

# Effect of Active Breaks on reading comprehension in a foreign language

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**ABSTRACT:** The aim of the present study was to find out whether Active-Breaks (AB) improve the three levels of reading comprehension in a foreign language which could be a determining variable in the academic success of the implementation of CLIL programmes. This study involved a total of 50 healthy students [ $n=25$ : Control Condition (CC), and  $n=25$ : Active-Break Condition (ABC)] from one secondary school in the Region of Andalucía (Spain). To investigate the acute effects of an AB on reading comprehension in a foreign language, those in the CC were asked to maintain their ordinary routines, while those in the ABC modified their class by introducing ten minutes of exercise. After that both groups complete a reading comprehension test. Significant differences were found in both question of literal comprehension,  $p=0.03$ ,  $d=0.38$ ,  $p=0.001$ ,  $d=0.11$ , and in both question of inferential comprehension,  $p=.003$ ,  $d=0.35$ ,  $p=0.03$ ,  $d=0.47$ . Crucially, in both question of evaluation,  $p=0.26$ ,  $d=0.20$ ,  $p=0.41$ ,  $d=0.40$ , no significant difference was appreciated. The present study demonstrated that overall student's reading comprehension in a foreign language improves after of AB of 10 min (compared with CC) and concretely, improve the efficiency in question of literal comprehension and inferential comprehension, contributing to enhancement of quality of education.

**Key words:** physical activity, CLIL, active-breaks, physical education.

## Efecto de los descansos activos físicos en la comprensión lectora de la lengua extranjera

**RESUMEN:** El objetivo de la presente investigación fue el de averiguar si los descansos activos mejoran los niveles de comprensión lectora en una lengua extranjera, lo que podría ser una variable determinante en el éxito académico en la implementación de los programas AICLE. En este estudio participaron un total de 50 estudiantes sanos ( $n=25$ : Condición Control, and  $n=25$ : Condición descanso activo) de un instituto de secundaria de Andalucía (España). Para investigar los efectos agudos de un descanso activo en la comprensión de lectura en un idioma extranjero, se les pidió a los estudiantes de Condición control que mantuvieran sus rutinas diarias, mientras que a los de la condición de descanso activo modificaron su clase introduciendo 10 minutos de ejercicio. Después de eso, ambos grupos completaron una prueba de comprensión lectora. Se encontraron diferencias significativas tanto en las preguntas de comprensión literal,  $p=0.03$ ,  $d=0.38$ ,  $p=0.001$ ,  $d=0.11$ , como en las preguntas de comprensión inferencia,  $p=.003$ ,  $d=0.35$ ,  $p=0.03$ ,  $d=0.47$ . Hay que destacar que, en ambas cuestiones de evaluación,  $p=0.26$ ,  $d=0.20$ ,  $p=0.41$ ,  $d=0.40$ , no se apreciaron diferencias significativas.

El presente estudio demostró que la comprensión lectora general en un idioma extranjero mejoró después de un descanso activo de 10 minutos en comparación con el Grupo Control y en concreto, mejoró de manera eficiente en términos de comprensión literal e inferencial, contribuyendo a mejorar la calidad de la educación.

**Palabras clave:** actividad física, AICLE, descansos activos, educación física.

## 1. INTRODUCTION

Reading comprehension predicts academic success (Bastug, M., 2014). Specifically, in foreign language learning environments such as CLIL, an adequate written text understanding level will impact the improvement of foreign language learning (Hamer, J., 2012). Therefore, good reading comprehension is the key to one of the 4Cs referred to by Coyle et al. (2010): content. It is, consequently, a basic premise that if we want a student to learn, we must first ensure that they understand what they are reading. However, over long school days, students' attention span fluctuates, so there are valleys in attention (Rabiner et al., 2016). This can harm the level of comprehension (Solan et al., 2003; Yildiz, M., & Çetinkaya, E. 2017), and thus limit access to content and foreign language learning.

In this sense, different studies have explored the effect CLIL methodology on students' reading comprehension and have proven positive effects on it, Guntur and Gani (2021); in this line, Segura et al. (2021) demonstrated that well-established CLIL programs lead to a better benefit in language skills, in the case of reading higher results were found, results which are in line with Navarro-Pablo & López Gándara (2019). Nevertheless, most studies insist on further research to better understand the effects of CLIL programs in mainstream education.

