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SCIENTIFIC ARTICLE

Quality of recovery after anaesthesia measured with QoR-40: a prospective observational study

Luís Guimarães-Pereira[a,b,*], **Maria Costa**[b], **Gabriela Sousa**[a], **Fernando Abelha**[a,b]

[a] *Anaesthesiology Department, Centro Hospitalar São João, Porto, Portugal*
[b] *Faculdade de Medicina, Universidade do Porto, Portugal*

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KEYWORDS
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Abstract
Background: QoR-40, a 40-item questionnaire on quality of recovery from anaesthesia, has been shown to measure health status after surgery. Our aim was to evaluate the incidence of poor quality of recovery in our Post Anaesthesia Care Unit and to compare their QoR-40 scores before surgery and 3 months later.
Methods: A prospective observational study was conducted in adult patients consecutively admitted from 18 June to 12 July 2012. The follow-up period was 3 months. We exclude patients submitted to cardiac surgery, neurosurgery, obstetric surgery and with a mini-mental state examination test score lower than 25. The primary endpoint was quality of recovery measured with the validated Portuguese for Portugal version of the QoR-40 before surgery (T0), 24 h after surgery (T1) and 3 months after (T2).
Results: A total of 114 patients completed the study. Mean QoR-40 score was 169 and patients with poor quality of recovery were identified if their QoR-40 score was lesser than 142. This occurred in 26 patients (24%). Global median scores for patients with poor quality of recovery were lower at T0 (121 *vs.* 184, $p < 0.001$), at T1 (120 *vs.* 177, $p < 0.001$) and at T2 (119 *vs.* 189, $p < 0.001$).
Conclusion: Patients with poor quality of recovery had lower quality of life. This fact may allow earlier and more effective interventions, in order to improve quality of life after surgery. Beside its utility after surgery, QoR-40 may be important prior to surgery to identify patients who will develop a poor quality of recovery.

* Corresponding author.
E-mail: luis.alberto.p@hotmail.com (L. Guimarães-Pereira).

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PALAVRAS-CHAVE
Anestesia;
Qualidade de recuperação;
Qualidade de vida;
QoR-40

Qualidade da recuperação pós-anestesia medida com QoR-40: um estudo observacional prospectivo

Resumo
Justificativa: QoR-40, um questionário com 40 itens sobre a qualidade de recuperação da anestesia, mostrou medir o estado de saúde após a cirurgia. O nosso objetivo foi avaliar a incidência de má qualidade da recuperação em nossa Sala de Recuperação Pós-anestesia e comparar os escores do QoR-40 antes e três meses depois da cirurgia.
Métodos: Estudo observacional prospectivo, realizado com pacientes adultos admitidos consecutivamente de 18 de junho a 12 de julho de 2012. O período de acompanhamento foi de três meses. Excluímos os pacientes submetidos à cirurgia cardíaca, neurocirurgia, cirurgia obstétrica e aqueles com escore inferior a 25 no miniexame do estado mental. O desfecho primário foi a qualidade da recuperação medida com a versão do QoR-40, validada para a versão do português de Portugal, antes da cirurgia (T0), 24 horas após a cirurgia (T1) e três meses após a cirurgia (T2).
Resultados: No total, 114 pacientes completaram o estudo. A media dos escores no QoR-40 foi de 169, e os pacientes com má qualidade de recuperação foram identificados se os seus escores no QoR-40 fossem menores que 142. Isso ocorreu em 26 pacientes (24%). As médias dos escores globais dos pacientes com má qualidade de recuperação foram menores em T0 (121 *vs.* 184, $p < 0{,}001$), T1 (120 *vs.* 177, $p < 0{,}001$) e T2 (119 *vs.* 189, $p < 0{,}001$).
Conclusão: Os pacientes com má qualidade de recuperação apresentaram uma pior qualidade de vida. Esse fato pode permitir intervenções precoces e mais eficazes para melhorar a qualidade de vida após a cirurgia. Além de sua utilidade após a cirurgia, o QoR-40 pode ser importante antes da cirurgia para identificar os pacientes que desenvolverão uma má qualidade de recuperação.

