



Obesity and Sexual Functioning

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Abstract

Purpose of the Review Sexual functioning is an important, yet often overlooked, aspect of quality of life for many individuals with obesity.

Recent Findings With the growing recognition of obesity as a significant, international public health issue, a developing body of research has investigated the relationship between obesity and sexual functioning. Several studies have found that obesity is associated with impairments in sexual functioning. The mechanisms of this relationship, whether physiological, psychosocial, or a combination of the two, are yet to be fully elucidated. Other studies have suggested that weight loss, whether induced by bariatric surgery or less intensive interventions, is associated with significant and clinically meaningful change in sexual functioning and relevant reproductive hormones.

Summary This chapter reviews the research in these areas and provides recommendations for future research on these relationships.

Keywords Sexual dysfunction · Obesity · Bariatric surgery · Body image

Introduction

Research on sexual behavior and functioning has a long and colorful past, particularly when considered against the backdrop of American culture. The seminal work by Kinsey and colleagues provided an invaluable foundation of information on sexual beliefs, interests, and behaviors of Americans in the mid-twentieth century [1, 2]. Masters and Johnson's subsequent work helped define normative as

well as dysfunctional sexual behavior. This work resonates today with respect to its influence on the characterization of sexual dysfunction, including formal disorders of sexual desire, arousal, orgasm, and genito-pelvic pain for both women and men, as represented in the Diagnostic and Statistical Manual for Mental Disorders [3]. The development of the HIV/AIDS crisis turned much of the research attention in sexual behavior to disease prevention, while the development of a number of medications for erectile dysfunction further medicalized sexual dysfunction and its treatment. While these issues continue to color the landscape of sexuality research today, currently, there is great focus on issues related to sexual orientation, gender identity, and sex reassignment surgery.

Throughout these and other major developments in our understanding of sexuality, the role of sexual identity and behavior as an important element of quality of life has remained constant. In the context of chronic diseases, such as obesity and cancer, there is great value in conceptualizing sexual behavior under the umbrella of quality of life [4, 5]. Quality of life is best understood as a multidimensional construct. When applied to the field of obesity, it includes dimensions of health-related quality of life, weight-related quality of life, and other psychological constructs such as body image and sexual functioning.

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Obesity and Quality of Life

Health-related quality of life (HRQOL) refers to the burden of suffering and the limitations in physical, vocational, and social functioning associated with illness [6]. HRQOL may be assessed by paper-and-pencil measures, the most common of which is The Medical Outcomes Survey, Short Form 36 (SF-36) [6]. The SF-36 is a standardized self-report measure that assesses eight separate domains of HRQOL including physical functioning, role functioning related to physical and emotional problems, social functioning, bodily pain, general mental health, vitality, and perception of general health.

Numerous studies have shown a correlation between BMI and the degree of impairment on most of the subscales of the SF-36 [7, 8]. The degree of obesity is commonly associated with increased physical limitations, bodily pain, and fatigue. Impairments in HRQOL are associated with increased symptoms of depression, especially among individuals with extreme obesity [9]. Individuals with extreme obesity are approximately five times more likely to have experienced a major depressive episode in the past year as compared those of average weight [10]. The risk of attempted suicide has been found to increase as BMI exceeds 40 kg/m² [11]. Impairments in HRQOL may be among the strongest motivators for seeking bariatric surgery [12–15]. The presence of major comorbidities that negatively impact HRQOL, such as type 2 diabetes, also are associated with interest in surgery [13, 14].

There also are a number of obesity specific measures of quality of life. Two of the most commonly used measures are the Impact of Weight on Quality of Life (IWQOL) scale [16] and its more commonly used short form, the IWQOL-Lite [17]. The IWQOL-Lite consists of 31 items which sum to a total score and yield subscale scores which assess physical functioning, self-esteem, sexual life, public distress, and work. This version has been used in a number of studies of bariatric surgery patients and has demonstrated that impairments in weight-related quality of life are strongly associated with BMI [18–20].

