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Original Article

Quality of life after total knee arthroplasty: systematic review ☆,☆☆

Robson Rocha da Silva^a, Ayrton André Melo Santos^a, José de Sampaio Carvalho Júnior^a, Marcos Almeida Matos^{a,b,*}^a Santa Casa de Misericórdia da Bahia, Hospital Santa Isabel, Salvador, BA, Brazil^b Bahia School of Medicine and Public Health, Salvador, BA, Brazil

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ABSTRACT

Objective: To review the literature on quality of life among patients who underwent total knee arthroplasty (TKA) and assess the impact of various associated factors.**Methods:** This was a systematic review of the literature in the Medline, Embase, Lilacs and SciELO databases, using the terms: TKA (total knee arthroplasty); TKR (total knee replacement); quality of life; and outcomes. There were no restrictions regarding study design.**Results:** 31 articles addressing this topic using various quality-of-life evaluation protocols were selected. SF-36/SF-12, WOMAC and Oxford were the ones most frequently used. The studies made it possible to define that TKA is capable of making an overall improvement in patients' quality of life. Pain and function are among the most important predictors of improvement in quality of life, even when function remains inferior to that of healthy patients.**Conclusion:** The factors associated negatively were obesity, advanced age, comorbidities, persistence of pain after the procedure and a lengthy wait for surgery.

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Qualidade de vida após artroplastia total do joelho: revisão sistemática

RESUMO

Objetivo: Revisar a literatura sobre qualidade de vida em pacientes submetidos a artroplastia total de joelho (ATJ) e avaliar o impacto de diversos fatores associados.**Métodos:** Revisão sistemática da literatura nos bancos de dados Medline, Embase, Lilacs e Scielo, com os termos: TKA (*total knee arthroplasty*); TKR (*total knee replacement*); *quality of life*; e *outcomes*. Não houve restrições quanto ao desenho do estudo.**Resultados:** Foram selecionados 31 artigos que abordavam o tema com vários protocolos de avaliação de qualidade de vida. SF-36/SF-12, Womac e Oxford foram os mais frequentes. Os estudos permitiram definir que a ATJ é capaz de melhorar globalmente a qualidade de vida

Palavras-chave:

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** Work developed in the Bahia School of Medicine and Public Health and at Santa Casa de Misericórdia da Bahia, Hospital Santa Isabel, Salvador, BA, Brazil.

* Corresponding author.

E-mail: malmeidamatos@hotmail.com (M.A. Matos).2255-4971© 2013 Sociedade Brasileira de Ortopedia e Traumatologia. Published by Elsevier Editora Ltda. Open access under [CC BY-NC-ND license](http://creativecommons.org/licenses/by-nc-nd/4.0/).<http://dx.doi.org/10.1016/j.rboe.2014.09.007>

dos pacientes. Dor e função estão entre os mais importantes preditores de melhoria da QV, mesmo quando a função permanece inferior à de pacientes saudáveis.

Conclusão: Os fatores associados negativamente foram obesidade, idade avançada, comorbididades, persistência de dor após o procedimento e espera demorada pela cirurgia.

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Introduction

Degenerative joint disease, or osteoarthritis, is generally the main cause of physical deficiencies among elderly people.¹ The pain and functional limitation caused by this condition, especially in the lower limbs, present a strong correlation with reduced quality of life (QOL) among these individuals.¹ In the case of degenerative knee arthropathy, total knee arthroplasty (TKA) is the preferred therapeutic option for cases of greater severity. This surgical procedure has been documented as very satisfactory with regard to pain relief and restoration of joint function. This has led to greatly increased demand for this procedure to be performed, with a consequent strong economic impact.²

The current methods for assessing the results from TKA are based mainly on clinical signs and symptoms, physical examination and radiographic evaluation. This type of assessment does not take into account all aspects of the treatment, given that it is unable to detect patients' real needs and expectations, such as changes to their QOL, social relationships and environment.