Some scholars have detected Spanish learners' difficulties with reading comprehension in English as a foreign language. (Sánchez, 2011), This reinforces the idea that fostering reading is a key factor in any learning process and beneficial in the CLIL approach (Garipova and Nicolás, 2016) as it benefits content learning and language processes.

One approach to compensate for this deficit may be to increase physical activity: research that has pointed to the impact of timely physical exercise on cognitive functioning is well known (see review by Erickson et al., 2019). More specifically, other works, have more prominently examined executive functions (Lubans et al., 2022; Ludyga et al., 2022). In addition, meta-analytically reviewed studies suggest timely physical exercise improves executive functioning in children, pre-adolescents, and adolescents (Verburgh et al., 2013).

Research has exploited physical activity's positive effect on improving academic success through active breaks (AB) (Janssen et al., 2014). An AB could be defined as a physical education period between sedentary class sessions (Sallis, Carlson & Mignano, 2012). In fact, using traditional didactic methodology in class leads to boredom, cognitive overload, and monotony throughout the school day, and always occurs in a completely passive situation (Loukidou, Loan-Clarke Larke & Daniels, 2009). In line with other studies that have linked AB to the improvement of executive functions (Muñoz-Parreño et al., 2021), the study showed in a sample of 166 Primary school students that 20 periods of weekly ABs (a period of 5-10 minutes, 3-5 times a day for 17 weeks), where physical activity was combined with curricular content, cooperative work and Emotional intelligence improves in all the executive functions variables and the emotional intelligence mood, stress management and global indices.

In parallel, in recent years, the importance of executive functions has been highlighted as a factor improving reading comprehension in different areas (Follmer, D. J. 2018; Butterfuss, R., & Kendeou, P. 2018). “Executive functions are proposed to facilitate reading comprehension by coordinating and controlling specific reading processes, such as integrating information, retrieving information from the mental lexicon, using strategies and simultaneously engaging in these multiple reading processes.” (Nouwens et al., 2021: 171).

To understand the concept of reading comprehension, the levels of comprehension theory developed from the 1970s to the present day proposes a “*continuum of reading comprehension skills in which a student must first proficiently engage in tasks of literal comprehension before engaging in deeper interactions with the text*” (Basaraba et al., 2013). On this basis, three levels are established for each of which different resources are put into practice: literal, inferential, and evaluation levels.

No studies have been found that analyse the effect of physical activity on different reading levels. However, as mentioned above, ABs improve executive functions and at the same time are an important factor in enhancing reading comprehension. Therefore, the aim of this study is to find out whether ABs improve the three levels of reading comprehension in a foreign language which could be a determining variable in the academic success of the implementation of CLIL programmes.

## 2. MATERIAL AND METHODS

### 2.1. Participants

A total of 50 healthy students ( $n=25$ : Control Condition, and  $n= 25$ : Active-Break Condition) from one secondary school in the Region of Andalucía (Spain), were recruited from a city of the province of Granada with a population ranging between 50.000 and 100.000 citizens registered in the National Institute of Statistic from Spanish Government (<http://www.ine.es/>). Concerning the sample size, the next equation was used:  $Sample\ Size = Z^2 (p) \times (1 - p) / C^2$ , where  $Z$  = confidence level (95%);  $p = 0.05$  and  $C$  = margin of error 0.05.

Inclusion criteria for participants’ group in this study were that reported normal vision, any partial/chronic injury and no history of neuropsychological impairment that could affect the results of the experiment. This study shows participants who were selected through the advisor of the centre and the Physical Education teacher.

They read and signed an informed consent statement before participating in the study. Moreover, their parents obtained information about the main aims of the research, and an informed consent form was requested. In addition, the study was conducted in accordance with the ethical principles of the Helsinki Declaration for Human Research and was approved by a scientific council of the local university (code: 2021/90).

### 2.2. Measures

In order to measure the sample, participants completed three types of measures: i) Active-Break, ii) Rating of Perceived Exertion (RPE). RPE was measured with the Borg scale [(RPE 6-20; (Borg, 1998)] immediately after the ABC Conditions and Control Conditions, and iii) Reading comprehension assessment test.

