Safety and efficacy of bariatric surgery: Longitudinal Assessment of Bariatric Surgery


aData Coordinating Center, University of Pittsburgh Graduate School of Public Health, Pittsburgh, Pennsylvania
bPresbyterian Medical Center, New York, New York
cUniversity of Pittsburgh Medical Center, Pittsburgh, Pennsylvania
dUniversity of Washington, Seattle, Washington
eNational Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, Maryland
fNeuropsychiatric Research Institute, Fargo, North Dakota
gEast Carolina Medical Center, Greenville, North Carolina
hOregon Health & Science University, Portland, Oregon

Received December 22, 2006; revised January 22, 2007; accepted January 23, 2007

Abstract

Background: Obesity is a leading health concern in the United States. Because traditional treatment approaches for weight loss are generally unsuccessful in the long term, bariatric surgical procedures are increasingly being performed to treat extreme obesity. To facilitate research in this field, the National Institute of Diabetes and Digestive and Kidney Diseases responded to this knowledge gap by establishing the Longitudinal Assessment of Bariatric Surgery (LABS) consortium.

Methods: A competitive National Institute of Diabetes and Digestive and Kidney Diseases grant process resulted in the creation of a group of investigators with expertise in bariatric surgery, internal medicine, endocrinology, behavioral science, outcomes research, epidemiology, biostatistics, and other relevant fields. These investigators have worked closely to plan, develop, and conduct the LABS study. The LABS consortium protocol is a prospective, multicenter observational cohort study of consecutive patients undergoing bariatric surgery at 6 clinical centers. LABS includes an extensive database of information systematically collected preoperatively, at surgery, perioperatively during the 30-day postoperative period, and longer term.

Results: The LABS study has been organized into 3 phases. LABS-1 will include all patients ≥18 years of age who have undergone bariatric surgery by LABS-certified surgeons with the goal to...
Obesity is one of the leading health concerns in the United States. Because traditional treatment approaches for weight loss are generally unsuccessful in the long term [1], bariatric surgical procedures are increasingly being performed to treat extreme obesity. Traditional treatment approaches for weight loss such as diet, exercise, and medications generally achieve no more than a 5–15% reduction in body weight [2,3]. Furthermore, most obese individuals who lose weight return to, or exceed, their baseline weight when followed up for >5 years [1,4]. As a result, bariatric surgical procedures that restrict stomach size or lead to altered absorption of nutrients are increasingly being performed to treat extreme obesity. These procedures often result in significant and sustained weight loss [5] and can have a dramatic effect on the co-morbid conditions associated with obesity [6]. However, it is not clear that short-term improvement in all co-morbid conditions is sustained over time [7]. Bariatric procedures also have considerable short- and long-term risks that must be balanced against these benefits.

The use of bariatric procedures has grown considerably during the past decade. In 1995, fewer than 20,000 bariatric operations were performed. In 2005, 180,000 bariatric procedures were performed, and in 2006, >200,000 procedures were performed (unpublished data: Pories W, estimate by the American Society for Bariatric Surgery, 2006). The factors contributing to such growth include the prevalence of obesity, increase in reports of surgical efficacy, availability of less-invasive procedures, and media exposure of successful bariatric procedures [8]. However, <1% of the 23 million morbidly obese in the United States will undergo a bariatric procedure [8]. One possible explanation for the disparity between potentially eligible patients and the numbers of procedures performed is financial (i.e., patients might not be able to attain insurance coverage or have the ability to pay for a procedure out of pocket). Another potential reason is uncertainty regarding the potential risks and benefits among both patients and referring physicians. This is particularly salient because during the years that bariatric procedures were being developed, they were associated with high complication rates, a failure to lose weight, and a need for frequent reoperations.

In 1991, the National Institutes of Health held a Consensus Development Conference on Gastrointestinal Surgery for Severe Obesity [9], at which time several research questions related to bariatric surgery were posed that have not yet been answered, more than 15 years later. These include a thorough understanding of the safety and efficacy of bariatric surgery and the mechanisms by which the surgery leads to weight reduction and improvements in co-morbid conditions. This knowledge gap stems, in part, from the lack of standardized data collection methods, procedures, and outcomes assessments. A National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK)-sponsored Working Group on Research in Bariatric Surgery, convened in May 2002, advised that a consortium of centers that perform bariatric surgical procedures should be established to develop a database to collect information on clinically important predictors and outcomes that would benefit clinical research and understanding of bariatric surgery and its sequelae [10].

