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# Long-Term Effects of Bariatric Surgery on Health-Related Quality of Life: A Systematic Review

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**Abstract:** Introduction: Obese patients who seek bariatric surgery (BS) have great impairment in health-related quality of life (HRQoL). Along with weight loss, BS leads to improvement in HRQoL in the short-term. However, physical, psychological and social issues that ensue after BS might impact on HRQoL in the long-term. The aim was to systematically review the literature in order to explore the impact of bariatric surgery on HRQoL of severely obese patients in the long-term. Methods: Electronic databases were searched (Pubmed/Medline, Lilacs, IBECs, Cochrane Library, SciELO) to retrieve studies of adults with BMI $\geq$ 35kg/m<sup>2</sup> which assessed HRQoL five or more years after BS. Hand search of references of previous reviews was also performed. GRADE was used to assess the quality of the evidence. Results: Of the 1226 articles retrieved, nine longitudinal studies were selected. A total of 4031 patients were followed-up. Female sex was predominant in all studies. Only one study did not find improvement in HRQoL after BS. Improvement of physical aspects of HRQoL was more commonly reported than mental aspects. The quality of the evidence retrieved was rated as low mainly due to the lack of adjustment for prognostic factors that might have led to confounding in the assessment of HRQoL and under-report of follow-up rates. Differences in the instruments to assess HRQoL and in the composition of control groups among the studies did not allow to perform meta-analysis. Conclusion: BS was associated with improvement in HRQoL in the long-term, particularly in physical aspects. The low quality of the studies selected points out to the need of controlled trials to better assess the long-term effects of BS on HRQoL.

**Keywords:** Quality of Life, Health-Related Quality of Life, Bariatric Surgery, Long-Term Effects

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## 1. Introduction

The global obesity epidemic has been rapidly becoming a major public health problem [1]. Obesity is associated with an increased risk for type 2 diabetes, hypertension, dyslipidemia, cardiovascular diseases, musculoskeletal disorders, psychological stress, certain types of cancer, mortality, and affects health-related quality of life (HRQoL) [2-4]. The primary objective of all forms of obesity treatment is to improve morbidity and mortality [4]. Bariatric surgery is, currently, considered the most effective treatment to

achieve sustained weight loss in patients with severe obesity [5, 6] and the number of individuals eligible for bariatric surgery exceeds public health care capacity for surgery [7].

Adherence to long-term follow-up after bariatric operation has been associated with better outcomes in regard to weight loss [8]. Current guidelines recommend that patients should be followed up during their entire life after bariatric surgery [9, 10]. Along with assessment of weight loss and regain, adherence to supplements use, comorbidities, occurrence of complications and reoperations [11], evaluation of HRQoL provides a comprehensive assessment of the burden and benefits of bariatric operations.

The World Health Organization (WHO) defines quality of life as the individuals' perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns [12]. Meanwhile, HRQoL encompass those aspects of overall quality of life that can be clearly shown to affect health—either physical or mental [13, 14]. Studies have shown HRQoL varies in overweight and obese patients by treatment-seeking status, and patients seeking bariatric surgery have the most impaired HRQoL [15]. Studies have demonstrated that bariatric surgery improves HRQoL in the short term [16, 17, 18]. However, changes in family, friends and employment relationships, as well as new health issues related to surgery, and potential complications might ensue after bariatric surgery. These changes might generate tension and pose special social, psychological, and lifestyle challenges to patients and comprise stressor factors in the long term ( $\geq$  five years) [19]. Furthermore, high drop-out rates after bariatric surgery [20, 21] make it difficult to investigate the effect of bariatric surgery on HRQoL in the long-term. Hence, the aim was to systematically review the literature in order to explore the impact of bariatric surgery on HRQoL of severely obese patients in the long-term.

## 2. Methods

For the purpose of this review, studies were eligible if they reported long-term data ( $\geq$  5 years) of adult ( $\geq$  18 years) patients submitted to bariatric operation. The exclusion criteria were: not HRQoL, not bariatric surgery, HRQoL available only for the pre-operative period, more than 50% of participants with BMI  $<$  35kg/m<sup>2</sup>, duplicated study (multiple papers reporting data from the same study were considered as one), not longitudinal studies, reoperation, jejunio-ileal bypass surgery, and studies that evaluated HRQoL only of specific subgroups, such as those with mental disorders.

