following bariatric surgery: study protocol for a multicenter prospective longitudinal evaluation. BMC Obes [Internet]. 2018 Nov 5 [cited 2022 Apr 22];5(1). Available from: https://pubmed.ncbi.nlm.nih.gov/30410772/

70. Papies EK, van Stekelenburg A, Smeets MAM, Zandstra EH, Dijksterhuis GB. Situating desire: Situational cues affect desire for food through eating simulations. Appetite. 2022 Jan 1;168:105679.

71. Grilo CM, Shiffman S, Wing RR. Relapse Crises and Coping Among Dieters. J Consult Clin Psychol [Internet]. 1989 [cited 2022 Nov 29];57(4):488–95. Available from: /record/1989-40411-001

72. Carels RA, Hoffman J, Collins A, Raber AC, Cacciapaglia H, O'Brien WH. Ecological momentary assessment of temptation and lapse in dieting. Eat Behav [Internet]. 2001 [cited 2022 Nov 29];2(4):307–21. Available from: https://pubmed.ncbi.nlm.nih.gov/15001025/

73. Story M, Neumark-Sztainer D, French S. Individual and Environmental Influences on Adolescent Eating Behaviors. J Am Diet Assoc. 2002 Mar 1;102(3):S40–51.

74. Fennis BM, Holland RW. Influence of the physical environment on eating behavior [Internet]. [cited 2022 Dec 1]. Available from: https://www.voedingscentrum.nl/Assets/Uploads/voedingscentrum/Documents/Professionals/Pers/Factsheets/English/Factsheet%20invloed%20omgeving%20eetgedrag%20engelse%20versie%20vormgeving%20DEF%20LR.pdf

75. Allison S, Timmerman GM. Anatomy of a binge: Food environment and characteristics of nonpurge binge episodes. Eat Behav. 2007 Jan 1;8(1):31–8.

76. Bauer JM, Nielsen KS, Hofmann W, Reisch LA. Healthy eating in the wild: An experience-sampling study of how food environments and situational factors shape out-of-home dietary success. Soc Sci Med. 2022 Apr 1;299:114869.

77. Edelman B, Engell D, Bronstein P, Hirsch E. Environmental effects on the intake of overweight and normal-weight men. Appetite. 1986 Mar 1;7(1):71–83.

78. Wong LY, Zafari N, Churilov L, Stammers L, Price S, Ekinci EI, et al. Change in emotional eating after bariatric surgery: systematic review and meta-analysis. BJS Open [Internet]. 2020 Dec 2 [cited 2022 Oct 19];4(6):995–1014. Available from: https://academic.oup.com/bjsopen/article/4/6/995/6136124

79. Larson R, Csikszentmihalyi M, Larson R, Csikszentmihalyi M. The Experience Sampling Method. Flow and the Foundations of Positive Psychology: The Collected Works of Mihaly Csikszentmihalyi [Internet]. 2014 Apr 1 [cited 2022 Feb 17];15:21–34. Available from: https://link.springer.com/chapter/10.1007/978-94-017-9088-8_2

80. Csikszentmihalyi M. The Experience of Psychopathology. The Experience of Psychopathology [Internet]. 1992 Mar 19 [cited 2022 Oct 25]; Available from: /record/1992-97728-000

81. Smyth J, Wonderlich S, Crosby R, Miltenberger R, Mitchell J, Rorty M. The use of ecological momentary assessment approaches in eating disorder research. International Journal of Eating Disorders. 2001;30(1):83–95.

82. Heber D, Greenway FL, Kaplan LM, Livingston E, Salvador J, Still C. Endocrine and nutritional management of the post-bariatric surgery patient: an Endocrine Society Clinical Practice Guideline. J Clin Endocrinol Metab [Internet]. 2010 [cited 2022 Oct 26];95(11):4823–43. Available from: https://pubmed.ncbi.nlm.nih.gov/21051578/

83. Endevelt R, Ben-Assuli O, Klain E, Zelber-Sagi S. The role of dietician follow-up in the success of bariatric surgery. Surgery for Obesity and Related Diseases. 2013 Nov 1;9(6):963–8.

84. Spaniolas K, Kasten KR, Celio A, Burruss MB, Pories WJ. Postoperative Follow-up After Bariatric Surgery: Effect on Weight Loss. Obes Surg [Internet]. 2016 Apr 1 [cited 2022 Oct 26];26(4):900–3. Available from: https://link.springer.com/article/10.1007/s11695-016-2059-6

85. Aarts MA, Sivapalan N, Nikzad SE, Serodio K, Sockalingam S, Conn LG. Optimizing Bariatric Surgery Multidisciplinary Follow-up: a Focus on Patient-Centered Care.

86. Parretti HM, Subramanian A, Adderley NJ, Abbott S, Tahrani AA, Nirantharakumar K. Post-bariatric surgery nutritional follow-up in primary care: a population-based cohort study. British Journal of General Practice [Internet]. 2021 Jun 1 [cited 2022 Nov 29];71(707):e441–9. Available from: https://bjgp.org/content/71/707/e441

87. Wheeler E, Prettyman A, Lenhard MJ, Tran K. Adherence to outpatient program postoperative appointments after bariatric surgery. Surgery for Obesity and Related Diseases [Internet]. 2008 Jul 1 [cited 2022 Nov 12];4(4):515–20. Available from: http://www.soard.org/article/S1550728908000749/fulltext

88. Nutrition & Obesity Treatment - Nutrition & Healthcare Alliance [Internet]. [cited 2022 Apr 12]. Available from: https://www.alliantievoeding.nl/en/projects/nutrition-obesity-treatment

89. Voorwaarden voor een operatie in het ZGT Obesitascentrum [Internet]. [cited 2022 Feb 14]. Available from: https://www.zgt.nl/aandoening-en-behandeling/onze-specialismen/obesitascentrum/operatie/voorwaarden-voor-een-operatie/

90. Het multidisciplinaire team van het ZGT Obesitascentrum staat voor u klaar [Internet]. [cited 2022 Mar 2]. Available from: https://www.zgt.nl/aandoening-en-behandeling/onze-specialismen/obesitascentrum/team/

