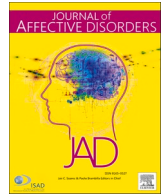




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# The relationship between post-traumatic stress and positive mental health symptoms among health workers during COVID-19 pandemic in Lombardy, Italy

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## ABSTRACT

**Background:** The COVID-19 pandemic is exposing health workers (HW) worldwide to extreme burden and risk of developing post-traumatic stress disorder (PTSD). This problem emerged in Lombardy, the Italian region where the pandemic exacted the heaviest toll. Study aims were to assess mental health of HW in Lombardy after the peak of COVID-19 related hospitalizations, through the joint evaluation of PTSD and positive mental health; and to explore the potential role of positive mental health in PTSD development.

**Methods:** HW completed an online survey including demographic and work-related information; PTSD Checklist for DSM-5; Mental Health Continuum Short-Form. Analyses comprised calculation of percentages of participants meeting a provisional PTSD and mental health diagnosis (flourishing, moderate, languishing); a binary logistic regression with demographics, work-related features, and positive mental health as predictors, and provisional PTSD diagnosis as outcome.

**Results:** Out of 653 participants, 39.8% received a provisional PTSD diagnosis; 33.4% reported flourishing, 57.7% moderate, and 8.9% languishing mental health. Regression analysis highlighted that women vs. men, nurses vs. technical/rehabilitation HW, frontline vs. second-line workers and languishing vs. moderately mentally healthy HW were more likely to receive a provisional PTSD diagnosis, whereas flourishing participants were more likely not to receive it. No role emerged for job seniority.

**Limitations:** Self-reported PTSD scores, stress symptoms related to COVID-19 considered as a global stressor, cross-sectional study design.

**Conclusions:** Findings suggest the potential usefulness of supporting vulnerable HW categories during massive disease outbreaks through emergency-focused professional training and psychological intervention addressing both positive mental health promotion and PTSD prevention.

## 1. Introduction

The coronavirus disease 2019 (COVID-19) outbreak officially hit Italy as first country in Europe on January 30 (Ministero della Salute, 2020). Despite containment measures leading to complete lockdown between March 8 and May 3, 210,717 total cases were detected nationally during this period; out of 28,884 deaths, 49.3% were reported in Lombardy alone, making it the worst-hit region in Italy. The epidemic put significant strain on the regional healthcare system (Fusar-Poli et al., 2020; Grasselli et al., 2020; Spina et al., 2020). The organization of hospital wards was quickly revised, COVID-19 wards were created and 741 Intensive Care Unit (ICU) beds were added (1700 in total), to adjust to a daily average of 9053.42 symptomatic patients (range: 2217–12077) and 971.67 ICU patients (range: 399–1381). Health workers (HW) experienced extreme working conditions, including work overload,

exposure to biological risk, change in professional tasks, patients in critical or complex conditions, lack of healing therapy. At the private level, they were deprived of rest and leisure activities, as well as family life to prevent contagion. Up to April 28, 20,831 HW had become infected and 215 had died nationally, the majority being doctors and nurses from Lombardy (Ministero della Salute, 2020).

Besides physical safety, HW's mental health was a major concern for authorities (ISS Working Group on Mental Health and Emergency COVID-19, 2020). Review data about HW during previous epidemics (SARS, MERS, Ebola, 1N1 influenza) and COVID-19 pandemic (primarily studies conducted in China) showed a high pooled prevalence of anxiety (45%), depression (38%), acute stress disorder (31%), burnout (29%), and post-traumatic stress disorder (PTSD, 19%; Ricci-Cabello et al., 2020). Main factors predicting worsened mental health were female gender, younger age, less job seniority, frontline work, and nursing

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profession (García-Fernández et al., 2020; Ricci-Cabello et al., 2020; Xiao et al., 2020; Yang et al., 2020; Zhang et al., 2020).