### *2.2.1. Active Break*

Active Breaks were based in High Intensity Interval Training (HIIT) (functional exercises, coordination abilities, locomotor skills (run, jump, ...)). High-intensity interval training can be organized based on different protocols. We follow the protocol of Tabata (Tabata et al., 1996). Notwithstanding, for the design of the AB of 10-minute, the following aspects will be considered: i) The instructions were visual and auditory and presented on a classroom projector. In this way, we ensured homogeneity among all study participants, while the intervention could be performed in any classroom with a teacher with no knowledge of physical activity. ii) The activity was organized by simply moving the desks and leaving space in front of the screen, and iii) The presentation of the exercises allowed for modifications in intensity and technical difficulty so that students can self-adapt.

### *2.2.2. Rating of Perceived Exertion*

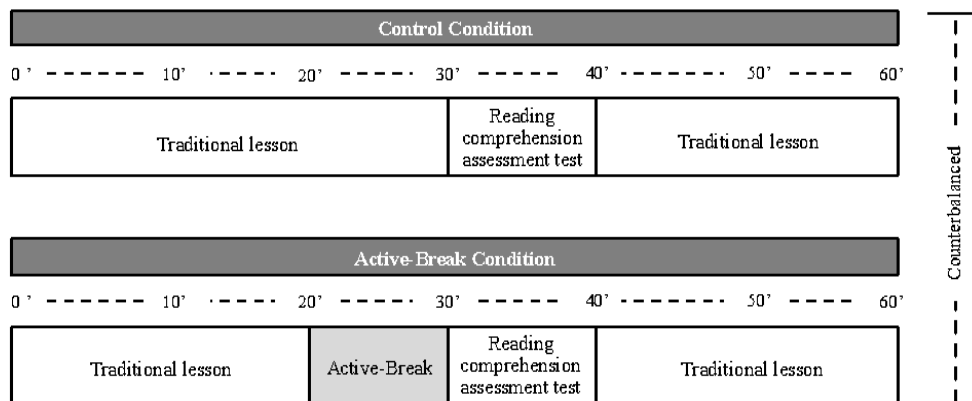
RPE was measured with the Borg scale [(RPE 6-20; (Borg, 1998)] immediately after the ABC Conditions and Control Conditions.

### *2.2.3. Reading comprehension assessment test*

Following the indications of the research team, the classroom teachers designed, for each of the measurement days, a written text on the content to be worked on in that same session. The texts contained between 400 and 600 words, were written in the CLIL language of instruction (English) and were appropriate to the linguistic level of the students. After the review of the texts by the research team, 6 reading comprehension questions (2 literal, 2 inferential and 2 evaluative) with multiple-choice answers were designed for each text.

## **2.3. Procedure**

The study was conducted between March and May 2022. The participants performed two effort condition (CC and ABC). Young students were assigned and paired into two groups, a CC and ABC. At the time of these observations, the students had completed one month of training and familiarization with AB protocols, tasks, and videos during different random classes. The students were selected for convenience. To investigate the acute effects of an AB on reading comprehension in a foreign language, those in the CC were asked to maintain their ordinary routines, while those in the ABC modified their class by introducing ten minutes of exercise. See Figure 1, for more information.



**Figure 1.** Schematic representation of a test day (see text for full description).

After starting the lesson with the usual procedure, the teacher interrupted the class at minute 20 in the AB condition group and at minute 30 in the control group. In the former, an AB video was projected with instructions to be followed by the students. Consequently, the students took the reading comprehension assessment test on the content worked during the first part of the class. On the other hand, the control group only took the reading comprehension test. Both groups continued as usual after the intervention until the end of the lesson.

**2.4. Statistical Analyses**

The statistical analyses were carried out by using the software Statistica (version 13.1; Statsoft. Inc. Tulsa. OK. USA) and the significance level was set at  $p < 0.05$ . For the treatment of the data, we use adequate statistical methods to calculate percentages and central and dispersion parameters (arithmetic mean and standard deviation). Normal distribution and homogeneity (Kolmogorov–Smirnov and Levene’s respectively) were conducted before to analysis was performed. The present research consisted of a one-way within-participants design with the factor of effort condition (CC and ABC) in each question. Paired sample  $t$ -test was used for determining differences (CC and ABC). Cohen  $d$  was the effect size indicator. To interpret the magnitude of the effect size, we adopted the following criteria:  $d = 0.20$ , small;  $d = 0.50$ , medium; and  $d = 0.80$ , large.

