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Original Research

Classification Into Different Patient Groups—A Step Toward Tailoring Care After Major Oncological Surgery?

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KEYWORDS
Classification;
Oncological surgery;
Postoperative recovery;
Rehabilitation;
Subjective health experience;
Tailored care

Abstract *Objective:* To evaluate how the distribution of patients in groups (based on subjective health experience) changes over time and to investigate differences in physical functioning and mental health between these patient groups.
Design: An observational cohort study.
Setting: University medical center.
Participants: Patients who underwent gastrointestinal or bladder oncological surgery (N=98).
Interventions: Not applicable.
Main Outcome Measures: The classification of patients into different groups based on the subjective health experience model (acceptance and perceived control), preoperatively and 1 and 3 months after discharge.
Results: In total, 98 patients were included. Preoperatively, 31% of the patients were classified as having low acceptance and perceived control (group 4), and this proportion increased to 47% and 45% 1 and 3 months after discharge, respectively. These patients had significantly lower levels of physical functioning (preoperatively, 55 vs 61; *P*=.030; 1 month, 47 vs 57; *P*=.002; 3 months, 52 vs 62; *P*=.006) and higher levels of anxiety and depression (preoperatively, 14 vs 9; *P*<.001; 1 month, 11 vs 3; *P*=.001; 3 months, 10 vs 3; *P*=.009) than patients with high acceptance and perceived control (group 1).
Conclusions: The classification of patients to different groups provides insight in different levels of physical and mental health. However, frequent evaluation is important because of changes in patient groups over time.

List of abbreviations: SHE, subjective health experience.
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For patients who undergo major oncological surgery, it is important to regain their normal level of functioning as soon as possible.[1,2] However, patients experience a decreased level of physical functioning or psychological distress after oncological surgery.[3-6] To optimize postoperative recovery and thereby patients' health experience, it is important to tailor care to the patient's needs.[7-9] Tailored care improves the effectiveness and efficiency of care and thereby might enhance clinical outcomes and lower health care costs.[10,11] However, practical guidance on how to tailor patient care after major oncological surgery is lacking.

Patient classification (ie segmentation) is one way to tailor care. It is an approach that aims to differentiate groups, to align support, and to facilitate care tailored to the patients' needs.[12] A promising model for tailoring care to the patients' needs is the model of Bloem and Stalpers.[13,14] From the literature, it is known that different psychological factors such as self-efficacy, locus of control, coping, and acceptance are related to health experience.[15-17] However, measuring all of the different factors in daily practice to tailor care is time consuming. Bloem and Stalpers[13] developed and validated a cross-disease model based on the most important psychological determinants (ie perceived control and acceptance) of subjective health experience (SHE).[18] Based on perceived control and acceptance, persons are divided in 4 patient groups and per-group insight is given in the different needs for support.

Previous studies have validated the SHE model in patients with inflammatory bowel disease and older adults.[19,20] However, it is unclear whether this approach can be applied to tailor postoperative care in patients undergoing a major life event such as oncological surgery. A first step to establish this is to gain insight into the classification of patients into different groups based on SHE before surgery to 3 months after discharge. The next step is to determine whether the physical and mental health of patients in these groups changes, knowledge which would help to tailor care.

The primary research aim of this study was to explore the distribution of patient groups over time. The secondary research aim was to evaluate differences in physical functioning and mental health between the different groups in patients who underwent major oncological surgery.

Methods

Study design and population

A single-center, observational cohort study was conducted at the University Medical Center Utrecht in the Netherlands between November 2020 and April 2022. Inclusion criterion was adult patients undergoing gastrointestinal (esophagus, stomach, colorectal, liver, pancreas) or bladder oncological surgery. Patients were excluded if they had a life expectancy of <3 months and if they were not able to fill in or sign the informed consent form because of cognitive problems such as delirium (defined as an acute disorder of attention and cognition, estimated by the medical and nursing staff). The study protocol was assessed and approved by the Medical Ethics Committee of University Medical Center Utrecht (research protocol number 19/026). All participants signed informed consent and all methods were performed in accordance with the Declaration of Helsinki.

