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Prediction of everyday task performance in older adults by perceived health, self-efficacy and cognitive ability

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Abstract: While research links neuropsychological performance to everyday functioning in cognitively impaired older adults, comparatively little research has investigated this relationship in unimpaired older people. This study investigated that relationship. A total of 134 independently living adults aged 60–93 years completed Cognistat, the Direct Assessment of Functional Status (DAFS), the Personality in Intellectual-Aging Contexts and a four-item subjective health measure. Hierarchical regression was used to examine the relative ability of these measures to predict the functional domains of the DAFS, hypothesizing that the health and self-efficacy measures would be more strongly associated with DAFS scores than with the cognitive domains. Self-reported health accounted for little variance in all measures, whereas self-efficacy contributed significantly to four functional domains. The cognitive variables contributed to only two domains, with memory the most consistent predictor. The study showed that a brief cognitive measure can partially predict the functional ability of older independently living adults.

Subjects: Health Psychology; Neuropsychology; Clinical Neuropsychology; Behavioral Psychology; Psychiatry & Clinical Psychology - Adult

Keywords: functional assessment; IADLs; cognition; older adults; self-efficacy; physical health

ABOUT THE AUTHORS

Edward Helmes currently is an adjunct professor of psychology at James Cook University. He developed his interest in older adults through working with them in a physical rehabilitation programme in Canada. When the opportunity came to develop a training programme for Australian psychologists, he took the opportunity to apply for that position in Perth, which he began in 1996. He then set up a parallel programme at James Cook University in 2001, which operated until his retirement in 2016. Joan Klinger was a student of his in Perth, and this research represents the results of her Master of Psychology thesis work. Helmes is spending some of his time in retirement publishing some of the studies from his students in the geropsychology programmes.

PUBLIC INTEREST STATEMENT

The number of older adults in most Western countries is increasing. It is generally desirable for older adults to remain in good health and not dependent upon their families or the health care system. This study explores the roles of cognition, self-efficacy and perceived health in older adults for the prediction of domains of functional skills. Perceived health correlated with only two of the functional domains; statistical analysis showed that self-reported health accounted for little of the variation in functional scales, whereas the self-efficacy measure and the cognitive scale both predicted the majority of the functional domains. In all, cognitive measures were the best predictors of everyday function. Results showed predicting functional ability may be more practical and cost-effective than a full functional assessment. We concluded that interventions aimed at improving cognitive status, in particular memory, have serious implications for performance in several areas of function.

1. Introduction

The inability to live independently a life in residential care is feared by many older adults more than illness, loss of financial resources or even death (Willis, 1996; Willis & Schaie, 1994). In order to maintain their independence, older adults may require selective assistance with commonly recurring tasks in everyday life (Cohen-Mansfield & Frank, 2008). Everyday competence has been defined as the ability of an older person to adapt successfully to environmental demands and to adequately perform activities considered essential for living independently (Willis & Schaie, 1994). However, the relationship between everyday competence and cognition has been debated in the literature (Backman & Hill, 1996).

Neuropsychological assessment has been widely used to assess performance in cognitive, perceptual and motor domains (McCue, 1997). On the other hand, functional assessment directly addresses skills required in everyday living. Such tasks may involve multiple cognitive processes, complicating an assessment of the relationship between cognition and functional domains. There is an extensive literature linking neuropsychological test performance to everyday functioning in cognitively impaired older adults (Burton, Strauss, Bunce, Hunter, & Hultsch, 2009; Dodge et al., 2005; Loewenstein, Rubert, Arguelles, & Duara, 1995; Mahurin, DeBettignies, & Pirozzolo, 1991; Nadler, Richardson, Malloy, Marran, & Brinson, 1993; Tuokko & Crockett, 1991; Wahl, 1991). However, only a minority of older adults in the community experience difficulty in functioning competently due to cognitive impairment (Carney, 1995; Fillenbaum, 1985; Kendig et al., 1996). Not surprisingly, comparatively little research has investigated the relationship between cognition and everyday competence in normal older adults (Garrett et al., 2013; Rovner, Casten, & Leiby, 2012).