### 3. RESULTS

Descriptive statistics were calculated for each variable (see Table 1, for more information).

**Table 2.** Participant's scores in different items at the two conditions (mean  $\pm$  SD).

		<i>STUDENTS (N=50)</i>							
		<i>CONTROL CONDITION</i>				<i>ACTIVE-BREAK CONDITION</i>			
	<i>Items</i>	<i>Score</i>	<i>LIC</i> <i>95%</i>	<i>IC</i>	<i>UIC</i> <i>95%</i>	<i>Score</i>	<i>LIC</i> <i>95%</i>	<i>IC</i>	<i>UIC</i> <i>95%</i>
<i>Inferential</i>	<i>Item 3</i>	0.69 $\pm$ 0.47	0.56	0.13	0.82	0.86 $\pm$ 0.35	0.76	0.10	0.95
	<i>Item 4</i>	0.76 $\pm$ 0.43	0.63	0.12	0.88	0.92 $\pm$ 0.28	0.84	0.09	1.00
<i>Literal</i>	<i>Item 1</i>	0.71 $\pm$ 0.46	0.59	0.13	0.84	0.90 $\pm$ 0.31	0.81	0.08	0.98
	<i>Item 2</i>	0.57 $\pm$ 0.50	0.43	0.14	0.71	0.86 $\pm$ 0.35	0.76	0.10	0.95
<i>Evaluative</i>	<i>Item 5</i>	0.61 $\pm$ 0.49	0.48	0.14	0.75	0.71 $\pm$ 0.46	0.59	0.13	0.83
	<i>Item 6</i>	0.69 $\pm$ 0.47	0.56	0.13	0.82	0.63 $\pm$ 0.49	0.50	0.14	0.77
Overall	Overall (6 points)	4.06 $\pm$ 1.39	3.68	0.39	4.45	4.86 $\pm$ 0.98	4.59	0.27	5.13
	Overall (10 points)	6.77 $\pm$ 2.32	6.13	0.64	7.41	8.10 $\pm$ 1.63	7.64	0.45	8.55

Note: LIC: Lower Interval Confidence; IC: Interval Confidence, and UIC: Upper Interval Confidence

#### *Ratio perceived exertion*

A paired sample t-test with RPE [CC (13.45  $\pm$  2.51) and ABC (8.35  $\pm$  2.28)] revealed higher values after of ABC,  $p=0.001$ ,  $d=0.20$ .

#### *Reading comprehension assessment test*

A different paired sample t-test with each question (inferential 1, inferential 2, Literal 1, Literal 2, Evaluative 1 and Evaluative 2) and factor of effort condition (CC and ABC) revealed a significant differences in inferential 1, inferential 2, Literal 1, Literal 2,  $p=0.03$ ,  $d=0.38$ ,  $p=0.001$ ,  $d=0.11$ ,  $p=.003$ ,  $d=0.35$ ,  $p=0.03$ ,  $d=0.47$ , respectively. However, the dataset did not reveal significant differences in Evaluative,  $p=0.26$ ,  $d=0.20$ , and Evaluative 2,  $p=0.41$ ,  $d=0.40$ . (See figure 2, for more information).

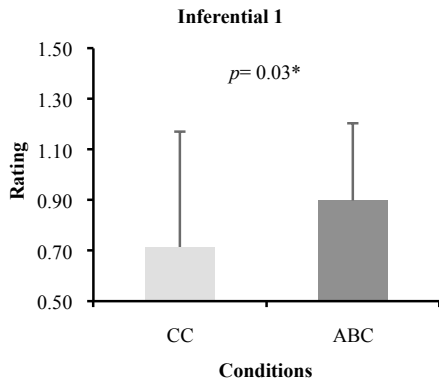


Figure a. Participant's inferential question one at the two conditions (mean ± SD).

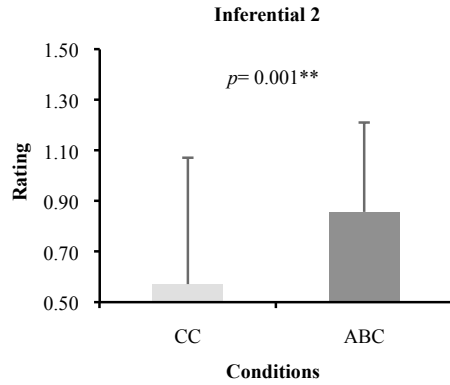


Figure b. Participant's inferential question two at the two conditions (mean ± SD).