Weight loss has been associated with improvements in both health- and weight-related quality of life in numerous studies [4, 21, 22]. These relationships appear to be particularly strong for persons with extreme obesity who lose substantial amounts of weight with bariatric surgery [9, 23–27, 28•, 29•]. In the vast majority of these studies, patients have reported both statistically and clinically significant improvements in health- and weight-related quality of life. Many of these improvements occur in the first few months after surgery and during the period of rapid weight loss [27]. Maximal improvement appears to occur in the first few postoperative years [30].

Other studies have documented improvements in other areas of quality of life. In a sample of over 2200 individuals who underwent bariatric surgery as part of the LABS Consortium, the majority of patients reported clinically significant improvements in bodily pain, physical functioning, and

improved 400-m walk times [31]. In participants who were on disability prior to surgery, as well as those who reported severe knee or hip pain, approximately three fourths experienced improvements in knee or hip functioning [31].

There appear to be gender differences in changes of quality of life after bariatric surgery. Women have reported statistically significant changes in all domains of the SF-36 and the IWQOL-Lite within the first year of surgery [28•]. These improvements were well maintained during the second postoperative year [28•]. In contrast, men reported changes in weight-related quality of life as well as changes in the physical functioning domains of the SF-36 [5]. They did not, however, report statistically significant changes on the mental health domains of the measure. There also is some evidence to suggest a mild deterioration in these improvements with a modest postoperative weight regain [21, 32, 33].

Obesity and Sexual Functioning

Obesity appears to have a detrimental impact on sexual functioning [4, 5, 34•, 35]. Obesity, and/or several obesity-related comorbidities, can impair sexual function and sexual quality of life. Obesity has been found to be associated with mild to moderate symptoms of erectile dysfunction, as assessed by the International Index of Erectile Function (IIEF), in the majority of studies of men with obesity [34•]. The relationship between obesity and sexual dysfunction appears to be particularly true for individuals with greater adiposity. Bond and colleagues, for example, found that approximately 60% of women who sought bariatric surgery reported sexual dysfunction [36•]. Dallal and colleagues (2008) found that men presenting for bariatric surgery reported impaired sexual functioning across several relevant domains and as compared to published reference controls [37•].

In the largest study of the issue to date, 2225 candidates for bariatric surgery completed a self-report survey about their sexual functioning in the previous month [38•]. Twenty-six percent of women and 12% of men reported no sexual desire and 33% of women and 25% of men reported no sexual activity. About half of women (49%) and men (54%) were moderately or very dissatisfied with their sexual life. Physical health limited sexual activity at least moderately in 38% of women and 44% of men. Among women, older age, white race, urinary incontinence, depressive symptoms, and antidepressant medication use were associated with poorer sexual function in multiple domains. In men, older age, not being married, depressive symptoms, and antidepressant medication use were associated with poorer sexual function in multiple domains.

The specific nature of the relationship between BMI and sexual dysfunction is unclear. For some individuals, concerns about physical appearance and body image may negatively impact sexual desire and activity [5]. Anecdotal clinical reports suggest that some individuals with obesity are reluctant

to be undressed in front of their partners or experience a level of body image dissatisfaction that leaves them reluctant to engage in sexual behavior. Similarly, physical limitations associated with extreme obesity may make sexual activity unpleasant, difficult, painful, or even impossible. Nevertheless, it is important to realize that sexual dysfunction, while often characterized as a condition of an individual, occurs in the context of a relationship. That is, other problems or issues in a romantic relationship can contribute to the development and maintenance of a sexual dysfunction, just as the presence of dysfunctional sexual behavior can negatively impact the quality of a romantic relationship.

Excess body weight has negative effects on a number of hormones that contribute to sexual behavior and reproductive potential. Adipose tissue is the site of sex steroid aromatization in which androgens are converted to estrogens. This conversion leads to androgen deficiency which may influence erectile dysfunction [39, 40]. In women with obesity, sex-hormone binding globulin (SHBG) levels are reduced, which results in an increased clearance of free sex steroids including testosterone, dihydrotestosterone, and androstenediol. As a result, a compensatory mechanism is activated which results in a hyperandrogenemic state and may have a negative effect on menstruation and ovarian function [41]. Several adipokines (e.g., interleukin-6, tumor necrosis factor alpha) are believed to be related to oxidative stress which can have detrimental effects on sperm function and overall fertility in both men and women [40]. These adipokines are at increased levels in persons with obesity.