91. Fried M, Yumuk V, Oppert JM, Scopinaro N, Torres A, Weiner R, et al. Interdisciplinary European guidelines on metabolic and bariatric surgery. Obes Surg [Internet]. 2014 Jan [cited 2022 Mar 1];24(1):42–55. Available from: https://pubmed.ncbi.nlm.nih.gov/24081459/

92. Vu T. Design and evaluation of an eHealth application that aims to support bariatric patients with lifestyle changes after bariatric surgery [Internet]. 1. 2021 [cited 2022 Oct 25]. Available from: http://essay.utwente.nl/89334/1/Vu_MA_TNW.pdf

93. Conner TS, Lehman BJ. Getting Started 1 Getting Started: Launching a Study in Daily Life.

94. Palmier-Claus JE, Myin-Germeys I, Barkus E, Bentley L, Udachina A, Delespaul PAEG, et al. Experience sampling research in individuals with mental illness: reflections and guidance. Acta Psychiatr Scand [Internet]. 2011 Jan 1 [cited 2022 Sep 12];123(1):12–20. Available from: https://onlinelibrary.wiley.com/doi/full/10.1111/j.1600-0447.2010.01596.x

95. Panigrahi ER. The Impact of Diet And Psychosocial Factors Post Bariatric The Impact of Diet And Psychosocial Factors Post Bariatric Surgery Surgery. [cited 2022 Dec 1]; Available from: https://digitalcommons.odu.edu/psychology_etds

96. Haedt-Matt AA, Keel PK. Revisiting the affect regulation model of binge eating: a meta-analysis of studies using ecological momentary assessment. Psychol Bull [Internet]. 2011 Jul [cited 2022 Oct 27];137(4):660–81. Available from: https://pubmed.ncbi.nlm.nih.gov/21574678/

97. Ambwani S, Roche MJ, Minnick AM, Pincus AL. Negative affect, interpersonal perception, and binge eating behavior: An experience sampling study. International Journal of Eating Disorders [Internet]. 2015 Sep 1 [cited 2022 Mar 29];48(6):715–26. Available from: https://onlinelibrary.wiley.com/doi/full/10.1002/eat.22410

98. Loh HH, Francis B, Lim LL, Lim QH, Yee A, Loh HS. Improvement in mood symptoms after post-bariatric surgery among people with obesity: A systematic review and meta-analysis. Diabetes Metab Res Rev [Internet]. 2021 Nov 1 [cited 2022 Dec 20];37(8):e3458. Available from: https://onlinelibrary.wiley.com/doi/full/10.1002/dmrr.3458

99. Billing-Bullen G, Nielsen D, Wham C, Kruger R. Enablers and barriers to prevent weight-regain post bariatric surgery – A qualitative enquiry. Eat Behav. 2022 Dec 1;47:101677.

100. Carels RA, Hoffman J, Collins A, Raber AC, Cacciapaglia H, O'Brien WH. Ecological momentary assessment of temptation and lapse in dieting. Eat Behav [Internet]. 2001 [cited 2022 Dec 1];2(4):307–21. Available from: https://pubmed.ncbi.nlm.nih.gov/15001025/

101. Thomas JG, Doshi S, Crosby RD, Lowe MR. Ecological Momentary Assessment of Obesogenic Eating Behavior: Combining Person-Specific and Environmental Predictors. Obesity [Internet]. 2011 Aug 1 [cited 2022 Dec 2];19(8):1574–9. Available from: https://onlinelibrary.wiley.com/doi/full/10.1038/oby.2010.335

102. Wedin S, Madan A, Correll J, Crowley N, Malcolm R, Karl Byrne T, et al. Emotional eating, marital status and history of physical abuse predict 2-year weight loss in weight loss surgery patients. Eat Behav. 2014 Dec 1;15(4):619–24.

103. Smyth J, Wonderlich S, Crosby R, Miltenberger R, Mitchell J, Rorty M. The use of ecological momentary assessment approaches in eating disorder research. International Journal of Eating Disorders [Internet]. 2001 Jul 1 [cited 2022 Dec 2];30(1):83–95. Available from: https://onlinelibrary.wiley.com/doi/full/10.1002/eat.1057

104. Kukk K, Akkermann K. Inhibitory control in eating disorder patients View project Emotion regulation difficulties among female and male binge eaters View project. 2017 [cited 2022 Nov 28]; Available from: http://dx.doi.org/10.1080/10640266.2016.1241058

105. Verhagen SJW, Hasmi L, Drukker M, van Os J, Delespaul PAEG. Use of the experience sampling method in the context of clinical trials. Evid Based Ment Health [Internet]. 2016 Aug 1 [cited 2022 Dec 1];19(3):86. Available from: /pmc/articles/PMC5040762/

106. Devlin MJ, King WC, Kalarchian MA, Hinerman A, Marcus MD, Yanovski SZ, et al. Eating pathology and associations with long-term changes in weight and quality of life in the longitudinal assessment of bariatric surgery study. Int J Eat Disord [Internet]. 2018 Dec 1 [cited 2022 Dec 20];51(12):1322. Available from: /pmc/articles/PMC6876117/

107. Dumas-Mallet E, Button KS, Boraud T, Gonon F, Munafò MR. Low statistical power in biomedical science: a review of three human research domains. R Soc Open Sci [Internet]. 2017 Feb 1 [cited 2022 Dec 1];4(2). Available from: /pmc/articles/PMC5367316/

108. Vachon H, Viechtbauer W, Rintala ; Aki, Myin-Germeys I. Compliance and Retention With the Experience Sampling Method Over the Continuum of Severe Mental Disorders: Meta-Analysis and Recommendations. Available from: https://www.jmir.org/2019/12/e14475

109. Bringmann LF, van der Veen DC, Wichers M, Riese H, Stulp G. ESMvis: a tool for visualizing individual Experience Sampling Method (ESM) data. Qual Life Res [Internet]. 2021 Nov 1 [cited 2022 Dec 1];30(11):3179–88. Available from: https://pubmed.ncbi.nlm.nih.gov/33222049/

110. van Os J, Verhagen S, Marsman A, Peeters F, Bak M, Marcelis M, et al. The experience sampling method as an mHealth tool to support self-monitoring, self-insight, and personalized health care in clinical practice. Depress Anxiety [Internet]. 2017 Jun 1 [cited 2022 Oct 28];34(6):481–93. Available from: https://onlinelibrary.wiley.com/doi/full/10.1002/da.22647

111. Development, adherence, and usability study of ESM for post-bariatric patients. 2018 [cited 2022 Dec 1]; Available from: https://www.getfilecloud.com/blog/2017/11/blockchain-beyond-cryptocurrencies/#.WorjsqjOVPY

112. Marcone MF, Madan P, Grodzinski B. An Overview of the Sociological and Environmental Factors Influencing Eating Food Behavior in Canada. Front Nutr. 2020 Jun 3;7:77.

