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Title: The Role of Metabolic and Bariatric Surgery on the Obesity Pandemic in Latin America: A Review of Current Practices and Future Directions.

Authors: Luis D Castellanos[1] (ORCID: 0009-0006-6243-0999), Paola Anselmetti[1], Arnaldo Acosta[2], Daniel Tomey[3], Robert Araujo-Contreras[4], Emiro Puche[5], Steven Elzein[3], Yitka Graham[6], Kamal Mahawar[7], Skye Marshall[8], Adel Abou-Mrad[9], Rodolfo J. Oviedo[10,11,12] (ORCID: 0000-0003-3784-6555).

Affiliations

1. *Universidad del Zulia, School of Medicine, Venezuela.*
2. *Universidad de los Andes, School of Medicine, Venezuela.*
3. *Department of Surgery, Houston Methodist Hospital, Houston, TX.*
4. *Department of Neurology, Boston Medical Center, Boston, MA, USA.*
5. *Universidad Francisco de Miranda, School of Medicine, Venezuela.*
6. *Helen McArdle Nursing and Care Research Institute, Sunderland, UK.*
7. *Department of Surgery, University of Sunderland, Sunderland, UK.*
8. *Research Institute for Future Health, Gold Coast, Queensland Australia; Bond University Nutrition and Dietetics Research Group, Bond University, Gold Coast, Queensland, Australia; and Centre for Health Services Research, The University of Queensland, Brisbane, Queensland, Australia.*
9. *Centre Hospitalier Universitaire d'Orléans, Loire, France.*
10. *Nacogdoches Center for Metabolic & Weight Loss Surgery, Nacogdoches, TX, USA.*
11. *Department of Surgery, University of Houston Tilman J. Fertitta Family College of Medicine, Houston, TX, USA.*

12. Department of Surgery, Sam Houston State University College of Osteopathic Medicine, Conroe, TX, USA.

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Correspondence: Planta Alta. Sector Paraíso Final Av. 20 al lado de la Maternidad Castillo Plaza Apartado Postal 15131, Maracaibo, Zulia, Venezuela. Email: luiscastellanos_1309@hotmail.com.

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Abstract

Latin America faces a significant public health challenge due to the high prevalence of obesity and its associated diseases. Metabolic and bariatric surgery is effective and safe to treat obesity when other treatments fail; however, its implementation in Latin America remains unsatisfactory. This review explores the current status, challenges, and innovations of metabolic and bariatric surgery in Latin America. We searched peer-reviewed journals in English and Spanish for relevant articles published between 1998 and 2023. We found that more than 20% of the Latin American population is affected by obesity. Unfortunately, only a limited number of patients have access to metabolic and bariatric surgery due to high cost, limited availability, and shortage of specialists. The review found that ongoing clinical trials are being conducted in Brazil, Mexico, Chile, and Venezuela, indicating some regional progress. However, published studies remain low in number compared with other regions. Furthermore, we summarized the clinical outcomes, risks, and perioperative assessments associated with metabolic and bariatric surgery. We discussed potential strategies to

enhance the availability and affordability of this intervention. This review emphasizes the significance of metabolic and bariatric surgery in addressing the obesity pandemic, specifically for Latin America, and proposes directions for future research and innovation.

Introduction:

Latin America (LA) is currently grappling with a significant burden of childhood and adult obesity, posing substantial economic and social costs[1]. While several non-surgical alternatives exist, metabolic and bariatric surgery (MBS) is now considered the preferred approach for treating obesity in adults when indicated. When combined with exercise, physical therapy, lifestyle behavior modification, dietary changes, and psychological support, MBS has demonstrated superior outcomes in terms of weight loss and the management of obesity-related diseases[2].

MBS has undergone significant development and innovation in LA, particularly Brazil, which has been a leader in the field since the early 2000s, when it introduced the innovative technique of bipartition and ileal transposition[3] and advocated for the stomach-preserving duodenal-ileal bypass to improve glycemic control[4]. These procedures, which are not endorsed by the International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO), have been extensively studied by Brazil for their effects on weight loss and comorbidity resolution. Brazil ranks second in the world in MBS volume, only behind the United States[5], and has been a major contributor to the advancement of the scientific knowledge and the clinical practice of MBS worldwide. Despite all of this, there remains limited and ambiguous information about this discipline across LA. A recent analysis of MBS research in LA highlighted Brazil and Chile as the region's most influential and productive countries. The majority of the publications in LA were original articles (76.6%)

and review articles (11.9%)[6]. Overall contribution of LA to scientific literature on this topic is sparse, emphasizing the need for more scholarly work on this subject. Therefore, this review aims to synthesize the available evidence on obesity and MBS in LA, encompassing epidemiological aspects, peri-operative management, and outcomes. Special attention is also given to discerning current practices and exploring future directions in therapeutics, public health, and MBS research in LA.