Skills required to live independently in the community are generally referred to as instrumental activities of daily living (IADLs), which are viewed as being more complex activities than basic daily living skills (Verbrugge & Sevak, 2002). The majority of instruments for measuring IADLs rely on self-report. Although self-report measures of functional IADLs can be accurate, supplementary information is frequently required to verify this (Schmitter-Edgecombe, Parsey, & Cook, 2011). Importantly, Kiyak, Teri, and Borson (1994) reported that IADLs in participants with Alzheimer's disease were consistently better than those of family members. Estimations of function by non-dementing participants were more concordant with reports by family members. As mild levels of impairment are not always clinically obvious, Kiyak et al. recommended obtaining data from both the person being assessed and a family member.

Although self-report measures are easier to administer than performance-based instruments, comparisons of the two formats of assessment may not always show close association (Kempen, Steverink, Ormel, & Deeg, 1996; Kuriansky, Gurland, & Fleiss, 1976; Little, Hemsley, Volans, & Bergmann, 1986). Furner, Rudberg, and Cassel (1995) noted that some chronic physical conditions affect only specific IADLs, making it likely that performance-based measures provide more precise information on specific aspects of functioning than self-report instruments.

As opposed to self-report ratings of functional ability, self-reported health has been found consistently to predict morbidity and mortality among older adults (Heidrich & Ryff, 1993; McCue, 1997; Salthouse, Kausler, & Saults, 1990; Walker, 1991). Self-reported health has also been associated with performance on intelligence tests (Clark, 1996; Perlmutter & Nyquist, 1990).

As with self-reported health, self-efficacy has been reported to be a strong predictor of exercise adoption (Clark, 1996), but few studies have examined the relationship of self-efficacy to everyday functioning of older adults in the community (Willis, Jay, Diehl, & Marsiske, 1992), even though cognitive competence in everyday tasks may be a crucial component of functional health. Willis and Marsiske (1991) correlated basic mental abilities with performance on everyday tasks. They found that performance on daily tasks on the first assessment occasion was not a strong predictor of performance on the same tasks seven years later. This is in the context of an average decline in performance over seven years on everyday tasks.

Of particular interest in this study is the issue of whether cognitive test performance is associated with functional skills in everyday living situations in normal older adults (Yam & Marsiske, 2013). It was expected that both self-reported health and self-efficacy beliefs would correlate highly with measured functional performance; therefore, statistical control for subjective health and self-efficacy was used to minimize their influence. Cognitive variables were expected to have moderate predictive power for everyday functioning. Finally, it was anticipated that salient predictors of individual functional domains would be found for specific cognitive variables.

2. Method

2.1. Participants

Study participants were recruited through advertisements in community newspapers, a radio interview, retirement villages, senior citizens' centres and local bowling clubs. Only those who were independently living, defined as not receiving formal care or living in a residential care facility and age 60 years and older were recruited.

One hundred and forty-three older people registered their interest. Nine could not be included: four cancelled the interview due to acute illness, three withdrew without reason and two used the opportunity of the interview as a counselling session. The final sample comprised 134 individuals, aged from 60 to 93 years (mean age of 76.5, SD = 7.48). The ratio of male to female participants, at 25:75%, was somewhat below the ratio of older males to females in the Australian population. The majority was widowed (58%, with 28% married). The remainder were divorced or never married. Most were native English speakers (92%). A majority (63%) had some ongoing health problem that required medication.

2.2. Measures

The Direct Assessment of Functional Status (DAFS; Loewenstein et al., 1989) was used as the dependent measure of functional abilities. It covers seven domains: time orientation, communication abilities, transportation, finances, shopping, eating and dressing/grooming. Because the current sample included only non-dementing older adults, the tasks of eating and dressing/grooming were not used. The DAFS has good interrater reliability and test–retest reliability. Convergent validity was demonstrated through comparisons with other measures of general functional status, with high correlations found.

Cognistat (Kiernan, Mueller, Langston, & Van DyKe, 1987) was designed as a screening instrument and provides a basis for formulating referral questions leading to more accurate diagnoses. It assesses intellectual functioning in five major areas: language, constructional ability, memory, calculations and reasoning. Mitrushina, Boone, Razani, and D'Elia (2005) reported adequate test–retest reliability, and sensitivity as high as 100% has been reported (Franzen & Martin, 1996). Doninger et al. (2006) and Ruchinskas, Repetz, and Singer (2001) provide evidence of its utility in rehabilitation settings.