For others, impaired sexual functioning may be associated with the physiological impact of obesity. Impairments in sexual functioning are associated with a number of obesity-related comorbidities, including hypertension, type 2 diabetes, and depression. In a study by Doumas and colleagues (2006), erectile function was assessed in 634 young and middle-aged men [42]. Of these men, 358 were found to have arterial hypertension and 276 were normotensive. When the two groups were compared, a statistically significant association was found between the presence of ED and hypertension [42]. In a meta-analysis of 12 prospective cohort studies performed by Dong and colleagues, ED was associated with a significantly increased risk of coronary heart disease and other cardiovascular risk factors [43]. Another meta-analysis of 12 observational studies in diabetic men also showed an association between ED and risk of cardiovascular events [44]. A large systematic review also concluded that sexual dysfunction is related to the severity of cardiovascular disease [45].

Erectile dysfunction is common in patients with diabetes, affecting up to 50% of men [46]. Erectile dysfunction can occur in diabetic patients due to impairment of peripheral nerve conduction to the penile vasculature. In a study that included 2377 patients with diabetes alone, 3906 patients with hypertension alone, and 1186 with both diabetes and

hypertension [47], 71% of those with diabetes, 67% of those with hypertension, and 78% of men with both disorders also had ED. Among men with diabetes, ED appears to be most common in those with the poorest glycemic control and the worst insulin resistance [48]. Women with diabetes also are at increased risk of sexual dysfunction, although the mechanisms for this are not well defined [49].

Relationships between obesity-associated comorbid conditions and sexual function are often confounded by age-related changes. Erectile and lubrication quality declines with age; time to orgasm increases for both women and men. In women, sexual functioning typically declines with menopause. The mechanism behind this change is likely due to a decreased production of estrogen, which leads to vaginal epithelial atrophy, dryness, and decreased vaginal tissue elasticity which results in pain during intercourse [50]. Urinary incontinence also may impact sexual functioning for both men and women [51–53].

Treatment of weight-related conditions also can negatively impact sexual functioning. Antihypertensives that have been associated with sexual dysfunction include some sympatholytic agents, beta-blockers, and diuretics [54, 55]. Many psychiatric medications also are known to negatively impact sexual functioning. Approximately 40% of pre-bariatric surgery patients take antidepressant medications [56, 57]. Following surgery, the majority of patients stay on their antidepressant medication [58, 59]. Many of the commonly used antidepressants (e.g., selective serotonin reuptake inhibitors, serotonin-norepinephrine reuptake inhibitors) are associated with some degree sexual dysfunction in a majority of patients.

A recent review of the literature on the relationship between obesity and sexual functioning concluded that there likely are three different pathways between the two [60]. These included the direct effects of adipose tissue on sexual response, the impact of obesity-related comorbidities of sexual desire and functioning, and the influence of relevant psychological variables. While these conclusions are largely consistent with those drawn by other authorities in the field, the review failed to include many of the reviewed in detail here.

Changes in Sexual Functioning With Weight Loss

A number of studies have looked at changes in sexual functioning following weight reduction. Most of these studies have been conducted on individuals with a weight-related comorbidity. Men with hypertension, for example, and who lost approximately 5% of their weight through a lifestyle modification program, experienced significant improvements in both self-report and physiologic measures of sexual function as compared to men treated with a beta-blocker (propranolol) or central alpha agonist (clonidine) [61]. Other studies with hypertensive patients have similarly shown improvements in sexual function following weight reduction or increased physical activity [62]. Men with obesity, but free of major weight-

related comorbidities, have been able to lose approximately 15 kg of weight in a behavioral modification program and experience significant improvements in erectile functioning [63]. The 5–10% weight losses seen with lifestyle modification and/or pharmacotherapy have been associated with positive effects on sex hormones [40, 41, 64] and may be contributing to improvements in sexual functioning as well.