Search strategy and selection criteria:

A narrative review of the literature on MBS in LA was carried out between April 2023 and September 2023. Electronic databases were searched for peer-reviewed articles published in English or Spanish between 1998 and 2023: PubMed, Web of Science, SciELO, and Latin American and Caribbean Health Sciences Literature (LILACS). Trial registries were interrogated for unpublished or ongoing studies: ClinicalTrials.gov, ISRCTN registry, and LILACS. We used a combination of keywords and synonyms related to LA and different MBS procedures, such as sleeve gastrectomy or Roux-en-Y gastric bypass. We included randomized clinical trials (RCT), prospective and retrospective cohort studies, and meta-analyses that reported on MBS outcomes, risks, or assessments in LA. We also included some narrative reviews that provided relevant background information or context, and web articles of reputable organizations. We excluded studies that had a sample size of fewer than 10 participants, that were not conducted in LA, or that did not focus on MBS.

Obesity:

Obesity is a complex, multifactorial, and chronic disease characterized by excessive accumulation of adipose tissue in the body, resulting in a body mass index (BMI) of 30 kg/m^2 or greater[7]. The global prevalence of obesity has been steadily increasing, with approximately 38% of the global population classified as overweight and 14% affected by obesity in 2020, with higher rates among women. In LA, countries such as the Dominican Republic (40%), Mexico (37%), and Costa Rica (36%), have the highest prevalence of female obesity, while Argentina (32%), Mexico (30%), Chile and Uruguay (29%) have the highest prevalence of male obesity[8] (Figure 1).

The etiology of obesity is multifaceted and involves a combination of both modifiable and non-modifiable factors. These include genetic (e.g., FTO, MC4R, PPARG), endocrine factors (e.g., leptin, insulin, cortisol), and psychiatric factors (e.g., binge-eating disorders), inadequate physical activity, and socio-cultural, lifestyle, and environmental contributors such as limited access to or preference for healthy food[9]. Consequently, obesity is associated with a wide range of chronic diseases including type 2 diabetes mellitus (T2DM), hypertension (HTN), dyslipidemia, coronary artery disease, atrial fibrillation, congestive heart failure, cerebrovascular accident, obstructive sleep apnea (OSA), osteoarthritis, and certain types of cancer[10,11]. Globally, obesity-related illnesses accounted for over 5.0 million deaths in 2019, with more than half of these deaths occurring among people under 70 years old[12].

Exposure to obesity stigma and discrimination is a major source of psychological distress for people living with obesity. These terms refer to the negative societal perceptions and unfair treatment of people with higher body weight, who are often stereotyped as lazy, weak, and lacking in self-control. They face teasing, bullying, and devaluation from their peers and superiors, in various settings[13]. The extent of this problem is difficult to measure, as most studies have limited scope and sample size. A 2020 study by Elia et al. found that adolescents with obesity in LA were

more likely to have suicidal thoughts and plans, but did not examine the cultural factors involved in stigmatization[14].

Additionally, the economic impact of obesity was estimated to be 2.19% of global gross domestic product (GDP) in 2019[15]. This includes direct and indirect costs from obesity-related diseases, such as medical and social care, and reduced economic productivity due to poor health and mortality. A recent study projected that obesity rates in LA could increase healthcare costs by 0.3-0.8% of GDP by 2030, with Mexico and Brazil being among the most affected countries[16,17]. These projections get worse when considering future trends, by 2060, the majority of countries in LA are expected to have overweight and obesity prevalence levels exceeding 70% of the entire population, including children[15].

The diagnosis of obesity typically relies on measuring BMI, calculated as weight in kilograms divided by height in meters squared. However, BMI alone does not provide a comprehensive assessment of adiposity or body fat distribution. Additional non-invasive measurements, such as waist circumference, skinfold thickness, and bioelectrical impedance analysis can offer further insights into body composition[7]. The treatment of obesity includes various approaches, including lifestyle modifications, such as dietary changes and increased physical activity, behavioral therapy, pharmacotherapy, and surgery. MBS is considered the most effective long-term treatment for severe obesity and its associated diseases[7,10,11].