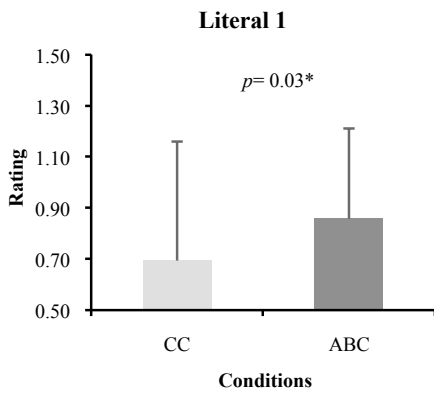


Figure c. Participant's literal question one at the two conditions (mean ± SD).

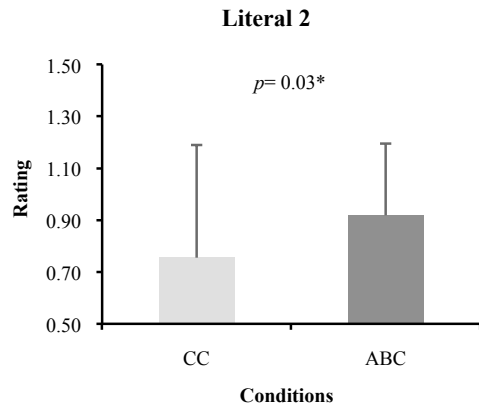


Figure d. Participant's literal question two at the two conditions (mean ± SD).

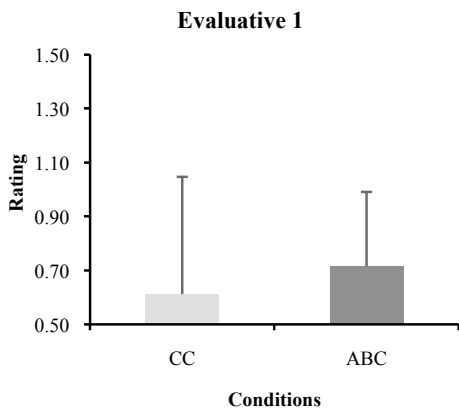


Figure e. Participant's evaluative question one at the two conditions (mean ± SD).

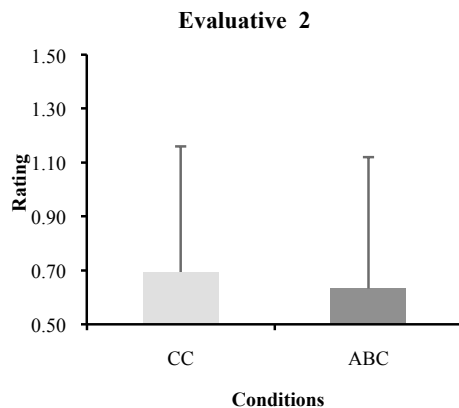
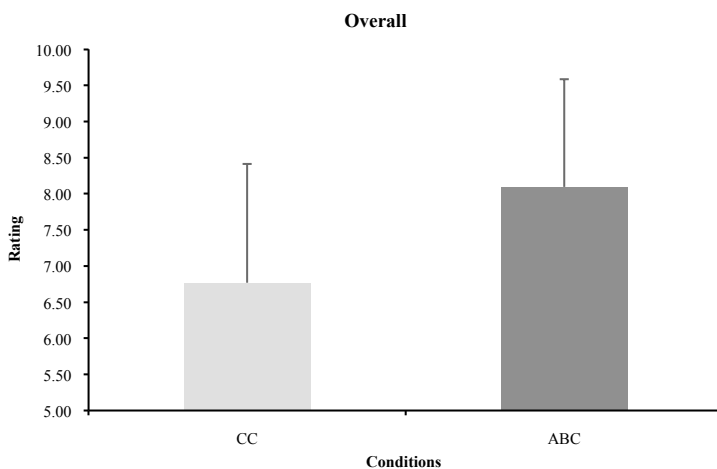


Figure f. Participant's evaluative question two at the two conditions (mean ± SD).

