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Protocol for physical assessment in patients with fibromyalgia syndrome

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ABSTRACT

Introduction: Fibromyalgia syndrome (FMS) is a chronic disease that causes pain and fatigue, presenting a negative impact on quality of life. Exercise helps maintaining physical fitness and influences directly on the improvement of quality of life.

Objective: Develop a protocol for health-related physical fitness assessment of patients with FMS with tests that are feasible and appropriate for this population.

Method: An exploratory and analytical literature review was performed, seeking to determine the tests used by the scientific community. With this in mind, we performed a literature revision through the use of virtual libraries databases: PubMed, Bireme, Banco de Teses e Dissertações da Capes and Biblioteca Digital Brasileira de Teses e Dissertações, published in between 1992-2012.

Results: A variety of tests was found; the following, by number of citations, stood out: Body Mass Index (BMI) and bioimpedance; 6-minute walk; handgrip strength (dynamometer, 1RM [Repetition Maximum]); Sit and reach and Shoulder flexibility; Foot Up and Go, and Flamingo balance.

Conclusion: These are the tests that should make up the protocol for the physical evaluation of FMS patients, emphasizing their ease of use.

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Protocolo para avaliação física em portadores de síndrome de fibromialgia

R E S U M O

Introdução: A síndrome da fibromialgia (SFM) é uma doença crônica que provoca dor e fadiga e apresenta impacto negativo na qualidade de vida. O exercício auxilia na manutenção da aptidão física e influencia diretamente na melhoria da qualidade de vida.

Objetivo: Elaborar um protocolo para avaliação física relacionada à saúde de portadores da SFM com testes que sejam viáveis e apropriados para esse público.

Método: Foi feita uma revisão da literatura de forma exploratória e analítica, para determinar os testes usados pela comunidade científica. Com isso, fez-se um levantamento bibliográfico por meio do banco de dados das bibliotecas virtuais PubMed, Bireme, Banco de Teses e Dissertações da Capes e Biblioteca Digital Brasileira de Teses e Dissertações publicados entre 1992 e 2012.

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Resultados: Demonstraram uma variedade de testes, em que se destacaram, em número de citações, os seguintes: Índice de Massa Corporal (IMC) e Bioimpedância; Caminhada de 6 minutos; Força de preensão manual (dinamômetro), 1 RM [Repetição Máxima]; Sentar e alcançar e Flexibilidade de ombro; Levantar e ir – *Foot Up and Go* e Equilíbrio do flamingo. **Conclusão:** Estes são os testes que devem compor o protocolo para avaliação física de portadores de SFM. Ressalte-se que esse protocolo é de fácil utilização.

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Introduction

Fibromyalgia syndrome (FMS) is a chronic disease of unknown origin characterized by diffuse muscle pain, sleep disturbances, fatigue and presence of multiple painful points, the so-called tender points.^{1,2} Many patients with FMS express anxiety and depression, that affect their quality of life.³

Exercise is an important factor for improving the quality of life of the patient, but it should be designed not to be strenuous.² The exercise is responsible for acquiring and maintaining physical fitness, which is defined as the set of attributes that people have or develop related to the ability to perform physical activities.⁴ Because of the pain, many patients with FMS have great difficulty in starting an exercise program.⁵ Thus, it is imperative that we specify exercises that influence the improvement of physical conditioning, but without causing pain.⁵

This facilitates the adhesion of FMS patients to an exercise program and minimizes the negative impact of lack of conditioning. It is important to note that untrained muscles are more prone to injury during activities,⁶ and this can result in more pain, making these patients more sedentary individuals (i.e. who do not engage in exercise regularly) and deconditioned.⁶

To maintain a good health/quality of life, it is necessary for the individual to keep on good levels the four physical capacities related to health: cardiovascular fitness, muscular strength and endurance, flexibility and appropriate body composition.⁴ This strategy should be considered for all individuals, including those with FMS. Sedentary people tend to have progressively lower levels of physical fitness, health and quality of life.⁷

One of the critical objectives of exercise intervention programs is the promotion of health, and they should focus on the improvement of physical fitness-related components. For that to happen, it is necessary to measure and monitor the fitness levels.⁸

Thus, the physical educator who works with patients with FMS needs to know about the fitness level of those patients needing help, performing a physical assessment. The measurement of fitness levels is done through tests and physical evaluations specific to each tested component that vary according to the approach, purpose and target population.⁸

Thus, the purpose of this narrative review is to identify the most commonly applied tests in the literature for the physical evaluation of patients with FMS, with the objective of developing a protocol for specific physical assessment for this population. Considering that, although there are evalu-

ating methods for FMS,⁹ until now no protocol or guideline for the evaluation of physical capacity of this target population has been developed.

