Social cognitive measures related to exercise behaviour: Validation in Indonesian middle-aged and older adults

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ABSTRACT

Introduction: Evidence shows that exercise adoption and maintenance are influenced by social-cognitive processes. Instruments have been developed to measure these processes, but none have been validated for use in the Indonesian context. This study aimed to validate scales measuring social cognitive constructs related to exercise in Indonesian middle-aged and older population.

Methods: The Self-Efficacy for Exercise, the Exercise Self-Efficacy, the Multidimensional Outcome Expectations for Exercise, the Exercise Goal-Setting, the Exercise Planning and Scheduling, and the Social Support for Exercise Behavior scales underwent forward-backward translation, readability, and content validity assessments with middle-aged and older Indonesian adults ($n = 126$; age = 61.2 ± 8.2 years, 72% female). Psychometric testing included assessments of internal consistency and 1-week test-retest reliability, convergent validity, known-group validity with self-reported moderate to vigorous physical activity (MVPA), and construct validity using confirmatory factor analyses (CFA).

Results: The scales were found to be readable and content valid. Internal consistencies were acceptable to excellent (Cronbach's $\alpha = 0.76$ – 0.93). Moderate to good repeatability estimates were demonstrated (ICC = 0.72 – 0.88). Convergent validity was supported by moderate correlations between scale scores and MVPA ($r = 0.42$ – 0.72). Participants with sufficient MVPA levels consistently scored higher on scales than those with insufficient PA levels. The CFA showed a moderate fit for all scales except the Social Support for Exercise Behavior scale.

Conclusion: Although the factor structure of the Social Support scale warrants further investigation, the evidence supports the use of the six scales in Indonesian middle and older adults, including for evaluating the impact of theory-based physical activity interventions in this population.

1. Introduction

Physical inactivity is a leading cause of morbidity and premature mortality.¹ Contributing 13.4 million DALYs (Disability-Adjusted Life Years) globally, it costs health care systems around the world \$53.8 billion.¹ The economic burden due to high physical inactivity affects countries worldwide, including Indonesia.² The global estimates of insufficient physical activity (PA) levels range from 15% in low-income countries to 29% in high-income countries.² The latest Indonesian Basic Health Survey reveals that 22% of adults aged 45–49 years are insufficiently active, and the prevalence of physical inactivity steadily increases as age increases, with 48% of adults aged 65+ years being

physically inactive.³ Thus, PA interventions in middle-aged and older adults are warranted for this population.

Promoting long-term PA behavior change is a challenging task.⁴ It requires behavior change strategies to influence social cognitive processes. According to Social Cognitive Theory, important constructs to influence PA behavior include self-efficacy, which is defined as confidence in being physically active even when faced with barriers⁵; outcome expectations, which are perceptions of the benefits of being physically active⁶; self-regulation of PA behavior; and social support for PA from friends and family.⁷ These constructs have been shown to be the main predictors of exercise behavior.⁸

Scales that assess changes in these constructs pre- to post-

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intervention have been developed in English or other Western languages. There are no scales that measure social cognitive constructs in the Indonesian language, and the validity and reliability of existing scales may not hold for the Indonesian population given social and ethnic differences. The development of new scales in the Indonesian language would require considerable time and resources; thus, adaptations of well-established scales are recommended. Moreover, the use of adapted scales allows for comparisons with studies from other settings.

Among the established scales for measuring social cognitive constructs are the Self-Efficacy for Exercise (SEE)⁵ and Exercise Self-Efficacy (EXSE) scales,⁹ the Multidimensional Outcome Expectations for Exercise (MOEE) scale,¹⁰ the Exercise Goal-Setting Scale (EGS),¹¹ the Exercise Planning and Scheduling (EPS) scale,¹¹ and the Social Support for Exercise Behaviours (SSEB) scale.¹² This study aimed to cross-culturally adapt and then psychometrically test these scales in middle-aged and older Indonesian adults.

2. Methods

2.1. Study design, participants and ethical clearance

This study is a cross-sectional study conducted in April 2019. Participants were recruited from the membership of two community centres that offer health services to local middle-aged and older residents in Yogyakarta, Indonesia. Members were eligible to participate if they were literate in and able to comprehend the Indonesian language and aged >45 years. All participants provided written informed consent. The procedure was approved by the Human Ethics Committee of Gadjah Mada University (approval number: KE/0142/02/2019).