Six electronic databases were searched (Pubmed/Medline, Lilacs, IBECs, Cochrane Library, SciELO) up to May 21<sup>st</sup>, 2015. No language restrictions were applied. Research was conducted both for Mesh terms and terms in titles/abstracts that corresponded to the following strategy: "massive obesity", "severe obesity", "morbid obesity", "abdominal obesity", "metabolic surgery", "weight loss surgery", "bariatric surgery", "bariatric medicine", "quality of life". Hand search of the references of previous reviews was also performed.

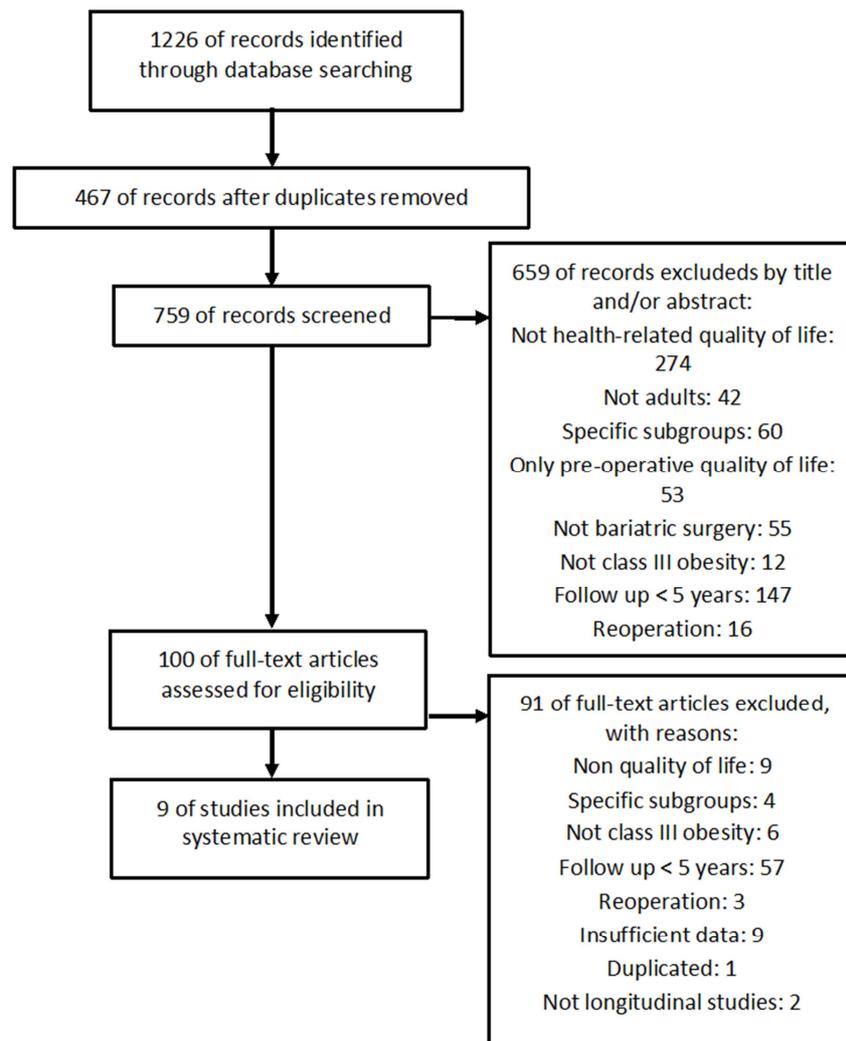


Figure 1. Literature identification strategy.

The search strategy resulted in 1226 articles. Of these articles 785 were excluded based on the title (467 were duplicated studies, 167 did not address HRQoL, 22 did not select adults, 36 investigated disease-specific groups, 37 assessed HRQoL only in the pre-operative period, 39 were not related to bariatric surgery – three selected more than 50% of participants with BMI < 35kg/m<sup>2</sup>, 13 did not have a long-term follow-up and - one was related to reoperation). 341 articles were excluded based on abstract screening (107 did not address HRQoL, 20 did not select adults, 134 did not have a long-term follow-up, 24 investigated disease-specific groups, 16 assessed HRQoL only in the pre-operative period, 16 were not related to bariatric surgery, nine did not assessed class III obesity and 15 were related to reoperation). Full text of the remaining 100 articles was read with 91 of them being excluded (nine did not address HRQoL, 57 did not have a long-term follow-up, four investigated disease-specific groups, six did not assess class III obesity, three were related to reoperation, nine had insufficient data and one was duplicated, two were not longitudinal studies). A summary flow chart of the literature identification strategy is presented in Figure 1.