After achieving pain relief and restoration of joint function during the late postoperative period, patients tend to reassess their priorities. From then on, the way in which the surgical results have had a positive impact on patients' overall health and function and on their QOL needs to be assessed. Recent studies have shown that subjective factors affect the way in which individuals internalize their symptoms and functional capacity. Consequently, objective medical evaluation based on clinical and radiographic examination may be less important than the personal and individual idea that the treatment was successful in providing the results that the patient himself or herself was expecting before the procedure.³⁻⁶

The impact on QOL and satisfaction in relation to expectations are gaining attention day by day as strong indicators for evaluating the results obtained subsequent to TKA. These two parameters are the only ones capable of presenting the results from patients' own point of view. They also enable better understanding of the real effects from the surgery, including physical and psychosocial benefits, which also should be taken into account in making decisions and in therapeutic management. Studies on QOL have started to be conducted and to be valued because of the fundamental importance that they also have within the scope of public health and public policies, and within the fields of health promotion and disease prevention, as indicators for assessing the efficacy and impact of treatments, especially those that have a high cost.

Many studies have revealed improvements in QOL among patients who have undergone TKA, but the variety of instruments and measurement intervals used, different scoring algorithms and non-standardized presentations of results

have also led to challenges in attempting to understand the literature on this topic. It also needs to be emphasized that the presence of various confounding variables such as age, gender, physical health conditions, psychological factors, schooling level, socioeconomic conditions, prior expectations and presence of complications, among others, reveals that there is a need for better comprehension of the real results provided by TKA regarding patients' QOL.⁷

This study had the aim of reviewing the literature on QOL among patients who undergo TKA, with a view to defining the impact of a variety of factors on the results and also defining which of them require better comprehension, in order to guide future studies on this subject.

Materials and methods

In order to survey the literature on this subject, the Medline, Embase, Lilacs and SciELO databases were searched using the following terms: TKA (total knee arthroplasty); TKR (total knee replacement); quality of life; and outcomes. The search was restricted to the English language and the last ten years. The reference lists of the studies selected were also searched for other articles that possibly could be included.

No restrictions were imposed regarding study design. Nonetheless, most of the studies selected were prospective and observational. Studies that, in addition to TKA cases, also included data on patients who underwent total hip arthroplasty (THA) were also accepted if they separated the knee and hip cases in their analyses.

Articles that aimed to validate or compare questionnaires, evaluate revision surgery or nonsurgical treatment, or compare different prosthesis models, were excluded. Likewise, those dealing with other subjects that did not relate directly to the objective of the systematic review were also excluded.

The articles selected through the search were read and evaluated by at least three of the present authors and were accepted through reaching a consensus. After inclusion, all these studies were classified according to their level of evidence, using the system of the Center for Evidence-Based Medicine (CEBM).⁸

The factors evaluated in the studies selected were of methodological nature, such as authorship, design, year, target population, sample, data-gathering instrument used and main clinical outcomes. A critical assessment of the instruments used, the factors that could have acted as confounding variables and the likely relationship between QOL and patients' expectations.

The studies selected were presented descriptively in tables and their data were analyzed in detail to construct a meta-analysis model. However, because of the methodological heterogeneity and the non-standardized form of presentation

Table 1 – Levels of evidence and designs of the studies selected.

Study number	Author	Year	Level of evidence	Design
1	Narayanasamy et al.	2011	2B	Prospective cohort
2	Santic et al.	2012	2B	Prospective cohort
3	Papakostidou et al.	2012	2B	Prospective cohort
4	Scott et al.	2012	2B	Prospective cohort
5	Grosse Frie et al.	2012	2B	Prospective cohort
6	Baker et al.	2012	2B	Prospective cohort
7	Schwartz et al.	2012	2B	Prospective cohort
8	Zhang et al.	2012	2B	Prospective cohort
10	Desmeules et al.	2010	2B	Prospective cohort
11	Bugala-Szpak et al.	2010	2B	Prospective cohort
12	Kaupila et al.	2010	2B	Prospective cohort
13	Gawel et al.	2010	2B	Prospective cohort
14	Brandes et al.	2010	2B	Prospective cohort
15	Desmeules et al.	2012	2B	Prospective cohort
17	Baumann et al.	2011	2B	Prospective cohort
16	Ackerman et al.	2011	2B	Prospective cohort
17	Gonzalez et al.	2010	2B	Prospective cohort
18	Kilic et al.	2009	2B	Prospective cohort
19	Nunez et al.	2009	2B	Prospective cohort
20	Loughead et al.	2008	2B	Prospective cohort
21	McHugh et al.	2008	2B	Prospective cohort
22	Fitzgerald et al.	2004	2B	Prospective cohort
23	Greidanus	2011	2B	Prospective cohort
24	Rissanen et al.	1996	2B	Prospective cohort
25	Nunez et al.	2007	2B	Prospective cohort
26	Bruyere et al.	2012	2B	Prospective cohort
27	Lingard et al.	2004	2B	Prospective cohort
28	Scott et al.	2010	2B	Prospective cohort
29	Jones et al.	2012	2A	Systematic review
30	Vissers et al.	2012	2A	Systematic review
31	Ethgen et al.	2004	2A	Systematic review