Subjective health experience

SHE is defined as "an individual's experience of physical and mental functioning while living life the way he/she wants to, within the constraints and limitations of individual existence."[13,14] The primary outcome measure was the classification of patients into different patient groups based on the SHE model. To this end, patients were asked 6 questions about the acceptance and perceived control of their current health condition. Three questions were about the level of acceptance—(1) "I am at peace with my health condition"; (2) "The way in which I am functioning physically and mentally, is acceptable to me"; (3) "I accept my health condition the way it is"—and 3 questions were about perceived control—(1) "I have the feeling that I have grip on my health condition"; (2) "My health condition is to a great extent in my own power"; (3) "I have a lot of influence on my health condition." Questions were answered on a scale of 1 (fully agree) to 7 (fully disagree). The questionnaire is only available in Dutch. The mean score of the 3 questions was calculated. A high acceptance score was defined as a score of ≥4.96, and a high perceived control score was defined as a score of ≥5.36.[14] Patients were also asked 2 questions about their SHE: "on which step do you feel you stand today and on average in the past month." The questions were answered on a visual analog scale (0-10) illustrated as a ladder, in which the lowest step represents the patients' worst day in the past month and the highest step represents the patients' best day in the past month.[13]

The acceptance and perceived control scores were used to classify patients into 1 of the following 4 groups (fig 1).[13,21]

Group 1

Group 1 included persons with a high level of acceptance and a high level of perceived control. These persons have a high level of self-reliance. They need information in order to strengthen a feeling of pride.

Group 2

Group 2 included persons with a high level of acceptance and a low level of perceived control. These persons are seekers; they have the willingness to change but lack the capacity and overview to achieve change. They need

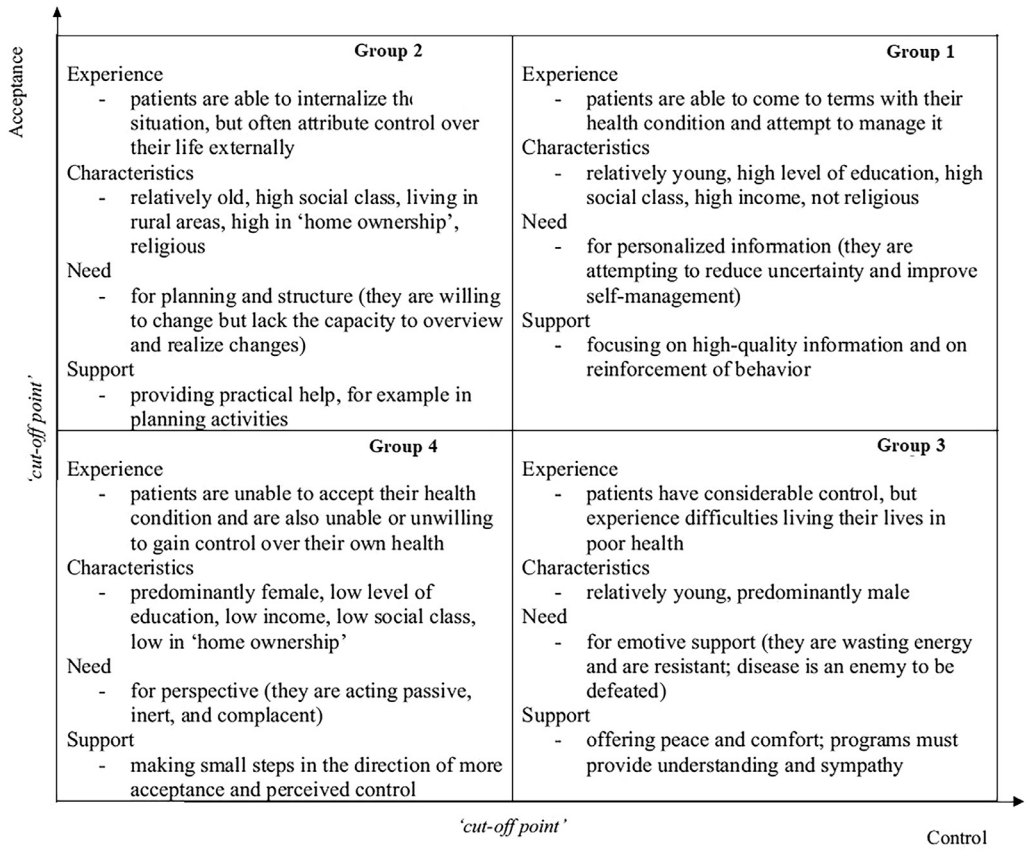

Fig 1 Updated Bloem and Stalpers[13] model of SHE to classify patients into different groups and to provide insight into different needs for support.[21] In the original model the term "segment" was used, but in this study the term "group" has been used.

structure and planning, which can be achieved by providing practical help.