Metabolic and Bariatric Surgery in LA:

As outlined by the American Society for Metabolic and Bariatric Surgery (ASMBS) and IFSO, MBS may be recommended for individuals meeting either of the following criteria: 1) BMI ≥35

kg/m^2, independent of the presence, absence, or severity of obesity-associated diseases, 2) BMI ≥30 kg/m^2 with type 2 diabetes mellitus; or 3) BMI of 30–34.9 kg/m^2 with failure to achieve substantial or durable weight loss or associated disease improvement using non-surgical methods[18]. Our review found that most countries in LA seem to be following the 1991 NIH Consensus Statement on Bariatric Surgery[19,20], with the exception of Brazil which follows the 1991 NIH consensus plus an indication for patients with grade I obesity and uncontrolled T2DM[21].

Presently, the two primary procedures performed worldwide are sleeve gastrectomy (SG) and Roux-en-Y Gastric Bypass (RYGB), accounting for approximately 90% of all operations conducted[22]. Less-frequently performed procedures include one-anastomosis gastric bypass (OAGB), adjustable gastric banding (AGB), and biliopancreatic diversion with duodenal switch (BPD-DS) and its safer variant, single anastomosis duodenoileostomy with sleeve gastrectomy (SADI-S), single anastomosis duodenal switch, or sleeve with transit bipartition. This trend is also observed in LA, where SG and RYGB account for 56% and 37% of weight loss procedures, respectively[22].

New weight loss procedures are being tested in LA. Brazil and Ecuador have tried the endoscopic sleeve gastroplasty (ESG) and intragastric balloon (IGB)[23,24], magnetic-assisted procedures have been successfully tested in Venezuela[25], and the success of robotic-assisted procedures has been reported in Brazil, Chile, and Mexico[26–28]. However, these techniques are currently not mainstream and should be regarded as investigational.

Surgical Procedures

Sleeve Gastrectomy (SG) is the most commonly performed procedure in LA, with a prevalence of 56%[22], it involves partial vertical resection of the stomach while preserving the pylorus, resulting in the creation of a gastric tube along the lesser curvature. The resection includes the fundus, body of the stomach, and a minimal portion of the antrum. It exhibits neuro-humoral effects that contribute to weight loss and the improvement of associated diseases [24]. Complications associated with this procedure may include gastroesophageal reflux, bleeding, gastric leak, gastroesophageal reflux, among others[29].

Roux-en-Y gastric bypass (RYGB) is the second most commonly performed procedure in LA, with a prevalence of 37%[22], it involves creation of a small gastric pouch separated from most of the distal stomach, which is called the gastric remnant. The gastric pouch is then directly anastomosed to a part of the jejunum called the Roux limb, forming a "Y" shape configuration. As a result, food bypasses the gastric remnant and the upper portion of the small intestine, leading to a reduced absorption of some vitamins, and minerals[26]. Neuronal and hormonal manipulation, contribute to the mechanism of action of this procedure[22]. Complications may include bleeding, anastomotic leak, ulcer/stricture at the gastrojejunostomy anastomosis, internal hernia, reactive hypoglycemia, among others[29].

The one-anastomosis gastric bypass (OAGB) or mini gastric Bypass (MGB) entails the creation of a long and narrow gastric pouch along the lesser curvature of the stomach, which is then anastomosed to a loop of the small intestine located 100-200 cm from the ligament of Treitz[30]. Currently, it is the third most commonly performed procedure globally[31] and its prevalence in LA is around 3%[22].

Adjustable gastric banding (AGB), which is an adaptation of the non-adjustable gastric band, was widely popular in the 1990s and early 2000s. However, due to long-term weight-loss failure, weight regains, and complications such as band slippage and perforation, the procedure has fallen out of favor, resulting in declining operation rates over the years, with a global prevalence of 0.9%, however, it is the second most commonly performed procedure in Bolivia with a prevalence of 31%[22,30].

Risks:

As with any surgical domain, MBS does not exist without risks. A meta-analysis by Chang et. al found that the risks associated with MBS procedures include internal herniation, intra-abdominal infection, pneumonia, ulcer/stricture, gastroesophageal reflux, bleeding, and weight recurrence, among others[32]. Some patients may even develop negative consequences for their mental health and health-related quality of life following surgery, including mood disorders such as depression, anxiety, suicidal behaviors and ideation[33–35]. In fact, a meta-analysis by Castaneda et. al analyzed 148,643 individuals, and found that the non-fatal self-harm risk was twice as high after MBS within the same population, and four times higher compared to age-, sex-, and BMI-matched controls[36]. Previous research has also demonstrated that suicide after MBS occurs more frequently in the first or second post-operative year[37]. Due to the observational nature of this data, causal effect cannot be deduced and it remains imperative to identify patient characteristics that can predict these adverse outcomes after MBS, enabling targeted post-operative psychosocial monitoring and support for high-risk patients[38].