Materials and methods

This research is characterized as a narrative review, because it describes and discusses the development of the topic from a theoretical and contextual points of view.¹⁰ Ours is not a systematic review because, although we clearly present the stages of the research, the data is not interpreted in order to assess the applicability of the results, as dictated by the systematic review.¹⁰

A literature search, using the databases PubMed (<http://www.pubmed.com.br>), Bireme (<http://brasil.bvs.br/>), as well as the Banco de Teses e Dissertações da Capes (<http://capesdw.capes.gov.br/capesdw/>) and the Biblioteca Digital Brasileira de Teses e Dissertações (<http://bdtd.ibict.br/>), was conducted.

During the article selection, the terms “flexibilidade”, “composição corporal”, “capacidade cardiorrespiratória”, “capacidade aeróbica” and “força muscular” (Brazilian Portuguese) and its English versions, i.e. “flexibility”, “body composition”, “cardiorespiratory fitness”, “aerobic fitness” and “muscle strength”, were used. To these terms the words “fibromialgia” and “fibromyalgia” (for the English versions) were added to the data entry field. In the research of dissertations, only the term fibromyalgia was used.

After the research material collection (articles, dissertations and theses), an exploratory analysis of the collected documents was conducted, by reading the abstracts in order to identify those who have had some kind of test for fitness assessment in patients with FMS.

Regarding dissertations and theses, at first the selection was made by title and then, if in doubt, by summary analysis. When, even after reading the summaries, the relevance of the document was unclear, our procedure was: for articles the full text was read, and for the theses its study methodology was read. Usually this strategy brought us more detailed information regarding the use, or lack, of the standardized tests.

Our inclusion criteria were: the articles should contain, in their methodology, a clear description of the tests applied, and should have been published from 1992-2012 (corresponding to the last 20 years). The articles reporting that a physical assessment had been carried out without mentioning the test used were discarded, as well as those that did not provide any information on physical assessment by using tests, rather by questionnaires instead.

As exclusion criteria for theses and dissertations, we chose to exclude those texts which, in their title, did not indicate the presence of an exercise, as well as when, in the methodology, did not describe clearly the tests used for the evaluation.

In addition to the common health-related variables of physical assessment, such as cardiorespiratory fitness, body composition, muscular strength and endurance, and flexibility, the variables "agility" and "balance" were also analyzed, as some articles have described the latter as important physical skills to be considered in FMS patients, since, due to pain and difficulty to perform exercise, this population also has a tendency to show a decline in these abilities.

For better understanding, the information contained in the articles were listed in tables and charts, and a list of tests suggested or mentioned in each article for each of the four main physical factors evaluated, but also for agility and balance, was elaborated.

The tables were arranged to display the number of times each test was mentioned. In some articles more than one test to evaluate a given physical skill was used, but as the purpose of this study is to identify the most commonly applied tests for physical evaluation, all tests were listed separately.

A clustering of articles of the same research group was also conducted, with the aim to emphasize whenever a given test was used by different studies and groups; yet these articles are presented in the same table indicating the amount of tests per research. For example, the Body Mass Index (BMI) test was quoted 19 times by 11 different groups.

To present the possibility of combining and using more of a test to assess physical skills, shown in the studies, charts with the percentage reported in the literature were created.

Results

We identified a total of 84 articles and four theses that contained tests for physical evaluation of FMS patients, totalling 88 documents.

In the first survey, 223 articles and 235 theses and dissertations with the words/terms used searched in the article title were found, but after reading the abstracts, 138 were excluded; and after reading the titles and summaries of dissertations and theses, 231 more were excluded, because they did not meet the inclusion criteria.