In response, a Request for Applications was released by NIDDK in November 2002 to establish and maintain a Bariatric Surgery Research Consortium, composed of clinical centers and a data coordinating center. The primary focus of this consortium was to support collaborative clinical, epidemiologic, and behavioral research by focusing on the role of bariatric surgery in treating obesity and its complications. The competitive peer-review process resulted in the selection of six clinical centers and one data coordinating center (DCC). As a result, in September 2003, the NIDDK established the Longitudinal Assessment of Bariatric Surgery (LABS) consortium. The researchers in the LABS consortium have expertise in bariatric surgery and obesity, as well as internal medicine, endocrinology, behavioral science, outcomes research, epidemiology, biostatistics, and other relevant fields. These clinical center investigators have worked closely with the DCC, in coop-
eration with the NIDDK scientific staff, to plan, develop, and conduct coordinated clinical, epidemiologic, and behavioral research associated with bariatric procedures.

The participating clinical centers are the University of Pittsburgh Medical Center (Pennsylvania), Columbia University Medical Center and Weill-Cornell University Medical Center (New York), University Health Systems of Eastern North Carolina and East Carolina University (North Carolina), Neuropsychiatric Research Institute (North Dakota), Oregon Health & Science University and Legacy Good Samaritan Hospital (Oregon), and Virginia Mason Hospital and the University of Washington (Washington). The DCC is located at the University of Pittsburgh Graduate School of Public Health. The LABS governing body, or Steering Committee, is composed of the 6 clinical center principal investigators, the DCC principal investigator, and the NIDDK project scientist.

This report explains the rationale, goals, and approach that this consortium has formulated to comprehensively assess bariatric surgical procedures by examining in-depth safety and efficacy, investigating clinically important predictors and outcomes of these procedures, and exploring mechanisms by which surgery leads to weight reduction and health improvements. In addition, the key outcome domains, hypotheses being tested, and research tools studied in LABS are elucidated.

**Rationale for research designs in bariatric surgery**

The 1991 National Institutes of Health Consensus Conference generated several important and unanswered questions. The LABS Steering Committee initially considered several potential study designs to address these questions and determined that, within the constraints of the available time and resources, an observational study was the most efficient means to test a multitude of important hypotheses about bariatric procedures. Hence, LABS included at its core, a multicenter, observational database of prospectively collected detailed patient and operative characteristics, short- and longer term clinical outcomes, and behavioral and health system outcomes. Because relatively little is known about the factors involved in adverse and favorable outcomes in bariatric surgery, a meticulously designed and implemented database that includes substantial data in a variety of content areas was considered necessary to test a multitude of hypotheses. Although randomized clinical trials provide higher order evidence of efficacy than do observational studies, the number of questions that can be addressed by a clinical trial is more limited.

In addition, the context of this decision to favor an observational study over a randomized controlled trial (RCT) was guided by the fact that research in the field of bariatric surgery has been associated with several challenges in the study of operative versus nonoperative treatment for severe obesity, as well as the feasibility, lack of comparable outcomes, and ethical issues. Past RCTs have compared procedures (e.g., vertical banded gastroplasty versus gastric bypass [11]) or surgical techniques (e.g., laparoscopic versus open gastric bypass [12]). However, considerable ethical and compliance barriers exist to a RCT comparing operative and nonoperative approaches to obesity treatment. In 1995, the Swedish Obesity Subjects study, the largest prospective study to date of bariatric surgery, was unable to obtain institutional review board approval for a RCT of bariatric surgery versus medical care because of the known risks and unclear expected benefits of surgical therapy [13]. Randomizing patients who do not have access to bariatric surgery for financial reasons was also considered by the LABS Steering Committee. This option was ruled out because the research funds that would be required to pay for the surgical and medical interventions were not available and the financial incentive of a potentially cost-free operation was judged to represent excessive coercion. Furthermore, in its recent Evidence Report on Pharmacological and Surgical Treatment of Obesity, the Agency for Health Research and Quality stated that the data were considered to be so conclusive regarding the superiority of surgical therapy to existing pharmaceutical and diet therapies in patients with a body mass index (BMI) >40 kg/m² that, in the absence of significant advances in medical therapies, comparative studies were not considered warranted [14]. Given the limited weight loss associated with even the best studies of nonoperative approaches, it would be difficult to recruit extremely obese subjects willing to be randomized and to have equipoise on the part of clinicians [15].