Similar patterns of adverse mental health outcomes following MBS have been observed in LA. A 2023 cross-sectional study by Furtado et. al found that after MBS, binge-eating disorder and depression were present in 24.9% and 24% of patients respectively[39].

Peri-operative assessments and Interventions:

Pre-surgical assessments and interventions play a crucial role in ensuring the safety and success of MBS. A comprehensive evaluation of obesity-related complications and underlying causes is required, including medical history, psychosocial history, physical examination, and laboratory testing. The informed consent process should include the risk and benefits, surgical options, choices of surgeon and medical institution, vitamin supplementation, and long-term follow-up. MBS centers should provide culturally and educationally appropriate materials and pre-operative sessions. Pre-operative weight loss may help patients with fatty liver disease or hepatomegaly, and patients with obesity-associated disease in some cases[40]. The mental health screening should use validated questionnaires for eating disorders, anxiety, and depression. MBS should be delayed until these are treated if found. The pre-operative interview should evaluate the patient's motivation, expectations, obesity history, prior weight loss treatments, support network, impulse control, and stressor management[41,42].

Post-operative assessment of MBS is essential to evaluate the success of the surgery and to optimize the lifestyle changes that are key for achieving adequate control of BMI and cardiometabolic risk factors with the assistance of a multidisciplinary team of experts, compound by the surgeon, the primary care physician or endocrinologist, social worker, psychologist or psychiatrist and the dietitian, It is important to pay special attention to the metabolic chronic

comorbidities because MBS patients with T2DM may experience rapid improvement in glycemic status and need adjustment of antidiabetic medications[43], as well as antihypertensive medications and lipid-lowering medications, although the latter do not pose the same risk of overtreatment as insulin and antihypertensive medications, and many MBS patients may still benefit from statins based on the current guidelines and recommendations. Long-term follow up is essential to maintain weight loss, detect errors in alimentary hygiene and control late metabolic disorders[44]. Regarding the social aspect, most patients get support from their social network, but some face negative reactions to their lifestyle changes. These changes can affect their mood and satisfaction with the surgery, particularly in regions where there is social stigma about losing weight, hence the patient perspective is essential to understand the psychosocial aspects of life after MBS, but there is a lack of studies that explore this dimension in LA countries. Psychological distress may arise post-surgery due to food restriction, malabsorption of psychotropic medications, or life stressors[45]. Patients with emotional eating may be more prone to depression due to the loss of their coping mechanism. Moreover, patients who take psychotropic medications may have reduced absorption and efficacy of these drugs after surgery, which can worsen their mental health conditions. Therefore, it is important to monitor patients' psychological distress and medication levels after surgery and adjust their treatment accordingly[46]. These patients can benefit from various post-operative tools that can enhance their long-term success and well-being. Support groups, behavioral therapy, and individualized psychological interventions can help patients with MBS. [47–49] On our review, no differences were detected between Latin America and global approaches to pre- and post-operative care for MBS patients.

Outcomes of MBS in LA

Numerous studies worldwide have demonstrated the superiority of MBS over non-surgical interventions for weight loss and resolution of these chronic illnesses. The two most extensively studied MBS procedures are RYGB and SG. A RCT with a 5-year follow-up showed that MBS, when combined with intensive medical therapy, was more effective than intensive medical therapy alone in reducing or resolving hyperglycemia in patients with T2DM[50]. Another RCT with a 10-year follow-up revealed that both RYGB and SG achieved significant and sustainable weight loss[51]. In addition to RYGB and SG, other procedures like the OAGB and BPD-DS have demonstrated positive outcomes in some studies[52–55]. However, AGB has lost popularity due to reported poor long-term outcomes in certain studies[56].