Two reviewers (RSRA and ALBA) independently carried out the selection of the studies according to the pre-defined eligibility criteria. Any disagreement between them was evaluated by two other authors (AMRB and MFHSD).

The assessment of the quality of the evidence retrieved by the systematic review was performed according to the GRADE approach to observational studies, which proposes the rating of the risk of bias (low, serious or very serious) of individual studies in regard to the appropriateness of (1) the control population and (2) measures of the outcome both in the intervention and control groups, (3) measurement of prognostic factors that are possible to influence on the outcome and (4) adjustment for them, (5) rates of follow-up and (6) the magnitude of the effect of the intervention [22]. Rating of the appropriateness of the control population took into account whether the comparison was undertaken both over time (before and after surgery) and between groups which

were and were not (waiting list, no treatment or non-surgical treatment) submitted to surgery. Additionally, the recruitment of the control and intervention group from the same population was considered as an adequate composition of the control group. The use of the same HRQoL instrument in control and intervention groups and follow-up rates superior to 50% were the criteria applied to rate the risk of bias related to measures of the outcome and follow-up rates [5]. Weight loss, resolution of physical and psychosocial comorbidities, postoperative complications, re-interventions and use of medications were considered as important prognostic factors to measure and control for. The lack of either measurement of these factors or adjustment of HRQoL results for them led to an increase in the risk of bias according to pre-specified criteria. Improvement of both physical and mental components of HRQoL or report of improvement by at least 75% of the participants were used as criteria to rate the magnitude of the effect as high.

### 3. Results

All studies included in the review are longitudinal with a total of 4031 patients followed-up. Female sex was predominant in all studies (Table 1). Most of the studies did not report race of the participants. Among those which did, white race was predominant (96%) in Adams *et al.* (2012) [21], and black race (58%) in Velcu *et al.* (2005) [23]. Besides differences regarding the instrument used to assess HRQoL, the form of application of the instrument also varied among studies. Face-to-face [24-27], face-to-face or telephone [21, 23], face-to-face, mail or telephone [28] have been reported. Most studies have applied Bariatric Analysis and Reporting Outcome System (BAROS) (54.5%) and Study 36-Item Short-Form Health Survey (SF-36) (45.4%) to assess HRQoL. One study have used a general and a specific HRQoL instruments [28]. Surgical intervention was laparoscopic in five studies [24, 26-29]. Other characteristics of the studies retrieved are depicted in Table 1.

*Table 1. Characteristics of the included studies.*

Study	Total Number of Patients	Origin	Female (%)	Age at baseline		BMI at baseline	
				SG	CG	SG	CG
Kalfarentzos <i>et al.</i> , 2001	35	Greece	77.0	31.6*		44.1*	
Weiner <i>et al.</i> , 2003	984	Germany	85.9	38.4*		47.4*	
Velcu <i>et al.</i> , 2005	41	USA	89.0	32.4*		53.4*	
Pasnik <i>et al.</i> , 2005	86	Poland	72.3	41.0*		51.3*	
Karlsson <i>et al.</i> , 2007	1276	Sweden	--	47.0*	48.4*	41.9*	39.9*
Suter <i>et al.</i> , 2011	379	Switzerland	74.4	39.4*	---	46.3*	---
Adams <i>et al.</i> , 2012	1002	USA	82.0	18-72#	---	47.3*	46.3*; 43.8*
Aftab <i>et al.</i> , 2014	184	Norway	75.0	38.0*		46*	
García <i>et al.</i> , 2015	44	Spain	77.3	39.6*		51.3* PS; 34.6*- 1 year; 36.7*- 5 years	