113. Kirov R, Jiménez-Murcia S, Conceição EM, Li DP, He Q, Chen R, et al. Decision Making Deficits in Relation to Food Cues Influence Obesity: A Triadic Neural Model of Problematic Eating. Frontiers in Psychiatry | www.frontiersin.org [Internet]. 2018;1:264. Available from: www.frontiersin.org

114. Sobal J, Bisogni CA. Constructing Food Choice Decisions. Annals of Behavioral Medicine [Internet]. 2009 Dec 1 [cited 2022 Oct 30];38(suppl_1):s37–46. Available from: https://academic.oup.com/abm/article/38/suppl_1/s37/4569654

115. Furst T, Connors M, Bisogni CA, Sobal J, Falk LW. Food choice: a conceptual model of the process. Appetite [Internet]. 1996 [cited 2022 Oct 30];26(3):247–66. Available from: https://pubmed.ncbi.nlm.nih.gov/8800481/

116. Cook W. The effect of personalised weight feedback on weight loss and health behaviours: Evidence from a regression discontinuity design. Health Econ [Internet]. 2019 Jan 1 [cited 2022 Oct 17];28(1):161–72. Available from: https://onlinelibrary.wiley.com/doi/full/10.1002/hec.3829

117. Hsieh G, Li I, Dey A, Forlizzi J, Hudson SE. Using Visualizations to Increase Compliance in Experience Sampling. 2008;

118. Montastier E, du Rieu MC, Tuyeras G, Ritz P. Long-term nutritional follow-up post bariatric surgery. Curr Opin Clin Nutr Metab Care [Internet]. 2018 Sep 1 [cited 2022 Oct 24];21(5):388–93. Available from: https://journals.lww.com/co-clinicalnutrition/Fulltext/2018/09000/Long_term_nutritional_follow_up_post_bariatric.13.aspx

Appendix A

Flyer

MEER INFORMATIE OVER HET ONDERZOEK

HET DOEL VAN HET ONDERZOEK

Onder bariatrische chirurgie worden alle operaties verstaan die tot doel hebben het gewicht te verminderen. Door het gewichtsverlies zorgen deze operaties meestal voor het verbeteren of voorkomen van gezondheidsproblemen zoals een hoge bloeddruk, gewrichtsklachten en suikerziekte. Voor het bereiken en het behouden van succesvol gewichtsverlies is het belangrijk om uw leefstijl aan te passen en inzicht te krijgen in factoren die van invloed zijn op succesvol gewichtsverlies. Met behulp van een smartphone applicatie is het mogelijk om inzicht te krijgen in emotie en eetgedrag bij patiënten die een bariatrische operatie hebben ondergaan. Wij willen u vragen of u mee wilt doen aan dit onderzoek. De resultaten van dit onderzoek zullen worden gebruikt om in de toekomst de behandeling en begeleiding beter op de individuele patiënt te kunnen afstemmen

HEEFT U VRAGEN BETREFT HET ONDERZOEK OF OVER DE AANMELDING?

DAN KUNT U CONTACT OPNEMEN MET

ROMEE TEN HAGEN

R.D.L.TENHAGEN@STUDENT.UTWENTE.NL

06-38752919

Appendix B

Qualtrics questionnaire and informed consent

Proefpersoneninformatie

Lees deze informatie goed door voordat je verder gaat.

Met deze informatiebrief willen we u vragen of u wilt meedoen aan medisch-wetenschappelijk onderzoek. Meedoen is vrijwillig. Dit onderzoek wordt geleid door Ziekenhuisgroep Twente (ZGT) in Almelo en Hengelo, in samenwerking met student-onderzoeker (onderzoeksleider) R.ten Hagen en arts-onderzoeker E. Kuipers. Daarnaast, wordt het onderzoek ook geleid door de Universiteit van Twente (UT), in samenwerking met scriptiebegeleider Dr. L. Kramer.

U leest hier om wat voor onderzoek het gaat, wat het voor u betekent, en wat de voordelen en nadelen zijn. Het is veel informatie. Wilt u de informatie doorlezen en beslissen of u wilt meedoen? Als u wilt meedoen, kunt u de vragen invullen die u vindt na de proefpersoneninformatie. Voor vragen kunt u terecht bij de onderzoeksleider R.ten Hagen, de contactgegevens staan onder aan deze pagina.

Doel van het onderzoek

Het doel van dit onderzoek is om te voorspellen welke factoren van invloed zijn op het behouden van het verloren gewicht na bariatrische chirurgie. Het verliezen van gewicht na de operatie helpt het verminderen of zelfs laten verdwijnen van gezondheidsproblemen die vaak voorkomen bij patiënten met obesitas, zoals: diabetes, hoge bloeddruk, hart -en vaatziekten of gewrichtsklachten. Wanneer patiënten na bariatrische chirurgie toch weer aankomen in gewicht,

zal dit ook invloed hebben op de bijbehorende gezondheidsproblemen. Voor het bereiken en het behouden van succesvol gewichtsverlies is het belangrijk om uw leefstijl aan te passen en inzicht te krijgen in factoren die van invloed zijn op succesvol gewichtsverlies. Met behulp van een smartphone applicatie is het mogelijk om inzicht te krijgen in emotie en eetgedrag bij patiënten die een bariatrische operatie hebben ondergaan. Wij willen u vragen of u mee wilt doen aan dit onderzoek. De resultaten van dit onderzoek zullen worden gebruikt om in de toekomst de behandeling en begeleiding beter op de individuele patiënt te kunnen afstemmen.