Several studies conducted in LA have also confirmed the long-term benefits of MBS for weight loss and resolution of comorbidities (Table 1). In Brazil, Cohen et. Al, determined that RYGB outperformed the best medical treatment in reducing albuminuria and CKD stages G1 to G3 and A2 to A3 in patients with type 2 diabetes and obesity after two years. However, after five years, both treatments were equally effective in curing albuminuria in patients with class 1 obesity and diabetic kidney disease, with uACR (urinary albumin-creatinine ratio) below 30 mg/g in 60-70% of patients. RYGB also had the advantage of improving blood sugar, diastolic blood pressure, lipids, body weight, and quality of life[57,58]. Also in Brazil, Schiavon et. al performed a 5-year follow-up RCT to evaluate the impact of RYGB on blood pressure compared to medical therapy and demonstrated its superiority, requiring fewer antihypertensive drugs to control HTN[59]. Furlan et. al investigated the effect of RYGB on OSA, and reported that it induced complete resolution in some patients[60]. Ruiz-Mar et. al assessed the outcomes of OAGB at 1 year postoperatively, and found them to be satisfactory[61]. Level et. al compared OAGB to RYGB at 5-years after surgery, and observed similar results in terms of excess weight loss % (EWL) and comorbidity remission[62].

However, it is important to note that some of these studies have limitations due to small sample sizes, highlighting the need for studies with larger samples to help elucidate these hypotheses.

Even when LA has pioneered several aspects of MBS, including the invention of surgical techniques and potential application of surgery in comorbidity resolution by Brazil[4,63], research on in the region still lags in the global arena. Despite the potential for scientific advancement, only a small proportion (3.7%) of clinical trials related to MBS registered on Clinicaltrials.gov at the time of this review, involve LA and Caribbean countries (n=14). Trials range from the incorporation of surgical adjuncts intraoperatively to additional pharmacotherapy in MBS patients. For example, one trial in Venezuela is investigating the use of magnetic tools in different stages of MBS to evaluate their safety and efficacy while another trial in Chile is comparing the adverse events of various liver retraction devices in MBS. Furthermore, a current Mexican trial aims to investigate the clinical effect of magnesium sulfate as an anesthetic adjuvant to reduce postoperative analgesia or the need for intraoperative requirements of anesthesia in patients who underwent MBS[64] (Table 2).

In terms of public health, the Brazilian experience of covering MBS in both public and private systems is a commendable step in addressing the complexities of obesity. This magnificent association allows over 68,000 surgeries per year in the country[65], with financial sources coming from private health insurance (78.3%), self-pay (11.1%), and public system coverage (7.2%)[66]. This approach reflects a commitment to comprehensive healthcare regardless of financial constraints. This aligns with a trend in global healthcare towards personalized and effective solutions and should be used as an example for other public systems. However, there are still challenges to face, the unequal distribution of bariatric professionals across the country also

showed a correlation between specialized training and the number of procedures per region demonstrating disparities in access for treatment and yet, opportunities for improvement[66].

Challenges for MBS in LA:

LA encompasses a wide range of cultural and ethnic diversity, emerging economies, high violence rates, growing political instability, and stark inequality. These factors add to the complexity and difficulty of understanding and describing the region, where resource scarcity is not the only issue, but also its inadequate and inequitable distribution. The health systems in LA suffer from severe fragmentation and segmentation, which impair the quality and equity of health care delivery and outcomes in the region and its society[67]. An estimated 30% of the population in LA and the Caribbean face economic barriers to access healthcare. The population distribution is often uneven and concentrated in certain areas or cities, leaving other groups underserved[68].

The accessibility of anti-obesity drugs and MBS in LA varies across countries, factors such as affordability, insurance coverage, education, and awareness poses a significant barrier to accessibility. In addition, the lack of adequate nutritional guidance in LA compared to European countries leads to the worsening of obesity in the region[9]. Furthermore, insufficient knowledge about the benefits, risks, and appropriate use of anti-obesity drugs may lead to underutilization or inappropriate prescribing practices.

Major cities and urban areas tend to have specialized centers that offer MBS. However, these facilities may be limited in rural or remote areas. The cost of the procedure, including pre-operative evaluations, surgery, hospital stay, and post-operative care can be substantial and prohibitive for many patients where extreme poverty and poverty levels were expected to reach 13,8% and 32,1% respectively, in 2021[69]. Besides Brazil, some countries like Colombia provide partial or full

insurance coverage for MBS[70], however, this is not included in coverage in other countries. Despite its rising adoption worldwide, robotic-assisted MBS has yet to take a strong foothold in LA, likely due to the elevated costs and lack of clear superiority over the laparoscopic approach[71,72].

