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ORIGINAL ARTICLE

The chain mediating role of social support and stigma in the relationship between mindfulness and psychological distress among Chinese lung cancer patients

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Abstract

Purpose Psychological distress greatly impaired the psychological and physical well-being of lung cancer patients. Identification of protective and risk factors is a prerequisite of developing effective psychological treatment protocol. The study aims to determine the relationship of mindfulness and psychological distress and further clarify the mechanism of mindfulness against psychological distress through perceived stigma and social support among Chinese lung cancer patients.

Method A cross-sectional survey study involving 441 valid Chinese lung cancer patients was conducted from September 2018 to August 2019. After all validated questionnaires that measured psychological distress, level of mindfulness, social support, and perceived stigma were returned by patients, we firstly performed correlation analysis to assess the associations between mindfulness, social support, perceived stigma, and psychological distress. Then structural equation modelling analysis was conducted to further clarify the mediating effects of perceived stigma and social support on the relationship between mindfulness and psychological distress.

Results According to our hypothesis and further modification, our revised model adequately fits to data. Mindfulness ($\beta = -0.107$, $p = 0.008$) and social support ($\beta = -0.513$, $p < 0.001$) had a direct effect on psychological distress. Meanwhile, mindfulness had a direct effect on perceived stigma ($\beta = -0.185$, $p < 0.001$), and perceived stigma had a direct effect on social support ($\beta = -0.373$, $p < 0.001$). Furthermore, mindfulness had also the indirect effect on psychological distress through the chain mediating role of stigma and social support among lung cancer patients.

Conclusions Mindfulness has direct negative effect on psychological distress and has also indirectly negative psychological distress through impacting social support and perceived stigma.

Keywords Lung cancer · Psychological distress · Mindfulness · Social support · Perceived stigma · Structural equation model

Introduction

According to the latest data, lung cancer was at the second rank for the incidence and the first rank for mortality, accounting for 11.4% of new cancer cases and 18.0% cancer-related deaths in 2020 worldwide, respectively [1]. Lung cancer patients have been reported to suffer from clinically significant psychological distress because of several factors such as a definitive diagnosis of lung cancer [2] and poor prognosis [3]. Meanwhile, compared to other types of cancers, lung cancer patients were even found to have the highest detection rate of psychological distress [4], with an empirical incidence of 17.0% to 73.0% [5–7].

Substantial evidence investigating the adverse consequences of psychological distress had been accumulated to

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date. For example, studies demonstrated that psychological distress deeply decreased patients' compliance with cancer treatment and increased the risk of somatic symptoms [8]. Moreover, evidence published recently even suggested that psychological distress may accelerate the growth of tumor cells and decrease therapeutic effects [9], which may significantly reduce the quality of life [7] and even increase mortality [10]. Considering these negative results, it is critically important to identify potential protective and risk factors and further clarify potential relationships of all factors in order to develop precise psychological treatment protocol for psychological distress among lung cancer patients.

Background

Mindfulness refers to meditation practice cultivating present moment nonjudgmental awareness [11]. As a positive psychological trait, the role of mindfulness in psychological and mental well-being has been extensively investigated, indicating a negative association between mindfulness and psychological distress [12], even among general population [13]. Meanwhile, mindfulness-based interventions such as mindfulness-based stress reduction (MBSR) have also been demonstrated to improve psychological outcomes [14]. It is noted that the specific role of mindfulness in affecting psychological outcomes among different populations may be changed [15]. What is exhilarating is that, however, a handful of studies revealed that mindfulness was negatively related to psychological distress among lung cancer patients [16], and a scatter of clinical trials also suggested a promising role of MBSR intervention in lung cancer patients for the alleviation of psychological distress [17, 18]. To date, there are restricted data on the relationship between mindfulness and psychological distress in lung cancer patients. More importantly, the mechanism of mindfulness in buffering psychological distress has not yet been adequately clarified in lung cancer patients.

As a positive external source, the protective effects of social support on psychological distress have been extensively demonstrated in previous studies [19, 20]. Meanwhile, a negative association between social support and psychological distress among lung cancer patients has also been shown in our previous study [21]. Moreover, some studies also indicated that social support was positively associated with mindfulness [22, 23], and mindfulness-based interventions significantly improved social support [24]. However, the associations between mindfulness, social support, and psychological distress among lung cancer patients were not investigated, and therefore it's unclear whether mindfulness can indirectly alleviate psychological distress through strengthening social support among lung cancer patients.