2.2. Measures

Social cognitive scales that exhibited excellent psychometric properties in previous studies, were well-used internationally, and were considered to be the most appropriate instruments for use in the target population were selected. These included two measures of self-efficacy, the SEE⁵ and EXSE⁹; one measure of outcome expectations, the MOEE, which has three subscales¹⁰; one measure of self-regulation, which has two subscales that are used separately, the EGS¹¹ and EPS¹¹; and one measure of social support, the SSEB, which combines three subscales.¹²

The scales' properties and their earlier psychometric testing results are shown in Table 1.

Other measures included demographic characteristics (age, sex, education level, marital status, employment status, and smoking status) and PA level, assessed with the validated interviewer-administered 7-Day Recall.¹³

2.3. Procedures

This study followed a recommended protocol, which involved forward and backward translation of all five scales from the source language (English) to the target language (Indonesian/Bahasa), readability and content validity assessments, and psychometric testing.¹⁴ Fig. 1 illustrates the research procedures.

Forward and backward translations were conducted by six independent translators. The sample size for the readability study followed the recommendation of Sousa et al.¹⁴ for 10 to 40 participants. For this assessment, participants in one community center reviewed paper copies of the translated scales. They then responded to each item that they understood and indicated items for which the wording was unclear. Following standard practice, if all scale items were not understood by at least 80% of participants, the scale was to be revised by the translators until this criterion was met.¹⁴

Content validity assessment was conducted by a panel of five experts. Each panel member rated each item on (1) the relevance of the content to the local culture and (2) the clarity and equivalence of phrasing. The ratings were on a 4-point Likert scale from 1 (not relevant or equivalent) to 4 (very relevant or equivalent). The proportion of experts who gave each item a rating of 3 or 4 was calculated to determine the content equivalence (content-related validity) of each item of a scale. The proportion is called the item content validity index, and a value of 0.78 or more indicates an acceptable content-related validity of an item.¹⁴ Items with values below this level were revised by the experts and re-evaluated for readability and content validity.

To assess convergent and construct validity, paper copies of the translated scales were administered in-person to participants at the second community center for self-completion. The sample size needed for testing validity was based on the ratio of the number of cases to the number of parameters that require statistical estimates of 5:1 for confirmatory factor analysis.^{15,16} The highest number of items in the

Table 1
Summary of the social cognitive scales.

Constructs	Scales	Items	Response option	Psychometric properties from previous studies
Self-efficacy	SEE ⁵	9 items measuring confidence in exercising at least 3 times per week for 20 min during adverse conditions	10-Likert scale from 1 (not confident) to 10 (very confident).	Cronbach's α = 0.92
	EXSE ⁹	8 items measuring ability to exercise at moderate intensity at least 3 times per week, with		Cronbach's α = 0.88
Outcome expectation	MOEE ¹⁰ with 3 subscales	6 physical outcome expectation items 4 social outcome expectation items 5 self-evaluative outcome expectation items	5 Likert scale from 1 (strongly disagree) to 5 (strongly agree)	Cronbach's α = 0.82, Cronbach's α = 0.81 Cronbach's α = 0.84
	EGS ¹¹	10 items in goal setting	5 Likert scale from 1 (does not describe) to 5 (describes completely)	Cronbach's α = 0.89 1-week repeatability: ICC = 0.87
Self-Regulation	EPS ¹¹	10 items in planning and schedule		Cronbach's α = 0.89 1-week repeatability: ICC = 0.87
	SSEB ¹² with 3 subscales	10 friends' support items	5 Likert scale from 1 (none) to 5 (very often).	Cronbach's α = 0.84 1-week repeatability: ICC = 0.79
		10 family participation and encouragement items		Cronbach's α = 0.91 1-week repeatability: ICC = 0.77
Social Support		3 family reward and punishment items		Cronbach's α = 0.61 1-week repeatability: ICC = 0.55

Note. EGS = Exercise Goal-Setting Scale. EPS = Exercise Planning and Scheduling. EXSE = Exercise Self-Efficacy. ICC=Intraclass correlation. MOEE = Multidimensional Outcome Expectations for Exercise. SEE=Self-Efficacy for Exercise. SSEB=Social Support for Exercise Behaviours.