Group 3
Group 3 included persons with a low level of acceptance and a high level of perceived control. These persons are resistant and waste energy and need emotive support.

Group 4
Group 4 included persons with a low level of acceptance and a low level of perceived control. These persons are passive and inert. They need personal guidance, which can be addressed by leading them by hand, in order to provide hope.

The SHE model in patients undergoing major surgery

Because the SHE model has been validated in a cross-disease population, we first determined whether it is applicable to patients who undergo major oncological surgery. We investigated correlations for the constructs "acceptance" and "perceived control" of the SHE model with those of well-established and validated questionnaires. For the construct acceptance, the acceptance subscale of the Illness Cognition Questionnaire was used as comparison.[22] For the construct perceived control, the General Self-Efficacy Scale was assessed.[23,24] For the construct acceptance a correlation of r=.622 was found and for the construct perceived control a correlation of r=.347.

Procedures

Within 72 hours of surgery, patients received information about the study and were asked to participate. If patients were eligible for the study and signed informed consent, they were asked to retrospectively fill in the questionnaires regarding their SHE and physical and mental status in the week before surgery. At 1 and 3 months after discharge, the participants received a digital questionnaire about their SHE and physical and mental health via email.

Baseline and clinical data

Baseline and clinical data were retrieved from electronic patient files. Baseline data included sex, age, body mass index, living situation, education level, comorbidities (pulmonary disease, cardiovascular disease, diabetes mellitus), American Society of Anesthesiologists classification of physical health, neoadjuvant treatment (radiotherapy, chemotherapy, chemoradiotherapy), tumor location, and operation technique. Clinical data included the number of complications, length of stay, and discharge destination.

Physical functioning

Physical functioning was measured with the Acute Measure for Post-Acute Care Basic Mobility Outpatients Routine Short Form.[25] Patients were asked 18 questions about the difficulty of performing specific activities on a scale from 1 (unable) to 4 (none). The total score ranged from 0 to 72 points, whereby a higher score represents less difficulty with performing daily activities. The Acute Measure for Post-Acute Care has a minimal administration burden and excellent reliability, validity, and sensitivity to change.[26,27] The minimal clinically important change lies between 3.9 and 5 points.[10]

Mental health

Mental health was measured with the Hospital Anxiety and Depression Scale. Patients were asked 14 questions about their perceived level of anxiety and depression. All items are equally weighted on a 4-point scale, where 0 reflects the positive extreme and 3 reflects the negative extreme of the scale. The total score ranged from 0 to 42 points, whereby a higher score represents a higher level of anxiety and depression. The Hospital Anxiety and Depression Scale had an adequate internal consistency and is sensitive to change in patients with cancer.[28] The minimal clinically important difference was 1.7 points.[29]

Statistical analyses

All analyses were conducted using IBM-SPSS version 26. The sample size was at least 15 patients per group based on earlier studies, leading to a sample size of at least 60. Categorical data are presented as numbers and percentage. Normally distributed continuous data are presented as means with SDs, and nonnormally distributed continuous data are presented as medians with ranges. To explore the change in patients' SHE over time, from preoperatively to 3 months after discharge, a Sankey diagram was plotted. Differences in physical functioning and mental health between patients in groups 1-4 were analyzed preoperatively and 1 and 3 months after discharge, with group 1 being considered as the reference group. An independent sample *t* test was performed if data were normally distributed, and a Mann-Whitney *U* test was performed if data were not normally distributed.

Results

In total, 98 patients were included (mean age ± SD, 63±12y; 57% men; table 1). Preoperatively, 35% (n=33) of the patients were classified into group 1, 17% (n=16) into group 2, 18% (n=17) into group 3, 31% (n=29) into group 4. Three months after discharge, 27% (n=17) of the patients were classified into group 1, 17% (n=11) into group 2, 11% (n=7) into group 3, and 45% (n=29) into group 4 (table 2). Data were missing for 3 patients preoperatively, 30 patients 1 month after discharge, and 34 patients 3 months after discharge. Figure 2 shows that data were missing 1 and 3 months after discharge in all 4 groups.