A number of studies have documented changes in sexual functioning and quality of life in persons who have lost significant amounts of weight after bariatric surgery [21, 65]. Ninety-seven men who underwent gastric bypass reported improvements in all domains of sexual functioning within the first few postoperative years [37]. The amount of weight loss was associated with the degree of improvement in sexual functioning. In a study of women who underwent bariatric surgery, female sexual dysfunction (diagnosed before surgery) resolved in 68% of women and women reported statistically significant improvements in all areas of sexual functioning after surgery [36, 66].

The Longitudinal Assessment of Bariatric Surgery consortium has included a number of studies that have investigated changes in sexual functioning after bariatric surgery. A subset of women who had undergone bariatric surgery, and lost approximately one third of their body weight, reported statistically significant improvement in satisfaction with their sexual functioning, as well as increases in desire, arousal, and frequency of orgasm, over the first two postoperative years [20]. They also demonstrated statistically significant changes in the reproductive hormones associated with sexual behavior. More specifically, a surgically induced weight loss of 33% of total body weight was associated with significant decreases in estradiol, total testosterone, and DHEA-S as well as significant increases in FSH, LH, and SHBG in women 2 years after surgery [20].

While impressive, there is some concern that these improvements may erode over time. From postoperative year 2 to postoperative year 4, these women experienced significant changes in their reproductive hormones, with the exception of estradiol [32]. Women reported significant improvements with respect to sexual desire, arousal, and satisfaction through year 3, but these changes were not maintained through year 4, and when women had regained approximately 10% of the weight, they had lost at year 2. Changes in romantic relationship quality and satisfaction followed the same pattern.

Men who underwent bariatric surgery also reported positive changes in their sexual functioning; however, these changes did not reach statistical significance over the first four postoperative years [29]. Interestingly, these men did experience statistically significant changes in relevant sex hormones as well as more general domains of psychosocial functioning, including health- and weight-related quality of life. This may be a function of the relatively small number of men enrolled in this study. However, it also may be that improvements in sexual functioning after bariatric surgery are more profound for women than men.

Conclusions and Future Directions

Obesity, and extreme obesity in particular, is associated with substantial and significant impairments in quality of life. Excessive body weight can limit physical functioning and also contributes to a number of medical comorbidities that can further erode quality of life. At the same time, the psychosocial burden of obesity cannot be underestimated. These multifactorial relationships underscore the necessity of seeing quality of life as multidimensional, umbrella-like term that encompasses both health- as well as weight-related quality of life.

Body image and sexual functioning are central aspects of quality of life. Not surprisingly, most individuals with obesity report heightened levels of body image dissatisfaction. Most also report impairments in sexual functioning. The potential mechanisms for these impairments in sexual functioning are likely multifactorial. Some impairments in sexual behavior may be the result of body image dissatisfaction or depression. For others, the sexual dysfunction may be the result of obesity-related comorbidities, like type 2 diabetes and hypertension, and their treatments.

Encouragingly, modest weight loss is associated with improvement in quality of life and sexual functioning. At the same time, the magnitudes of these improvements often appear to be associated with the size of the weight loss. Many studies have documented the improvements in health- and weight-related quality of life that occur after bariatric surgery. Recently, a number of studies have documented significant changes in many domains of sexual functioning postoperatively and which endure for several years.

There are limitations to the existing work that also provide opportunities for future research. Much of the focus on the relationship between obesity and sexual functioning has focused on person with extreme obesity and who undergo bariatric surgery. While the effects of obesity on functioning are most profound among those with higher BMIs, and the benefits in functioning greatest in those who experience large weight losses, less is known about those with less severe obesity. The vast majority of participants in the studies reviewed here have been white and with high levels of education. While this is true of many studies in the bariatric surgery literature, the nature of these samples limits the ability to understand these relationships in non-white individuals. In addition, several of these studies were challenged to account for changes in menstrual or menopause status, age, or relevant comorbidities such as hypertension, heart disease, and type 2 diabetes. Use of hormone replacement therapies or sexual dysfunction treatments also has received little attention. Finally, little research has been on non-heterosexual behavior and relationships. This represents an area for future inquiry.