Fig. 1. Legends: The instrument cross-cultural adaptation process.

scales adapted in this study was the SSEB, which consisted of 23 items. Thus, the minimum sample required for the analysis was 115 participants. The number of participants recruited exceeded this number.¹⁴ A subsample of participants who completed the initial assessment returned for a second assessment one week later to complete the scales again for a 1-week test and retest reliability assessment.

2.4. Statistical analysis for psychometric testing

Pearson's chi-square test was used to compare the characteristics of participants who completed the readability assessment to those of participants who completed the psychometric testing. For the psychometric testing, first, reverse coding of inversely-worded items was conducted. Next, Cronbach's α was computed to assess internal consistency reliability of the scales. The commonly-used threshold of $\alpha \geq 0.70$ was selected to indicate acceptable reliability while a corrected item-total correlation above 0.40 indicated good discrimination of an item.¹⁷ To measure 1-week test-retest reliability, intraclass correlation coefficients

(ICCs) were calculated for each score using the one-way random average ICC model. ICC values < 0.50 were considered poor; 0.50–0.75 moderate; 0.75–0.90 good; and > 0.90 excellent.¹⁸

For convergent validity assessment, we computed Pearson's Product correlations between each scale score and time spent in engaging in moderate and vigorous PA in the previous week. For the known-group validity testing, participants were classified as meeting PA recommendations if they had engaged in at least 150 min of moderate PA or 75 min of vigorous PA,¹⁹ and independent sample t-tests were computed to compare scale scores between these groups.

Last, we conducted confirmatory factor analysis (CFA), to assess the construct validity of each scale. We evaluated the model fit of the data according to the hypothetical structure informed by the initial developers of each scale based on the maximum likelihood. An acceptable model fit was indicated by several goodness of fit indices. First was the $\chi^2/\text{degree of freedom (df)}$ ratio for which a value < 3 indicated good fit. Second was the root mean square error of approximation (RMSEA). A value < 0.08 indicated good fit; a value between 0.08 and 0.10 indicated

mediocre fit; and a value > 0.10 indicated poor fit.²⁰ Also calculated were the comparative fit index (CFI), Tucker–Lewis index (TLI), and the standardized root mean square residual (SRMR).²⁰ Values greater > 0.90 on the CFI and TLI and values < 0.08 on the SRMR indicated an adequate fit between the hypothesized model and the observed data.²⁰

Data were analyzed using SPSS® v21.0 (IBM, Chicago, IL, US), except for the CFA analyses, for which STATA v15 (College Station, TX, US) was used. A p -value < 0.05 represented statistical significance.

3. Results

3.1. Participant characteristics

Twenty-five members of one community center (mean age: 59.3 ± 7.5 years) completed the readability assessment. Another 126 members of the second community center (mean age: 61.6 ± 8.3 years) completed the psychometric testing, and of these, 70 (mean age: 62.9 ± 7.6 years) also completed the test re-test reliability assessment. Table 2 shows that the characteristics of participants were similar across steps of the protocol. In brief, most participants were women, married, educated at a secondary level, non-smokers, and unemployed or retired. Most participants in the psychometric testing met recommended PA levels. PA level was not measured among participants in the readability assessment.

3.2. Translation, readability, and content validity assessments

A minor modification was made during the translation process to the response options of the EGS and EPS. The scales' original response options, which ranged from 'does not describe completely' to 'describe completely', were modified to 'never', 'rarely', 'a few times', 'often' or 'very often' a participant did the activity described in the item statement. It was expected that these options would be easier for participants to answer because they are more commonly used in the Indonesian language. After this change, all translated scales met the requirement outlined by Sousa et al.¹⁴ that all items of a scale be understood by at least 80% of participants. Experts consistently gave positive feedback by

rating all items as either 3 or 4 for equivalency and relevance, indicating that all items had acceptable content validity. Therefore, no further adjustments were made.

3.3. Psychometric testing

As shown in Table 3, internal consistency of all scales ranged from acceptable to excellent (Cronbach $\alpha = 0.76$ – 0.94). No corrected item-total correlation was < 0.40 ; thus, all items were retained. The repeatability coefficients were moderate to good (ICCs = 0.72 – 0.85). Positive, moderate correlations between each score and PA were found ($r = 0.42$ – 0.72). Participants who met PA recommendations scored higher than those who did not on all social cognitive measures ($p < 0.01$).