Wat meedoen inhoudt

- U zal gedurende twee weken via een app op de telefoon 6 keer per dag een korte vragenlijst gaan invullen. Deze vragenlijst is altijd hetzelfde en neemt ongeveer 2 minuten in van uw tijd. Deze vragen gaan over emotie, eetgedrag en omgevingsfactoren zoals: waar u bent, met wie u bent en wat u aan het doen bent.
- Als u meedoet aan het onderzoek zal u een app moeten downloaden op uw telefoon, deze app is gratis te downloaden.
- Als u deelneemt aan het onderzoek zal u dezelfde behandeling ontvangen, dan wanneer u niet meedoet aan het onderzoek.
- U hoeft niet vaker naar het ziekenhuis te komen als u meedoet aan het onderzoek.

Potentiële voordelen en nadelen

Voordat u meedoet aan het onderzoek is het belangrijk om de voordelen en nadelen tegen elkaar af te wegen. Zelf haalt u geen direct voordeel uit dit onderzoek. U zorgt voor meer kennis over de emotionele factoren en omgevingsfactoren die mogelijk van invloed zijn op eetgedrag na een maagverkleining. Een nadeel van dit onderzoek kan zijn dat u gedurende twee weken lang

meerdere keren per dag een vragenlijst gaat invullen, om deze last te verminderen duurt het invullen van de vragenlijst slechts enkele minuten.

Vergoeding

U ontvangt voor deelname aan dit onderzoek geen vergoeding.

Vertrouwelijkheid van gegevens

Wij doen er alles aan uw privacy zo goed mogelijk te beschermen. Er wordt op geen enkele wijze vertrouwelijke informatie of persoonsgegevens van of over u naar buiten gebracht, waardoor iemand u zal kunnen herkennen. Voordat onze onderzoeksgegevens naar buiten gebracht worden, worden uw gegevens compleet geanonimiseerd. Dit wordt gedaan door een code te geven aan uw naam en gegevens, waardoor de onderzoeksgegevens niet tot u te herleiden zijn. In een publicatie zullen anonieme gegevens worden gebruikt. De documenten die in het kader van deze studie worden gemaakt of verzameld, worden opgeslagen op een beveiligde locatie bij het ZGT en op de beveiligde (versleutelde) gegevensdragers van de onderzoekers. De onderzoeksgegevens worden bewaard voor een periode van 15 jaar. De onderzoeksgegevens worden indien nodig en alleen in anonieme vorm ter beschikking gesteld aan personen buiten de onderzoeksgroep.

Tot slot is dit onderzoek beoordeeld en goedgekeurd door de ethische commissie van de faculteit ‘Behavioural, Management and Social Sciences’ van de UT en door de adviescommmissie lokale uitvoerbaarheid van ZGT.

Vrijwilligheid

Deelname aan dit onderzoek is geheel vrijwillig. U kunt als deelnemer uw medewerking aan het onderzoek te allen tijde stoppen zonder opgaaf van redenen. Het stopzetten van deelname heeft

geen nadelige gevolgen voor u. Als u tijdens het onderzoek besluit om uw medewerking te staken, zullen de gegevens die tot dat moment zijn verzameld gebruikt worden voor het onderzoek. Wilt u stoppen met het onderzoek, of heeft u vragen en/of klachten? Neem dan contact op met de onderzoeksleider R. ten Hagen.

Uitsluitend ten behoeve van het onderzoek zullen de verzamelde onderzoeksgegevens worden gedeeld met arts-onderzoeker E.Kuipers van Ziekenhuisgroep Twente en Dr. L. Kramer van de Universiteit van Twente.

Vragen

Indien u voor, tijdens of na de studie vragen heeft, kunt u contact op nemen met de onderzoeksleider R. ten Hagen.

- Voor bezwaren met betrekking tot de opzet en of uitvoering van het onderzoek kunt u zich ook wenden tot de Secretaris van de Ethische Commissie / domein Humanities & Social Sciences van de faculteit Behavioural, Management and Social Sciences op de Universiteit Twente via ethicscommittee-hss@utwente.nl. Dit onderzoek wordt uitgevoerd vanuit de Universiteit Twente, faculteit Behavioural, Management and Social Sciences. Indien u specifieke vragen hebt over de omgang met persoonsgegevens kun u deze ook richten aan de Functionaris Gegevensbescherming van de UT door een mail te sturen naar dpo@utwente.nl.

Contactformulier

Romee ten Hagen

06-38752919

r.d.l.tenhagen@student.utwente.nl

Door dit toestemmingsformulier te ondertekenen erken ik het volgende:
1. Ik heb de proefpersoneninformatie gelezen en heb daarna de mogelijkheid gehad vragen te kunnen stellen. Deze vragen zijn voldoende beantwoord. Ik heb genoeg tijd gehad om te beslissen of ik meedoe.

2. Ik neem vrijwillig deel aan dit onderzoek. Het is mij duidelijk dat ik deelname aan het onderzoek op elk moment kan beëindigen zonder dat ik hiervoor een reden hoef te geven. Ik hoef een vraag niet te beantwoorden als ik dat niet wil.

3. Ik geef toestemming om mijn onderzoeksgegevens 15 jaar na afloop van dit onderzoek te bewaren.

U kunt er per onderdeel voor kiezen wel of geen toestemming te geven.
De volgende 3 vragen kunt u toestemming op geven.

U kunt er per onderdeel voor kiezen wel of geen toestemming te geven.
De volgende 3 vragen kunt u toestemming op geven.

Heb je deze informatie goed doorgelezen en geeft u toestemming om mee te doen aan dit onderzoek?

- ○ Ja
- ○ Nee

Vraag 1 *

Ik geef toestemming voor het verzamelen en gebruiken van mijn gegevens voor de beantwoording van de onderzoeksvraag in dit onderzoek.

- ○ Ja
- ○ Nee

Vraag 2 *

Ik geef toestemming om de bij mij verzamelde onderzoeksdata te bewaren en te gebruiken voor toekomstig onderzoek en voor onderwijsdoeleinden.

- ○ Ja
- ○ Nee

Algemene gegevens

Vraag 1 *

Wat is je geslacht?

- ○ Man
- ○ Vrouw
- ○ Zeg ik liever niet

Vraag 2

Welke datum bent u geopereerd?

Maand

Dag

Jaar

Vraag 3

Om je verder te informeren over het onderzoek en te helpen met het installeren van de app op de telefoon, zijn de volgende twee contactgegevens nodig:

Wat is je e-mailadres?

Vraag 4

Wat is je telefoonnummer?