Introduction

Postoperative recovery is a key outcome in the perspective of anaesthesiologists. It is defined as the patients return to the normal state after a surgery, and has traditionally been referred in terms of pain scores, duration of hospital stay, and return to normal activities.[1] It involves several factors such as regain of physical, physiologic and social functions. Therefore, it is fundamental for the evaluation of health care and patient satisfaction after surgery.[2]

Regarding outcomes, in the past what concerned more the health professionals were the mortality and complication rates. Since these parameters have improved, as a result of surgical techniques enhancement, patient's Quality of Life (QoL) is now more than ever a central aspect.[1,3,4] Satisfaction remains the best way to assess the outcome from the point of view of the patient.[5] Patient satisfaction was illustrated as the most clinically relevant measure of outcome[6] and also became a fundamental step in processes of hospital accreditation.[7] Therefore, it is vital to estimate patients' Quality of Recovery (QoR) from their perspective, which might be related to perception of their own QoL.

QoL is defined by the World Health Organization as the individual perception of one's position in life, in the context of his culture, objectives, expectations and worries.[8] The complexity and subjectivity of this concept makes it difficult to evaluate and even more difficult to measure appropriately.[9] So the question arises: how can we define and assess changes in the QoL after surgery?

A valid and reliable measure of QoR after anaesthesia and surgery, the QoR-40, was developed by Myles et al.[10] It has shown superior content validity and construct validity, when compared to other pre-existing questionnaires, and did not reveal any negative ratings[1] This questionnaire was specifically designed to measure a patient's health status after surgery and anaesthesia and has been proposed as a measure of outcome in clinical trials.[10] Recently, a meta-analysis of seventeen studies with a sample size of 3459 patients concluded that QoR-40 is well suited to measure quality of postoperative recovery.[11] A significant correlation between QoR-40 scores and the SF-36 questionnaire has been demonstrated.[12–14] A poor score on QoR-40 was associated with a poor score on the SF-36. This supports the belief that a Poor Quality of Recovery (PQR) can predict a poor QoL after surgery.[12] Hence, QoR-40 might be used as a predictive index to identify patients whose health status is about to change.

If it was possible to foresee a PQR, more effective support strategies could be proposed for these patients during their hospital stay.[12] Furthermore, a PQR was associated with a prolonged duration of stay in the hospital, readmission and post-operative complications, indicating not only patient discomfort but also consumption of economic resources.[14]

The aims of our study were to evaluate the incidence of Poor Quality of Recovery (PQR) in the Post Anaesthesia Care Unit (PACU), to compare QoR-40 scores before surgery, 24 h after surgery and 3 months later, and to identify the most affected dimensions of QoR-40.

Methods

The study was conducted in the in the PACU of Centro Hospitalar São João (CHSJ), in Porto, Portugal. Ethical approval (Ethical n° 127/2012) was provided on April 25, 2013, by the Ethical committee of CHSJ (Comissão de Ética para a Saúde do Hospital de São João – Chairperson Professor Filipe Almeida) and written informed consent was obtained from all patients.

CHSJ is a tertiary hospital with 1124 beds in a major metropolitan area that serves 3,000,000 people. A prospective study was conducted in the 12-bed PACU over a 4 week period from 18 June to 12 July 2012.

During this period of time, every patient admitted to the PACU, who was able to provide written informed consent in advance, was included in the study. Exclusion criteria were patient refusal, inability to provide informed consent, age under 18 years, foreign language, and known neuromuscular disease. A score under 25 in the Mini-Mental State Examination test (MMSE) determines inability for providing informed consent. Urgent or emergent surgery, cardiac surgery, neurosurgery and obstetric surgery were also excluded for logistic reasons, as these patients go to other postoperative units.

Baseline demographic data were collected for descriptive purposes.

The validated QoR-40 Portuguese version was used to measure health status before surgery (T0), 24 h after surgery (T1) and 3 months after surgery (T2). QoR-40 was applied by personal interview at T0 and T1, and by telephone interview at T2.

QoR-40 contains five sub-scales: Physical Comfort (PC), Emotional State (ES), Patient Support (PS), Physical Independence (PI), and Pain (P). Each item is rated on a scale of 1–5, providing a minimum score of 40 and maximum of 200.[12]

For each dimension of the QoR-40, impairment was defined if an individual score was less than one standard deviation below the group mean. PQR was defined by impairment in two or more dimensions, or impairment of the global QoR-40.[12]

The anaesthesiologist in charge was blinded to patient involvement in the study. Anaesthesia was provided and monitored according to the criteria of the anaesthesiologist in charge, but this conduct followed minimum departmental standards. Usually, the patient was extubated in the operating room and transferred to the PACU.