The measure used to assess self-efficacy, the Personality in Intellectual-Aging Contexts (PIC; Lachman, Baltes, Nesselroade, & Willis, 1982), has six scales, assessing Internal Control, Chance and Powerful Others, as well as Achievement Motivation, Anxiety and Morale. Reported psychometric properties are satisfactory, with internal consistency reliabilities from .76 to .91 and five-month test–retest correlations at .74 to .88.

Subjective health was measured using four items that asked participants to rate their own health compared with earlier health status and their view of peers' health (Liang, 1986). Ratings are made on three- or four-point rating scales, with lower scores indicating perceptions of better health.

2.3. Procedure
Appointments were made by telephone with participants to arrange a visit to their home for testing and completion of the questionnaires. Each participant was informed as to the nature of the study, which was approved by the Edith Cowan University Ethics Review Board. Tests were administered in the following order: subjective health, cognitive assessment, self-efficacy and finally the functional assessment. Total testing time was approximately 90 min.

2.4. Analysis
Tables in Cohen (1992) were used to determine that with a desired power of .80, and with a medium effect size at the statistical significance of .05, a sample size of 107 is required with eight independent variables. With 12 independent variables for a dependent variable, a minimum sample size of 118 is required.

Hierarchical regression analysis was used with the five DAFS scales as the dependent variables. Subjective health, intellectual self-efficacy scores and the cognitive dimensions from Cognistat were used as the 12 independent variables. For all five DAFS scores, the order of entry was subjective health, then adding the self-efficacy scores, with the cognitive screening dimensions added at the third level.

3. Results
Prior to analysis, all variables were examined for accuracy of the assumptions of multivariate analysis. Four cases (<3%) were identified as outliers. The age range of these cases was 83–92 years, and in one case, 12 of the 17 variables in the analysis were outliers. It was decided to retain all the cases in order to maintain generalizability to all independently living older adults. There was no pattern to the missing data, which were dealt with by calculating a participant's mean for the respective scale based on the recorded responses, and replacing the missing values with the calculated mean.

Table 1. Means and standard deviations for age, education level and analysis variables

Variable	Mean	S.D.
Age-all participants	76.5	7.48
Females	76.6	7.67
Males	76.3	7.02
Years of education	10.8	3.14
Subjective health	7.8	1.74
PIC-internal	61.4	6.58
PIC-chance	43.0	13.35
PIC-achievement	57.6	7.92
PIC-morale	43.0	13.01
PIC-powerful others	50.6	13.13
PIC-anxiety	48.0	15.43
Cognistat-calculations	3.8	0.63
Cognistat-reasoning	10.0	2.01
Cognistat-memory	10.1	2.22
Cognistat-constructions	4.5	1.36
Cognistat-language	25.3	2.74
DAFS-time orientation	15.8	1.02
DAFS-communication abilities	12.0	1.50
DAFS-transportation	11.5	1.28
DAFS-financial skills	19.0	2.86
DAFS-shopping skills	20.3	2.00

Notes: PIC- Personality in Intellectual-Aging Contexts; DAFS-Direct Assessment of Functional Skills.

Table 1 reports descriptive statistics and Table 2 reports correlations among the variables. Results of the five hierarchical regressions are reported in Tables 3–7. Tables 3–7 are based on the format recommended by Nicol and Pexman (2010, pp. 120–121). As can be seen in Table 3, neither subjective health nor self-efficacy contributed significantly to the variance in the time orientation scale. The cognitive variables, however, made a significant contribution of 15% of the variance, $F(12, 121\ df) = 3.04$, $p < .001$. An examination of the results with all variables entered indicates that the self-efficacy measures of powerful others and anxiety, and the memory and construction scores from the cognitive measure were significant predictors of performance on time orientation.

Table 2. Correlations of functional domains with predictor variables

Predictor variables	Time orientation	Communication abilities	Transportation	Financial skills	Shopping skills
Subjective health	−.04	−.24**	−.09	−.07	−.17**
PIC-internal	.09	.26**	.23*	.39***	.23**
Chance	.18*	.41***	.38***	.36***	.28***
Achievement	.22**	.4”.)***	.37***	.49***	.31***
Morale	.14*	.30***	.36***	.31***	.24**
Powerful others	.14	.39***	.40***	.52***	.30***
Anxiety	.24**	.41***	.31**	.46***	.31***
Cognistat-Calculations	.20*	.41***	.34***	.42***	.36***
Reasoning	.19*	.37***	.20*	.38***	.42***
Memory	.37**	.54***	.50***	.63***	.52***
Constructions	.32**	.50***	.15	.55***	.34***
Language	.28**	.54***	.44***	.48***	.45***

Note: PIC-Personality in intellectual-aging context.