of the effect size of the outcome variables, it was not possible to sum the effects and proceed with construction of a meta-analysis model. Thus, the results were presented in the form of a systematic review, in order to show the main qualitative findings from each study.

Results

From the search, 31 articles were selected: 28 observational and three review articles (two systematic reviews and one narrative review). [Table 1](#) shows the classification of the articles selected according to their level of scientific evidence and type of design. [Table 2](#) presents the main qualitative data of the observational studies selected. [Table 3](#) presents the main characteristics of the review studies.

The SF-36 and/or SF-12 questionnaire was found in 20 of the studies evaluated, as a generic QOL instrument. The WOMAC questionnaire was used in 13 of the studies as a specific instrument for QOL in osteoarthritis. All the evaluation instruments used are shown in [Table 4](#).

Discussion

Questionnaire for assessing quality of life

All the studies evaluated reported that the patients who underwent TKA achieved improvement of their QOL. However,

many factors were evaluated and different methods and protocols were used. The studies also varied greatly in relation to the length of the assessment period, going from short-term to long-term analyses.

Most of the studies used a generic QOL questionnaire that addressed general aspects of patients' physical, mental, psychological and social wellbeing. Another questionnaire was almost always used to assess physical and functional issues, specifically for patients with arthrosis. Some studies used non-traditional questionnaires or questions for evaluating individuals' satisfaction regarding the surgery. This multiplicity of methods was a limiting factor and made it impossible to conduct standardized comparisons on the results from studies.

Among the various factors evaluated that were associated with the concept of QOL, one of the factors most frequently seen was function. In an observational study, Gawel et al.⁹ found that there was a significant improvement in knee function among the patients when they used the leg for walking, going up stairs, standing and turning. These positive findings were observed as early as in the fourth week of evaluation. However, Fitzgerald et al.¹⁰ observed that, one month after the surgery, despite improvements in other respects, their patients presented significantly decreased physical function, which increased their dependency on family support. Papakostidou et al.¹¹ observed that, six weeks after the surgery, despite improvement in their patients' pain and relief of their depressive states, function remained unsatisfactory.

Table 2 – Main characteristics of the observational studies.