The recorded patients' characteristics were age, gender, weight, height, body mass index, benzodiazepines administration before surgery, chronic benzodiazepines use, site of surgery (intra-abdominal, musculoskeletal, head and neck), ASA physical status (ASA-PS), Revised Cardiac Risk Index (RCRI),[15] duration of preoperative fluid fasting, type of anaesthesia, duration of surgery, surgical risk, temperature at admission, and Length of Stay (LoS) in the PACU. Surgical risk was defined according to the Guidelines on Perioperative Cardiovascular Evaluation and Care for Noncardiac Surgery of the American College of Cardiology/American Heart Association.[16]

Data for other preoperative clinical information regarding chronic obstructive pulmonary disease (COPD), hypertension and dyslipidemia were collected from routine clinical documentation.

Pain measured with Visual Analog Scale (VAS) was evaluated at PACU admission.

Residual neuromuscular block (RNMB) was defined as TOF < 0.9 and it was quantified at admission to the PACU using acceleromyography of the adductor pollicis muscle (TOF-Watch®).[17,18]

The nursing delirium screening scale (Nu-DESC)[19] was used at PACU discharge and in the ward the day after surgery, and patients with a Nu-DESC score of 2 or more points at one evaluation were considered delirium positive.

Postoperative nausea and vomiting (PONV) was evaluated and measured with PONV Intensity scale described by Myles et al.[20]

Statistical analysis

Descriptive analysis of variables was used to summarize data. Ordinal and continuous data found not to follow a normal distribution, based on the Kolmogorov–Smirnov test for normality of the underlying population. The QoR-40 values are presented as median and 25 and 75 percentiles. Non parametric tests were used to compare continuous variables and Chi-square or Fisher's exact test to compare proportions between 2 groups of subjects.

The related samples Wilcoxon signed rank test was used to compare Qor-40 scores between the assessments. The Mann–Whitney *U* test was used to compare QoR-40 scores between patients with PQR and those without PQR. A *p*-value less than 0.05 were considered significant. All analyses were performed with Statistical Package for the Social Sciences software for Windows Version 19.0 (SPSS Inc., Chicago, IL, USA).

Results

From 207 patients consecutively admitted in the PACU during the study period, 27 were excluded initially: 11 patients were less than 18 years old, 3 patients did not speak Portuguese, 2 patients underwent neurosurgery, and 11 patients had no informed consent due to refusal or inability to provide it (MMSE < 25). From the remaining 180 patients, 66 were lost during the follow-up or had incomplete information crucial to data analysis, and consequently a total of 114 patients had completed the study (63.3%).

At T1, mean QoR-40 score was 169 and patients with PQR were identified if their QoR-40 score was lesser than 142, calculated as mentioned previously. Thus, PQR occurred in 26 patients (24%).

Table 1 lists pre-admission patient's characteristics and postoperative variables. There were no differences in the pre-admission patient's characteristics between patients with PQR and patients without PQR. Patients with PQR and without PQR did not differ in respect of RNMB, Delirium, VAS for pain and LoS in PACU. However, patients with PQR had more frequently PONV (42% *vs.* 25%, $p = 0.038$).

The median QoR-40 score for our sample was 180 at T0, 174 at T1 and 182 at T2.

Table 2 shows QoR-40 scores at T0, T1 and T2, registered in patients with PQR and without PQR.

At T1, patients with PQR had lower global QoR-40 scores compared to patients without PQR (median: 120 *vs.* 174,

Table 1 Pre-admission patient's characteristics and outcomes.