Table 1 Patients characteristics, surgical characteristics, and postoperative outcomes in patients after oncological surgery.

Characteristics	Values
Patient characteristics	**N=98**
Male, n (%)	56 (57)
Age (y), mean ± SD	63±12
BMI, mean ± SD	26±4
Living alone, n (%)	16 (16)
SHE, mean ± SD	
"On which step do you feel you stood (0-10)"	
The day before surgery	6±3
On average in the month before surgery	7±2
Level of education, n (%)	
Low	11 (11)
Medium	24 (25)
High	30 (31)
Comorbidities, n (%)	
Pulmonary	20 (20)
Cardiovascular	34 (35)
Diabetes Mellitus	11 (11)
ASA classification, n (%)	
I	11 (11)
II	42 (43)
III	39 (40)
Unknown	6 (6)
Pretreatment, n (%)	
No	61 (62)
Chemotherapy	15 (15)
Radiotherapy	1 (1)
Chemoradiotherapy	21 (21)
Surgical characteristics	
Tumor location, n (%)	
Esophagus	20 (20)
Stomach	8 (8)
Colorectal	25 (26)
Liver	17 (17)
Bladder	24 (25)
Other	4 (4)
Operation technique, n (%)	
Laparoscopic	70 (71)
Open	26 (27)
Unknown	2 (2)
Postoperative outcomes	
Complications, n (%)	31 (32)
Length of stay in hospital, median (min-max)	9 (3-68)
Destination after discharge, n (%)	
Home	93 (95)
Rehabilitation center	4 (4)
Other	1 (1)

Abbreviations: ASA classification, American Society of Anesthesiologists Classification of physical health; BMI, body mass index; max, maximum; min, minimum.

Change in patient groups over time

Table 2 provides an overview of the distribution of patients over the 4 groups both preoperatively, and 1 and 3 months after discharge. Preoperatively, most patients were

Table 2 Number of patients per group before surgery and 1 and 3 months after discharge.

Subjective Health Experience	Before Surgery (n=95)	1 mo After Discharge (n=68)	3 mo After Discharge (n=64)
Group 1, n (%)	33 (35)	15 (22)	17 (27)
Group 2, n (%)	16 (17)	14 (21)	11 (17)
Group 3, n (%)	17 (18)	7 (10)	7 (11)
Group 4, n (%)	29 (31)	32 (47)	29 (45)
Missing	3	30	34

classified into group 1 (35%). However, 1 and 3 months after discharge, only 22% and 27% of patients were classified into this group, respectively. One and 3 months after discharge, 47% and 45% of patients were classified into group 4, respectively. Figure 2 provides an overview of the change in group classification from preoperative to 3 months after discharge. Overall, most patients who were preoperatively classified into group 1 changed to another group after discharge. Patients who were preoperatively classified into group 4 tended to remain in this group after discharge.

Differences in physical functioning and mental health between groups

Physical functioning

Patients in group 4 had significantly lower levels of physical functioning than patients in group 1 during the perioperative period (preoperatively: group 4 vs group 1, 55±12 vs 61±9; *P*=.030), 1 month after discharge (group 4 vs group 1, 47±10 vs 57±10; *P*=.002), and 3 months after discharge (group 4 vs group 1, 51±12 vs 62±8; *P*=.002; table 3). Patients in group 3 had significantly lower levels of physical functioning than patients in group 1 at 3 month after discharge (group 3 vs group 1, 53±2 vs 62±8; *P*=.033). No statistical differences in physical functioning were found between groups 1 and 2.

Mental health

Patients in group 4 had significantly higher levels of anxiety and depression than patients in group 1 in the perioperative period (group 4 vs group 1, 14 [range, 0-28] vs 9 [range, 0-22]; *P*<.001), 1 month after discharge (group 4 vs group 1, 11 [range, 3-32] vs 3 [range, 0-8]; *P*=.001), and 3 months after discharge (group 4 vs group 1, 10 [range, 1-29] vs 3 [range, 0-15]; *P*=.009; table 4). Mental health was not significantly different in patients in group 2 and 3 compared with patients in group 1.