*Table 1. Continued.*

Study	Surgical Technique	QoL Instrument	Follow-up (years)	Improvement in QoL
Kalfarentzos <i>et al.</i> , 2001	BPD	BAROS	5.0	No
Weiner <i>et al.</i> , 2003	LAGB	SF-36; BAROS	8.2 <sup>+</sup>	Yes

Study	Surgical Technique	QoL Instrument	Follow-up (years)	Improvement in QoL
Velcu et al., 2005	RYGB	SF-36	5.0	Yes
Pasnik et al., 2005	BPD	BAROS	Preoperative, 5.0 – 6.0 <sup>#</sup>	Yes
Karlsson et al., 2007	BPD; LAGB; RYGB	Current Health Scale	6.0– 10.0 <sup>#</sup>	Yes
Suter et al., 2011	RYGB	BAROS	5.0-7.0 <sup>#</sup>	Yes
Adams et al., 2012	RYGB	SF-36; IWQOL-Lite	5.8 <sup>+</sup>	Yes
Aftab et al., 2014	RYGB	SF-36; Obesity-related Problems scale	5.2*	Yes
García et al., 2015	BPD	BAROS	5.0	Yes

BMI: Body mass index; QoL: Quality of life; SG: Surgical Group; CG: Control Group; RYGB: Roux-en-Y Gastric Bypass; BPD: Biliopancreatic Diversion; LAGB: Laparoscopic Adjustable Gastric Banding; PS: Pre Surgical; QoL: Quality of Life; BAROS: Bariatric Analysis and Reporting Outcome System; SF-36: Short-Form Health Survey; IWQOL-Lite: Impact of Weight Quality of Life

\*: mean; +: median; #: range

Control groups characteristics differed widely among the studies. Control groups were comprised of obese participants waiting for bariatric surgery [23, 26, 27], obese participants either undergoing medical treatment [30] or without any treatment [21]. Likewise, surgical procedures varied importantly among studies. Additionally, individual studies investigated the effects of different types of bariatric operations on HRQoL, as shown in Table 1. Although differences in the instruments to assess HRQoL were noted among the studies (Table 1), they did not differ between the

intervention and control groups within individual studies. In general, the studies performed appropriate measures of prognostic factors both in the intervention and control groups. However lack of adjustment for these factors was common [23, 25, 26, 27, 30]. Most of the studies reported follow-up rates superior to 50%, but data on this issue was missing in two studies [27, 29]. Taking all these issues into account, the quality of the evidence retrieved by this review as low (Table 2).

Table 2. Quality of the evidence of the included studies.

Study	Control population		Exposure and outcome measurements		Control for confounding factors		Follow-up
	Control population	Selection	No differences	Similar surveillance	Accurate measurement	Matching	Complete
Kalfarentzos et al., 2001	XX	NA	X	NA	XX	XXX	X
Weiner et al., 2003	XXX	NA	XX	NA	X	XX	X
Velcu et al., 2005	XXX	NA	X	NA	XX	XXX	X
Pasnik et al., 2005	X	X	X	NA	XX	XXX	XXX
Karlsson et al., 2007	X	X	NA	X	NA	XXX	XXX
Suter et al., 2011	XX	NA	XX	X	X	XX	XXX
Adams et al., 2012	X	X	X	XX	X	X	XX
Aftab et al., 2014	XX	X	X	X	X	XXX	X
Garcial et al., 2015	XX	NA	X	X	X	XXX	XXX

X - Low Risk of Bias; XX - Serious Risk of Bias; XXX Very Serious Risk of Bias; NA – not available

Control population: Control population (control of time and group); Selection: Selection of exposed and unexposed in cohort studies not from different populations; No differences: No differences in measurement of exposure ( different types of operation, different types of treatment in the control group, BAROS recall bias); Similar surveillance: Similar surveillance for outcome in exposed and unexposed in cohort studies (same instruments were used in the experimental and control groups); Accurate measurement: Accurate measurement of all known prognostic factors; Matching: Adequate match for prognostic factors and/or lack of adjustment in statistical analysis; Follow-up: Complete follow-up

According to pre-defined criteria, four of the nine studies [23-25, 27] reported a high magnitude of the effect of bariatric surgery on quality of life. Only one found that HRQoL was reduced after surgery [25]. This study selected only patients submitted to vertical banded gastroplasty. Most of the studies, however, observed that improvement was not consistent among all aspects of HRQoL. According to Velcu et al. (2005) [23], SF-36 scores have improved after gastric bypass. Yet, no significant difference was noted between the

5-year postoperative group and the U.S. norm. In Karlsson et al. (2007) [30] study, at 10 years net gains were noted in all HRQoL domains compared to baseline. Surgical group presented better outcomes on current health perceptions, social interaction, psychosocial functioning and depression, whereas no significant differences were found for overall mood and anxiety. A detailed description of HRQoL results per article is presented in table 3.