A recent study of adolescents who underwent bariatric surgery suggest that there are often changes in engagement in sexual behavior postoperatively [67]. These changes have

led to some concern about the risk of sexually transmitted infections and unintended pregnancies as these adolescents adjust to their postoperative lives. Given the interplay of sexual and more general psychosocial development of adolescents and young adults, further study of the relationship between weight loss and adolescent sexual behavior is warranted and may have important implications for clinical practice [68].

Another is the physical and psychosocial impact of body contouring procedures to remove excess skin following a massive weight loss. The American Society of Plastic Surgeons (2017) reported that approximately 50,000 individuals undergo surgical procedures of the abdomen, thighs, arms, and breast annually and in an effort to address the physical discomfort and body image dissatisfaction associated with this excess skin [69]. Early reports suggest that many patients who undergo these procedures report satisfaction with the results and improvements in physical and psychosocial health. Unfortunately, these procedures are expensive and rarely covered by third-party payers. As a result, opportunities to study the presumed benefits to quality of life and sexual functioning have been limited.

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References

Papers of particular interest, published recently, have been highlighted as:

- Of importance

1. Kinsey AC, Pomeroy WB, Martin CE. Sexual behavior in the human male. Philadelphia: WB Saunders and Company; 1948.
2. Kinsey AC, Pomeroy WB, Martin CE, Gebhard PH. Sexual behavior in the human female. Philadelphia: WB Saunders and Company; 1953.
3. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5th ed. Arlington, VA: American Psychiatric Publishing; 2013.
4. Sarwer DB, Lavery M, Spitzer JC. A review of the relationships between extreme obesity, quality of life, and sexual function. *Obes Surg.* 2012;22(4):668–76.
5. Sarwer DB, Steffen KJ. Quality of life, body image and sexual functioning in bariatric surgery patients. *Eur Eat Disord Rev.* 2015;23(6):504–8.
6. Ware JE. SF-36 health survey: manual and interpretation guide. Boston, MA: The Health Institute; 1993.
7. Fontaine KR, Barofsky I. Obesity and health-related quality of life. *Obes Rev.* 2001;2(3):173–82.
8. Kolotkin RL, Meter K, Williams GR. Quality of life and obesity. *Obes Rev.* 2001;2(4):219–29.
9. Sarwer DB, Allison KC, Bailer BA, Faulconbridge LF. Psychosocial characteristics of bariatric surgery candidates. In: Still C, Sarwer DB, Blankenship J, editors. *The ASMBS textbook of bariatric surgery: volume 2: integrated health.* New York: Springer New York; 2014. p. 3–9.
10. Onyike CU, Crum RM, Lee HB, Lyketos CG, Eaton WW. Is obesity associated with major depression? Results from the third National Health and nutrition examination survey. *Am J Epidemiol.* 2003;158(12):1139–47.
11. Dong C, Li WD, Li D, Price RA. Extreme obesity is associated with attempted suicides: results from a family study. *Int J Obes.* 2006;30(2):388–90.
12. van Hout GC, Verschure SK, van Heck GL. Psychosocial predictors of success following bariatric surgery. *Obes Surg.* 2005;15(4):552–60.
13. Wee CC, Jones DB, Davis RB, Bourland AC, Hamel MB. Understanding patients' value of weight loss and expectations for bariatric surgery. *Obes Surg.* 2006;16(4):496–500.
14. Munoz DJ, Chen E, Fischer S, Roehrig M, Sanchez-Johnson L, Alverdy J, et al. Considerations for the use of the Beck depression inventory in the assessment of weight-loss surgery seeking patients. *Obes Surg.* 2007;17(8):1097–101.
15. Allegri C, Russo E, Roggi C, Cena H. Quality of life (QoL) and motivation for treatment: a female issue? *Eat Weight Disord.* 2008;13(1):e8–e13.
16. Kolotkin RL, Head S, Hamilton M, Tse CK. Assessing impact of weight on quality of life. *Obes Res.* 1995;3(1):49–56.
17. Kolotkin RL, Crosby RD, Kosloski KD, Williams GR. Development of a brief measure to assess quality of life in obesity. *Obes Res.* 2001;9(2):102–11.
18. Boan J, Kolotkin RL, Westman EC, McMahon RL, Grant JP. Binge eating, quality of life and physical activity improve after roux-en-Y gastric bypass for morbid obesity. *Obes Surg.* 2004;14(3):341–8.
19. Dymek MP, Le Grange D, Neven K, Alverdy J. Quality of life after gastric bypass surgery: a cross-sectional study. *Obes Res.* 2002;10(11):1135–42.
20. Sarwer DB, Spitzer JC, Wadden TA, Rosen RC, Mitchell JE, Lancaster K, et al. Sexual functioning and sex hormones in persons with extreme obesity and seeking surgical and nonsurgical weight loss. *Surg Obes Relat Dis.* 2013;9(6):997–1007.
21. Kolotkin RL, Davidson LE, Crosby RD, Hunt SC, Adams TD. Six-year changes in health-related quality of life in gastric bypass patients versus obese comparison groups. *Surg Obes Relat Dis.* 2012;8(5):625–33.
22. Kolotkin RL, Crosby RD, Wang Z. Health-related quality of life in randomized controlled trials of lorcaserin for obesity management: what mediates improvement? *Clin Obes.* 2017;7(6):347–53.
23. Billy HT, Sarwer DB, Ponce J, Ng-Mak DS, Shi R, Cornell C, et al. Quality of life after laparoscopic adjustable gastric banding (LAP-BAND): APEX interim 3-year analysis. *Postgrad Med.* 2014;126(4):131–40.
24. Pilone V, Mozzi E, Schettino AM, Furbetta F, di Maro A, Giardiello C, et al. Improvement in health-related quality of life in first year