	All ($n = 114$)	No PQR ($n = 88$) 76%	PQR ($n = 26$) 24%	p
Age in years, median (IQR)	60 (43–68)	60 (42–68)	55 (44–71)	0.685[a]
Age group, n (%)				0.603[b]
<65 years	75 (66)	59 (67)	16 (62)	
>65 years	39 (34)	29 (33)	10 (38)	
Gender, n (%)				0.937[b]
Male	49 (43)	38 (43)	11 (42)	
Female	65 (57)	50 (57)	15 (58)	
ASA physical status, n (%)				0.543[c]
I/II	87 (76)	66 (75)	21 (81)	
III/IV	27 (24)	22 (25)	5 (19)	
Body mass index in kg/m^2, median (IQR)	26 (24–30)	26 (24–30)	29 (24–32)	0.207[a]
Duration of anaesthesia (min), median (IQR)	120 (90–180)	120 (90–180)	120 (84–189)	0.868[a]
Type of anesthesia, n (%)				0.062[a]
General/combined general locoregional	94 (82)	75 (85)	19 (73)	
Locoregional	20 (18)	13 (15)	7 (17)	
Site of surgery				0.860[c]
Abdominal	52 (46)	39 (44)	13 (50)	
Musculoskeletal	49 (43)	39 (44)	10 (39)	
Head and neck	13 (11)	10 (11)	3 (11)	
Temperature at PACU admission, median (IQR)	35.5 (34.9–36.0)	35.5 (34.9–35.9)	35.7 (35.2–36.0)	0.201[a]
Hypertension, n (%)	56 (49)	46 (52)	10 (39)	0.216[b]
Hyperlipidemia, n (%)	40 (35)	32 (36)	8 (31)	0.599[b]
COPD, n (%)	8 (7)	5 (6)	3 (12)	0.263[c]
High-risk surgery, n (%)	28 (25)	22 (25)	6 (23)	0.841[b]
Ischaemic heart disease, n (%)	7 (6)	5 (6)	2 (7)	0.503[c]
Congestive heart disease, n (%)	3 (3)	2 (2)	1 (4)	0.544[c]
Cerebrovascular disease, n (%)	1 (3)	1 (1)	0	0.772[c]
Renal insufficiency, n (%)	9 (8)	8 (9)	1 (4)	0.346[c]
Insulin therapy for diabetes, n (%)	17 (15)	16 (18)	1 (4)	0.059[c]
Total RCRI, n (%)				0.676[c]
≤2	109 (96)	83 (95)	26 (96)	
>2	5 (4)	4 (5)	1 (4)	
Medication with benzodiazepines	31 (27)	22 (25)	9 (35)	0.333[b]
Benzodiazepines premedication	43 (38)	31 (35)	12 (36)	0.536[b]
Crystalloids, median (IQR)	1000 (1000–2000)	1000 (1000–2000)	1000 (1000–2600)	0.889[a]
Colloids, n (%)	3 (3)	2 (2)	1 (4)	0.579[c]
Erythrocytes, n (%)	2 (2)	2 (2)	0	0.569[c]
RNMB, n (%)	19 (17)	16 (18)	3 (12)	0.715[c]
PONV, n (%)	34 (30)	22 (25)	12 (42)	0.038[b]
Delirium, n (%)	18 (16)	13 (15)	5 (19)	0.584[c]
VAS for pain at PACU discharge, median (IQR)	0 (0–2)	0 (0–2)	1 (0–3)	0.599[a]
SICU length of stay (min), median (IQR)	114 (85–146)	110 (81–144)	120 (110–188)	0.169[a]

PQR, Poor Quality of Recovery; IQR, interquartile range; ASA, American Society of Anesthesiologists; COPD, Chronic Obstructive Pulmonary Disease; RCRI, Revised Cardiac Risk Index; PACU, Post Anesthesia Care Unit; PONV, Postoperative Nausea and Vomiting; RNMB, Residual Neuromuscular blockade; VAS, Visual Analog Scale.

[a] Mann–Whitney *U* test.

[b] Pearson χ^2.

[c] Fisher's exact test.

Table 2 QoR-40 scores at T0, T1 and T2 in patients.