The use of a nonrandomized comparator group that would include people who did not undergo bariatric surgery was also considered. However, several limitations of that approach would make it difficult to interpret the results. These include differences between those who did and did not undergo surgery, including physical and mental health issues, differences in socioeconomic status, and underlying physician or patient motivation, all of which could affect the results and limit the ability to generalize the findings.

Given these difficulties and finite resources, the LABS consortium determined that the high-priority scientific questions could be most efficiently addressed by creating an extensive database to test and to explore hypotheses related to bariatric surgical outcomes. The limitations of such an observational approach were also considered. Optimally, the data should be collected prospectively and in sufficient detail to measure known and currently unknown factors related to outcomes. LABS investigators attempted to standardize the definitions of the data items and data collection procedures. Common protocols were designed to include specific data collection points, data collection instruments, and methods for computerizing data collection, entry, and analysis. Manuals of operations and procedures were created that defined each data element and provided instructions for collection. Data collectors, including study coor-
Overview of LABS goals

The goals of the LABS study are to assess the risks and health benefits associated with bariatric surgery and to identify the aspects of the procedures, as well as patient characteristics, associated with optimal outcomes. To achieve these goals, LABS investigators defined a range of several relevant outcome domains in bariatric surgery. Whenever possible, LABS included objective measures of patient status and co-morbid disease burden. When objective measures of disease (e.g., 24-h pH testing for gastroesophageal reflux) are not feasible, validated and standardized data collection instruments should be used, if available. Investigators sought to identify existing data collection instruments that are psychometrically sound. When validated data collection instruments were not available, LABS investigators created new instruments appropriate for patients undergoing bariatric surgery or adapted questionnaires from other clinical studies.

The LABS study is organized into 3 phases: LABS-1, LABS-2, and LABS-3. LABS-1 includes all patients ≥18 years of age who have undergone bariatric surgery at participating centers by LABS-certified surgeons. The primary goal of LABS-1 is the evaluation of the short-term safety of bariatric surgery. The primary endpoints include important adverse outcomes, such as death and percutaneous or operative reintervention, that occur within 30 days of surgery. A limited data set of the patient and operative characteristics was gathered to describe the frequency of these events in different subgroups and to assess the relationship between adverse outcomes and patient and operative characteristics. The sample size for LABS-1 was selected to be able to obtain precise estimates of safety events (e.g., 30-day mortality) and to have ≥80% power to identify a ≥2-fold increase in the risk of 30-day mortality, reintervention, or deep vein thrombosis/pulmonary embolism between important subgroups (e.g., men versus women, BMI <50 kg/m² versus ≥50 kg/m²) (LABS-1 forms).

The primary goal of LABS-2 is to evaluate the longer term safety and efficacy of bariatric surgery and to more comprehensively evaluate patient characteristics as they relate to short- and intermediate-term outcomes. The sample size for LABS-2, approximately 2400 patients, was determined to be able to detect “small” effect sizes [16] for continuous outcomes (e.g., change in excess body weight), and a ≥2-fold increase or decrease in the incidence or prevalence for categorical efficacy outcomes (e.g., resolution of diabetes). In as much as the LABS study was designed to address multiple hypotheses, many of which are exploratory, adjustments for multiple comparisons did not enter into the sample size calculation. When appropriate for a particular analysis, such adjustments will be considered and implemented. The sample size, which provides adequate statistical power to detect differences in the occurrence of some uncommon events in relatively small subgroups, will be adequate to allow such adjustment when events are more common or the subgroups are larger. To address the aims of LABS-2, the extensive collection of demographic, anthropometric, clinical, behavioral, surgical, and postoperative care variables will be used to determine their associations with the outcomes. The data will be collected before surgery, during surgery, and postoperatively (at the 30-day, 6-months, 1-year, and 2-year follow-up visits).

LABS-3 will involve additional subsets, determined in composition and size by the hypotheses underlying the mechanisms to be studied, of patients from the LABS-2 cohort. One LABS-3 study will measure the psychosocial and behavioral aspects of obesity, such as quality of life, and a second LABS-3 study will examine the mechanisms underlying diabetes resolution. A proposed third LABS-3 study will assess changes in health economic outcomes and resource use. Other aspects of the pathophysiology of obesity and obesity-related diseases will be studied, either through additional substudies or by separately funded ancillary studies approved by the LABS Ancillary Studies Subcommittee (Funded LABS Ancillaries and ASC guidelines).