Of the 88 documents analyzed, 23 contained information on tests for body composition assessment by 13 different research groups. Table 1 lists these tests, and also shows the number of times each one was named by each research group. We must emphasize that some studies quote more than one test. Thus, the amount of 31 refers to the number of tests indicated in the 23 studies collected. It was observed that the most commonly used test for body assessment is BMI; also, this test is also the most quoted by different research groups.

In the selected studies it was observed that BMI, in addition to being the most individually quoted test, better combines the evaluation of body composition (52%), and also appears more often in combination with other tests, especially with bioimpedance (17%).

Table 2 lists the tests applied to assess cardiorespiratory capacity, and 41 studies conducted by 28 different research groups were identified. The total number of tests (44) is higher than the number of studies, because some of them used more than one test. Individually, the 6-minute walk test (6MWT), with 54.55%, was the most quoted test, and by different research groups (42.86%).

Regarding the use of combined tests to assess cardiorespiratory fitness, it was observed that the 6-minute walk is the most frequent test in the combination of tests (59%). Tests for thoracic expansion, submaximal cycle ergometer and anaerobic threshold and VO_{2max} , with a 7% incidence, belong to the second group of most common applied tests.

There were found 58 studies that quoted tests for evaluation of muscular strength and endurance, conducted by 34 different groups. Table 3 lists these tests, noting that the total amount of 82 quoted in the studies is due to the fact that several studies applied more than one test. It is observed that the use of "handgrip" (dynamometer) (24.39%) and "isometric

Table 1 – List of tests used for body composition assessment.

Tests	Quantity	%	By research group	%
BMI (Body Mass Index)	19	61.29	11	57.89
Bioimpedance	7	22.58	3	15.79
Waist circumference	3	9.68	3	15.79
Skin folds	1	3.23	1	5.26
WHR (Waist-Hip Ratio)	1	3.23	1	5.26
Total	31	100.00	19	100.00

Table 2 – List of tests for cardiorespiratory fitness assessment.

Tests	Quantity	%	By research group	%
6-minute walk	24	54.55	15	42.86
Anaerobic threshold and VO_{2max} (maximal oxygen consumption) by gas analysis	4	9.09	4	11.43
Submaximal cycle ergometer	4	9.09	4	11.43
10-meter walk	4	9.09	4	11.43
Chest expansion	3	6.82	3	8.57
Treadmill test (20' with deliberate speed)	2	4.55	2	5.71
Bench test	2	4.55	2	5.71
Maximum load	1	2.27	1	2.86
Total	44	100.00	35	100.00

Table 3 – List of tests for muscle strength and endurance assessment.

Tests	Quantity	%	By research group	%
Handgrip strength (dynamometer)	20	24.39	13	22.41
Isometric force apparatus	18	21.95	12	20.69
30-second sit to stand from a chair test	15	18.29	9	15.52
Isokinetic strength apparatus	10	12.20	8	13.79
1RM (Repetition Maximum)	8	9.76	6	10.34
Leg	4	4.88	3	5.17
Biceps curl test	2	2.44	2	3.45
Pelvic elevation	2	2.44	2	3.45
Standing flexion	1	1.22	1	1.72
Phantom chair (wall squat)	1	1.22	1	1.72
Abdominal and lumbar	1	1.22	1	1.72
Total	82	100.00	58	100.00

strength apparatus" (21.95%) tests is very similar. The least applied tests were: Leg (4.88%), biceps curl test (2.44%), pelvic lift (2.44%), standing flexion (1.22%), phantom chair (1.22%), and abdominal and lumbar tests (1.22%).

About 24 possible combinations of tests to assess muscle strength and endurance were identified. It was found that the isometric force apparatus is still the most quoted in the studies (21%), followed by handgrip strength (14%) and isokinetic strength apparatus and 1 RM (11%).

It was observed that with the combination of more than one test, the 30-second sit to stand from a chair test is the most used along with others, in combination with grip strength (dynamometer) and isokinetic strength apparatus (2%), isometric and isokinetic strength apparatuses (2%), biceps curls and handgrip strength (2%), leg test (2%), also combined with isometric force apparatus (2%), isokinetic strength apparatus (2%), handgrip strength (9%), and biceps curl (2%).