Table 3. Health-related Quality of Life Results.

Article	Comparison Group	QoL Instrument and Outcome	
		CG	SG
Kalfarentzos et al., 2001	Same patients at 5 postoperative years	----	BAROS: No improvement in QoL. At 5 years postoperatively, none of the patients were in the very good or excellent categories
Weiner et al.,	Same patients at 8	----	Using the SF-36, the changes were small; however,

Article	Comparison Group	QoL Instrument and Outcome	
		CG	SG
2003	postoperative years		with BAROS a stable improvement was found <sup>^</sup> SF-36: PCS: 50.9; MCS: 48.5
Velcu et al., 2005	Pre-surgical obese (same surgical patients)	SF-36: PCS: 33.5***; MCS: 42.8***	5-year postoperative group and the U.S. norm*
Pasnik et al., 2005	-----	-----	BAROS: > 90% of the patients reported improvement in QoL
Karlsson et al., 2007	Conventional treatment	Current health perceptions: 55.4***** Social interaction: 7.7*** Obesity-related problems: 31.3***** Overall mood: 3.11 Depression: 3.7** Anxiety: 4.0	Current health perceptions: 57.5 Social interaction: 8.4 Obesity-related problems: 29.7 Overall mood: 3.06 Depression: 3.7 Anxiety: 4.6
Suter et al., 2011	-----	-----	BAROS: More than 95% of the patients had a good to excellent 5-year overall results
Adams et al., 2012	Bariatric surgery vs pre-surgical obese (CG1) vs population-based sample of severely obese adults without prior history of bariatric surgery (CG2)	SF-36: PSC - CG1: 33.3 (9.7)*; CG2 39.3 (10.2)**; MCS - CG1: 40.4 (12.0); CG2: 47.8 (11.4) IWQOL-Lite total score: CG1: 34.9 (18.4); CG2: 54.5 (19.5)	SF-36: PCS - 31.4 (9.3); MCS - 41.4 (11.7) IWQOL-Lite total score: 31.4 (16.5)
Aftab et al., 2014	Pre-surgical obese awaiting bariatric surgery	OP-scale: 28 SF-36: PCS: 35.5***; MCS: 40.1*** BAROS: Greatly diminished (20,5%), diminished (27,3%), minimal to no change (34,1%), improved (13,6%) greatly improved (4,5%)	OP-scale: 70 SF-36: PCS: 47.4; MCS: 46.9 BAROS: Greatly diminished (6,7%), diminished (13,3%), minimal to no change (26,7%), improved (20%) greatly improved (33,3%)
Garcia et al., 2015	Pre-surgical obese (same surgical patients)		

CG: Control Group; SG: Surgical Group; PCS: Physical Component Score; MCS: Mental Component Score; PF: Physical functioning; RP: Role-physical; BP: Bodily pain; GH: General health; VT: Vitality; SF: Social functioning; RE: Role-emotional; MH: Mental health; BAROS: Bariatric Analysis and Reporting Outcome System; SF-36: Short-Form Health Survey; IWQOL-Lite: Impact of Weight Quality of Life; OP-Scale: Obesity-related Problems scale

Maximum score of greatly improved in BAROS: +3; OP-Scale: range of scores 0 (no impairment) to 100 (maximum impairment); SF-36: range of scores 0-100 with higher scores indicating better health status, physical component score 12-69 with 69 being best, mental component score 8-73 with 73 being best; IWQOL-Lite total score: range of scores 0-100, with 100 being best and normative mean of 94.7