Table 4 shows the model fit parameters for each scale. All χ^2/df ratios were < 3.0 , and RMSEAs were between 0.09 and 0.10 , except for the SSEB (χ^2/df ratio = 3.78 ; RMSEA = 0.14). Thus, there was a moderate fit for all scales except the SSEB, for which there was a poor fit.

4. Discussion

Valid and reliable social cognitive scales are needed in Indonesia for monitoring, evaluating, and intervening to change exercise behaviour. This study was the first to cross-culturally adapt selected social cognitive scales for use in the Indonesian population. The study resulted in the Indonesian and English language versions of the scales being semantically similar. The translated version resulted in excellent readability and content validity among middle-aged and older adults. These findings indicate that the constructs measured in the selected scales are transferable to the Indonesian context. This study also showed that the Indonesian translated versions of the scales have satisfactory psychometric properties.

The internal consistency of the Indonesian version of the SEE scale was good ($\alpha = 0.88$). It was higher than the estimate reported for a study in Taiwan ($\alpha = 0.72$) in predominantly male participants, aged 60–91 years, who were mostly physically active and city dwellers,²¹ but lower than the estimate reported in a study in China ($\alpha = 0.95$), which was conducted in a younger population with cardiovascular disease.²² Our estimate was comparable to the one reported for the initial study that tested the psychometric properties of the scale in the US ($\alpha = 0.92$). That study recruited elderly living in a continuing care retirement community and was interviewer-administered,⁵ whereas we recruited community-dwelling middle-aged to older adults who tended to be more physically active. The differences in the study participants' characteristics among those studies may contribute to the variety of findings. Nonetheless, all resulted in acceptable estimates of internal consistency. Our study also resulted in a good 1-week test and retest reliability, which supports the finding from a study in an older population in Sweden.²³ In addition, a moderate fit of our data using the original one-factor structure was found, thus supporting findings from studies in China²¹ and in African American and Latino older adults in the US.²⁴

Self-efficacy was also measured with the EXSE scale. Our internal reliability estimates were comparable to those initially reported.⁹ High internal consistency ($\alpha = 0.92$) of the scale was also reported in a population with multiple sclerosis in the US.²⁵ We also found good 1-week test and retest reliability and a fair fit of the data using the original one-factor structure. The scale has been widely used in the US²⁶ and Europe,²⁷ but to our knowledge, no other validation study has been conducted for this scale. Our study, thus, extends the evidence in the literature to support the use of this scale in an Asian population, namely Indonesian middle-aged and older adults.

Outcome expectations were measured with the MOEE scale.¹⁰ Our study showed that the physical and social subscales have acceptable internal consistency reliability and the self-evaluative subscale has good internal consistency reliability; these findings corroborate findings from studies conducted in the US in continuing-care retirement communities²⁸ and in community-dwelling adults with multiple sclerosis.²⁵ Our

Table 2
Participants' sociodemographic characteristics and physical activity status.

Variables	Readability assessment (n = 25)	Internal consistency study (n = 126)	Test-retest study (n = 70)
	n (%)	n (%)	n (%)
Sex			
Female	16 (64)	93 (74)	59 (84)
Male	9 (36)	33 (26)	11 (16)
Age (years)			
40–50	2 (8)	16 (13)	5 (7)
51–60	4 (16)	35 (28)	17 (24)
61–70	12 (48)	58 (46)	38 (54)
71–80	2 (8)	17 (14)	10 (15)
Marital status			
Married	21 (84)	91 (72)	49 (70)
Not married/ widowed	4 (16)	33 (28)	21 (30)
Highest education level			
Primary	2 (8)	18 (14)	11 (16)
Secondary	12 (48)	58 (45)	34 (49)
Tertiary	11 (44)	52 (41)	25 (36)
Employment status			
Employed	6 (24)	14 (11)	6 (9)
Unemployed/ retired	19 (76)	112 (89)	64 (91)
Physical activity^a			
Sufficient	–	74 (59)	42 (60)
Insufficient	–	52 (41)	28 (40)

^a Participants were classified as sufficiently active if they engaged in at least 150 min of moderate physical activity or 75 min of vigorous physical activity in the previous week.