End of Survey

Hartelijk dank dat u geïnteresseerd bent in ons onderzoek.

Na het invullen van deze enquete zal u zo spoedig mogelijk bericht

ontvangen op uw e-mail over het starten van het onderzoek.

Appendix C

Instructions Ethica Data

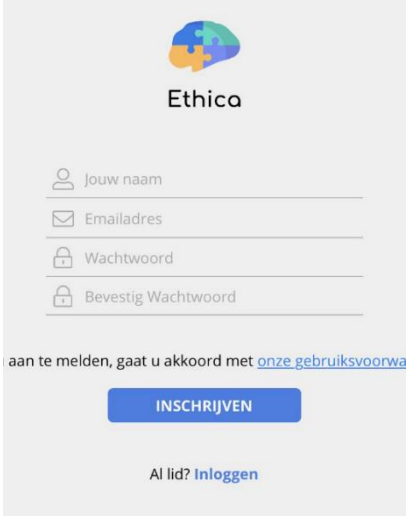
Installeer de applicatie op uw smartphone

1. Ga naar de app store (voor iOS, Apple) of google play store (voor Android) op uw smartphone.
2. Zoek op ‘Ethica’. U herkent de applicatie aan het logo hiernaast.
3. Klik op download. Nu wordt de app geïnstalleerd.

Voor de start van het onderzoek

1. Ga naar de Ethica app. U komt in het beginscherm van de app (zie afbeelding 1).
2. Inschrijven of inloggen:
    a. Heeft u nog geen account? Dan klikt u op ‘inschrijven’. Vervolgens kunt u een account aanmaken door uw naam, emailadres en wachtwoord in te vullen (afbeelding 2). Klik op inschrijven.
    b. Heeft u al een account bij Ethica? Klik op inloggen en vul uw inloggegevens in.
3. Er volgen nu een aantal schermen met korte informatie over Ethica. Op een gegeven moment ziet u het scherm zoals op afbeelding 3.
4. In de balk vult u de 4-cijferige registratiecode in. Deze code is: **2639**. Klik op ‘doe mee met studie’.
5. U ziet het scherm zoals in afbeelding 4. Lees de informatie en klik op ‘registreer’ indien u akkoord gaat met deelname.

6. U ziet een scherm met ‘er staat op dit moment geen vragenlijst voor u klaar’. Indien er een vragenlijst voor u klaar staat krijgt u een melding middels een notificatie en/of



geluidssignaal. U ontvangt de eerste vragenlijst op de eerstvolgende dag nadat u zich heeft aangemeld (dus niet op de dag van de aanmelding).

Afbeelding 1 *Afbeelding 2* *Afbeelding 4*

Afbeelding 3

Instellingen voor het correct ontvangen van meldingen / notificaties

Voor iOS, Apple:

1. Ga naar de app ‘instellingen’ op uw smartphone en tik op ‘berichtgeving’.
2. Ga naar de Ethica app onder ‘meldingsstijl’.
3. Zet ‘sta berichtgeving toe’ aan en zet ‘strookstijl’ op blijvend. Zet ‘geluiden’ en ‘badges’ aan.

Voor Android:

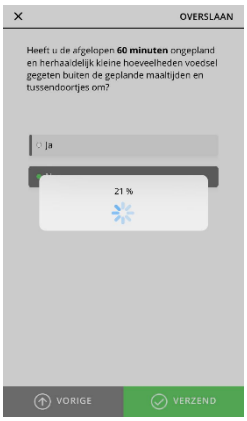
1. Ga naar de app ‘instellingen’ op uw smartphone en tik op ‘apps’.
2. Ga naar de Ethica app en tik op ‘meldingen’.
3. Klik op ‘meldingen toestaan’.

Let op!

- Zorg ervoor dat u uw geluid en meldingen / notificaties aan heeft staan zodat u daadwerkelijk een melding krijgt wanneer er een vragenlijst klaar staat.
- Het kan zijn dat u geen meldingen meer ontvangt wanneer u een aantal vragenlijsten niet heeft ingevuld. Ga naar de app, dan ontvangt u wel weer meldingen.
- Vul de vragenlijst direct in wanneer u een melding krijgt. Na 15 minuten verloopt de vragenlijst, deze kunt u dan niet meer invullen.
- De Ethica app uploadt automatisch de verzamelde gegevens wanneer er een internetverbinding beschikbaar is (mobiel of wifi). Deze instelling kunt u aanpassen door de optie ‘enkel uploaden via wifi’ aan te zetten op het instellingenscherm.

- Na het invullen van de vragenlijst kan het voorkomen dat er op het scherm een icoon staat dat weergeeft dat de app aan het laden is (zie de afbeelding hieronder). Wanneer dit nog steeds in beeld staat als u de volgende keer de app opent, dan kunt u de app afsluiten. Dit doet u als volgt:
    - **Voor iPhone**: Druk snel 2 keer achter elkaar op de thuisknop. Vervolgens veegt u de app over het scherm naar boven.

      Heeft u geen thuisknop? Veeg dan omhoog vanaf de onderzijde van het scherm. Houd even vast ter hoogte van het midden van het scherm. Veeg de app naar boven om deze te sluiten.



    - **Voor Android:** druk de thuisknop een aantal seconden in. Vervolgens kunt u de app naar de linker- of rechterkant van het scherm te vegen. Bij sommige toestellen moet u de app naar boven of onderen vegen.

CONTACTGEGEVENS COÖRDINEREND ONDERZOEKER
Bij vragen of onduidelijkheden kunt u contact opnemen met de onderzoeker.

Naam: Romee ten Hagen
Email: r.d.l.tenhagen@student.utwente.nl

E-mail participants

Geachte heer/mevrouw,

Hartelijk dank dat u geïnteresseerd bent in mijn onderzoek. In de bijlage '**Proefpersoneninformatie**' kunt u lezen over de inhoud van het onderzoek en wat er van u verwacht wordt. Daarna kunt u de bijlage '**Instructies Ethica Data**' openen met de schriftelijke uitleg over de smartphone applicatie en het installeren van de app. Met deze applicatie worden de vragenlijsten afgenomen.