Table 4 shows the tests used to assess flexibility. In the evaluation of physical fitness, 25 studies, written by 17 research groups, were found; stressing that more than one test was quoted by some studies. Thus, the total number is 35. The three most commonly used tests are sit and reach (42.86%), shoulder flexibility (28.57%) and 3rd finger to the ground (17.14%).

For the combined tests for flexibility assessment, we found equilibrium in the use of tests: sit and reach (31%), sit and reach and shoulder flexibility together (27%), followed by 3rd finger to ground (19%).

For assessment of balance and agility, 16 studies were found; the number of 22 appears because some studies have quoted more than one test, and were conducted by 8 different groups that quoted assessment tests for this physical skill. Table 5 lists these tests for evaluation. Foot Up and Go (45.45%) and flamingo balance (40.91%) stood out.

For the combination of balance and agility tests, the flamingo balance stood out with 31%, followed by Foot Up and Go and Flamingo balance with Foot Up and Go (25%).

Given these results, the protocol for physical assessment of FMS patients should be made up of the four main physical skills (body composition, cardiorespiratory fitness, muscular strength and endurance, and flexibility) with agility and balance being added; we suggest, for that protocol, the tests presented in Table 6.

Discussion

This study aimed to identify the most commonly used tests for the physical assessment of FMS patients presented in the literature, in order to generate a testing protocol that is viable and more suitable for the physical assessment of this population, facilitating the choice of the tests.

Firstly, it was found that, unlike what happens to the general public, for which body composition, cardiorespiratory fit-

Table 4 – List of tests for flexibility assessment.

Tests	Quantity	%	By research group	%
Sit and Reach	15	42.86	9	40.91
Shoulder flexibility	10	28.57	4	18.18
3rd finger to the ground	6	17.14	5	22.73
Joint range of motion	3	8.57	3	13.64
Passive flexibility	1	2.86	1	4.55
Total	35	100.00	22	100.00

Table 5 – List of tests for balance and agility assessment.

Tests	Quantity	%	By research group	%
Foot Up and Go (dynamic balance and motor agility)	10	45.45	5	41.67
Flamingo balance (static equilibrium)	9	40.91	4	33.33
FAB (Fullerton Advanced Balance - rotating 360 degrees; retrieve object with closed eyes on a surface)	1	4.55	1	8.33
Vibratory platform	1	4.55	1	8.33
Berg Balance Scale	1	4.55	1	8.33
Total	22	100.0	12	100.0

Table 6 – Protocol for Physical Assessment in FMS patients.

Physical fitness	Test
Body composition	Bioelectrical impedance and BMI. Note: Possibility of a choice between one test, or both combined.
Cardiorespiratory fitness	6-Minute walk.
Muscular strength and endurance	Isometric strength apparatus (ideal); 30-second sit to stand from a chair test, combined with handgrip strength (dynamometer), or 1-RM test.
Flexibility	Sit and reach or 3rd finger to the ground test, combined with shoulder flexibility test.
Agility and Balance	Flamingo Balance with Foot Up and Go

ness, muscular strength and endurance and flexibility were defined as physical skills related to health components,⁴ in the case of the physical evaluation in FMS patients is important to pay attention to the balance and agility as physical skills related to health. Because of the pain, these individuals have difficulty in performing daily activities and beginning a physical exercise program,⁵ affecting significantly their agility and balance.

Thus, there is a need to specify exercises that influence the improvement in physical condition without causing pain,⁵ considering the physical skills related to health, with the addition of agility and balance.

It was observed that in the past 20 years, very few studies have specifically addressed physical assessment as a major component of the study, being considered as a means to an end, i.e., the physical assessment only as a means to evaluate the effectiveness of a particular type of treatment of patients with SFM. In addition, there is no protocol or guideline for the evaluation of the physical skills in this target population.

The physical assessment is required to lend a parameter to the organization of an exercise intervention program, in order to promote health and improve health-related physical fitness components.⁸ Thus, it is important to establish a protocol that suits the profile of individuals with FMS, defining the tests that will promote a better measurement of physical fitness levels without causing pain or discomfort and allowing the test performance by the patient assessed.