Stigma refers to a negative emotional experience involving isolation, rejection, degradation, and criticism owing to patients suffer from some undesirable diseases such as lung cancer [25], which has been found to negatively impact many outcomes in cancer patients. For example, evidence demonstrated stigma was positively related to poorer quality of life (QoL) and psychological distress in lung cancer patients [26]. Meanwhile, stigma has also been found to significantly decrease the level of social support of advanced lung cancer patients [27] and mindfulness of youth with inflammatory bowel disease [28]. It is noteworthy that the relationship of mindfulness, social support, and stigma in lung cancer patients had not been empirically tested.

As discussed above, in this study, we firstly determined the relationship of mindfulness, social support, or perceived stigma and psychological distress, and then we further clarified whether perceived stigma and social support played mediators in the relationship between mindfulness and psychological distress among lung cancer patients.

Methods

Study design

The present study was a cross-sectional, correlational, descriptive survey design.

Participants

We designed inclusion criteria according to the previous studies [5]: (a) adult patients with definitive diagnosis of lung cancer and (b) having ability to clearly and accurately read and write. We excluded those patients who were identified to have the psychiatric disorder which was confirmed based on the medical information extracted from electronic medical record system or other types of cancer or participated in studies investigating the effects of psychological treatment or other survey studies with similar study aims. Sample size was calculated using the formula for cross-sectional survey design: $N = \left[\mu^2_{\alpha/2}\pi(1-\pi)\right]/\delta^2$. In this formula, π and δ represent the incidence and tolerance error, respectively. Theoretical sample size of 384 was determined eventually after α of 0.05, π of 0.5, and δ of 0.5 were defined, respectively. Eligible lung cancer patients were recruited from 7 hospitals in Chongqing, China from September 2018 to August 2019. All questionnaires were independently and anonymously completed by patients. At the end of study, total 450 eligible lung cancer patients were surveyed, and 441 validated questionnaires were collected eventually, with a validate response rate of 98.0%.

Procedure

This study is strictly in accordance with the provisions of the Declaration of Helsinki. Moreover, the protocol of the current study has been approved by the Institutional Review Board with an approval number of CUCH_P20180225. All eligible patients were enrolled based on convenience sampling, and all participants fully understood aims and procedure of this study and patients' rights before participating in the survey. The principal investigator orally informed all eligible patients about the aims and procedures of this study based on written research protocol before conducting the formal survey. More importantly, the formal survey was conducted after all patients gave informed consent orally. STROBE guideline (Strengthening the Reporting of Observational Studies in Epidemiology) was utilized to guide us to report all data [29].

Study variables

Demographic information

In this study, the following sociodemographic and clinical variables were collected with self-designed standard demographic information collection sheet including gender, age, educational level, occupational status, marital status, family history of lung cancer, smoking history, and alcohol consumption, time from diagnosis, surgical history, metastasis, comorbidity, pain degree, and TNM stage.

Psychological distress

In the current survey study, distress thermometer (DT) was utilized to measure psychological distress at 11-point thermometer scale from 0 to 10, and 0 and 10 indicates no distress and extreme distress, respectively [30]. DT was established to have satisfactory reliability and validity, and its psychometric characteristics have also been tested across diverse settings [31]. Studies indicates that patients reporting a cut-off of 4 would be considered to be clinically significant level of psychological distress [31, 32]. The cut-off value of 4 was also extensively accepted for Chinese cancer populations, with an area under the receiver operating characteristic curve of 0.885 in an empirical study [31].

Mindfulness

We used the Five Facet Mindfulness Questionnaire (FFMQ), which was designed by Baer and colleagues in 2006 [33], to measure the level of mindfulness. In the original version, total 39 items were effectively pooled to assess mindfulness from five facets including observing, describing, acting with awareness, nonjudging, and nonreacting at 5-point Likert scale, with a total score of ranging 39 to 195 [33]. In this study, we used Chinese version of original FFMQ, which was translated and then validated by Deng and colleagues in 2011 indicating an acceptable psychometric properties [34], to measure the level of mindfulness among lung cancer patients.