Visible stigmata like severe and complex obesity can lead to discrimination and negative attitudes from others, specifically, weight stigma refers to negative attitudes and actions towards people with overweight or obesity[73,74], a survey done by the Brazilian Association for the Study of Obesity and Metabolic Syndrome showed that most people with obesity experienced embarrassment from their relatives, healthcare professionals and coworkers[75]. Hence, societal attitudes toward obesity remain a significant barrier to the treatment of obesity in LA. Healthcare professionals have a crucial role to play in shifting the social discourse away from stigmatized notions towards one that is focused on health and addresses the stigma of obesity[74] (Figure 2).

Recommendations for MBS in LA:

Based on the findings of this review and the current state of MBS in LA, several recommendations can be made in order to increase the effectiveness of MBS in the region. To begin, increased promotion of MBS amongst Latin American healthcare professionals is necessary. Furthermore, sensitivity training regarding the care of patients with obesity may be helpful in addressing the stigma of obesity in LA. Additionally, more research is needed to identify psychosocial, metabolic, and genetic predictors of successful weight loss of patients in LA. This may help to identify factors that may influence the success of MBS in this disproportionately affected population, and inform the development of tailored treatment approaches for LA specifically. Finally, reduction of costs

and MBS coverage by health insurance companies would greatly increase access to the procedures in the region.

Conclusions:

This review provides a comprehensive overview of the current status of MBS in LA and offers insights into potential areas for improvement. Although MBS is growing in the region, LA continues to face serious challenges in widespread implementation of MBS including lack of feasible access to the general public. Furthermore, there is a disproportionate scarcity of data on MBS in the region relative to the prevalence of obesity in Latin American societies. Overall, MBS represents a remarkable opportunity for helping to solve the obesity pandemic in LA if the aforementioned barriers can be overcome. Further attention and investigation are warranted to help bring about positive impact on obesity in LA.

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Abbreviations:

LA: Latin America

MBS: Metabolic and bariatric surgery

IFSO: International Federation for the Surgery of Obesity and Metabolic Disorders

LILACS: Latin American and Caribbean Health Sciences Literature

RCT: Randomized clinical trials

BMI: Body mass index

T2DM: Type 2 Diabetes Mellitus

HTN: Hypertension

OSA: Obstructive Sleep Apnea

GDP: Gross domestic product

ASMBS: American Society for Metabolic and Bariatric Surgery

SG: Sleeve gastrectomy

RYGB: Roux-en-y gastric bypass

OAGB: One-anastomosis gastric bypass

MGB: Mini gastric bypass

AGB: Adjustable gastric banding

BPD-DS: Biliopancreatic diversion with duodenal switch

SADI-S: Single anastomosis duodenoileostomy with sleeve gastrectomy

ESG: Endoscopic sleeve gastroplasty

IGB: Intragastric balloon

EWL: Excess weight loss

BPL: Biliopancreatic limb

MT: Medical therapy

UC: Usual care

CKD: Chronic kidney disease

AHI: Apnea-hypopnea index

FBG: Fasting blood glucose

uACR: Urinary albumin-creatinine ratio

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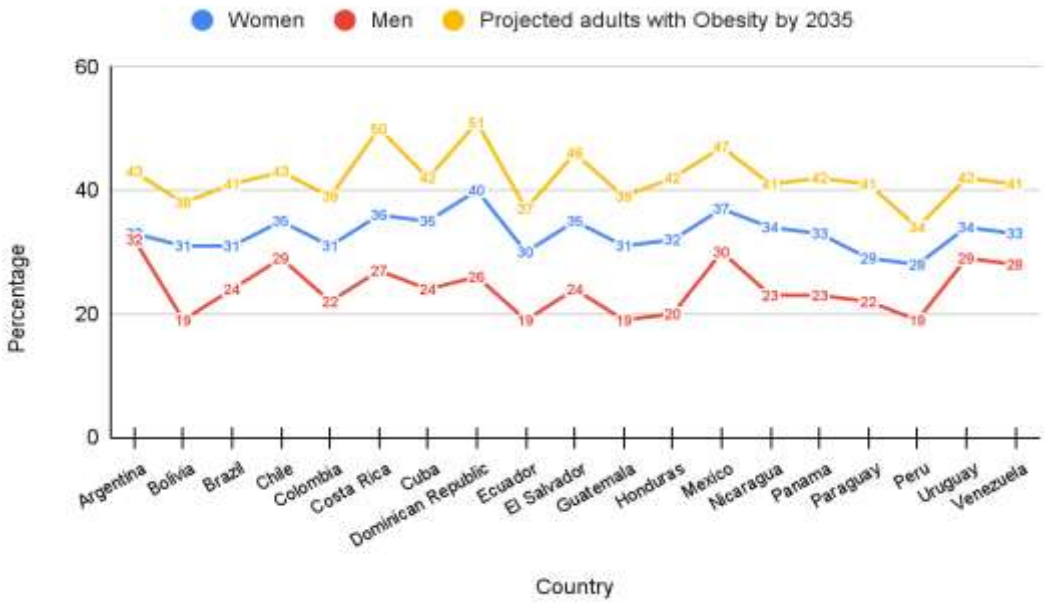
Supplement