*$p < .05$.

**$p < .01$.

***$p < .001$.

Table 3. Prediction of time orientation

Predictor	Beta	R^2 change	*p*
Subjective health rating	−.04	.00	.65
PIC-self-efficacy scales:		.08	.11
PIC-internal	−.15		.16
PIC-chance	.02		.88
PIC-achievement	.12		.28
PIC-morale	−.05		.69
PIC-powerful others	−.32		.03
PIC-anxiety	.28		.05
Cognistat-cognitive variables:		.15	.001
Cognistat-calculations	.09		.34
Cognistat-reasoning	−.00		.99
Cognistat-memory	.31		.003
Cognistat-constructions	.21		.04
Cognistat-language	.01		.94

Note: PIC-Personality in intellectual aging context.

Table 4. Prediction of communication abilities

Predictor	Beta	R^2 change	*p*
Subjective health rating	−.23	.06	.006
PIC-self-efficacy scales:		.20	.000
PIC-internal	−.06		.50
PIC-chance	.15		.22
PIC-achievement	.15		.09
PIC-morale	−.14		.16
PIC-powerful others	−.18		.13
PIC-anxiety	.13		.26
Cognistat-cognitive variables:		.25	.000
Cognistat-calculations	.16		.03
Cognistat-reasoning	.05		.49
Cognistat-memory	.28		.001
Cognistat-constructions	.17		.04
Cognistat-language	.19		.03

Table 5. Prediction of transportation

Predictor	Beta	R^2 change	*p*
Subjective health rating	−.09	.01	.37
PIC-self-efficacy scales:		.20	.002
PIC-internal	−.01		.96
PIC-chance	.13		.41
PIC-achievement	.10		.40
PIC-morale	.03		.84
PIC- powerful others	.22		.15
PIC-anxiety	−.16		.26
Cognistat-cognitive variables:		.19	.000
Cognistat-calculations	.08		.46
Cognistat-reasoning	−.06		.56
Cognistat-memory	.37		.001
Cognistat-constructions	−.28		.01
Cognistat-language	.23		.06

Note: PIC-Personality in intellectual-aging context.

Communication ability was better predicted, as shown in Table 4. Self-reported health accounted for 6% of the variance in this domain (F(1, 132 df) = 7.67, $p < .01$), while the self-efficacy variables contributed a further 20% (F(7, 126 df) = 6.30, $p < .001$). The cognitive variables contributed a further 25% of the variance (F(12, 121 df) = 10.27, $p < .001$). With all variables in the equation, four cognitive components were significant predictors of communication abilities: calculations, memory, construction and language. None of the individual self-efficacy scales showed significant predictive ability.

Table 5 presents the results of the analysis of the transportation scale. For this measure, the subjective health rating did not provide a significant contribution, but both the self-efficacy and the cognitive measures were predictive. The addition of the self-efficacy measures added an additional 20% to the predicted variance (F(7, 92 df) = 3.38, $p < .002$). The cognitive skills added a further 19% (F (12, 87 df) = 4.68, $p < .001$). In this case, the cognitive measures of memory and constructions

Table 6. Prediction of financial skills

Predictor	Beta	R^2 change	*p*
Subjective health rating	−.07	.01	.40
PIC-self-efficacy scales:		.33	.000
PIC-internal	.02		.76
PIC-chance	−.10		.36
PIC-achievement	.12		.15
PIC- morale	−.12		.21
PIC-powerful others	.09		.40
PIC-anxiety	.19		.07
Cognistat-cognitive variables:		.24	.000
Cognistat-calculations	.12		.08
Cognistat-reasoning	.01		.87
Cognistat- memory	.40		.000
Cognistat-constructions	.18		.02
Cognistat-language	.10		

Note: Personality in intellectual-aging context.