Examining Table 1 it was observed that, in the case of a body composition assessment, the tests most frequently used were BMI with 61.29% (being quoted 19 times in the literature and 11 times by different research groups) and bioimpedance with 22.58% (being quoted 7 times in the literature and 3 times by different research groups). Therefore, these tests may be considered the most commonly used and possibly the most suitable protocols for the physical evaluation of patients with FMS, and could even be combined for a more accurate measurement of body composition.

The bioimpedance test is a test in which an electric current passes through the body via two pairs of adhesive electrodes placed on the right hand and foot, with the aim to evaluate the percentage of fat, lean body mass and hydration, allow-

ing one to calculate the ideal range of weight for the subject tested, according to age and sex.¹¹

BMI is equal to body mass divided by height squared.¹² This is an inexpensive and easily applicable test; on the other hand, bioimpedance requires a specific device to obtain body measurements. In a study comparing bioimpedance and anthropometry, it was demonstrated that the body composition may equivalent tests of simple measure, such as BMI and bioimpedance, showing that both tests are reliable.¹³ Thus, the choice of the best test will depend on to the possibilities of the evaluator, i.e., whether he has, or not, the equipment available and if has been trained to use it.

Regarding the assessment of cardiorespiratory fitness, the most prominent test was 6MWT with 54.55% of our search (quoted 24 times in the literature and 15 times by different research groups). The other tests mentioned did not reach 10% of publications, suggesting that 6MWT is the most suitable test for the target population, without need of a supplementary test.

The 6MWT evaluates the individual's aerobic endurance; the subject must try to cover the longest distance in 6 minutes.¹² This is a practical, simple and inexpensive test that requires a short corridor of 30 meters (ranging from 20 to 50 meters) and a timer, without need of any other equipment or of advanced training for technicians.¹⁴ The 6MWT has good applicability, since walking is a daily activity that almost all patients are able to perform.

To evaluate the muscular strength and endurance, the tests most appropriate, according to the publications, are: grip strength (dynamometer) with 24.39%, isometric force apparatus, 21.95%, and 30-second sit to stand from a chair test, 18.29%. It was found that most of the selected articles advise the combination of more than one test for muscle strength and endurance assessment; so, one should consider the combination of the most prominent tests. Thus, we included the 1RM test.

The handgrip test measures the maximal voluntary handgrip strength using a dynamometer.¹⁵ The isometric force device (most often a dynamometer) is a test that evaluates most muscle groups, with reference to any type of process directed towards force measurement and pressure distribution.¹⁶

The 30-second sit to stand from a chair test intends to assess the strength and endurance of the lower extremities by the number of executions in 30" (get up and sit down) without the use of the upper limbs.¹² The 1RM test aims to find the maximum load that an individual can perform in only one repetition of a certain exercise with the use of weight machines, free weights, washers; devices that allow the execution of resistance exercises and progressive loading.⁸

Importantly, the device of isometric strength and 1RM can evaluate upper and lower limbs; the difference is that to perform the isometric strength test, it is indispensable to use a specific device that must be well calibrated and available for the assessment. The sit and stand in the chair test evaluates only lower limbs; then, it must be combined with another test. The same applies to handgrip strength (dynamometer) that only assesses the strength of upper limbs. We suggest the combination of 30-second sit to stand from a chair and handgrip tests.

In the analysis of Table 4, it was found that for the evaluation of the flexibility, the most frequently used tests were: to

sit and reach 42.86%; shoulder flexibility test 28.57%; and 3rd finger on the ground 17.14% of studies. The combination of sit and reach test and shoulder flexibility stand out in 27% of the publications.

The sit and reach test measures with efficacy the lower body flexibility (flexion of hips and spine),¹⁷ conducted with the patient seated with one leg bent and the preference leg extended; the participant must bring his hands up to the toes of the extended leg without flexing it.¹²

The 3rd finger to the ground test means to assess the mobility of the entire spine and pelvis,¹⁸ thus being equivalent to the sit and reach test. To carry out this test, the operator asks the patient to make an anterior trunk flexion, aiming to reach the ground; knee flexion is not allowed. The distance from the tip of 3rd finger (always of the right hand) to the ground should be measured with a measuring tape or ruler.¹⁹

On the other hand, the shoulder flexibility test assesses the general movement of the shoulder: adduction, abduction, and internal and external rotation.²⁰ This test is performed with the patient in a standing position, who lifts his dominant hand and tries to reach a point as low as possible toward the middle of the back, with palm down and fingers extended (elbow pointed upward).¹² The patient moves the hand of his other arm in a inferior-posterior direction, with his palm facing upward, and reaching as far as possible in an attempt to touch (or overlap) the middle fingers of both hands.¹²

We suggest a combination of the shoulder flexibility test with one of the other two tests (sit and reach and 3rd finger to ground tests).