Study number	Follow-up	Scales	Main finding
1	Pre, 6 m, 24 m	SF-36, Oxford	There were improvements in the SF-36 and Oxford scores, especially regarding physical aspects and pain.
2	Pre, 2 y	SF-36	TKA and THA significantly increased elderly patients' QOL.
3	Pre, 6 w, 3 m, 6 m, 12 m	WOMAC, KSS, VAS	Six weeks after surgery, despite improvement in pain and relief of depressive states, function remained unsatisfactory.
4	Pre, 1 y	Oxford, SF-12	Achievement of expectations was highly correlated with degree of satisfaction.
5		Oxford, EQ-5D	Increases in health indicators after TKA could be achieved through reduction of postoperative complications.
6	Pre, 6 m	Oxford, EQ-5D	The increases in Oxford and EQ-5D scores were significantly greater in TKR than in UKR
7	Pre, 1 y	Oxford, SF-36	There was a significant improvement in dynamic balance one year after surgery.
8	Pre, 6 m, 18 m	SF-36, EuroQol	There were significant improvements in QOL among patients undergoing TKA, both 6 and 18 months after surgery
10	Pre	WOMAC, SF-36	Preoperative waiting time had a significantly negative impact on pain, function and QOL.
11	1-3 d, 6 w	KOOS, SF-36	Sex, age, axis, presence of other implants and preoperative contractures did not significantly QOL after surgery.
12	Pre, 12 m	WOMAC, 15D, Omeract, OARSI	The findings highlighted the multifactorial nature of the state of health in TKA cases.
13	Pre, 4 s	Lysholm and Gilquist, SF-36	The positive effects from surgery could be seen as early as 4 weeks after the operation.
14	Pre, 2 m, 6 m, 12 m	KSS, SF-36, DynaPort ADL monitor, step activity monitor	The level of activity after treatment seems to be more influenced by physical activity behavior before the operation than by the treatment itself.
15	Pre, 6 m	WOMAC, SF-36, OAKHQOL, Quality of Care Scale	Long preoperative waits had a negative impact on QOL and contralateral pain. Patients who were satisfied with the medical information received had high postoperative QOL scores.
16	Pre	AQoL, WOMAC, Kessler PDS	More than half of the participants waiting for joint replacement experienced deterioration of QOL during the waiting period.
17	Pre, 3 m, 12 m	WOMAC, SF-12, EQ-5D	The patients' expectations were achieved and there were large QOL gains.
18	Pre, 6 s, 3 m, 6 m	SF-36, KSCRS	A significant improvement in QOL was achieved among female patients, six weeks after the operation.
19	Pre, 7 y	WOMAC, SF-36	Obesity and post-discharge complications were associated with worse scores in all dimensions of WOMAC.
20	15 y	WOMAC, SF-36	No significant differences were found between revised and non-revised cases.
21	3 m, 6 m, 9 m	VAS, WOMAC, SF-36	There were significant deteriorations in pain and physical function on the WOMAC scale among patients who were on the waiting list.
22		SF-36	Body pain and physical function improved after arthroplasty. Social support was correlated with improvement of pain and physical function.
23	Pre, 2 y	WOMAC, Oxford-12, SF-12, reported satisfaction	In follow-ups on TKA revision, the patients continued to have worse results, in comparison with primary TKA.
24	Pre, 6 m, 12 m, 24 m.	Nottingham Health, 15D	Greater gains were observed regarding pain, sleep and mobility. On average, in most QOL dimensions, the patients achieved QOL similar to that of the general population.
25	Pre, 36 m	WOMAC	There were significant differences from before to after the operation regarding pain, stiffness and functional scores.
26	Pre, 6 m, 7 y	WOMAC, SF-36	Six months after surgery, an improvement was observed through both SF-36 and WOMAC.
27		WOMAC, SF-36	Patients who had significant functional limitations, severe pain and low mental health scores were more likely to have worse postoperative results.
28	Pre, 6 m, 1 y		Management of patients' expectations and mental health might reduce dissatisfaction.

Pre, preoperative period; d, days; w, weeks; m, months; y, years.

SF-36, Short Form Health Survey 36/12; WOMAC, Western Ontario and McMaster Universities; Oxford, Oxford Knee Score; EQ-5D, European Quality of Life Instrument; KSS, Knee Society Score; KOOS, Knee Injury and Osteoarthritis Outcome; Omeract-OARSI, Rheumatology-Osteoarthritis Research Society International; OAKHQOL, Osteo Arthritis Knee and Hip Quality Of Life; AQoL, Assessment of Quality of Life; Kessler PDS, Kessler Psychological Distress Scale; KSCRS, Knee Society Clinical Rating System.

Table 3 – Main characteristics of the review studies.

ID	Study number	Design	Number of studies analyzed	Details of the study
1	29	Narrative review	33	Clinically significant alterations were found with regard to pain and function from before to after the operation, on the WOMAC scale. Smaller changes were reported regarding joint stiffness. The complication rate from TKA was low. Generic health scales presented lower magnitude of changes, since the construction of these scales includes the effect of other health conditions.
2	30	Systematic review	35	There was strong evidence that patients with catastrophic pain reported more pain after the operation. There was strong evidence that preoperative depression did not influence postoperative function, one year after the operation. There was strong evidence that low preoperative mental health was associated with poor function and pain scores.
3	31	Qualitative systematic review	74	Age was not shown to be an obstacle for the surgery to be effective. Men seemed to be benefited by the surgery more than women. When there were significant comorbidities, the gain was modest. Patients with poorer preoperative QOL presented greater likelihood of gains. Data on health-related QOL are valuable and may provide important information regarding the state of health. Such data should be used rationally for implementing healthcare standards.