Social support

In the present study, we used the 12-item Multidimensional Scale of Perceived Social Support (MSPSS) to measure social support from three aspects including family, friends, and significant others [35]. Eligible lung cancer patients were asked to rate each item at a 7-point Likert scale (1 = very strongly disagree to 7 = very strongly agree), with an overall scores from 12 to 84. Previous study has tested the psychological properties of MSPSS and reported that the coefficient alpha values of subscales were ranging from 0.81 to 0.98 [35]. The reliability of the Chinese version of MSPSS was established to be 0.90 [36].

Perceived stigma

Lung cancer stigma was measured with the Cataldo lung cancer stigma scale (CLCSS) [25]. In the original version, a total of 31 items were pooled to measure four aspects including stigma and shame, social isolation, discrimination, and smoking. All items should be rated at 4-point Likert scale, with a total score from 31 to 124 and a higher score indicating a higher level of perceived stigma. In 2017, the Chinese version of CLCSS was translated by Yu and colleagues, reporting a Cronbach alpha of 0.932 for an overall scale and 0.799, 0.922, 0.863, and 0.803 for individual 4 subscales, respectively [37].

Statistical analysis

For patients' sociodemographic and clinical variables, we used descriptive statistics to express all. Numerical variables including age, the score of psychological distress, mindfulness, social support, and perceived stigma were expressed as median with interquartile rang (IQR) because of all did not follow normal distribution according to the results from Kolmogorov–Smirnov test. Meanwhile, Spearman rank correlation analysis was conducted to determine the correlation matrix among psychological distress, mindfulness, social support, and perceived stigma. The following indices were calculated in order to evaluate the fitness of the overall model: the ratio of Chi-square ($\chi 2$) to degrees of freedom (df), comparative fit index (CFI), goodness of fit index (GFI), adjusted GFI (AGFI), Tucker-Lewis index (TLI), incremental fit index (IFI), and root-mean-square error of approximation

(RMSEA). Model fit was regarded as good when a ratio of $\chi 2$/df was equal to or less than 3. For GFI and AGFI, a value of more than 0.90 indicates a good model fit. Moreover, CFI of ≥ 0.90 and RMSEA of < 0.05 were also suggesting a good model fit. Moreover, bootstrap test was also used to test a mediating effect of social support and perceived stigma in the relationship between mindfulness and psychological distress. A $p < 0.05$ indicated significance for all analyses. Dada was analyzed with the Statistical Package for the Social Sciences (Chicago, Illinois, USA) and IBM AMOS 21.0 (Chicago, Illinois, USA).

Results

Sample characteristics

Total 450 questionnaires were distributed during survey, and 441 valid questionnaires were received finally, with an effective response rate of 98.0%. Details of 441 Chinese lung cancer patients' sociodemographic and clinical were presented in Table 1. The participants had a median age of 60.0 (IQR: 52.0–67.0), and most were male (71.4%). Most participants did not get adequate education (68.0%), and a significant number of participants were unemployed (44.9%). Most participants were married (99.3%) and had medical insurance (97.3%), and more than half of them had no drinking history (53.7%) and diagnosis duration of less than 6 months (53.1%). In addition, most participants had no family history of lung cancer (87.8%) and no comorbidity (74.1%). However, most of these participants were at the advanced stage (85.7%) and most experienced metastasis (62.6%). Moreover, a minority of these participants experienced moderate to severe pain (19.0%), but most participants did not receive surgery (61.9%).

Correlation matrix of psychological distress, mindfulness, social support, and perceived stigma

The score of psychological distress, mindfulness, social support, and perceived stigma was 2 (2–3), 117 (111–123), 66 (61–70), and 98 (84–107), respectively. Among 441 lung cancer patients who returned valid questionnaires, 78 patients were confirmed to achieve a clinically significant level of psychological distress, indicating an incidence of 17.7%. Table 2 documented the results of correlation analyses of psychological distress, mindfulness, social support, and perceived stigma. The results of the Spearman rank correlation analyses showed all variables were significantly correlated with one another.