Discussion

This observational cohort study investigated the distribution of different patient groups over time and examined differences in their physical functioning and mental health. In the perioperative period, 35% of patients were classified into group 1 (high acceptance, high perceived control), but at 1 and 3 months after discharge, this proportion had decreased to 22% and 27%, respectively. After discharge, most patients were classified into group 4 (low acceptance, low perceived control): 47% 1 month after discharge and 45% 3 months after discharge. Significant differences in physical functioning and mental health were found between groups 1 and 4 both preoperatively and 1 and 3 months after discharge. Patients in group 4 had a significantly lower level of physical functioning and higher levels of anxiety and depression than patients in group 1.

This study showed that patients' SHE changed over time when undergoing major oncological surgery. Preoperatively, the distribution of patients over the 4 groups (35% in group 1, 31% in group 4) was comparable with the distribution in the healthy population (32% in group 1, 32% group in 4).[14] However, 1 and 3 months after discharge, most patients were classified into group 4, consistent with earlier findings for patients with inflammatory bowel disease.[19] This suggests that a major life event like oncological surgery influences patients' perceived control and acceptance about their SHE. Therefore, it seems important to monitor patients

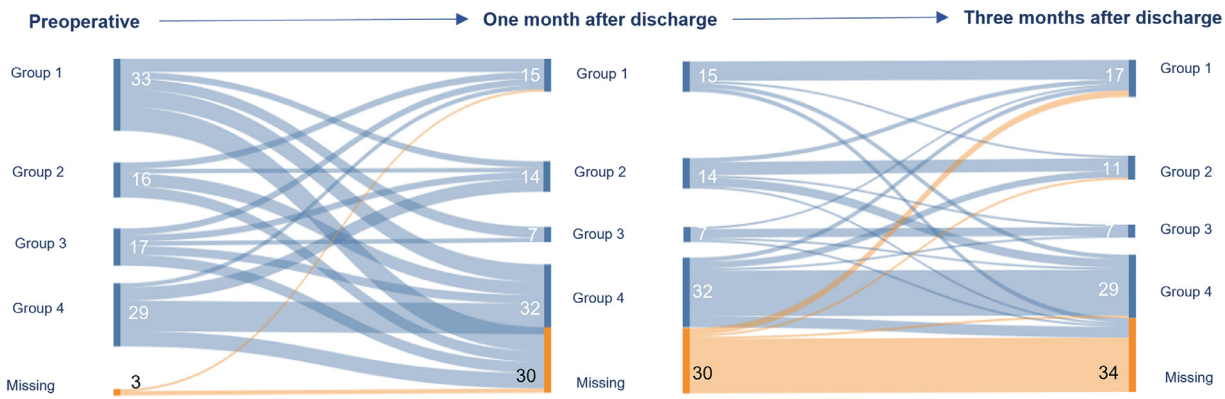

Fig 2 Change in group classification from before surgery to 3 months after discharge of patients who underwent major oncological surgery

Table 3 Differences in physical functioning between groups.

	Group 1		Group 2			Group 3			Group 4		
Subjective Health Experience	n	Mean ± SD	n	Mean ± SD	*P* Value*	n	Mean ± SD	*P* Value*	n	Mean ± SD	*P* Value*
Preoperatively	30	61±9	12	58±8	.324	17	61±4	.889	28	55±12	.030
1 mo after discharge	15	57±10	14	57±9	.940	7	52±10	.275	32	47±10	.002
3 mo after discharge	17	62±8	11	57±9	.169	7	53±2	.033	29	51±12	.002

NOTE. The physical functioning score ranged from 0 to 72, whereby a higher score represents a higher level of physical functioning.
* Patients classified into group 1 were used as reference.

frequently in the postoperative period in order to tailor care to the individual patient's needs.