<sup>^</sup>no numeric results were provided in the reference paper

\*p>.05 \*\*p<.05 \*\*\*p<.01 \*\*\*\*p<.001 \*\*\*\*\*p<.0001

## 4. Discussion

The great majority of the studies retrieved by this systematic review reported that bariatric surgery was associated with long-term improvement in HRQoL. Actually, improvement of physical aspects of HRQoL was more common than mental aspects in the long-term after bariatric surgery. These results are consistent with recent reviews [18, 31, 32]. False expectations that bariatric surgery does not demand long-term maintenance of healthy lifestyle habits in order to control weight and comorbidities, as well as changes in social ties after surgery [19], might explain the lack of improvement in mental aspects of HRQoL. These results highlight the need for adjunctive interventions targeting mental health and social and environmental factors to facilitate improvement in all domains of HRQoL following bariatric surgery [18]. Furthermore, Andersen et al. (2015) [33] showed impaired HRQoL prior to surgery and much of initial HRQoL improvements were maintained over the long term.

Both disease-specific and generic HRQoL instruments were used in the studies included in this review. Ballantyne (2003) [34] recommended that studies addressing the issue of HRQoL and obesity should have at least one generic and

specific HRQoL questionnaire for better HRQoL information and to facilitate comparisons of results across studies. BAROS, which is a questionnaire used to evaluate the results of surgical treatment of morbid obesity [35], was the disease-specific instrument most commonly applied among the studies retrieved in the review. Recall bias may have occurred in studies which applied BAROS only in the post-operative period with inherent comparison to conditions in the pre-operative period. On the other hand, with the use of generic instruments such as SF-36, the HRQoL is assessed both, at pre and post-operative time, by each of eight domains (limitations in physical activities, social activities usual role activities, bodily pain, general mental health, vitality, and general health perception) [36], and it is possible to evaluate the HRQoL both at the time of the pre-operative and post-operative [37]. However, since it is a generic health-related HRQoL measurement, in contrast with BAROS which is a disease specific instrument developed to study samples of obese patients [38], SF-36 may not capture all the changes that occur with the obese population who undergo bariatric surgery.

The GRADE also suggests the assessment of imprecision, inconsistency and risk of bias of the evidence retrieved by systematic reviews with meta-analysis. Like Andersen et al. (2015) [33], meta-analysis of the data would not be

appropriate due to substantial differences between the studies in regard to design and use of multiple instruments of HRQoL that are not comparable, these criteria were not evaluated.

The quality of the evidence retrieved was considered as low, particularly due to under-report of follow-up rates. Results of studies that did not take follow-up rates into account might have been biased since HRQoL might differ between those who were and were not followed. Additionally, failure to account for an imbalance between surgical and control groups in relation to factors that might influence HRQoL, such as the presence of comorbidities and the use of medications at baseline and changes over the follow-up, might have introduced bias to the studies. Moreover, great differences in control groups characteristics, surgical procedures and types of HRQoL instruments lead to high heterogeneity among the studies, which makes it difficult to compare the results. Other limitations include the lack of pre-operative scores in the surgical group [26], the lack of designated control groups [28], and the small study population [29]. A further limitation of this review is that none of the included studies met all GRADE quality criteria.

The investigation of factors, such as weight loss [30], associated with HRQoL after bariatric surgery gives some clues to health professionals to aspects to pay attention to in bariatric surgery patients' care, in order to achieve favorable outcomes regarding the long-term HRQoL.

The high proportion of good results in comparison to poor results after surgery found in this review raises suspicion of publication bias, since one study showed no improvement or decrease in QoL and eight showed an improvement in QoL. Publication bias occurs when the outcome of a study influences the decision whether to publish it or not. Literature reviews on support for a hypothesis can be biased if the original literature is contaminated by publication bias. Although has not been investigate the occurrence of this bias by statistical methods, the search included grey literature evidence, which is more prone to contain negative results.

## 5. Conclusion

In general, bariatric surgery was associated with improvement in HRQoL in the long-term, particularly in physical aspects. This suggests that psychosocial interventions are essential in the long-term care after bariatric surgery. The low quality of the studies selected points out that future research should include randomized trials, make clear report of follow-up rates and control for prognostic factors such as weight loss, resolution of physical and psychosocial comorbidities, postoperative complications, reoperations and drug use.

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## Conflict of Interest

All the authors do not have any possible conflicts of interest.

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