For the assessment of balance and agility, the Foot Up and Go test (dynamic balance and motor agility) was the most mentioned, with 45.45%; followed by the flamingo balance test (static balance) with 40.91%. We noted a frequent combination of these two tests (31%), suggesting that they may be appropriate for patients with FMS.

The Foot Up and Go test begins with the patient participating fully seated on a chair (upright posture), hands on thighs and feet flat on the ground. At the signal "start" the participant rises from the chair, walks as fast as possible around the cone (by either of its sides) and returns to the chair in order to walk as quickly as possible (without running) around the cone and back. The cone must be at a distance of 2.44 m from the chair.¹²

The flamingo balance test is performed with the subject with one foot on the longitudinal axis of the beam (steel or wood beam, 50 cm long, 3 cm wide and 4 cm in height) and, bending the free leg, grabs his dorsal forefoot with the hand on the same side, mimicking the position of flamingo.²¹ Then, the participant attempts to maintain his balance in this position for 1 minute.²¹

Both tests are easy to apply and have a good applicability in the evaluation of physical mobility and balance.¹²

Through this literature review, it was found that the most commonly used tests to assess the health-related physical skills are components of Rikli and Jones¹² battery to assess elderly people. This is because even with SFM affecting patients of any age, due to their pain the patients have low engagement in physical exercise programs, meaning a negative impact on quality of life and difficulty in performing daily activities.

Nevertheless, it is important to note that the selected studies were conducted on subjects with a mean age ≥ 30 years, who tend to have a history of this syndrome. Few studies were based on younger subjects with a more active lifestyle, which would allow the use of more intensive testing for the person assessed. However, the proposed protocol also applies to this population.

The proposed protocol should be used for physical evaluation of FMS patients, which is consistent with what has been already used by the medical and academic community for the assessment of this group of individuals.

The tests defined in this study are easily performed and can be used both in the gym as well as in physiotherapy clinics. Despite the physical assessment being carried out by physical educators, physical therapists also work with human movement, conducting examinations and guiding physical activity for their patients. Some tests require specific equipment, but other viable options that use simple materials, allowing its easy application, stand out.

There is no standardization of tests for physical assessment of patients with FMS and just a 6-minute walk test has been validated for this population.²² Thus, we intend, in future studies, to validate the proposed protocol.

Conclusion

Through this research it was concluded that few studies have addressed the physical evaluation as a focus of study. Thus, there is no explicit indication of an accepted standardization for the set of tests for health-related physical assessment of patients with FMS. Therefore, the evaluator must decide which tests are more suitable, according to the experience and life story of his patients.

Therefore, this study aimed to create a protocol based on the literature, which can serve as a parameter for decision making in choosing the most appropriate tests.

Thus, according to publications of the past 20 years, the tests that should make up the physical assessment protocol for patients with FMS are:

- Body composition: BMI and bioimpedance (combined or not).
- Cardiorespiratory capacity: 6-minute walk.
- Muscular strength and endurance: Grip strength (dynamometer), isometric force apparatus, 30-second sit to stand from a chair test, and 1 RM test. The isometric force apparatus test and 1 RM test can be used alone. Lift from the chair and dynamometer can be combined.
- Flexibility: Combination of sit and reach test and shoulder flexibility.
- Balance and agility: Combination of Foot Up and Go test (dynamic balance and motor agility) and flamingo balance (static balance).

It follows that the standardization of tests for physical evaluation of FMS patients is important to assist in a proper physical assessment. The above tests are consistent with the ability of achievement of this target population; therefore, they are suitable for assessing health-related physical com-

ponents thereof. The protocol created is easy to use and it can be applied in the gym as well as in physiotherapy clinics.

We recommend the use of this protocol, and intend to perform a validation of the tests contained therein through future prospective studies.

Conflicts of interest

The authors declare no conflicts of interest.

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