Table 3

Estimates of reliability, convergent validity of social cognitive scale scores.

Constructs, scales and subscales	Reliability		Convergent validity		Known group validity		
	Cronbach's α	ICC (95%CI)	Correlation ^a	p-value	Sufficient PA ^b Mean $\pm$ SE	Insufficient PA Mean $\pm$ SE	p-value
Self-efficacy							
In overcoming PA barriers (SEE)	0.88	0.75 (0.65–0.83)	0.72	<0.001	6.35 $\pm$ 0.14	4.15 $\pm$ 0.21	<0.001
In PA engagement (EXSE)	0.87	0.88 (0.81–0.93)	0.60	<0.001	5.47 $\pm$ 0.17	3.67 $\pm$ 0.20	<0.001
Outcome expectations (MOEE)							
Physical subscale	0.76	0.83 (0.73–0.89)	0.50	<0.001	3.82 $\pm$ 0.08	3.48 $\pm$ 0.10	0.005
Social subscale	0.76	0.84 (0.75–0.92)	0.47	<0.001	3.99 $\pm$ 0.07	3.31 $\pm$ 0.10	<0.001
Self-evaluative subscale	0.83	0.72 (0.59–0.82)	0.42	<0.001	3.93 $\pm$ 0.08	3.36 $\pm$ 0.11	<0.001
Self-regulation							
Goal setting (EGS)	0.94	0.85 (0.75–0.90)	0.64	<0.001	2.95 $\pm$ 0.11	1.81 $\pm$ 0.90	<0.001
Planning and scheduling (EPS)	0.83	0.77 (0.63–0.86)	0.65	<0.001	2.87 $\pm$ 0.07	1.92 $\pm$ 0.09	<0.001
Social support (SSEB)							
Family participation and involvement subscale	0.90	0.79 (0.67–0.87)	0.49	<0.001	2.78 $\pm$ 0.10	2.00 $\pm$ 0.10	<0.001
Family reward and punishment subscale	0.80	0.76 (0.61–0.85)	0.51	<0.001	2.06 $\pm$ 0.12	1.59 $\pm$ 0.09	0.002
Friends' participation and punishment subscale	0.93	0.73 (0.57–0.83)	0.64	<0.001	2.90 $\pm$ 0.09	2.01 $\pm$ 0.10	<0.001

Note. EGS = Exercise Goal-Setting Scale. EPS = Exercise Planning and Scheduling. EXSE = Exercise Self-Efficacy. ICC= Intraclass correlation coefficient. MOEE = Multidimensional Outcome Expectations for Exercise, which is composed of three subscales. PA = physical activity. SEE= Self-Efficacy for Exercise. SSEB=Social Support for Exercise Behaviours, which is composed of three subscales.

^a Correlation with moderate- and vigorous-intensity physical activity.

^b Engaged in at least 150 min of moderate-intensity physical activity or 75 min of vigorous-intensity physical activity in the previous week.

Table 4

Results of confirmatory factor analysis: Model-fit parameters of social cognitive scales (n = 126).

Scales	χ^2/df ratio	RMSEA	CFI	TLI	SRMR
Self-efficacy in overcoming PA barriers (SEE)	2.02	0.09	0.94	0.94	0.06
Self-efficacy in PA engagement (EXSE)	2.02	0.09	0.93	0.90	0.06
Outcome expectations (MOEE)	2.35	0.10	0.85	0.83	0.07
Self-regulation (EPS and EGS)	2.39	0.10	0.90	0.85	0.07
Social support (SSEB)	3.78	0.14	0.71	0.67	0.09

Note: EXSE = Exercise Self-Efficacy. EGS = Exercise Goal-Setting Scale. EPS = Exercise Planning and Scheduling. MOEE = Multidimensional Outcome Expectations for Exercise. PA = physical activity. SEE=Self-Efficacy for Exercise. SSEB=Social Support for Exercise Behaviours, χ^2/df ratio = Chi-square divided by degree of freedom. RMSEA = Root mean squared error of approximation. CFI=Comparative fit index. TLI = Tucker-Lewis index. SRMR=Standardized root mean square residual.