To correctly interpret pooled data, the specific period in which data were collected should however be considered: Prevalence scores change during the epidemic course (Allan et al., 2020), with a post-traumatic stress symptoms (PTSS) prevalence of 23.3% during and up to 1.5 months post-epidemic, and 11.9% one year or more post-epidemic. Moreover, little is known about cultural and regional differences as most recent studies on epidemics were conducted in Asia. Particularly, psychological outcomes that may characterize the European setting are still underexplored. To the best of our knowledge, only one study (Rossi et al., 2020) thus far investigated Italian HW's mental health during COVID-19 epidemic. Sampling period was March 27-31, immediately preceding the contagion peak occurring in the first week of April, when healthcare services were close to saturation. Findings from a national sample including the worst-hit North and the mildly-hit Center and South confirmed high prevalence of PTSS (49.4%), depression (24.7%), anxiety (19.8%), and stress (21.9%), with women, younger individuals, and frontline workers reporting higher PTSS.

Adding to this initial evidence, aim of the present study was to assess mental health of HW in Lombardy (the region bearing the heaviest brunt of the epidemic) during the second half of April, the last period of the lockdown phase characterized by gradual decrease in hospitalized patients. To obtain a comprehensive picture of participants' mental conditions, assessment of PTSS was combined with evaluation of positive mental health following the Dual Continua Model theory (Keyes, 2002, 2007) and related operationalizations, that were adopted in this study to assess mental health. Extensive literature attests that, though correlated, mental health and mental illness are not opposite ends of the same continuum, rather lying on two different continua (Keyes, 2002, 2005). Far from equating with absence of psychopathology, positive mental health is defined through a set of positive indicators, comprising an emotional or hedonic component, tapping into individuals' affective dimension, and two components tapping into the dynamic process of optimal functioning and development at the personal and collective levels: psychological and social well-being. In order to assess mental health in its positive components, a specific scale was developed, the Mental Health Continuum Short-Form (MHC-SF; Keyes, 2005). Adopting a diagnostic approach consistent with the DSM-based approach in relation to mental illness, mental health can be considered as a syndrome of symptoms, the simultaneous presence of which allows for a categorical mental health diagnosis (Keyes, 2002): Individuals are diagnosed as flourishing when they report high levels on at least one symptom of hedonia and on more than half of the symptoms of optimal functioning as measured through MHC-SF; to the contrary, they are diagnosed as languishing when they report low levels on at least one hedonic symptom and on more than half of the optimal functioning symptoms. A moderate mental health diagnosis is formulated in the intermediate condition of neither flourishing nor languishing.

Importantly for the purposes of the present study, scientific evidence suggested that high levels of positive mental health (i.e. flourishing) among the general population may protect from mental illness and that low levels (i.e. languishing) may instead represent a risk factor (Keyes et al., 2010; Iasiello et al., 2019). In addition, positive mental health was shown to coexist with mental illness (for example, anxiety disorders) and, controlling for socio-demographic and physical health variables, it was shown to influence recovery from mental illness over a 3-year period (Schotanus-Dijkstra et al., 2019). In light of these findings, the aim of our study was to investigate the potential contribution of positive mental health to PTSD development among HW, along with socio-demographic and work-related factors.

## 2. Materials and Methods

### 2.1. Study design

This cross-sectional web-based study took place between April 15 and May 3, corresponding to the final period of the national lockdown phase. The protocol was approved by the Ethical Committee of the University of Milano (N. 31/20, 15 April 2020).

### 2.2. Participants and procedures

Inclusion criterion was being a HW actively working in Lombardy during the epidemic. A letter presenting the research and containing the link to the online survey was sent to physicians' and nurses' associations in Lombardy; researchers' direct contacts led to the enrolment of additional HW, also including professionals involved in rehabilitation and diagnostic activities. Interested HW could access the survey only after signing the informed consent form. No missing information was permitted as participants had to complete all survey fields to move forward. Anonymity was preserved through assignment of an alphanumeric code. Median survey completion time was 11.17 minutes (IQR=6.11).