Figure 1. Prevalence of obesity in Latin American countries as of 2020, and the projected rate of adults with obesity by 2035[8]



618 **Figure 2**. Challenges related to MBS in LA.

619 **Table 1.** Summary of studies performed in LA.

Study Title	Authors	Publication year	Country	Sample characteristics	Key findings
The One Anastomosis Gastric Bypass Technique: Results After One Year Of Follow-Up [a]	Ruiz-Mar et. al	2019	Mexico	51 patients (43 female, 8 male)	- EWL% was 65. - T2DM 57% remission - HTN 37% remission - Hyperlipidemia 43% remission
Three-Year Outcomes of	Schiavon et. al	2020	Brazil	100 patients (76 female, 24	- A greater proportion of

Bariatric Surgery in Patients With Obesity and Hypertension : A Randomized Clinical Trial [b]				male) were randomly assigned 1:1 to RYGB plus medical therapy (MT) versus MT alone.	RYGB plus MT patients achieved HTN remission, although it was not statistically significant. - RYGB plus MT was significantly more likely than MT alone to reduce the number of antihypertensive medications by at least 30%.
Bariatric surgery program implementation at the	Juris et. al	2020	Ecuador	39 patients (29 female, 10 male) retrospectively reviewed.	- After two years, EWL reached 91%, nonetheless, 13 patients were

Hospital de Especialidades de las Fuerzas Armadas N° 1: initial results					lost to follow-up.
Three-year effects of bariatric surgery on obstructive sleep apnea in patients with obesity grade 1 and 2: a sub-analysis of the GATEWAY trial [b]	Furlan et. al	2021	Brazil	37 patients, of which 24 were allocated to RYGB and 13 to usual care (UC).	- Roux-en-Y gastric bypass (RYGB) significantly contributed to the remission of OSA and lessened the severity of the most extreme forms of OSA, compared to UC, which failed to facilitate weight loss and was linked with

					worsened OSA severity.
Long versus short biliopancreatic limb (BPL) in Roux-en-Y gastric bypass: short-term results of a randomized clinical trial	Zerrweck et. al	2021	Mexico	210 patients (181 female, 29 male) randomized 1:1 to "standard" RYGB (BPL of 50 cm and 150 cm alimentary limb) versus a "long" RYGB (BPL of 200 cm and 50 cm alimentary limb).	- At 12 months, the longer BPL induced more weight loss than the shorter BPL. - The longer BPL also produced lower HbA1C levels, however, similar effects on other co-morbidities were noted.
One anastomosis gastric bypass vs. Roux-en-Y gastric bypass:	Level et. al	2021	Venezuela	33 patients randomized 1:2 to OAGB (9 patients)	- After five years, both groups showed a decrease in weight, BMI,

a 5-year follow-up prospective randomized trial [c]				and RYGB (24 patients).	and %EWL, with no differences between them. - Complete remission of T2DM and dyslipidemia was observed in the OAGB group. - Complete remission of T2DM, dyslipidemia and GERD was observed in the RYGB group.
Gastric bypass versus best medical treatment for diabetic	Cohen et. al	2022	Brazil	100 patients (55 male, 45 female) with T2DM, obesity and	- After 5 years, RYGB was superior in improving blood sugar

kidney disease: 5 years follow up of a single-centre open label randomised controlled trial [d]				chronic kidney disease (CKD) randomized 1:1 to RYGB or best MT.	levels, blood lipids, body weight, diastolic blood pressure and quality of life. - Both groups obtained albuminuria remission, however, there was not a statistically significant difference between them.
Sleeve Gastrectomy Versus Roux-en-Y Gastric Bypass for Treating Obesity in	Pajecki et. al	2023	Brazil	36 patients were randomized 1:1 to either SG or RYGB.	- After 3 years, RYGB was associated with more significant weight loss and lower Hb1AC

Patients > 65 Years Old: 3-Year Outcomes of a Randomized Trial					and lipid levels.
Randomized Trial of Effect of Bariatric Surgery on Blood Pressure After 5 Years [e]	Schiavon et. al	2024	Brazil	100 patients (76 female, 24 male) were randomly assigned 1:1 to RYGB plus medical therapy (MT) versus MT alone.	- A greater proportion of RYGB plus MT patients achieved HTN remission. - RYGB plus MT was significantly more likely than MT alone to reduce the number of antihypertensive medications.