ID, identification.

Only in the assessment three months after the operation was an improvement in the functional aspect of QOL observed, both through WOMAC and through KSS.

Gains in functional factors after the initial evaluation were also observed in other studies. Kilic et al.¹² showed in evaluations made after six weeks and six months using SF-36 and KSCRS that there were significant improvements on all the scales after six weeks. However, only the physical dimension continued to improve significantly up to the end of the evaluation. In another study, it was observed that from six weeks after the operation until the end of the follow-up, there was a continual improvement in the dimensions of physical function and emotional state, both in SF-36 and in WOMAC.¹³ Improvement in dynamic balance also correlated positively with increased functional capacity and better QOL.¹⁴

Brandes et al.¹⁵ observed that TKA provided profound improvement and excellent clinical results for most of their patients. Nonetheless, despite this improvement, many patients do not reach the level of physical activity of healthy patients. The level of activity after the treatment seems to be more influenced by the habit of practicing physical activity before the surgery than by the treatment itself.¹⁵

With regard to pain, improvements have been observed in several studies.^{11,12,16-19} The positive effects from surgery can be observed as early as one,¹⁰ four²⁰ or six¹¹ weeks after the operation and have been seen to last for up to seven years after the surgery.¹⁹ The improvement in pain has a close correlation with achieving better QOL scores, but if pain continues to be present in postoperative assessments, the possibility of attaining good results becomes lower.²¹ Furthermore, generalized preoperative pain that is unrelated to the

knees has been found to negatively influence postoperative QOL scores.¹⁹ Social support¹⁰ and practicing physical activity before the operation^{15,19} have also been strongly associated with improvements both in pain and in joint function.

Table 4 – Protocols for quality-of-life (QOL) assessment.

QOL protocols	Frequency of use in studies (%)
SF-36/12	18 (35.2%)
WOMAC	12 (22.2%)
Oxford	6 (11.1%)
EQ-5D/EuroQoL	4 (7.4%)
KSS	2 (3.7%)
KOOS	1 (1.8%)
15D	2 (3.7%)
Omeract	1 (1.8%)
OARSI	1 (1.8%)
Lysholm	1 (1.8%)
OAKHQOL	1 (1.8%)
Quality of Care Scale	1 (1.8%)
AQoL	1 (1.8%)
Kessler PDS	1 (1.8%)
KSCRS	1 (1.8%)
Nottingham Health	1 (1.8%)

SF-36/12, Short Form Health Survey 36/12; WOMAC, Western Ontario and McMaster Universities; Oxford, Oxford Knee Score; EQ-5D, European Quality of Life Instrument; KSS, Knee Society Score; KOOS, Knee Injury and Osteoarthritis Outcome; Omeract-OARSI, Rheumatology-Osteoarthritis Research Society International; OAKHQOL, Osteo Arthritis Knee and Hip Quality of Life; AQoL, Assessment of Quality of Life; Kessler PDS, Kessler Psychological Distress Scale; KSCRS, Knee Society Clinical Rating System.

Sociodemographic factors that influence quality of life

Associations between sociodemographic data and QOL were tested in the studies that were analyzed in this review. Regarding gender, according to Papakostidou et al.,¹¹ female patients presented lower scores in assessments conducted both before the operation and six weeks afterwards. However, in another study that used SF-36 and KOOS, it was observed that gender, age, axis, presence of other implants and preoperative contractures did not significantly influence the pain scores.²² According to Rissanen et al.,¹⁸ advanced age limited the gains, in evaluating the TKA results in terms of scoring. In another study, it was observed that both advanced age and pulmonary disease reduced the possibility of reaching satisfactory QOL.²¹

In relation to other demographic factors, Papakostidou et al.¹¹ found that schooling level did not interfere with the QOL of patients undergoing TKA. Moreover, housing location, education level and social support were not predictors of QOL after the surgery. In another study, conducted by Fitzgerald et al.,¹⁰ preoperative pain, physical function, demographic characteristics and social support presented significant correlations with improvement of pain and physical function.