- after laparoscopic adjustable gastric banding. *Surg Obes Relat Dis*. 2012;8(3):260–8.
25. Lier HO, Biringir E, Hove O, Stubhaug B, Tangen T. Quality of life among patients undergoing bariatric surgery: associations with mental health- a 1 year follow-up study of bariatric surgery patients. *Health Qual Life Outcomes*. 2011;9:79.
 26. Kolotkin RL, Crosby RD, Gress RE, Hunt SC, Adams TD. Two-year changes in health-related quality of life in gastric bypass patients compared with severely obese controls. *Surg Obes Relat Dis*. 2009;5(2):250–6.
 27. Sarwer DB, Wadden TA, Moore RH, Eisenberg MH, Raper SE, Williams NN. Changes in quality of life and body image after gastric bypass surgery. *Surg Obes Relat Dis*. 2010;6(6):608–14.
 28. Sarwer DB, Spitzer JC, Wadden TA, et al. Changes in sexual functioning and sex hormone levels in women following bariatric surgery. *JAMA Surg*. 2014;149(1):26–33. **Examination of changes in sexual function and hormone profiles before and after bariatric surgery among women.**
 29. Sarwer DB, Spitzer JC, Wadden TA, et al. Sexual functioning and sex hormones in men who underwent bariatric surgery. *Surg Obes Relat Dis*. 2015;11(3):643–51. **Examination of changes in sexual function and hormone profiles before and after bariatric surgery among men.**
 30. Sjoström L, Lindroos AK, Peltonen M, et al. Lifestyle, diabetes, and cardiovascular risk factors 10 years after bariatric surgery. *N Engl J Med*. 2004;351(26):2683–93.
 31. King WC, Chen J, Belle SH, et al. Change in pain and physical function following bariatric surgery for severe obesity. *JAMA*. 2016;315(13):1362–71.
 32. Sarwer DB, Wadden TA, Spitzer JC, et al. 4-year changes in sex hormones, sexual functioning, and psychosocial status in women who underwent bariatric surgery. *Obes Surg*. 2018;28(4):892–899.
 33. Sarwer DB, Polonsky HM. The psychosocial burden of obesity. *Endocrinol Metab Clin N Am*. 2016;45(3):677–88.
 34. Kolotkin RL, Zunker C, Ostbye T. Sexual functioning and obesity: a review. *Obesity (Silver Spring)*. 2012;20(12):2325–33. **A comprehensive review of sexual functioning in obesity.**
 35. Moore RH, Sarwer DB, Lavenberg JA, Lane IB, Evans JL, Volger S, et al. Relationship between sexual function and quality of life in obese persons seeking weight reduction. *Obesity (Silver Spring)*. 2013;21(10):1966–74.
 36. Bond DS, Vithiananthan S, Leahey TM, et al. Prevalence and degree of sexual dysfunction in a sample of women seeking bariatric surgery. *Surg Obes Relat Dis*. 2009;5(6):698–704. **One of the first reports to show impaired sexual functioning in women prior to bariatric surgery.**
 37. Dallal RM, Chernoff A, O'Leary MP, Smith JA, Braverman JD, Quebbemann BB. Sexual dysfunction is common in the morbidly obese male and improves after gastric bypass surgery. *J Am Coll Surg*. 2008;207(6):859–64. **One of the first reports to show impaired sexual functioning in men prior to bariatric surgery and improvement thereafter.**
 38. Steffen KJ, King WC, White GE, et al. Sexual functioning of men and women with severe obesity before bariatric surgery. *Surg Obes Relat Dis*. 2016; **A large cohort study of sexual functioning prior to bariatric surgery and factors associated with various domains of functioning.**
 39. Du Plessis SS, Cabler S, McAlister DA, Sabanegh E, Agarwal A. The effect of obesity on sperm disorders and male infertility. *Nat Rev Urol*. 2010;7(3):153–61.
 40. Cabler S, Agarwal A, Flint M, du Plessis SS. Obesity: modern man's fertility nemesis. *Asian J Androl*. 2010;12(4):480–9.
 41. Brewer CJ, Balen AH. The adverse effects of obesity on conception and implantation. *Reproduction*. 2010;140(3):347–64.