### 2.3. Materials

Socio-demographic data collection included age, gender, marital status, and education. Work-related data were gathered on profession, job seniority, workplace province, and workplace. PTSS was assessed with the PTSD Checklist for DSM-5 (PCL5; Sacchi et al., 2018; Weathers et al., 2013), a 20-item self-report measure assessing symptoms severity over the last month on scales ranging from 0 'not at all' to 4 'extremely'. Confirmatory Factor Analysis (CFI) was applied to PCL-5 items. Following Blevins and colleagues (2015), items were clustered according to the 6-factor Anhedonia model (Liu et al., 2014) comprising intrusion, avoidance, negative alterations in mood and cognitions, anhedonia, dysphoric arousal, and anxious arousal factors. A global second-order PCL-5 factor was also modeled. Fit indices were found to be adequate (Hu and Bentler, 1995; 1999):  $S-B\chi^2(164)=947.34$ ,  $p<.001$ ; RMSEA=.086; CFI=.97; SRMR=.065. Cronbach alpha for the second-order factor was .94. To screen participants for PTSD, a total summed score was calculated; scores  $\geq$  the cut-off point of 33 were indicative of a provisional PTSD diagnosis (Weathers et al., 2013).

Positive mental health over the last month was measured with the Mental Health Continuum Short-Form (MHC-SF; Keyes, 2005; Petrillo et al., 2015), comprising 14 items on scales from 0 'never' to 5 'everyday': 3 items measured the frequency of emotional well-being (EWB), 6 psychological well-being (PWB), and 5 social well-being (SWB). CFI was applied to MHC-SF items, modeling three first-order factors (EWB, PWB, and SWB) on a second-order positive mental health factor (Petrillo et al., 2015). Fit indices were found to be adequate (Hu and Bentler, 1995; 1999):  $S-B\chi^2(74)=475.06$ ,  $p<.001$ ; RMSEA=.091; CFI=.96; SRMR=.065. For descriptive purposes, a summed score was calculated for each component and for total well-being (TWB). Alpha values were: EWB  $\alpha=.80$ , SWB  $\alpha=.78$ , PWB  $\alpha=.88$ , TWB  $\alpha=.91$ . A categorical mental health diagnosis was computed based on Keyes (2005): *flourishing* was diagnosed when participants experienced at least 1 of the 3 EWB symptoms and 6 of the 11 PWB/SWB symptoms 'every day' or 'almost every day' in the past month. *Languishing* was diagnosed when participants experienced at least 1 of the 3 EWB symptoms and 6 of the 11 PWB/SWB symptoms 'never' or 'once or twice' during the past month. Participants who were neither flourishing nor languishing were diagnosed with *moderate mental health*.

### 2.4. Statistical analyses

Prior to analyses with SPSS 26, the dataset was cleaned: records were

removed if they did not meet inclusion criteria, were completed  $\geq 24$ h after survey start, or contained inconsistent answers. Descriptive statistics (means and standard deviations) as well as Pearson's correlations were calculated for PTSS and positive mental health dimensions. Percentages of participants meeting a provisional PTSD and mental health diagnosis (flourishing, moderate, languishing mental health) were also computed. Binary logistic regression analysis was conducted to investigate the contribution of positive mental health, gender, marital status, profession, job seniority, and workplace (independent variables) to provisional PTSD diagnosis (outcome variable). Significance level was set at  $p < .05$ .

### 3. Results

A total of 686 HW completed the survey. As enrolment mostly relied on the assistance of professional associations, the response rate could not be calculated. After data cleaning (Fig. 1), 33 (4.8%) participants were excluded; the final dataset thus comprised 653 records. Based on the Italian classification system of health professions, participants were physicians, nurses and midwives, professionals in technical (e.g., technicians in radiology, biomedical lab) and rehabilitation areas (e.g., physiotherapists, language therapists), and healthcare assistants. They were divided into three categories based on their workplace: The category "Inpatient frontline" included HW working with hospitalized patients in acute care, emergency, infectious diseases wards and ICU; "Inpatient second line" comprised HW working with hospitalized patients in medical and surgical domains (e.g., hematology,

gastroenterology, gynecology); "Outpatient & services second line" encompassed HW working in outpatient departments or labs, and family doctors.

Socio-demographic and work-related characteristics are displayed in Table 1, along with descriptive statistics and prevalence estimates of study measures. PTSS total score was negatively correlated with each positive mental health dimension at  $p < .001$ ; EWB,  $r = -.52$ ; SWB,  $r = -.30$ ; PWB,  $r = -.39$ .

Altogether, 39.8% of the participants met the criterion for a provisional PTSD diagnosis. According to the categorical diagnosis of mental health, 33.4% were flourishing, 57.7% reported moderate mental health, and 8.9% were languishing.