Other points evaluated that improved through surgery and were positively correlated with better QOL included edema, claudication²⁰ and sleep,¹⁸ along with dynamic balance, which correlated with improved mobility.¹⁴

Obesity and postoperative complications have been associated with worse scores in all the dimensions of WOMAC. Both separately and in combinations, they negatively influenced the results in the initial assessments and also over the long term, and they predicted poorer QOL for the patients.¹⁹ Low postoperative WOMAC scores have been found in the presence of severe obesity, with significant impairment regarding pain, stiffness and functional scores.²³

Reports of complications among patients have presented high correlations with low QOL scores. Higher indicators and lower levels of comorbidities in patients' health after TKA can be achieved through reducing or preventing complications during the postoperative period.²⁴ Lingard et al.²⁵ reported that the most significant predictors of poor pain and function scores from WOMAC and poor function scores from SF-36 were high numbers of comorbidities and low preoperative mental health scores from SF-36.

The length of time spent waiting for surgery and its correlation with QOL were studied in some of the articles selected. Desmeules et al.²⁶ observed that a long wait for surgery had a significantly negative impact on pain, function and QOL. Another observational study divided the patients into four groups, depending on the length of their wait for surgery: < three months; three to six months; six to nine months; and > nine months.²⁷ In cases with a wait of more than six months, there was a significant difference in QOL between the groups in relation to pain in the contralateral knee. Patients who had to wait for more than nine months presented the worst scores.²⁷ For example, McHugh et al.²⁸ observed worsened pain and function on the WOMAC scale, starting from a wait for surgery of three months.

More than half of the participants who were waiting for joint replacement experienced deterioration of QOL during

the waiting period. These data provide the necessary evidence to guide healthcare professionals and public policymakers in drawing up care programs and allocating resources for individuals who require surgery to replace this joint.²⁹

Relationship between level of expectation, postoperative satisfaction and quality of life

The preoperative level of expectation was not significantly associated with satisfaction with these expectations or with the results obtained.³⁰ However, achievement of expectations was highly correlated with the degree of satisfaction. Patients who reported that their expectations had been met, at an evaluation conducted 12 months after the surgery, also presented a significantly greater gain in QOL.³¹

The patients had high expectations of benefits from surgery, especially with regard to pain relief, ability to walk and social interaction.³¹ Those whose expectations were achieved consequently had large gains in QOL. Gonzalez et al.³¹ reported that health insurers should help their patients to develop realistic expectations regarding the impact of knee arthroplasty, so as to avoid frustration with the surgical results.

Through a multicenter observational study, Scott et al.³² evaluated 1217 patients who underwent TKA and observed that their expectations had a high correlation with satisfaction, one year after the surgery. They reported that management of patients' expectations and mental health might reduce their dissatisfaction. Nevertheless, the most important predictor of dissatisfaction was pain-free total arthroplasty.³²

Patients who were satisfied with the medical information received regarding the surgery had high postoperative QOL scores. Satisfaction with the immediate care after surgery is a good predictor of achievement of patients' expectations one year after the surgery and is an important indicator for patients' self-reported health.³³

Study perspectives

Our study has revealed that there is a need to standardize QOL scales, given that the existence of various health-related QOL instruments has turned comprehension and comparison of the literature into a challenge. Standardization may improve the use of information coming from this type of survey.

It can also be suggested, for future studies on this topic, that assessments on patients' QOL should place value on broader parameters than symptom control, reduction of mortality or increased life expectancy.^{34,35} Evaluations on patients undergoing TKA cannot be limited to their conditions of health but must include their feelings, expectations and behavior, especially with regard to their functional abilities for activities of daily living.³⁶⁻⁴⁴

Conclusion

TKA is a procedure that is capable of providing an overall improvement in patients' QOL. This improvement seems to continue, even six months after the procedure. Pain and

function are among the most important predictors of improved QOL, even when function remains inferior to that of healthy patients. Other factors that were positively correlated with better QOL after TKA included better dynamic balance, less claudication, better quality of sleep, physical activity practiced before the procedure, adequate social and familial support and fulfillment of patients' expectations regarding the results from the surgery. The factors that were negatively associated were obesity, advanced age, comorbidities, persistence of pain after the procedure and waiting a long time for the operation.

Conflicts of interest

The authors declare no conflicts of interest.

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