 42. Dumas M, Tsakiris A, Douma S, Grigorakis A, Papadopoulos A, Hounta A, et al. Factors affecting the increased prevalence of erectile dysfunction in Greek hypertensive compared with normotensive subjects. *J Androl*. 2006;27(3):469–77.
 43. Dong J-Y, Zhang Y-H, Qin L-Q. Erectile dysfunction and risk of cardiovascular disease: meta-analysis of prospective cohort studies. *J Am Coll Cardiol*. 2011;58(13):1378–85.
 44. Yamada T, Hara K, Umematsu H, Suzuki R, Kadowaki T. Erectile dysfunction and cardiovascular events in diabetic men: a meta-analysis of observational studies. *PLoS One*. 2012;7(9):e43673.
 45. Nascimento ER, Maia AC, Pereira V, Soares-Filho G, Nardi AE, Silva AC. Sexual dysfunction and cardiovascular diseases: a systematic review of prevalence. *Clinics (Sao Paulo)*. 2013;68(11):1462–8.
 46. DiPiro JT, Talbert RL, Yee GC, Matzke GR, Wells BG, Posey L, editors. *Pharmacotherapy: A Pathophysiologic Approach*. 9e New York, NY: McGraw-Hill; 2014.
 47. Giuliano FA, Leriche A, Jaudinot EO, de Gendre AS. Prevalence of erectile dysfunction among 7689 patients with diabetes or hypertension, or both. *Urology*. 2004;64(6):1196–201.
 48. Weinberg AE, Eisenberg M, Patel CJ, Chertow GM, Leppert JT. Diabetes severity, metabolic syndrome, and the risk of erectile dysfunction. *J Sex Med*. 2013;10(12):3102–9.
 49. Giraldi A, Kristensen E. Sexual dysfunction in women with diabetes mellitus. *J Sex Res*. 2010;47(2):199–211.
 50. Mattar CN, Chong YS, Su LL, Agarwal AA, Wong PC, Choolani M. Care of women in menopause: sexual function, dysfunction and therapeutic modalities. *Ann Acad Med Singap*. 2008;37(3):215–23.
 51. Abrams P, Cardozo L, Fall M, Griffiths D, Rosier P, Ulmsten U, Wein A. The standardisation of terminology of lower urinary tract function: Report from the standardisation sub-committee of the international continence society. *NeuroUrol Urodyn*. 2002;187(1):116–126.
 52. Boyle P, Robertson C, Mazzetta C, Keech M, Hobbs R, Fourcade R, et al. The association between lower urinary tract symptoms and erectile dysfunction in four centres: the UrEpiK study. *BJU Int*. 2003;92(7):719–25.
 53. Wein AJ, Coyne KS, Tubaro A, Sexton CC, Kopp ZS, Aiyer LP. The impact of lower urinary tract symptoms on male sexual health: EpiLUTS. *BJU Int*. 2009;103:33–41.
 54. Fecic SE. Drug-induced sexual dysfunction. *Medical Update for Psychiatrists*. 1998;3(6):176–81.
 55. Smith, S. Drugs that cause sexual dysfunction. *Psychiatry*. 2007;6(3):111–14
 56. Sarwer DB, Cohn NI, Gibbons LM, Magee L, Crerand CE, Raper SE, et al. Psychiatric diagnoses and psychiatric treatment among bariatric surgery candidates. *Obes Surg*. 2004;14(9):1148–56.
 57. Longitudinal Assessment of Bariatric Surgery C, Flum DR, Belle SH, et al. Perioperative safety in the longitudinal assessment of bariatric surgery. *N Engl J Med*. 2009;361(5):445–54.
 58. Cremieux PY, Ledoux S, Clerici C, Cremieux F, Buessing M. The impact of bariatric surgery on comorbidities and medication use among obese patients. *Obes Surg*. 2010;20(7):861–70.
 59. Segal JB, Clark JM, Shore AD, Dominici F, Magnuson T, Richards TM, et al. Prompt reduction in use of medications for comorbid conditions after bariatric surgery. *Obes Surg*. 2009;19(12):1646–56.
 60. Rowland DL, McNabney SM, Mann AR. Sexual function, obesity, and weight loss in men and women. *Sex Med Rev*. 2017;5(3):323–38.
 61. Kostis JB, Rosen RC, Brondolo E, Taska L, Smith DE, Wilson AC. Superiority of nonpharmacologic therapy compared to propranolol and placebo in men with mild hypertension: a randomized, prospective trial. *Am Heart J*. 1992;123(2):466–74.
 62. Rosen RC, Kostis JB, Brondolo E. Nondrug treatment approaches for hypertension. *Clin Geriatr Med*. 1989;5(4):791–802.