Approach to define operative procedures

Although several different types of bariatric procedures exist, the Roux-en-Y gastric bypass (RYGB) is the most commonly performed in the United States [17]. The restrictive laparoscopic adjustable gastric band is increasingly used in the United States [18]. Biliopancreatic diversion (BPD), with or without the duodenal switch, has also increased in use. Finally, some LABS centers perform a planned 2-stage procedure in very high-risk, extremely obese patients in which a BPD or BPD plus duodenal switch follows an initial gastric sleeve. Widespread variability exists among surgeons in the ways in which RYGB and BPD are performed. Different approaches to the size of the gastric pouch, length of the alimentary limb, method of anastomotic construction, and extent of nerve interruption of the
stomach might or might not have important roles in the postoperative outcomes. Thus, any data gathering project in bariatric surgery that aims to link procedural characteristics with outcomes must acknowledge such variability and either standardize the intervention or measure it with enough detail to assess and analyze the variation. The LABS study elected the latter approach and will measure each aspect of this variation in detail.

Although the placement of the laparoscopic adjustable gastric band is more standardized, the methods and strategies for postprocedural band adjustment also vary considerably among practitioners. This is particularly important for postprocedural interventions in the laparoscopic adjustable gastric band because it has been demonstrated that the adjustments (rather than the band alone) are the key to effective weight loss [19]. This could also be relevant for RYGB and BPD, for which behavioral and dietary interventions before and after the procedure could have important effects on the outcome. If unmeasured, the impact of these pre-, peri-, and postprocedural components of bariatric surgery might inappropriately be ascribed to the procedure itself. The LABS study will not standardize the surgical procedures or pre- or postoperative care, per se, but rather will attempt to measure and then describe this variability through strictly defined and enforced/audited data collection and analysis.

Approach to assessing outcome domains in bariatric surgery

The short- and longer term risks of bariatric surgery differ with aspects of the procedure [20] and in relation to patient characteristics, such as age, gender, and co-morbidities [9,21,22]. A complete assessment of bariatric surgery involves ascertaining its impact on patient health, wellbeing, quality of life, and healthcare use. For descriptive purposes, the LABS investigators have clustered outcomes into “safety” and “nonsafety” domains. The terminology involved in describing untoward events has been problematic within the field of bariatric surgery. Anastomotic complications are of primary interest in RYGB and BPD procedures. However, no definitions have been universally accepted [23]. To assess which anastomotic complications clinicians consider clinically significant, LABS investigators developed a measurement scheme to record all percutaneous or operative reinterventions and the details of the presumed and confirmed reasons. For standardization, the LABS study has an Adjudication Committee that will review and classify all deaths and those reoperations and unplanned postdischarge anticoagulation therapies for which the reason could not be confirmed.

The limited data set of LABS-1 was designed to describe the frequency of interventions or hospitalizations occurring within 30 days after bariatric surgery and the factors associated with those events and with death. The duration of the postprocedure surveillance for important adverse outcomes determines the number and types of events identified. Administrative claims have demonstrated that data analyses considering only in-hospital mortality miss approximately 50% of the deaths within 30 days of gastric bypass [21]. The appropriate window to describe a postoperative event remains unclear. By convention, events occurring within 30 days postoperatively are considered surgically related.

The LABS-2 data set was designed to measure and evaluate longer term outcomes and to evaluate the efficacy of bariatric surgery. Key groups of nonsafety outcomes for LABS-2 include (but are not limited to) weight loss, changes in body composition, functional impairment, psychosocial function (including quality of life), and cardiovascular, metabolic, pulmonary, renal, musculoskeletal, urogynecologic, reproductive, and gastrointestinal outcomes.