Table 7. Prediction of shopping skills

Predictor	Beta	R^2 change	*p*
Subjective health rating	−.17	.03	.05
PIC-self-efficacy scales:		.11	.01
PIC-internal	−.01		.90
PIC-chance	.03		.85
PIC-achievement	.06		.55
PIC-morale	−.10		.35
PIC-powerful others	−.10		.43
PIC-anxiety	.09		.49
Cognistat-cognitive variables:		.25	.000
Cognistat-calculations	.15		.07
Cognistat-reasoning	.20		.02
Cognistat-memory	.34		.000
Cognistat-constructions	.00		.99
Cognistat-language	.15		.12

Note: PIC: Personality in intellectual-aging context.

were significantly associated with the transportation scale, but no self-efficacy measure retained its predictability once cognition had been added to the equation.

The self-efficacy and cognitive measures again were significant contributors to the variance in financial skills, as shown in Table 6. The self-rated health measure did not contribute, but self-efficacy accounted for 33% of the variance ($F(7, 126\ df) = 8.91$, $p < .001$). The Cognistat scales accounted for an additional 24% of the remaining variance ($F(12, 121\ df) = 13.52$, $p < .001$). As for transportation, the self-efficacy scales were not significant predictors of financial skills, whereas memory and constructions again showed significant predictive power.

Subjective health did not contribute to the variance in shopping skills, accounting for only 3% of the variance as shown in Table 7. In this domain, the addition of the self-efficacy measures accounted for an additional 11% of the variance (F(7, 126 df) = 2.89, $p < .01$). Adding the cognitive scales contributed a further 25% of the variance in shopping skills (F(12, 121 df) = 6.38, $p < .001$). Cognitive measures were again the only significant predictors, with memory and reasoning being the primary predictors. Once again, specific self-efficacy scales were not predictive.

4. Discussion

The main purpose of this study was to investigate the degree to which cognitive variables predict performance on specific tasks of everyday life of older independently living adults when subjective health and self-efficacy beliefs are held constant. The hypothesized high correlation between self-rated health and everyday task performance was not supported, likely due in part to the general good health of the sample. The association of subjective health with the cognitive domains was mostly negligible, with only two correlations showing significant results (for communication abilities and shopping skills). It is understandable that better self-reported health is related to adequate shopping skills. However, the highest correlation observed was between subjective health and communication abilities. As the items in this DAFS sub-scale only involved use of the telephone and communication by mail, physical exertion that might be expected to be strongly associated with a subjective health measure is not implicated. Instead, cognitive skills, in particular memory and language competence, are strongly involved. This finding differs from Plehn, Marcopulos, and McLain (2004) who found that social functions were predicted by neuropsychological test performance.

The hypothesis of a high correlation between self-reported health and everyday competence was not supported. Although Mulrow, Gerety, Cornell, Lawrence, and Kanten (1994) reported a positive correlation between observed performance on IADLs and a subjective health rating in their study, both these measures correlated poorly with actual medical conditions. Self-reported health is complex, and likely to be influenced by many factors, not the least of which is cognitive competence. Despite the wide range of ratings on the self-rated health measure in the current study, all participants were living independently in the community, coping with the environmental demands on them.

It was notable that all PIC scales correlated with performance on the financial skills domain. The powerful others scale reveals the strongest relationship here. Not surprisingly, the highest overall correlations with everyday task competence were found with cognitive variables. Practical tasks are all strongly associated with each of the cognitive skills measured by Cognistat. In particular, three cognitive variables (calculations, memory and language) showed significant correlations with each of the functional domains.

The results of the hierarchical regressions provide evidence consistent with the simple correlations. Cognitive variables emerged as highly significant predictors of performance on the time orientation function scale, contributing 15% to the variance. Constructions and memory were the primary predictors. Similar results were reported by Loewenstein et al. (1995). Perhaps unexpectedly, performance on time orientation is the only functional domain where the predictive power of self-efficacy measures was evident. Powerful others and anxiety proved to be the only PIC variables that showed any predictive power. It may be that the particular variables predictive of time orientation reflect aspects of control of the time and processing resources allocated to certain tasks. The powerful others PIC scale operated in the opposite direction to other measures, perhaps reflecting an Australian attitude towards being ordered about by others.