63. Esposito K, Giugliano F, Di Palo C, et al. Effect of lifestyle changes on erectile dysfunction in obese men: a randomized controlled trial. *JAMA*. 2004;291(24):2978–84.
64. Gosman GG, Katcher HI, Legro RS. Obesity and the role of gut and adipose hormones in female reproduction. *Hum Reprod Update*. 2006;12(5):585–601.
65. Strain GW, Kolotkin RL, Dakin GF, Gagner M, Inabnet WB, Christos P, et al. The effects of weight loss after bariatric surgery on health-related quality of life and depression. *Nutr Diabetes*. 2014;4:e132.
66. Bond DS, Wing RR, Vithiananthan S, et al. Significant resolution of female sexual dysfunction after bariatric surgery. *Surg Obes Relat Dis*. 2011;7(1):1–7. **A post-surgical follow-up study assessing improvement in sexual functioning after bariatric surgery among women.**
67. Becnel JN, Zeller MH, Noll JG, Sarwer DB, Reiter-Purtill J, Michalsky M, et al. Romantic, sexual, and sexual risk behaviours of adolescent females with severe obesity. *Pediatr Obes*. 2017;12(5):388–97.
68. Zeller MH, Noll JG, Sarwer DB, Reiter-Purtill J, Rofey DL, Bauchcum AE, et al. Child maltreatment and the adolescent patient with severe obesity: implications for clinical care. *J Pediatr Psychol*. 2015;40(7):640–8.
69. American Society of Plastic Surgeons. 2017 Plastic Surgery Statistics Report. <https://www.plasticsurgery.org/documents/News/Statistics/2017/plastic-surgery-statistics-full-report-2017.pdf>