Structural equation modeling of the association of psychological distress, mindfulness, social support, and perceived stigma

Structural equation modeling (SEM) with maximum likelihood was used to analyze the route correlations. We firstly constructed the structure of all variables according to the results of correlation analyses. However, the relationship between perceived stigma and psychological distress did not get statistically significant. We therefore eliminated the direct route to good fit the structural model which was presented in Fig. 1 (χ^2/df = 1.201, CFI = 0.999, GFI = 0.999, AGFI = 0.986, TLI = 0.995, IFI = 0.999, RMSEA = 0.021 [0.000 to 0.130]). Corresponding numerical results were summarized in Table 3.

As illustrated, mindfulness ($\beta = -0.107$, $p = 0.008$) and social support ($\beta = -0.513$, $p < 0.001$) had direct negative effects on psychological distress. The direct pathway from mindfulness to perceived stigma ($\beta = -0.185$, $p < 0.001$) was statistically significant. Meanwhile, the direct pathway from perceived stigma to social support ($\beta = -0.373$, $p < 0.001$) was also statistically significant. The results from bootstrap test for significance of indirect pathways are summarized in Table 4. The results indicated that the indirect pathways between mindfulness and psychological distress through chain mediating effect of perceived stigma and social support were statistically significant ($B = -0.048$, 95% CI [−0.102 to 0.000], $p = 0.048$). Overall, the total effect of mindfulness in againsting psychological distress was −0.155. Furthermore, mindfulness had only an indirect positive effect on social support through route of perceived stigma ($B = 0.069$, 95% CI [0.037 to 0.105], $p = 0.001$). Meanwhile, perceived stigma had only indirect positive effect on psychological distress through social support ($B = 0.191$, 95% CI [0.240 to 0.149], $p < 0.001$). The results suggested that perceived stigma and social support play a chain mediating role in the relationship between mindfulness and psychological distress among Chinese lung cancer patients.

Discussion

Psychological distress was extensively regarded as an important negative psychological consequence of diagnosis of cancer and anti-cancer, which has been demonstrated to be negatively related to poor treatment effectiveness, increased risk of morbidity and mortality, and poor quality of life [30]. The incidence of psychological distress among lung cancer patients was detected to be highest compared to other types of cancer [4]. Therefore, it is imperative to identify protective and risk factors in order to further develop precise psychological treatment protocol for psychological distress

Table 1 Socio-demographic and clinical characteristics of 441 Chinese lung cancer patients

Characteristic	Percentage, %
Age: Median (IQR)	60.0 (52.0–67.0) yrs
Gender	
Male	71.4%
Female	28.6%
Educational level	
Primary	27.2%
Junior high	40.8%
Senior high	19.1%
University	12.9%
Occupational status	
Not working	44.9%
Working	12.2%
Retired	42.9%
Marital status	
Married	99.3%
Divorced/Widowed	0.7%
Time from diagnosis, month	
< 1	11.6%
1–6	41.5%
7–12	19.0%
> 12	27.9%
Family history of lung cancer	
No	87.8%
Yes	12.2%
Smoking history	
No	36.1%
Yes	63.9%
Alcohol consumption	
No	53.7%
Yes	46.3%
Surgery	
No	61.9%
Yes	38.1%
Metastasis	
No	37.4%
Yes	62.6%
Co-morbidity	
No	74.1%
Yes	25.9%
Pain	
No pain	41.5%
Mild	39.5%
Moderate	18.4%
Severe	0.06%
TNM stage	
I	9.5%
II	4.8%
III	10.9%
IV	74.8%

IQR, interquartile rang; yrs, years

Table 2 Spearman correlation coefficient of study variables ($n=441$)

Variables	Score, median (IQR)	Psychological distress	Perceived stigma	Social support	Mindfulness
Psychological distress	2 (2 – 3)	1			
Perceived stigma	98 (84 – 107)	0.340**	1		
Social support	66 (61 – 70)	-0.444**	-0.392**	1	
Mindfulness	117 (111 – 123)	-0.152**	-0.237**	0.122*	1