Risk stratification

Risk stratification is a useful tool to put safety measures into context. Currently, no evidence-based scheme for risk stratification in bariatric surgery has been accepted. Acquiring the broad evidence base to support the development of such a risk stratification tool is one of the goals of the LABS study. Administrative claims and case series data suggest that older patients and men have a greater risk of perioperative death than do younger patients and women, respectively [22,24]. However, little is known about other patient or procedural factors that relate to outcomes. LABS-1 and LABS-2 will study the extent to which patient demographic characteristics, BMI, co-morbid conditions, medication use, and physiologic status relate to these outcomes. From this evidence base of associated factors, LABS investigators plan to provide the evidence and elements for a meaningful risk stratification/adjustment strategy. Because many poor surgical outcomes are relatively infrequent events, a large study cohort is necessary to define a risk stratification scheme.

LABS-1 is testing the following risk assessment hypotheses: that men have greater rates of percutaneous or operative reintervention and 30-day mortality than do women; that a greater BMI is associated with greater rates of venous thromboembolism, percutaneous or operative reintervention, and 30-day death; and that wound infection is more common among open than among laparoscopic procedures. Furthermore, the severity of the various co-morbidities, collected for all participants in LABS-1, will be examined for association with poor outcomes (LABS-1 Pre-Operative form). LABS-2 includes more detailed measures of severity than LABS-1, and the analyses will help determine whether they are more predictive of events than the less-detailed measures used in LABS-1. Other hypotheses to be tested in LABS-2 include whether other, more detailed, patient fac-
Table 1

<table>
<thead>
<tr>
<th>Outcome domains in bariatric surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight loss and body composition</td>
</tr>
<tr>
<td>Diabetes mellitus and insulin resistance</td>
</tr>
<tr>
<td>Cardiovascular and pulmonary disease</td>
</tr>
<tr>
<td>Renal disease</td>
</tr>
<tr>
<td>Liver function</td>
</tr>
<tr>
<td>Behavioral/psychosocial factors</td>
</tr>
<tr>
<td>Musculoskeletal and functional status</td>
</tr>
<tr>
<td>Gender issues</td>
</tr>
<tr>
<td>Nutrient deficiencies</td>
</tr>
<tr>
<td>Economic impact</td>
</tr>
</tbody>
</table>

tors and characteristics of the surgical procedure (surgical procedural components) are related to outcome.

**Outcome domains in bariatric surgery**

The outcome domains studied in LABS-2 and described below are listed in Table 1. This comprehensive evaluation of outcomes resulted from the consortium’s collaborative efforts in structuring a thorough, yet feasible and standardized, database. Table 2 outlines the standard forms and measures used in LABS-2 to assess each of these domains, as well as the contact points at which they should be administered. Even more detailed information on each of these outcome domains, along with the definitions and specific measures used can be found on the links within Table 2 or, if applicable, the text of this report.

**Weight loss and body composition**

The primary intent of bariatric procedures is to induce weight loss by limiting intake and to promote behavioral changes in the overall energy balance that result in significant and sustained decreases in weight. LABS-2 will measure the patients’ weight at each of the annual follow-up visits using a standard scale (Tanita model TBF-310H01A). The LABS investigators have hypothesized that men will experience greater weight loss than women and that a direct relationship will be found between physical activity and weight loss at the follow-up intervals. We have also hypothesized that diabetic patients will lose less weight and that a longer length of bypassed limb in gastric bypass surgery is associated with greater weight loss maintenance [25,26] (LABS Physical Measurements Protocol).

**Diabetes mellitus and insulin resistance**

Type 2 diabetes mellitus, the metabolic syndrome, and the insulin resistance syndrome are common metabolic comorbidities of obesity. Many case series have demonstrated significant and sustained improvements in these parameters after weight loss procedures [6], but the measures of these parameters in large cohorts have been limited. LABS-2 will evaluate the longer term efficacy of bariatric surgery with respect to type 2 diabetes mellitus according to the clinical history of medication use and serial measurements of fasting blood glucose and hemoglobin A1c levels. Assessing the efficacy for preventing or resolving the metabolic syndrome and insulin resistance syndrome will be done using fasting glucose levels, insulin levels, lipoprotein profiles, resting blood pressure, and waist circumference. We have hypothesized that the improvement in type 2 diabetes mellitus, metabolic syndrome, and insulin resistance syndrome will be related to the degree of weight loss, degree of loss of fat mass, and level of physical activity at follow-up [27,28].