In contrast, all three independent variables explained significant amounts of variance in communication abilities. Of the five functional domains under investigation, this is the only area in which the subjective health rating played a major role. The Cognistat memory scale was the strongest predictor with language, calculations and constructions also predictive. Although Loewenstein et al. (1995) evaluated using the telephone and preparing a letter by people with Alzheimer's disease as separate domains, similar cognitive measures to those in the current study emerged as the best predictor of these tasks. The results highlight the importance of social interaction for older adults and the factors that influence it. The composite self-efficacy measure in this study accounted for a significant proportion of variance in communication abilities. However, none of the six scales was individually predictive, with the Achievement scale having the strongest association. The results for the self-efficacy construct may be an effect of the higher reliability of the weighted sum of the individual scales, which may account for this rather anomalous result.

Both the composite self-efficacy measure and the cognitive variables explained significant variance in the Transportation scale of DAFS, along with the memory and constructions scales from Cognistat. Prior to beginning the study, some concern was raised about the use of driving skills rather than public transport by DAFS. However, 75% of all participants ranging in age from 60 to 93 years used their own vehicle as the major mode of transportation.

Results of the analysis evaluating the prediction of financial skills from cognitive variables closely resembled those with the transportation domain. The only individual self-efficacy variable that approaches significance is anxiety. Dealing with the ever-changing banking technology in recent times may be tantamount to taking an intelligence test for many of the current cohorts of older adults. This speculation is reinforced by the high predictive power of the memory scale in managing financial affairs. The multiple changes which have taken place in handling money and accounting practices in recent years may be a cause for confusion for many older people, often associated with memory deficits.

Finally, the composite self-efficacy measure and the cognitive variables both made significant contributions to the variance accounted for in shopping skills. Once again, however, none of the individual self-efficacy scales emerged as a significant predictor. As might be expected, the most salient predictor of shopping skills was again memory. The nature of the main DAFS test item in this domain, which requires participants to select grocery items identified earlier in the testing session, particularly involves recognition in recent memory functions, but may also implicate visuospatial memory processes. However, when presented with a "shopping list" of four items to buy from the mock store, only a few participants in the current sample were unable to locate the correct items. Most participants related that they used a list when shopping and were lost without it. Of particular interest is the other cognitive variable showing predictive power in shopping skills: reasoning. As Bieliauskas (1996) comments "tests of judgment and reasoning … reflect … subtle and complicated aspects of behavior in the elderly" (p. 272). Placed in an unfamiliar situation away from their local store where they normally shopped, abstract thought processes and practical judgements about other grocery items may prove challenging for some older individuals.

As is evident in the discussion on the predictability of functional domains by two cognitive variables, memory and constructions were consistently significant predictors of competence and everyday living situations. This is a novel finding of this study and warrants replication. The importance of good memory for IADLs is perhaps not surprising, but the importance of Constructions is unexpected. This task is primarily visuospatial in Cognistat, with a task resembling the Wechsler Block Design task being used. Whether other construction tasks would show similar results requires more study. All functional skills were assessed by direct observation, so even if external assistance is provided on actual tasks, the present results can be taken at face value.

The present study, of course, has its limitations. Participants were requested to indicate whether they had any ongoing health problems and two-thirds of the sample reported they did so, consistent with the observation those health complaints are prevalent among older adults (Salthouse et al., 1990). However, only one-third of participants received any form of care assistance; having a medical condition does not necessarily influence the functional ability of the older adult. In order to obtain a representative sample of independently living older adults, researchers consequently need to include not only those who self-report good physical health. By virtue of its "testing" implication, any assessment is likely to include a degree of artificiality. However, when the evaluation takes place in the familiar home setting, it is likely to provide a more accurate indication of abilities than studies that are based in separate testing facilities. Several of the participants expressed such ideas. Reassurance was also necessary to many that the measures they were completing would not be used as an evaluation for their admission to long-term care.

The current study identified the Cognistat variable memory as the most powerful predictor in each of the functional domains evaluated. In addition, the relationship between memory and everyday task performance increased in strength with increasing age. While not all shortcomings and practical functioning can be accounted for by poor memory skills, amelioration of some deficits in everyday competence could be achieved by encouraging and providing training in the use of memory aids to older adults living independently in the community. This service may be particularly relevant for isolated individuals in the oldest category.

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The authors declare no competing interest.

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