*$P<0.05$, **$P<0.01$. IQR, interquartile rang

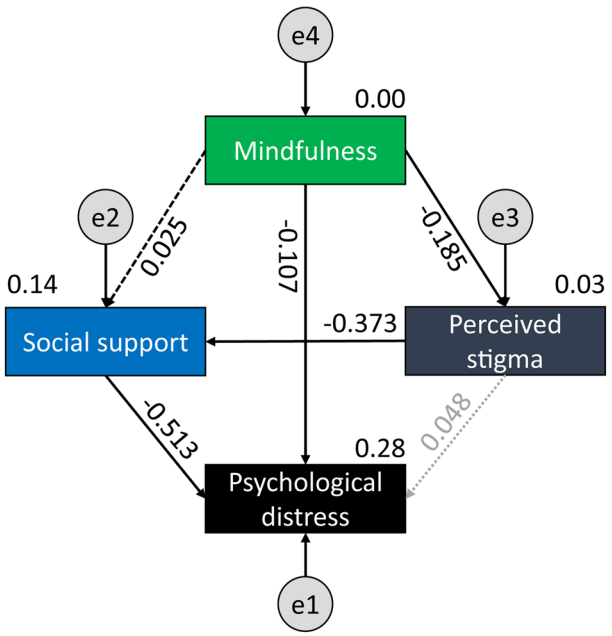

Fig. 1 Structural routes of mindfulness, social support, perceived stigma, and psychological distress among 441 Chinese lung cancer patients**.** Grey dotted arrow indicates the unconnected direct route between perceived stigma and psychological distress resulted from no statistical significance. Black solid arrow indicates statistically significant direct route, and black dotted arrow represents no statistical significance. Values are standardized coefficients for direct paths

among lung cancer patients. In this cross-sectional descriptive study, we revealed a relatively lower detection rate of psychological distress among lung cancer (17.7%); possible reasons such as higher proportion of advanced lung cancer patients and usage of DT have been deeply discussed in our previous study [21]. Meanwhile, we determined mindfulness and social support had direct positive effects on psychological distress as protective factors among lung cancer patients. Meanwhile, perceived stigma indirectly and negatively impacted psychological distress through reducing social support. Furthermore, mindfulness also alleviated psychological distress via the only chain mediating route between perceived stigma and social support due to the direct route between mindfulness and social support was not statistically significant.

Mindfulness is a positive psychological trait of regulating awareness and attention through meditation practice in which thoughts, feelings, and physical sensations are observed and then accepted at present moment non-judgmentally[38]. Mindfulness has been found to be beneficial for improving adverse psychological outcomes through effective self-designed regulation and keeping positive emotional status [14]. For example, studies revealed that self-reported mindfulness skills were related to less psychological distress in cancer patients [39] and less perceived stigma in other populations [28], which were further demonstrated in our current study.

Table 3 Decomposition of standardized effects from the path model

Variables	Mindfulness			Perceived stigma		Social support
	Perceived stigma	Social support	Psychological distress	Social support	Psychological distress	Psychological distress
Total effects	-0.185**	0.094	-0.155*	-0.373**	n.a	-0.513**
Direct effects	-0.185**	0.025	-0.107*	-0.373**	n.a	-0.513**
Indirect effects	0.000	0.069**	-0.048*	0.000	0.191**	0.000

*$P<0.05$, **$P<0.01$. n.a., not applicable

Table 4 Bias-corrected bootstrap test for all analyzed direct and indirect pathways

Direct pathway	**Bootstrap estimate (95% CI)**	***P* value**
psychological distress ← mindfulness	-0.107 (-0.195 to -0.017)	0.022
perceived stigma ← mindfulness	-0.185 (-0.098 to -0.272)	0.001
social support ← perceived stigma	-0.373 (-0.302 to -0.439)	0.001
psychological distress ← social support	-0.513 (-0.588 to -0.437)	0.001
social support ← mindfulness	0.025 (-0.004 to 0.192)	0.061
Indirect pathway	**Bootstrap estimate (95% CI)**	***P* value**
psychological distress ← mindfulness	-0.048 (-0.102 to 0.000)	0.048
social support ← mindfulness	0.069 (0.037 to 0.105)	0.001
psychological distress ← perceived stigma	0.191 (0.240 to 0.149)	< 0.001