**Cardiovascular and pulmonary disease**

Obesity is a major risk factor for cardiovascular diseases and obstructive sleep apnea, which have been increasingly recognized in patients with extreme obesity [6,29–34]. The prevalence of sleep apnea and changes from baseline status will be assessed by self-report using the Berlin Sleep Questionnaire [35] and the reported use of positive airway pressure devices. We have hypothesized that weight loss and reductions in neck circumference will be associated with improvements in sleep apnea. To assess the efficacy of bariatric surgery to reduce the risk of cardiovascular disease, LABS-2 will measure C-reactive protein, lipoprotein profiles, resting blood pressure, and waist circumference and determine the clinical history of medication use. We have hypothesized that improvement in cardiovascular diseases risk factors will be related to the magnitude of weight loss, loss of fat mass, and lower BMI postoperatively [36]. Furthermore, changes in cardiac function will be measured by the time needed to complete a 400-m corridor walk, with the hypothesis that changes will be related to age, BMI, gender, and other factors.

**Renal disease**

Obesity causes and complicates diabetes and hypertension, the 2 most common causes of kidney failure [37]. In addition, several mechanisms exist by which obesity may independently and negatively affect renal function, including adipogenic hormones that could have direct injurious actions on the kidney [38]. However, bariatric surgery itself has been associated with progressive renal disease through a variety of mechanisms [39] and might also contribute to the development of renal calculi. For these reasons, LABS-2 will evaluate renal function by measuring serum creatinine and cystatin and urinary albumin and creatinine, and will assess the prevalence of diagnosed nephrolithiasis at baseline and follow-up. The LABS investigators have hypothesized that albuminuria will diminish after successful bariatric surgery and that renal function as measured by serum creatinine will remain stable after successful surgery.

**Liver function**

Another problem of growing public health concern is the increased prevalence of nonalcoholic fatty liver disease in
Table 2
Standard forms and measures used in Longitudinal Assessment of Bariatric Surgery-2

<table>
<thead>
<tr>
<th>LABS-2 Form Name/Details*</th>
<th>Baseline</th>
<th>Baseline Update</th>
<th>Time of Discharge</th>
<th>30-days Followup</th>
<th>6-mo. Followup</th>
<th>12-mo/Annually</th>
</tr>
</thead>
<tbody>
<tr>
<td>400-Meter Eligibility Form [<a href="http://www.edc.gsph.pitt.edu/labs/Public/LABS-1DescriptionPaper/LABS2MeterEligibilityForm.pdf">http://www.edc.gsph.pitt.edu/labs/Public/LABS-1DescriptionPaper/LABS2MeterEligibilityForm.pdf</a>]</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>400-Meter corridor walk form [<a href="http://www.edc.gsph.pitt.edu/labs/Public/LABS-1DescriptionPaper/400MeterDataCollectionForm.pdf">http://www.edc.gsph.pitt.edu/labs/Public/LABS-1DescriptionPaper/400MeterDataCollectionForm.pdf</a>]</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>6-month Follow-up Form [<a href="http://www.edc.gsph.pitt.edu/labs/Public/LABS-1DescriptionPaper/6monthFollowupQuestions.pdf">http://www.edc.gsph.pitt.edu/labs/Public/LABS-1DescriptionPaper/6monthFollowupQuestions.pdf</a>]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Questions from Goals and Relative Weights Questionnaire (GRWQ) [<a href="http://www.edc.gsph.pitt.edu/labs/Public/LABS-1DescriptionPaper/BehaviorBaseline.pdf">http://www.edc.gsph.pitt.edu/labs/Public/LABS-1DescriptionPaper/BehaviorBaseline.pdf</a>]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Questionnaire on Eating/Weight Patterns (QEWPP) [<a href="http://www.edc.gsph.pitt.edu/labs/Public/LABS-1DescriptionPaper/BehaviorBaseline.pdf">http://www.edc.gsph.pitt.edu/labs/Public/LABS-1DescriptionPaper/BehaviorBaseline.pdf</a>]</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Alcohol use (AUDIT) [<a href="http://www.edc.gsph.pitt.edu/labs/Public/LABS-1DescriptionPaper/BehaviorBaseline.pdf">http://www.edc.gsph.pitt.edu/labs/Public/LABS-1DescriptionPaper/BehaviorBaseline.pdf</a>]</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Beck Depression Inventory (BDI)**</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Short Form Health Survey (SF-36) [<a href="http://www.edc.gsph.pitt.edu/labs/Public/LABS-1DescriptionPaper/SF36.pdf">http://www.edc.gsph.pitt.edu/labs/Public/LABS-1DescriptionPaper/SF36.pdf</a>]</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Work Productivity and Activity Impairment (WPAI:GH)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
obese populations [40] and the growing identification of nonalcoholic fatty liver disease when evaluated by liver biopsy in patients undergoing a bariatric surgical procedure [41]. Limited data are available defining the prevalence and severity of nonalcoholic steatohepatitis, as assessed by intraoperative liver biopsy, in extremely obese persons undergoing bariatric surgery, although nonalcoholic steatohepatitis is an increasingly recognized cause of “cryptogenic” cirrhosis [42]. We have hypothesized that the prevalence and severity of nonalcoholic steatohepatitis has been underestimated by traditional clinical measures and that liver disease severity will correlate with short-term postoperative morbidity. We have also hypothesized that increased liver size at surgery will be associated with a greater rate of failed laparoscopic approaches to bariatric procedures.