	All ($n = 114$)	No PQR ($n = 88$) 76%	PQR ($n = 26$) 24%	p[a]
T0				
Global	180 (157–190)	184 (170–192)	121 (117–139)	<0.001
Emotional State	36 (27–42)	39 (33–42)	24 (22–28)	<0.001
Physical Comfort	54 (48–57)	55 (51–58)	29 (28–38)	<0.001
Psychological Support	35 (34– 35)	35 (34–35)	35 (35–35)	0.115
Physical Independence	25 (23–25)	25 (23–25)	25 (23–25)	0.937
Pain	31 (26–35)	33 (29–35)	10 (7–26)	<0.001
T1				
Global	174 (151–183)	177 (166–187)	120 (107–134)	<0.001
Emotional State	38 (30–42)	40 (35–43)	23 (20–28)	<0.001
Physical Comfort	51 (43–55)	53 (50–56)	30 (25–41)	<0.001
Psychological Support	35 (34–35)	35 (34–35)	35 (31–35)	0.166
Physical Independence	21 (15–25)	22 (17–25)	14 (12–22)	0.001
Pain	30 (25–32)	31 (28– 33)	13 (10–24)	<0.001
T2				
Global	182 (161–196)	189 (173–198)	119 (115–175)	<0.001
Emotional State	38 (29–44)	41 (33–45)	22 (21–37)	<0.001
Physical Comfort	57 (47–60)	58 (53–60)	28 (28–53)	<0.001
Psychological Support	35 (34–35)	35 (34–35)	35 (34–35)	0.794
Physical Independence				
Pain	32 (26–34)	34 (29–35)	10 (7–30)	<0.001

T0, before surgery; T1, 24 after surgery; T2, 3 months after surgery; PQR, Poor Quality of Recovery.
Values are showed in median (25–75% percentile).
[a] Obtained with Mann–Whitney *U* test.

$p < 0.001$), and also, lower scores for ES, PC, PI and P dimensions.

When analysing the initial QoR-40 scores obtained at T0, patients with PQR (identified at T1) had lower global QoR-40 scores (median: 121 *vs.* 184, $p < 0.001$), and also, lower scores for ES, PC and P dimensions.

When analysing QoR-40 scores obtained at T2, patients with PQR (identified at T1) remained with lower global QoR-40 scores, compared with those without PQR (median: 119 *vs.* 189, $p < 0.001$), and also, lower scores for ES, PC and P.

Patients without PQR showed an improvement in PC dimension between T0 and T2 (median: 55 *vs.* 58, $p = 0.004$), but there were no differences in the other scores (Table 3). On the other hand, in patients with PQR there were no differences in the QoR-40 scores between T0 and T2 (Table 4).

Discussion

The main findings of this study were as follow: the incidence of PQR was 24%; PQR was positively associated with PONV; patients with PQR had lower QoR-40 scores prior to surgery and 3 months after surgery; and prior health status was restored after 3 months of surgery in both groups.

The incidence of PQR 24 h after surgery in our study (24%) is in accordance with the current literature,[13] although there is a lack of studies with the same methodology after non-cardiac surgery.[11,21]

Our results did not find any association with PQR and pre-admission patient's characteristics and post-operative variables such as RNMB, Delirium, VAS for pain and LoS in PACU. However, we cannot conclude that these

Table 3 QoR-40 global score and scores for each QoR-40 dimension in patients without PQR.

	Before surgery	3 months after surgery	p[a]
Global	184 (170–192)	189 (173–198)	0.306
Emotional State	39 (33–42)	41 (33–45)	0.110
Physical Comfort	55 (51–58)	58 (53–60)	0.004
Psychological Support	35 (34–35)	35 (34–35)	0.905
Physical Independence	25 (23–25)	25 (24–25)	0.747
Pain	33 (29–35)	34 (29–35)	0.886

QoR-40, quality of recovery score; PQR, poor quality of recovery.
Values are showed in median (25–75% percentile).
[a] Obtained with Wilcoxon signed rank test.

Table 4 QoR-40 global score and scores for each QoR-40 dimension in patients with PQR.

	Before surgery	3 months after surgery	p^a
Global	121 (117–139)	119 (115–175)	0.306
Emotional State	24 (22–28)	22 (21–37)	0.935
Physical Comfort	29 (28–38)	28 (28–53)	0.108
Psychological Support	35 (35–35)	35 (34–35)	0.309
Physical Independence	25 (23–25)	25 (24–25)	0.502
Pain	10 (7–26)	10 (7–30)	0.311

QoR-40, quality of recovery score; PQR, poor quality of recovery.
Values are showed in median (25 to 75% percentile).
[a] Obtained with Wilcoxon signed rank test.

variables are not important for a PQR, and in future studies a larger sample may allow more definite conclusions about the importance of these variables for the development of a PQR.