[a] Remission criterion for all the comorbidities were left unspecified.

[b] Remission of OSA was considered when the apnea-hypopnea index (AHI) was <5 events/h.

[c] Remission of T2DM was classified as fasting blood glucose (FBG) < 100 mg/dl, or HbA1c < 6%, off medication. Remission of dyslipidemia was classified as total cholesterol < 200 mg/dl, Triglycerides < 150 mg/dl, LDL < 100 mg/dl, off medication. Lastly, remission of GERD was assessed subjectively with the absence of symptoms without medications.

[d] Remission of albuminuria comprised a urinary albumin-creatinine ratio (uACR) <30 mg/g.

[e] Remission of hypertension was obtained with a blood pressure <140/90 mm Hg without medications.

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621 **Table 2.** A summary of ongoing MBS trials in LA which are active or currently recruiting
622 patients[64]**.**

Country	Study Title	Intervention
Brazil	Glycemic Patterns After Bariatric Surgery and High Glycemic Variability and Hypoglycemia Unawareness Risk Factors (NCT05728320)	- Device: Glucose monitoring with flash glucose monitor
Brazil	Inspiratory Muscle Training and Pulmonary Function in Patients Submitted to Bariatric Surgery (NCT05575089)	- Device: Inspiratory muscle training - Powerbreath - Other: Aerobic exercise in cycle ergometer - Other: Deep breathing exercises
Brazil	Randomized Study Comparing Metabolic Surgery with Intensive Medical Therapy to Treat Diabetic Kidney Disease (OBESE-DKD) (NCT04626323)	- Procedure: Roux-en-Y gastric bypass - Drug: Best medical treatment
Brazil	Effects of Physical Training on Health Markers of Post-bariatric Patients (NCT04193397)	- Behavioral: Exercise training
Brazil	Chewing, Swallowing and Orofacial Motricity in Severe Obese (NCT05516693)	- Other: Myofascial muscle training protocol.

Brazil	Effect of Pelvic Floor Muscle Training on Urinary Incontinence Reports in Obese Women Undergoing a Low-Calorie Diet Prior to Bariatric Surgery (NCT04159467)	- Other: Pelvic Floor Muscle Training
Brazil	Surgery Treatment of Type 2 Diabetes Mellitus Patients with Grade 1 Obesity and Overweight (NCT03333642)	- Procedure: Duodenal Ileal Interposition with Sleeve Gastrectomy
Chile	Prospective, Multi-center, Single-arm, Open Label Study Designed to Assess the Safety and Feasibility of the Use of the Dual Robotic Arm Accessory with the Levita Magnetic Surgical System in Laparoscopic Procedures (NCT05695989)	- Device: Dual Robotic Arm Accessory
Chile	Clinical Evaluation of the Levita Robotic Platform (NCT05353777)	- Device: Levita Robotic Platform
Mexico	Magnesium Sulfate in Bariatric Surgery (MgSObs) (NCT05843812)	- Drug: Magnesium Sulfate 10 MG/ML

Mexico	The Effect of Aprepitant Reducing Post-operative Nausea and Vomiting in Patients Undergoing Laparoscopic Gastric Sleeve Surgery (NCT05772676)	- Drug: Aprepitant - Other: Placebo
Venezuela	Magnetic System in Bariatric and General Surgery (NCT04944810)	- Procedures: Magnetic Gastric Bypass; Magnetic Sleeve Gastrectomy; Revisional Bariatric Surgery; Nissen/Sleeve Gastrectomy with Magnetic Assistance; Magnetic General Surgery.
Venezuela	9-Step Magnetic Bariatric Revisional Surgery (NCT04945304)	- Procedures: magnetic bariatric surgery; Magnetic gastric bypass
Venezuela	Nissen Sleeve by Single Port with Magnetic Assistance (NCT04931706)	- Other: Magnetics Assisted by Single port

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