Het is goed u te beseffen dat u kunt starten met het onderzoek wanneer dat voor u het beste uitkomt. Dat werkt als volgt: voer de stappen onder het kopje '*voor de start van het onderzoek*' in de bijlage '**Instructies Ethica Data**' uit één dag voordat u wilt starten met de studie. Wilt u bijvoorbeeld op dinsdag starten, dan registreert u zich op maandag. Zodoende kan u deelnemen aan het onderzoek wanneer u dat wenst.
De vragenlijsten beginnen 1 dag na het registreren.

Ik hoop u hiermee voldoende geïnformeerd te hebben. Bij vragen kunt u contact opnemen met de coördinerend onderzoeker. Contactgegevens zijn te vinden in beide documenten in de bijlagen.

Met vriendelijke groet,

Romee ten Hagen, student-onderzoeker.

Appendix D

Ethica data app

Wat is uw geslacht?

A ID: 1	Man
A ID: 2	Vrouw
A ID: 3	Anders

Q ID: 4 Number

Hoe oud bent u?

Q ID: 5 Single Answer

Welke type maagverkleining heeft u ondergaan?

Hoe vaak heeft u een maagverkleining ondergaan?

A ID: 1 1 keer

A ID: 2 2 keer

A ID: 3 3 keer

Q ID: 7 Calendar

Op welke datum heeft u de (laatste) maagverkleining ondergaan?

Q ID: 8 Mass

Wat was uw gewicht voor de operatie?

Q ID: 9 Mass

Wat is uw huidige gewicht?

Q ID: 10 Length

Wat is uw lengte?

Appendix E

Self-reports

EMOTIE EN EETGEDRAG RONDOM BARIATRISCHE CHIRURGIE, GEMETEN MET EEN SMARTPHONE APPLICATIE

VRAGENLIJST EMOTIE EN EETGEDRAG

1. Hoe was de kwaliteit van uw nachtrust?

Erg slecht										Erg goed
0	1	2	3	4	5	6	7	8	9	10

Omcirkel per uitspraak het cijfer op schaal van 0 t/m 10 dat **op dit moment** het beste bij uw past.
Kies één antwoord.

	Nee										Ja
2. Ik voel me boos / geïrriteerd	0	1	2	3	4	5	6	7	8	9	10
3. Ik voel me angstig / bang	0	1	2	3	4	5	6	7	8	9	10
4. Ik voel me ontspannen / kalm	0	1	2	3	4	5	6	7	8	9	10
5. Ik voel me opgewekt / blij	0	1	2	3	4	5	6	7	8	9	10
6. Ik voel me somber / verdrietig	0	1	2	3	4	5	6	7	8	9	10
7. Ik voel me gespannen / gestrest	0	1	2	3	4	5	6	7	8	9	10
8. Ik verveel me	0	1	2	3	4	5	6	7	8	9	10
9. Ik walg van mezelf	0	1	2	3	4	5	6	7	8	9	10
10. Ik ben moe	0	1	2	3	4	5	6	7	8	9	10
11. Ik heb honger	0	1	2	3	4	5	6	7	8	9	10

12. Met wie ben ik?
- Partner
- Kinderen
- Familie
- Huisgenoten
- Huisdier(en)
- Vriend(en)
- Collega's
- Hulpverleners
- Bekenden
- Onbekenden
- Niemand

13. Wat doe ik?
- Werk
- School
- Huishouden
- Zelfverzorging
- Zorg voor anderen
- Eten, drinken
- Onderweg, reizen

- In gesprek
- Online contact
- Beweging, sport
- Ontspanning
- Rusten
- Niets
- Iets anders

14. Waar ben ik?
- Werk
- School
- Thuis
- Bij iemand thuis
- Winkel
- Café, restaurant
- Sportschool
- Zorgplek
- Onderweg
- Buiten
- Ergens anders

15. Heeft u de afgelopen 30 minuten een verlangen gehad naar een specifiek voedingsmiddel? Hoe sterk was dit verlangen? Kies één antwoord op schaal van 0 t/m 10.

Niet										Erg
0	1	2	3	4	5	6	7	8	9	10

16. Heeft u de afgelopen 60 minuten iets gegeten en / of gedronken wat waarschijnlijk van negatieve invloed is op uw gewicht?
- Ja
- Nee

17. Heeft u de afgelopen 60 minuten ongebruikelijke grote hoeveelheden ongezonde voeding gegeten?
- Ja
- Nee

18. Heeft u de afgelopen 60 minuten ongepland en herhaaldelijk kleine hoeveelheden voedsel gegeten buiten de geplande maaltijden en tussendoortjes om?
- Ja
- Nee