reliability estimates are also comparable to the estimates reported for the initial development of the English version of the scale.¹⁰ Our study also showed that each subscale has good test-retest reliability. The original three-factor structure, however, only moderately fit the data, with a RMSEA of 0.10. Similarly, a mediocre fit of the original structure was reported by Hall et al.²⁸ who preceded with the deletion of items with low factor loadings and conducted a subsequent CFA on the remaining items. The result was a better fit of the data. However, these researchers recommended that these items be retained pending additional validity and factorial invariance testing in other samples and over time. We support the retention of all items to allow direct comparison to be made across studies. Moreover, McAuley et al.²⁵ reported a reasonable fit for the original 3-factor solution among multi-sclerosis patients after rerunning the model with a correlation between the residuals of two social outcome expectations items that appeared to overlap. Exploration of modification indices to obtain a suitable algorithm for interpreting the scales for specific populations; thus, the MOEE is recommended including in Indonesian middle-aged and older populations.

Minor modifications to the response options that were made to the self-regulation subscales, the EGS and the EPS, resulted in acceptable to good internal consistency reliability and test-retest reliability. These findings support those reported for the initial study.¹¹ Two studies conducted among undergraduate students in the US²⁹ and Thailand,³⁰

however, suggested that EPS contains two subscales. Elavsky et al.²⁹ labelled the subscales 'deprioritizing' and 'planning-schedule' following modification indices from CFA, whereas Sriramatr et al.³⁰ introduced the idea that the two subscales represent positive and negative EPS, after extracting factors in a principal component analysis. Their approaches appeared to be justified as following this proposed structure, they reported acceptable reliability for their three subscales, and the 3-factor structure resulted in a good fit of the data, in contrast with our findings of a moderate fit for the original 2-factor structure. These findings suggest that further exploration of the scale's factor structure may improve the fit of the data in Indonesian populations.

The SSEB subscales were also shown to have acceptable internal consistency reliability. Our reliability estimates were comparable to those found for a US study,³¹ but our estimate for the family reward and punishment subscale ($\alpha = 0.80$) was much higher than the estimate reported by the US scale developer ($\alpha = 0.61$).¹² Differences in estimates may reflect stronger roles for Indonesian families in providing rewards and punishments for modifying individual behavior like physical activity than seen in Western cultures.¹² However, the US researchers reported a better fit of the data than we found using the same approach. That approach was to allow correlation among factors but with the omission of two items with low factor loadings. Model modification for this scale could improve the fit of the data in Indonesian populations.

We found moderate to high correlations between scale scores and PA, thus supporting the convergent validity of the scales. Likewise, known-group validity was supported as the participants who met the PA recommendation scored consistently higher on all social cognitive scales than participants who did not meet this recommendation. This finding supports those of other studies that have posited the importance of the relationship of social cognitive processes to PA behaviors.⁶

The main strength of this study was the use of a comprehensive process of cross-cultural adaptation of measures for adopting well-used scales into a new context. However, there are notable limitations. First, due to time and resource limitations, the sample size for the CFA was based on five participants per number of items/parameters, which is a minimal sample size requirement for CFA analysis.¹⁵ The recommended minimum sample size for CFA is 200 participants, or at least 10 participants per parameter.³² We did not examine the modification indices in the CFA as we recognized that attempts to modify the factor structure were limited by our modest sample size. Second, the study was conducted in a community-dwelling setting, thereby limiting the generalization to other populations including adults in residential care and

younger adults. This study was also likely to attract participants who had an interest in PA, which would also limit the study's generalizability, although participants were sufficiently heterogeneous in their level of PA to produce acceptable reliability estimates. Third, our study was limited by the cross-sectional nature of the data; further validation studies that employ longitudinal designs for assessing the predictive validity and responsiveness to change are recommended.

5. Conclusion

The overall findings provide evidence of readability, reliability, content validity, convergent, and construct validity of the measures. The findings substantiate the applicability of the Indonesian versions of social cognitive scales related to exercise behavior in Indonesian middle-aged and older adults. It is expected that the adapted scales will be useful for evaluating the impact of theory-based exercise interventions, as well as for identifying and developing evidence-based recommendations for promoting exercise to improve health and well-being, based on social cognitive processes associated with exercise adoption and maintenance in this population.

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Declaration of competing interest

The authors declare that they have no competing interests.

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