Behavioral/psychosocial factors

Evidence has suggested that pre-existing psychological and behavioral factors could influence the outcomes after bariatric surgery [43]. Thus, patients who have active, untreated substance abuse, binge eating, or depression at baseline could experience greater rates of postoperative medical complications and less weight loss [44,45]. Conversely, those subjects who intentionally lose weight before surgery will be more likely to achieve greater weight loss in the short- and longer term [46]. Behavioral measures will be assessed at baseline and follow-up and will include questions on preoperative weight loss practices and eating patterns (including binge eating and eating beyond satiation), tobacco and alcohol use, history of psychiatric disorders, and counselor/therapist contact. Depressive symptoms will be assessed using the Beck Depression Inventory, version 1 [47]. Objective measures of physical activity will be assessed using the STEPWATCH 3 Step Activity Monitor (www.cymatech.com) at baseline and follow-up visits.

Musculoskeletal and functional status

Osteoarthritis, either caused or aggravated by obesity, is a major limiting co-morbid condition among the population of patients undergoing bariatric surgery. Functional limitations resulting from back, hip, and knee joint degeneration is a leading cause of functional decline, use of durable medical goods (e.g., wheelchairs, walkers, electric scooters) and impaired quality of life. LABS investigators will test the hypothesis that patients’ functional status will improve with surgery and that the extent of improvement will be associated with the degree of weight loss. In addition, we will investigate whether functional limitations before surgery are linked to poor outcomes after the bariatric procedure. Functional status will be assessed in the LABS study through a combination of self-reports (e.g., walking ability, use of assistance devices), as well as a timed corridor walk.

Gender issues

Obesity affects all aspects of well-being, including those that are gender specific. Also, potential gender differences exist in the longer term efficacy of bariatric surgery. For example, obesity is a known risk factor for several health conditions specific to, and prevalent among, women, such as menstrual abnormalities, infertility [48], and urinary incontinence [49]. We have hypothesized that menstrual abnormalities, fertility, urinary incontinence, and symp-
toms of polycystic ovarian diseases will improve after bariatric surgery. These will be assessed using several questionnaires.

**Nutrient deficiencies**

Another potential long-term risk of bariatric surgery is nutrient deficiency [50]. LABS-2 will be able to investigate micro- and macronutrient deficiencies stratified by surgical procedure (hypothesizing more frequent occurrences with malabsorptive procedures) [25,51] and by various components of surgery such as Roux limb length and pouch size. Plasma and serum samples will be stored in a specimen repository for future analysis of macro- and micronutrients.

**Economic impact**

Workers who are obese have a high prevalence of work limitations [52] and severe obesity increases the number of work loss days and is an important factor in the workplace [53,54]. The effects of weight loss surgery on productivity at work, absenteeism, and presenteeism are not well studied. LABS will administer several validated questionnaires to assess this impact, including the Work Productivity and Activity Impairment form, version 2.0 [55]. We have hypothesized that patients undergoing surgery will lose fewer days of work and that productivity at work will improve after surgery.

**Biospecimens**

Blood and urine specimens will be obtained from LABS-2 participants at baseline and postoperatively at 6 and 12 months and annually thereafter. Aliquots of whole blood, plasma, and serum will be banked in the NIDDK Biospecimens Repository for future investigations into factors such as changes in metabolic parameters and markers of risk. An additional quantity of whole blood will be drawn to be used for future DNA analysis, with appropriate consent obtained. These specimens will be a major resource for funded, LABS-associated ancillary studies. Non-LABS investigators will also be able to request access to these biospecimens through application by way of the LABS ancillary studies process.