Appendix F

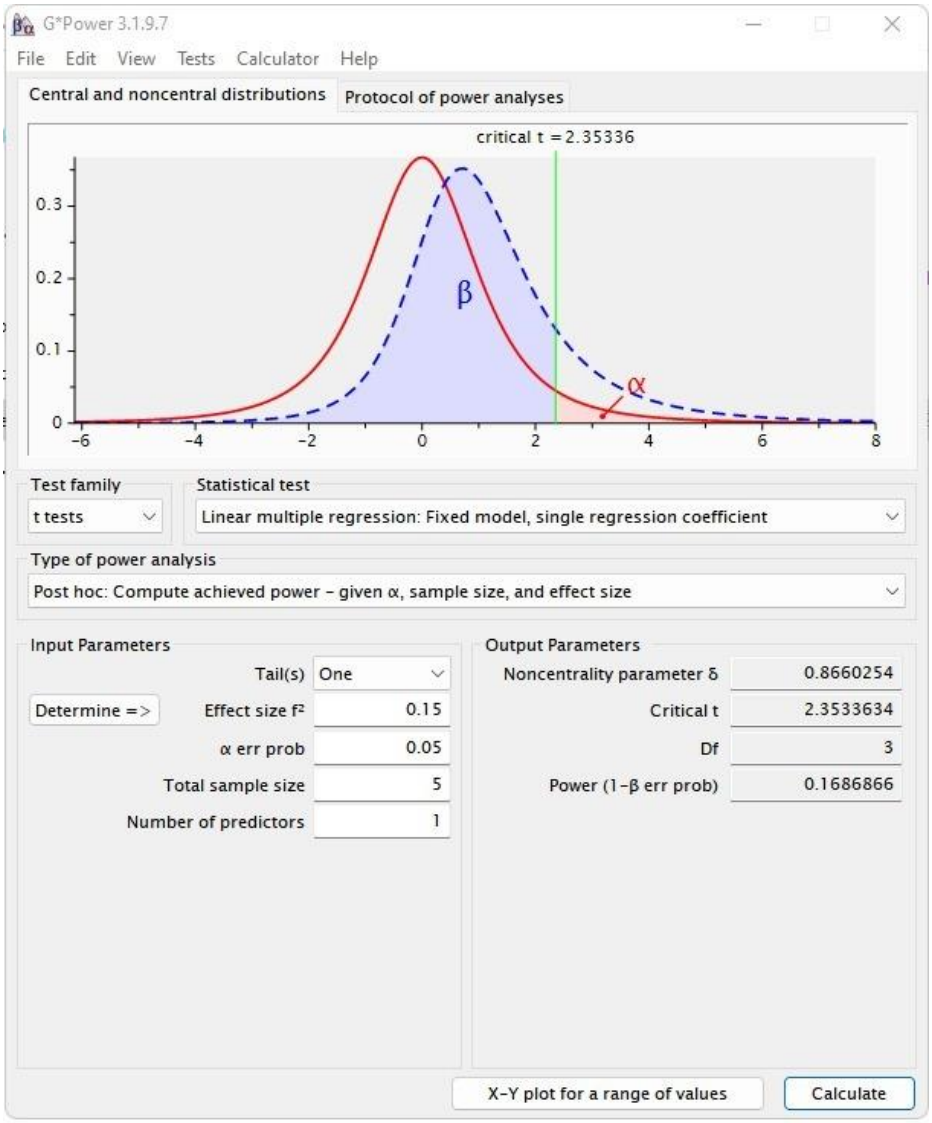
Demographics

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Sex	5	2	2	2.00	.000
Age	5	33	61	48.00	11.314
TypeBariatricSurgery	5	1	3	2.60	.894
CountBariatricSurgery	5	1	1	1.00	.000
WeightBeforeSurgery	5	114.00	122.00	117.4000	3.13050
WeightRightNow	5	62.00	76.00	68.1200	6.66123
Length	5	164.00	176.00	169.8000	4.71169
TimeAfterSurgery	5	1.00	5.00	2.2000	1.78885
BMIbefore	5	38.40	43.10	40.7600	1.68018
BMIafter	5	20.30	27.90	23.7600	3.40265
Valid N (listwise)	5				