CI, confidence interval

Social support was also listed as an important variable in this study. As one of the most common positive external sources coping with negative psychological events, social support has been extensively cited as a protective source on psychosocial adjustment [40]. Previous studies have demonstrated that social support plays a curial role in predicting psychological distress [41]. One study focusing on breast cancer patients also suggested that a higher level of social support was the association with higher benefit when a critical threshold of social support was reached [41]. In this study, we also demonstrated the direct negative correlation between social support and psychological distress, which were consistent with previous studies [41]. However, in this study, the role of social support in the relationship between mindfulness and psychological distress was not determined due to the direct effect of mindfulness on social support was not significant. Nevertheless, mindfulness was demonstrated to have an indirect effect on social support via mediating route of perceived stigma and further negatively influence psychological distress. Cancer stigma has been extensively regarded as a stressor [42, 43]. Previous studies consistently suggested that lung cancer stigma impeded patients to seek external supports [44], such as medical help-seeking behavior [45]. Therefore, nursing practitioners should design more support elements into mindfulness-based intervention protocols in order to significantly reduce the impact of perceived stigma on social support and further enhance the protective effect of mindfulness on psychological distress.

A few limitations in the current study must be further interpreted. First, the nature of the cross-sectional, observational, descriptive design limits the ability of interpreting causal interference between the mindfulness, social support, and perceived stigma. Although we proposed the theoretical model according to previous studies, the findings in our study should also be interpreted cautiously. Additional studies with longitudinal or experimental designs should be conducted to establish our findings. Second, all eligible lung cancer patients were enrolled based on convenience sampling, which impaired the representativeness of the sample. Therefore, we suggest future studies with random sampling method to further demonstrate the relationships of all variables. Third, the level of psychological distress, mindfulness, social support, and perceived stigma was measured with self-reported questionnaires, and thus inflation in results cannot be neglected due to subjective bias from patients. We therefore suggest designing more studies with physiological assessment and ecological momentary assessment. Forth, the relationships revealed in the current study may be specific to all lung cancer patients regardless of cancer treatment modalities and the level of symptom burden and not applicable to other populations. Additional studies with samples of greater diversity should be performed to determine these relationships. Fifth, DT was selected to measure the level of psychological distress in the present study; however as a self-answered scale at grade evaluation, it cannot separate the risk of psychological distress and the accumulated level of psychological distress. Therefore, further study should be designed to develop an instrument of measuring the risk of psychological distress based on objective variables. Sixth, demographic characteristics such as marital status may have an impact on the levels of social support and perceived stigma; the generalizability of our findings may be limited because of we did not further investigate the role of demographic characteristics on targeted variables such as social support.

Conclusion

In conclusion, to our knowledge, this is the first study that investigated the associations between mindfulness, social support, perceived stigma, and psychological distress among lung cancer patients. As expected, through conducting investigation among 441 lung cancer patients, this study showed that mindfulness have direct negative impact on psychological distress, and social support and perceived stigma mediated the relationship between mindfulness and psychological distress. It suggested that clinicians and

nursing professionals may enhance the positive effects of mindfulness-based intervention protocol through involving more social support elements on perceived stigma in psychological treatments, and further lessen psychological distress finally.

Clinical implications

This study enhanced our understanding on the associations between mindfulness, social support, perceived stigma, and psychological distress in lung cancer patients. From our current findings, practitioners may enhance the benefits of mindfulness-based intervention protocol involving social support elements through alleviating the level of perceived stigma of lung cancer patients and eventually reduce the adverse consequences caused by psychological distress.

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Author contribution Xu Tian had full access to all of the data in the study and held responsible for the integrity of the data and accuracy of the data analysis. Concept and design: Hui Lei, Xu Tian and Maria F. Jiménez-Herrera. Acquisition, analysis, or interpretation of data: Hui Lei, Xu Tian, Yan-Fei Jin, and Ling Tang. Drafting of the manuscript: Hui Lei, Xu Tian, and Hui Chen. Critical revision of the manuscript for important intellectual content: Wei-Qing Chen and Maria F. Jiménez-Herrera. Statistical analysis: Lei Hui and Xu Tian. Obtaining funding: Xu Tian. Administrative, technical, or material support: Wei-Qing Chen. Supervision: Maria F. Jiménez-Herrera.

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Data availability The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval Not applicable.

Consent to participate Not applicable.

Consent for publication Not applicable.

Conflict of interest The authors declare no competing interests.

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