The binary logistic regression model was significant ( $\chi^2(12) = 121.99$ ,  $p < .001$ ), and distinguished between participants with and without provisional PTSD diagnosis. The model explained between 17% (Cox & Snell  $R^2$ ) and 23% (Nagelkerke  $R^2$ ) of the variance, and correctly classified 68.1% of the cases.

As shown in Table 2, among socio-demographic factors, women were 1.62 times more likely than men to receive a provisional PTSD diagnosis. Within the work domain, profession and workplace emerged as significant PTSD risk factors. Nurses and midwives were 2.50 times more likely to receive a provisional PTSD diagnosis than technical and rehabilitation professionals (TRP). The same trend, even though marginally non-significant ( $p = .05$ ), was observed for healthcare assistants, who were 2.48 times more likely than TRP to receive the diagnosis. Furthermore, odds of inpatient frontline workers were 2.01 times higher than those of outpatient & services second-line workers. Concerning positive mental

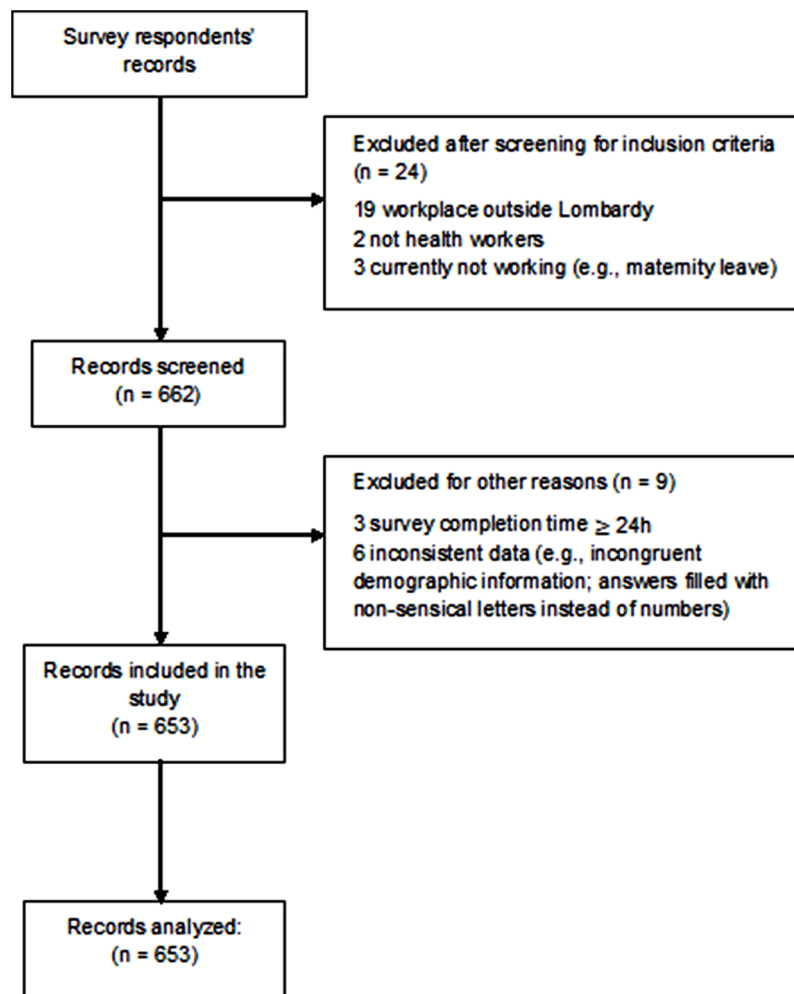


Fig. 1. Participants' flow diagram.