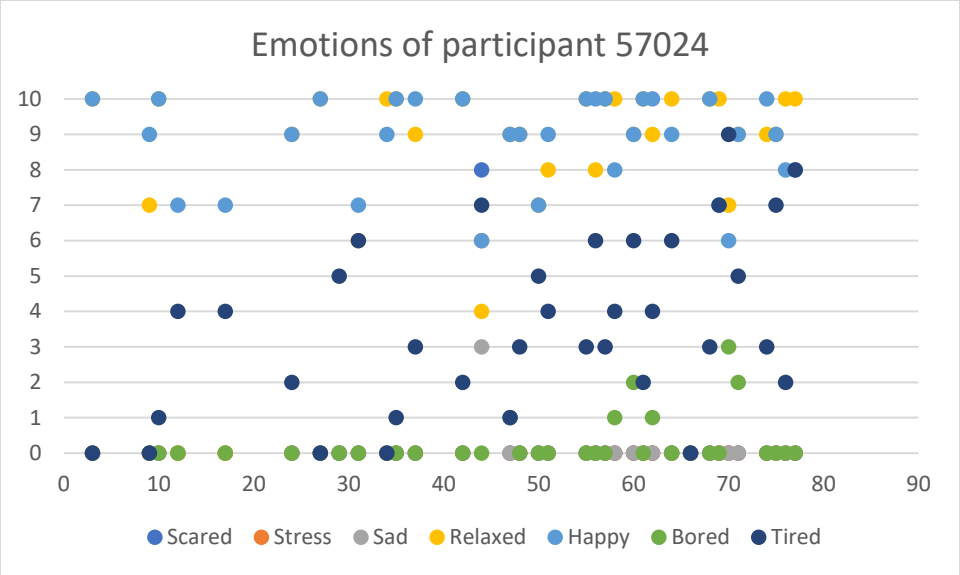
Appendix G

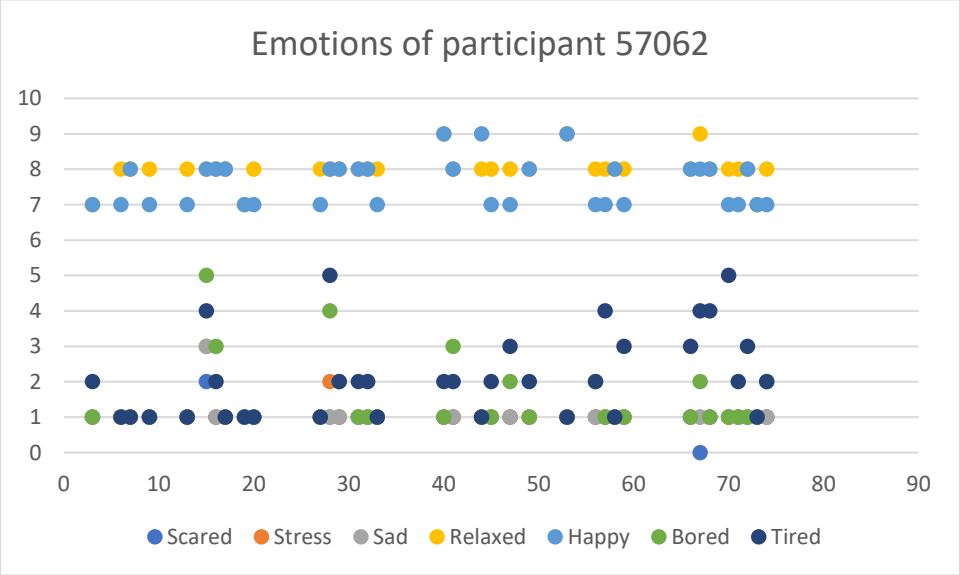
Post-hoc power analysis

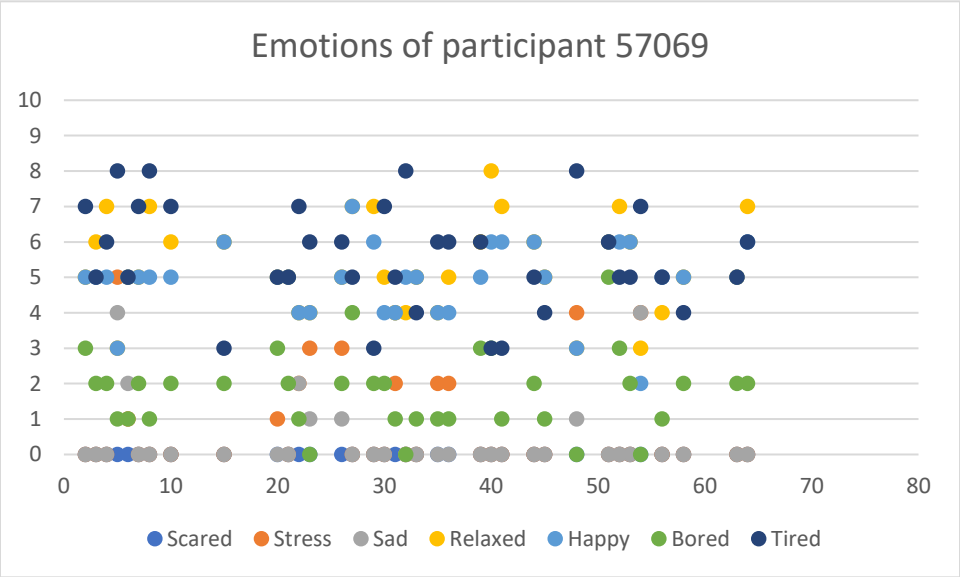


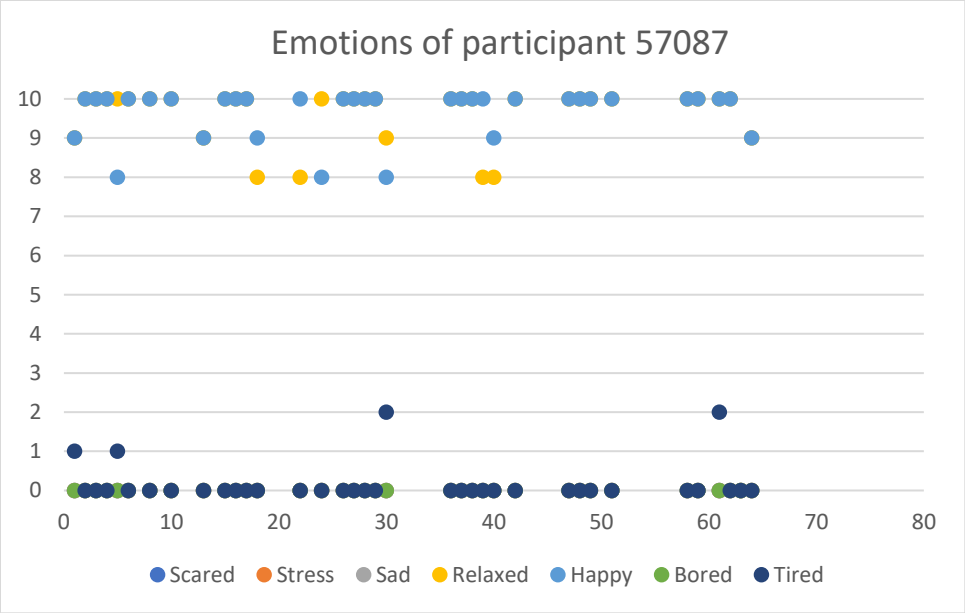
Appendix H

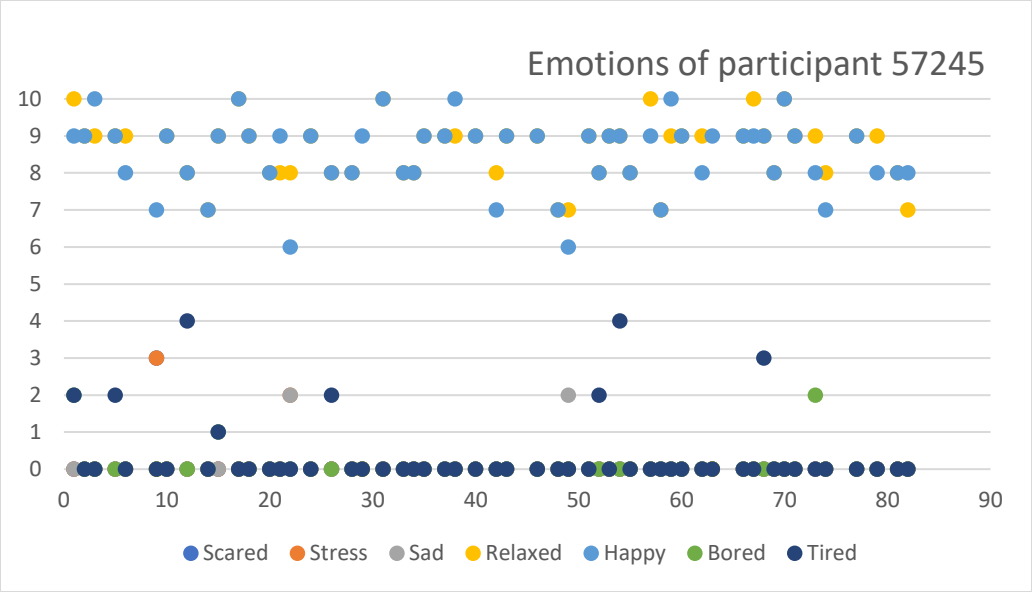
Emotions of participants during the entire study period of 14 days






Emotions of participant 57069
10
9
8
7
6
5
4
3
2
1
0
0
10
20
30
40
50
60
70
80
Scared
Stress
Sad
Relaxed
Happy
Bored
Tired


Emotions of participant 57087
10
9
8
7
6
5
4
3
2
1
0
0
10
20
30
40
50
60
70
80
Scared
Stress
Sad
Relaxed
Happy
Bored
Tired


Emotions of participant 57245
10
9
8
7
6
5
4
3
2
1
0
0
10
20
30
40
50
60
70
80
90
Scared
Stress
Sad
Relaxed
Happy
Bored
Tired