**Figure 2.** Participant's rating in each question (mean ± SD). Figure a. Participant's inferential question one at the two conditions; Figure b. Participant's inferential question two at the two conditions; Figure c. Participant's literal question one at the two conditions; Figure d. Participant's literal question two at the two conditions; Figure e. Participant's evaluative question one at the two conditions; and Figure f. Participant's evaluative question two at the two conditions.

At this point, a new paired sample t-test with overall score (CC and ABC) also revealed a significant difference,  $p=0.001$ ,  $d=0.76$ , respectively. Figure 3.



**Figure 3.** Participant's rating in overall (mean ± SD)



#### 4. DISCUSSION

The purpose of this research was to investigate the acute effects of an AB to improve the three levels of reading comprehension in a foreign language which could be a determining variable in the academic success in the implementation of CLIL programmes. The results show that taking an active break of ten minutes prior to a reading comprehension test has a positive impact on reading scores. Those students who undertook an AB improve their reading comprehension test results as there were significant differences in literal comprehension, inferential comprehension and evaluation comprehension in the group that took an AB. The participants' scores revealed significant differences in inferential 1, inferential 2, literal 1, literal 2,  $p=0.03$ ,  $d=0.38$ ,  $p=0.001$ ,  $d=0.11$ ,  $p=.003$ ,  $d=0.35$ ,  $p=0.03$ ,  $d=0.47$ , with the exception of evaluative 1,  $p=0.26$ ,  $d=0.20$ , and evaluative 2,  $p=0.41$ ,  $d=0.40$  were no significant difference was appreciated, revise figure 2.

On the one hand, in terms of relationship between exercise and cognitive improvement, these results are in line with the findings of other works that examine the effect of acute exercise as AB in cognition and academic performance (Daly-Smith et al., 2018, Watson et al., 2017). In fact, the idea of implementing AB methodologies in classroom routines help to improve performance and produce cognitive benefits and metacognition in youths (Álvarez-Bueno et al., 2017). On the other hand, in terms of reading comprehension in a foreign language and its relationship with physical exercise, although no studies have been found that directly link these two variables, there is literature on the positive impact of physical activity on executive functions (Diamond, 2015; Salas-Gómez et al., 2020) and on the impact of physical activity on reading comprehension (Kieffer & Christodoulou, 2020). The present study would be in this line since results hint that an AB helps to ensure comprehension in students when they read in a foreign language. In other words, this sort of physical activity helps students to understand what they read which is a predictor of academic success (Bastug, M., 2014). All of this is especially relevant in CLIL contexts, such as the one in this study, since an adequate reading understanding level will impact the improvement of foreign language learning (Hamer, J., 2012).

Scientific literature has demonstrated that young students learn better with those active methodologies that have evolved to a new perspective that implies active roles in the lessons (Ribeiro-Silva et al., 2022). In fact, it is well known that students' passive role has a negative impact on attention a retained information (Windschitl, 1999), which in turn could decrease students' learning ability (Janssen et al., 2014). Therefore, regardless of the effect of the physical activity on executive functions, the fact of including an AB as part of the session makes the student take a more active role, which may explain the improvement in reading comprehension observed in this study. Furthermore and coming to the objective of our study, in those schools following a bilingual program this methodology can be easily replicated as there are qualified personnel in Physical Education who can train and explain other teachers how to carry AB intervals in their classes with the positive effects it produces not only in reading comprehension, as it has been proved, but also for physical, social and psychological development (Mavilidi et al., 2020) not to mention the physiological benefits that increasing physical activity brings to better the health style of the students. The present study provides a crucial and innovative perspective to implement AB for improving the quality of life and health of populations. Future research may compare different micro-doses and intensities while extending the approach to other populations.

## 5. CONCLUSION

Implementing an active break during a bilingual English class improved students' reading comprehension (literally and inferentially) compared to a control group that did not engage in physical activity. Although not observed in this study, one possible explanation may be that the improvement in executive functions due to physical activity positively impacts reading comprehension. As for the implications of this study, regardless of the benefits of physical activity per se, it is shown that a relatively simple method to improve comprehension of written texts is to perform a 10-minute AB session. Ultimately, it can be noted that reading comprehension, i.e., that students understand what they read, is possibly one of the aspects determining the quality of CLIL programs.

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### Competing interests

The authors declare that they have no conflicts of interest relevant to the content of this manuscript.

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