**Table 1**  
Participant characteristics and mental health scores (N = 653).

Socio-demographic variables	n	%	M (SD)	Range
Age			42.91 (12.10)	23-74
Gender				
Female	482	73.8		
Male	171	26.2		
Education				
High school	22	3.4		
Professional school	102	15.6		
Bachelor degree	263	40.3		
Master's degree	129	19.8		
Specialty	123	18.8		
Doctorate	14	2.1		
Marital status				
Single	184	28.2		
Married	282	43.2		
Cohabiting	133	20.4		
Separated/divorced	51	7.8		
Widowed	3	0.5		
Work-related variables				
Profession				
Medical doctor	189	28.9		
Nurse and midwife	318	48.7		
Technical and rehabilitation professional	114	17.5		
Healthcare assistant	32	4.9		
Job seniority (in years)			17.87 (12.23)	0-45
0-10	249	38.1		
11-20	129	19.8		
21-30	147	22.5		
>30	128	19.6		
Workplace				
Inpatient frontline	261	40.0		
Inpatient second line	258	39.5		
Outpatient & services second line	134	20.5		
Study measures				
Post-Traumatic Stress Symptoms (PCL-5)				
Total score			29.72 (16.66)	0-76
≥ 33 cut-off score	260	39.8		
Positive Mental Health (MHC-SF)				
Total score			40.01 (13.58)	0-69
Emotional well-being			9.28 (3.55)	0-15
Social well-being			11.18 (5.51)	0-25
Psychological well-being			19.54 (6.65)	0-30
Flourishing	218	33.4		
Moderate mental health	377	57.7		
Languishing	58	8.9		

health, compared to HW with moderate mental health, flourishing participants were 3.85 (1/0.26) times more likely not to receive a provisional PTSD diagnosis, while languishing participants were 3.00 times more likely to receive it.

#### 4. Discussion

To the best of our knowledge, this was the first study to investigate mental health among HW in Lombardy, the worst-hit region in Italy, in the final period of the COVID-related lockdown, as the epidemic curve was slowly flattening and pressure on the healthcare system was easing up. This is a delicate period for HW, in which stress reactions prompted by the emergency could evolve into persistent morbid responses (ISS, 2020; Weathers et al., 2013).

In line with previous studies (Allan et al., 2020; Ricci-Cabello et al., 2020; Rossi et al., 2020; Zhang et al., 2020) and the global concern about the mental health implications of COVID-19 pandemic (WHO, 2020), a substantial share of the HW participating in this survey were provisionally diagnosed with PTSD. Normally, HW are more exposed to PTSD than the general population: Based on DSM-5 diagnostic criteria,

**Table 2**  
Binary logistic regression analysis with provisional Post-Traumatic Stress Disorder (PTSD) diagnosis as outcome variable.

	B (SE)	Wald	df	p	OR	OR 95% CI Lower	Upper
Constant	-1.62 (0.38)						
Gender [Male]	0.48 (0.21)	5.26	1	.02	1.62	1.07	2.44
Marital status [Alone]	0.12 (0.19)	0.37	1	.54	1.12	0.77	1.63
Job seniority [0-10 years]		1.04	3	.79			
11-20	-0.01 (0.25)	0.003	1	.96	0.99	0.60	1.61
21-30	0.16 (0.24)	0.42	1	.52	1.17	0.73	1.87
>30	0.21 (0.26)	0.69	1	.41	1.24	0.75	2.06
Profession [TRP]		21.71	3	<.001			
Medical doctor	0.04 (0.29)	0.02	1	.89	1.04	0.59	1.85
Nurse and midwife	0.92 (0.27)	11.28	1	.001	2.50	1.46	4.28
Healthcare assistant	0.91 (0.47)	3.78	1	.05	2.48	0.99	6.19
Workplace [OSSL]		6.58	2	.04			
Inpatient frontline	0.70 (0.27)	6.57	1	.01	2.01	1.18	3.43
Inpatient second line	0.47 (0.26)	3.23	1	.07	1.60	0.96	2.69
Positive mental health [MMH]		62.71	2	<.001			
Flourishing	-1.36 (0.21)	42.20	1	<.001	.26	0.17	0.39
Languishing	1.10 (0.33)	10.92	1	.001	3.00	1.56	5.77

Note. Reference category is reported within square brackets; Marital status was dichotomized into 0=alone (single/separated/divorced/widowed) and 1=with partner (married/cohabiting); TRP: Technical and rehabilitation professional; OSSL: Outpatient & services second line; MMH: moderate mental health; OR: Odds Ratio; CI: Confidence Interval.