**Conclusion**

The goal of the LABS consortium is to accelerate clinical research and progress in understanding the pathogenesis of extreme obesity and its complications, as well as in understanding the risks and benefits of bariatric surgery as a treatment modality. Through the use of standardized definitions, high-fidelity data collection, and the use of validated measurement instruments, LABS investigators aim to enhance the ability of clinicians to provide meaningful evidence-based recommendations for patient evaluation, selection for surgery, and follow-up care.

Extreme obesity affects nearly every organ system and many aspects of the human experience. A comprehensive assessment of surgical treatments for obesity must assess multiple facets in as objective a manner as possible. At present, no multisite data sets are available that capture comprehensive predictors and outcomes of bariatric surgery with fidelity. The data being collected by the LABS, and described in this report and on the LABS website, should help to provide researchers with standardized measurement instruments that can be used across centers. LABS investigators hope to provide evidence to assess the broad impact of these operations on patients and the healthcare system. Future reports will detail the results and progress in these areas.

**Appendix**

The LABS personnel contributing to the study included Paul D. Berk, M.D. (Principal Investigator), Marc Bessler, M.D. (Co-Investigator), Dan Davis, D.O. (Co-Investigator), W. Barry Inabnet, M.D. (Co-Investigator), Amna Daud, M.D., M.P.H. (Coordinator), and Munira Kassam (Data Manager) at Columbia University Medical Center, New York, NY; Columbia Campus; Michel Gagner, M.D. (Co-Investigator), Alfons Pomp, M.D. (Co-Investigator), Greg Dakin, M.D. (Co-Investigator), Faith Ebel (Coordinator), Gladys Strain, Ph.D. (Coordinator), Alex Broseus (Data Manager) at Cornell University Medical Center, New York, NY; William Chapman, M.D., F.A.C.S., Lynis Dohm, Ph.D., Dwan Finch, R.N., Kenneth MacDonald, M.D., F.A.C.S., and Walter Pories, M.D., F.A.C.S. at East Carolina Medical Center, Greenville, NC; James E. Mitchell, M.D. (Principal Investigator), Michael Howell, M.D. (Investigator), Tim Monson, M.D. (Investigator), Kathy Lancaster, B.A. (Research Coordinator), and Justin Boseck, B.A. (Research Assistant) at Neuropsychiatric Research Institute, Fargo, ND; Bruce M. Wolfe, M.D. (Principal Investigator), Clifford Deveney, M.D. (Co-Investigator), Jonathan Purnell, M.D. (Co-Investigator), Donald McConnell, M.D. (Surgical Investigator), Robert O’Rourke, M.D. (Surgical Investigator), Stefanie Green (Research Coordinator), Chad Sorenson (Research Coordinator), Milena Petrovic (Research Coordinator), and Robyn Lee (Data Manager) at Oregon Health & Science University; Emma Patterson, M.D. (Co-Investigator), Dennis Hong, M.D. (Co-Investigator), Jay Jan, M.D. (Co-Investigator), and Amy Free (Research Coordinator) at Legacy Good Samaritan Hospital, Portland, OR; Iselin Austrheim-Smith, C.C.R.P. (Research Coordinator), Laura Machado, M.D. (Surgical Investigator) at Sacramento Bariatric Medical Associates, Sacramento, CA; Anita P. Courcoulas, M.D., MPH, F.A.C.S. (Principal Investigator), David E. Kelley, M.D. (Co-Investigator), Lewis H. Kuller, M.D., Dr.P.H. (Co-Investigator), William Gourash, M.S.N., C.R.N.P. (Research Coordinator), and Joelle M. Kidder, B.S. (Research...
Disclosures

Dr. Courcoulas is a consultant for KCI, Inc., Stryker, U.S. Surgical, Inc. (Tyco Health), and GNC (General Nutrition Corporation)—paid consultant. Dr. Pories is a member of the speakers’ bureau, a consultant for, and is a recipient of a research grant and meeting expenses reimbursement from Ethicon Endosurgery (Johnson & Johnson, Inc.), receives meeting expense reimbursement from U.S. Surgical, Inc. (Tyco Health, Inc.), and is the Chairman of the Board of Directors of and receives meeting expense reimbursement from the Surgical Review Corporation.

References