In our study there was an association between PQR and PONV. As expected, the incidence of PONV was higher in patients with PQR, because QoR-40 has three items related to nausea and vomiting; this was already studied by Myles et al.[18] that concluded that patients with PONV had lower QoR-40 scores, even if they remove those three items from QoR-40. On the other hand, the number of patients with PONV in comparison with patients without PQR was higher than we expected, since PONV is well weighted in the questionnaire. This could be explained by the fact that PONV, on its own, is not enough to determine a PQR and there are other contributors for it.

Our study suggests that patients who had PQR may be identified prior to surgery, because these patients had lower global QoR-40 scores measured at T0. The ES, PC and P dimensions might be the most important dimensions to distinguish these patients from those who will not have a PQR. This is important because as soon as these patients are identified the sooner efforts might be taken to provide important measures capable of improving the QoR and, consequently, QoL. Important measures to improve scores in ES, PC and P dimensions could be implemented in patients previously identified, such as more careful follow-up, more efficient comfort measures and more effective analgesic regimens.

As others had proposed in analogous studies,[11] PQR measured 24 h after surgery can predict a poor QoL 3 months after surgery. QoR-40 is related with QoL after surgery.[11] In our study, patients with PQR defined at T1, maintain lower QoR-40 scores 3 months after surgery. That is why we suggest that improving measures in patients with PQR might be able to improve the QoL 3 months after surgery. Others have described a relationship between QoR-40 after surgery and QoL up to 3 years,[12] so QoR-40 may be considered an indirect tool to measure QoL.

Patients with PQR, identified 24 h after surgery, maintain lower QoR until at least 3 months after surgery, especially in ES, PC and P dimensions.

The PS and PI dimensions at T0 and T2 showed no differences in both patients with PQR and without it, which suggests that these dimensions may not contribute to develop a PQR and for the low QoR after 3 months.

Globally, the results show that prior health status was restored after 3 months of surgery in both groups. When we compared scores before surgery and 3 months after it for patients without PQR, there was only improvement in one dimension, which was PC. This may suggest that the more accurate dimension to measure improvement in these patients could be PC, but more studies are needed to confirm it.

Some might be waiting for an improvement in prior health status, represented by an increase in patient's global QoR-40 scores 3 months after surgery. However, both groups did not show an increase in their global QoR-40 scores, when we compared the prior to surgery scores and 3 months after surgery scores. We believe that there are different reasons for this, according to each group. Patients without PQR did not improve their global QoR-40 score after 3 months, which can be explained by the fact that they had high QoR-40 scores previously. On the other hand, in patients with PQR, the global QoR-40 score and scores for each QoR-40 dimension did not improve also; however, their prior scores were not as high as in patients without PQR, and some could expect to raise it. Our interpretation is that these patients had a prior bad heath status that cannot be improved by surgery for several reasons such as multiple co-morbidities, oncologic surgery and pessimism about their health status.

In order to reduce bias we were strict about timing measurements since it was essential in a dynamic process such as postoperative recovery. Also by selecting a heterogeneous surgical population we ought to be able to measure great extremes of comfort and mobility.[11] In this study it was the investigator that administered the questionnaire, what may be seen as a more efficient use of resources.[22]

Limitations of the study

One of the limitations of our study was the loss of some patients during the follow-up leading to a rate of patients that completed the study as 63.3%.

Some may consider that we should have used a previously validated tool to measure QoL, as Sf-36 questionnaire; however, we assumed the relationship between QoR-40 and QoL, which was previously described.[11–13] QoR-40 and SF-36 contain similar scopes and dimensions that will assist their association and also because they represent similar psychosocial aspects, they ought to be correlated.[12,13]

To conclude, QoR is crucial for QoL after surgery. QoR-40 score is an important tool to assess QoR and our study

suggests that beside its utility after surgery, QoR-40 may be used prior to surgery to identify patients who will develop a PQR. Moreover, recognizing the most affected dimensions could help to implement actions in order to achieve a better QoR, and consequently a better QoL after surgery. However, more studies are needed in order to validate this tool prior to surgery.

Conflicts of interest

The authors declare no conflicts of interest.

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