The question remains whether patients regain their preoperative SHE after major oncological surgery. Postoperative recovery is characterized by an abrupt decline in function, followed by a progressive return to original state.[1,30] More than 50% of patients undergoing major oncological surgery do not regain their physical functioning 3 months after discharge.[4-6] Therefore, it is important to gain insight into the patients who recover postoperatively and those who do not. We found that different patient groups differed markedly in their physical functioning and mental. These findings are in line with a previous study showing an association between patients' perceived control and quality of life in patients who underwent radical prostatectomy.[31] Additionally, even in patients who underwent minor surgery, both physical functioning and mental health seemed to be important for postoperative recovery.[32] The identified differences in postoperative recovery suggest that the SHE model might be useful to select patients at risk (group 4) of delayed recovery. This may help to refer patients to appropriate care, for advice to increase self-management when possible (ie group 1), and for guidance when needed (ie group 4), to optimize postoperative recovery for all patients.[33]

For clinical use, it is important that the discriminative ability of the SHE model is adequate. The correlations for the construct acceptance (r=.622) and perceived control (r=.347) were examined 1 month after discharge. In the literature, different cutoff points have been used to determine a strong correlation.[34] McDowell and Newell[35] (1996) stated that the correlation between questionnaires that measure health-related outcomes varies between 0.4 and 0.6. Therefore, the acceptance score seems good; however, the perceived control score showed a correlation of r=.347 compared with the General Self-Efficacy Scale, which is below this cutoff point. A possible explanation for the low correlation is that perceived control is a more overarching construct including both "locus of control" and "self-efficacy."[18] Therefore, further research is needed to evaluate the discriminative value of the perceived control score in patients who underwent major oncological surgery. Clinically relevant differences in both physical functioning and mental health were seen in patients in group 1 vs patients in group 4. Overall, the discriminative value of the SHE model for the classification of patients who underwent major oncological surgery into different patient groups seems acceptable. The possibility to distinguish between patients who require information to improve their self-management and patients who need personal guidance can facilitate the provision of tailored care.[36]

Study limitations

This study is the first study presenting a model based on SHE to identify different patient groups who underwent major oncological surgery. This longitudinal cohort study covered different types of oncological surgery and included a wide variety of patients, which might increase the generalizability of findings to other populations. Furthermore, the longitudinal character made it possible to investigate changes in SHE over time, from before surgery to 3 months after discharge. Insight into the different patient groups could be the first step to guide health care professionals in referring patients to appropriate care, to optimize postoperative recovery.

This study had some limitations. First, missing data was a problem for the 1 and 3 months after discharge measurements. Additional analyses of data for patients with complete data and dropouts showed that dropouts experience more complications (1mo after discharge, 32% vs 39%; 3mo

Table 4 Differences in mental health between the different groups.

	Group 1		Group 2			Group 3			Group 4		
	n	Median (min-max)	n	Median (min-max)	*P* Value*	n	Median (min-max)	*P* Value*	n	Median (min-max)	*P* Value
Preoperatively	32	9 (0-22)	14	10 (3-20)	.186	16	9 (3-24)	.759	28	14 (0-28)	<.001
1 mo after discharge	15	3 (0-8)	14	5 (0-18)	.139	7	3 (0-18)	.630	32	11 (3-32)	0.001
3 mo after discharge	17	3 (0-15)	11	3 (1-20)	>.990	7	4 (1-13)	.659	29	10 (1-29)	0.009

NOTE. The mental health score ranged from 0 to 42, whereby a higher score represents a higher level of anxiety and depression.
Abbreviations: max, maximum; min, minimum.
* Patients classified into group 1 were used as reference.

after discharge, 32% vs 40%) and longer length of hospital stay (1mo after discharge, 10d vs 14d; 3mo after discharge, 11d vs 12d). This implies that the missing data were not at random and could have influenced outcomes. Second, the preoperative questionnaires were administered retrospectively, which might have given rise to recall bias. As the risk of recall bias is lower with a shorter recall period, we asked patients to complete the questionnaire within 1 week after surgery.[37]

Conclusions

In patients who underwent major oncological surgery, the classification into 4 different groups based on their SHE provides insight into their physical functioning and mental health, which may facilitate the provision of tailored care. However, given that patients' SHE changed after surgery, it is important to carry out frequent evaluations. Furthermore, postoperatively, most patients had a low acceptance and perceived control (group 4), which indicates that these patients are unable to regain control over their own health and therefore might need guidance for an optimal recovery.

Disclosures

S.B. is chair at Nyenrode Business University and is sponsored by Jansen-Cilag BV. C.V. reports grants from different Dutch organizations that give grants for public research (no private companies) but did not receive a grant for this specific study. The other authors have nothing to disclose.

Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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