average PTSD prevalence among physicians and nurses respectively amounts to 14.8% (Sendler et al., 2016) and 18% (Mealer et al., 2009) as compared to the general population, whose PTSD lifetime prevalence is 7-8% (Kessler et al., 2005). Figures from this study attested to the high risk for HW to develop PTSD in relation to COVID-19 pandemic. Findings further confirmed that women, nurses and midwives, and frontline workers were exposed to higher risk of developing PTSD (García-Fernández et al., 2020; Ricci-Cabello et al., 2020; Xiao et al., 2020; Zhang et al., 2020). Higher risk, though with a marginally non-significant estimate, was also detected among healthcare assistants, a working category often neglected in research studies. Notably, in contrast with some recent studies (García-Fernández et al., 2020; Xiao et al., 2020), job seniority did not emerge as a significant risk factor for PTSD, highlighting that HW were professionally unprepared to face the challenges posed by the epidemic irrespective of their past work experience.

Besides exploring socio-demographic and work-related factors associated with PTSD development among HW, the novel contribution of the present study was the investigation of HW's positive mental health. Previous studies substantiated the measurement of positive mental health in populations under adverse conditions, such earthquake survivors (Rafiey et al., 2017), and attested that positive mental health can be a significant predictor of mood and anxiety disorders (Iasiello et al., 2019; Keyes, 2002, 2005; Schotanus-Dijkstra et al., 2019). In the present study, the majority of participants reported moderate mental health, about one third was flourishing, and less than 10% was languishing. To the best of our knowledge, no data are available on positive mental health prevalence among HW prior to COVID-19 pandemic,



while in a recent study involving 1438 Italian healthy adults (mean age 47.12 years), 52.9% of participants reported moderate mental health, 28.5% were flourishing, and 10.5% were languishing (Petrillo et al., 2015). These figures are similar to those obtained in the present study, tentatively suggesting that positive mental health prevalence may be stable in adverse times.

Taking into account the predictive role of positive mental health on provisional PTSD diagnosis, findings showed that compared to moderate mental health, languishing emerged as a potential risk factor for PTSD, whereas flourishing proved to be a potential protective factor. This finding is consistent with recent longitudinal data showing that individuals who maintained or gained the highest levels of positive mental health over time were respectively 27.6 and 7.4 times more likely to recover from mental illness than individuals maintaining the lowest level of positive mental health (Iasiello et al., 2019). This latter finding bears promising practical implications, as it may open up new treatment avenues besides traditional approaches such as prolonged exposure therapy, cognitive behavioral therapy, and eye movement desensitization and reprocessing (Radstaak et al., 2020). Considering that individuals with languishing mental health can be more vulnerable to adversities, intervention focused on well-being promotion such as well-being therapy (WBT; Fava, 2016; Radstaak et al., 2020) may facilitate restoration of positive functioning as well as reduction of PTSS, in line with increasing evidence that “the route to enduring recovery lies not exclusively in alleviating the negative, but also in engendering the positive” (Fava, 2012, p.102).

## 5. Limitations

Besides novel contributions, three limitations characterize the present study. First, a self-report measure was used to formulate a provisional PTSD diagnosis; in the future, a DSM-5 based diagnosis issued by a psychiatrist is warranted. Second, DSM-5 diagnostic criterion A (identification of the stressor) was not specifically explored; considering that participants reported intense PTSS, pinpoint identification of single stressors may help personalize intervention. Finally, the cross-sectional study design precluded conclusions about causality. Follow-up studies should be performed to monitor PTSS and positive mental health over the course of the COVID-19 pandemic, as well as to clarify the potential role of flourishing and languishing in respectively protecting from or exposing individuals to PTSD progression.

## 6. Conclusions

Despite limitations, findings from this study can offer hints on present and future challenges connected to the COVID-19 pandemic that could be useful for mental health professionals and policy makers. Actions aimed at providing adequate training, protecting more vulnerable workers' categories and promoting positive mental health may mitigate the negative psychological impact of the pandemic, and help plan for a post-pandemic phase (Yang et al., 2020; Zhou et al., 2020). In addition, present findings from Lombardy may provide suggestions for implementing preventive measures and early interventions in countries where the contagion is still contained.

## Author statement

### Contributors

MB, LN, ADF and RA provided equal contributions to the conception and design of the work; the acquisition, analysis, and interpretation of data; drafting the work and revising it critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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## Declaration of Competing Interest

None.

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