

# Implications of dedicated tracheostomy care nurse program on outcomes

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Received: 5 July 2013 / Accepted: 17 September 2013 / Published online: 6 October 2013  
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## Abstract

**Purpose** Tracheostomy is a common occurrence in intensive care units (ICU), and a greater number of tracheostomized patients are shifted from ICU to non-critical areas. Tracheostomy care needs a multidisciplinary approach, particularly involving the nurses, and complications such as tube blockage, infection, and bleeding can be prevented by good bedside nursing. The aim was to study the impact of dedicated tracheostomy care nurse program on outcomes of tracheostomized patients.

**Methods** A tracheostomy care nurse program was improvised by the critical care physicians, with the objective of improving care of tracheostomized patients, wherein nursing staff from noncritical areas were selected for training purposes. The training included evidence-based knowledge and hands-on training. After a written assessment and a skill test, they were certified as ‘Tracheostomy Care Nurse.’ At least one of the tracheostomy care nurses was supposed to be responsible for tracheostomy care in specific wards. Comparative data of two periods, a pre-intervention period from January 2011 to November 2011 and a post-intervention period from December 2011 to October 2012, were analyzed.

**Results** During the pre-intervention period, of 82 tracheostomized patients, 28 (34.15 %) had complications including 20 (24.39 %) readmissions to the ICU. During the post-intervention period, 107 patients had a tracheostomy, of which 7 (6.54 %) had complications with only 2 (1.87 %) readmissions, which was significant ( $p < 0.05$ ). Decannulations nonsignificantly increased during the post-intervention period (25 vs. 16 %,  $p > 0.05$ ). The average length of hospital stay (ALOS) decreased from 36 to 27 days ( $p < 0.05$ ).

**Conclusion** The support of a specialist tracheostomy nurse can decrease complication rates and readmissions to the ICU and reduce ALOS.

**Keywords** Tracheostomy · Complications · Tracheostomy care nurse program · Dedicated nursing care · Specialist nurses

## Introduction

Tracheostomy is an increasingly common procedure in the intensive care unit (ICU) [1]. With more patients admitted to ICUs, more tracheostomies are being performed in the ICU, which results in a greater number of patients being discharged from the ICU to noncritical areas with tracheostomy tubes in situ [2]. However, most of the patients on transfer from the ICU are often lost to follow-up [2]. Numerous studies have reported an association of a tracheostomy tube with increased post-ICU mortality [3, 4]. This increase may be attributed to the inadequate experience of nursing staff who are responsible for care of tracheostomized patients in the wards. It has been seen that nurses working in noncritical areas are lacking in the skills, knowledge, and confidence to provide safe tracheostomy care [5].

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Tracheostomy care needs a multidisciplinary approach, particularly involving nursing care. Good tracheostomy care needs regular suctioning, stoma care, nutrition, speech therapy, and periodic changing of the tracheostomy tube [6]. Life-threatening complications, such as accidental decannulation requiring emergent ICU readmission in the absence of trained personnel, have occurred at our institution and have been reported in the literature [6, 7]. Also, other tracheostomy-associated complications such as tube blockage, respiratory infection, and bleeding can be prevented by early recognition and prompt management by good bedside nursing. These preventable adverse events emphasize the need for specialized knowledge and regular follow-up in the care of patients with tracheostomy tubes.

Upon analysis of tracheostomized patient data at our institution, it was observed that the complications and ICU readmission rate of tracheostomized patients was high. A tracheostomy care nurse program was launched by the Department of Critical Care at SPS Apollo Hospitals, Ludhiana, at the end of July 2011, with the objective of training and sensitizing the nursing staff in noncritical care areas to tracheostomy care. Our hospital tracheostomy care nurse program is an innovation over the Western concept of a multidisciplinary tracheostomy care team including the respiratory physician, respiratory therapists, physiotherapist, and a clinical specialist nurse, to meet the complex care needs of patients transferred from the ICU to the wards with a tracheostomy tube in situ. In developing countries such as India, because of the paucity of resources and nonavailability of respiratory therapists and specialized nurses, we planned to train our identified staff nurses in tracheostomy care.

This study was designed to assess the impact of this dedicated specialized tracheostomy care nurse program on tracheostomy care outcomes and the incidence of tracheostomy-related complications.

**Materials and methods**

To implement the tracheostomy care nurse program, critical care clinicians and the nursing staff were included in the care team. A program was improvised wherein nurses from various noncritical areas were identified for training purposes. Keeping in mind their expertise, competence, and level of knowledge, a total of 42 nurses were selected for training. Multiple training and retraining sessions including theoretical teaching and practical hands-on training sessions were conducted by the consultants of the critical care units. A broad program schedule is outlined in Table 1.

A module was formulated for the training that included an evidence-based knowledge of general tracheostomy

**Table 1** Tracheostomy care nurse program details

<ul style="list-style-type: none"> <li>• Involves tracheostomy care in noncritical areas by specially trained nurses</li> <li>• Program started in July 2011, and after 4 months of intensive training, 37 certified Tracheostomy Care Nurses were identified</li> <li>• After certification, presence of at least one certified specialist nurse was mandatory in each ward in all the shifts</li> </ul>		
<b>On initiation</b>		
For Initial 2 months	4 h per week of classroom teaching	Theoretical knowledge sessions on tracheostomy including: <ul style="list-style-type: none"> <li>✓ Types</li> <li>✓ Indications</li> <li>✓ Procedure</li> <li>✓ Complications</li> <li>✓ Recognition of tube blockages</li> <li>✓ Suctioning procedure</li> <li>✓ Stoma Care</li> <li>✓ Identification of local site infections</li> <li>✓ Management of complications</li> <li>✓ Emergency equipment</li> <li>✓ Feeding with tracheostomy in situ</li> <li>✓ Speech and communication aids for tracheostomized patients</li> </ul>
	Two sessions weekly in Skill Lab	Hands-on training on mannequin with tracheostomy including: <ul style="list-style-type: none"> <li>✓ Insertion technique</li> <li>✓ Securing the tracheostomy tube</li> <li>✓ Suctioning technique</li> <li>✓ Stoma care</li> <li>✓ Monitoring of tracheostomy cuff pressure</li> </ul>
For next 2 months	6 h per week of ICU posting	Hands-on practice on tracheostomized patients in ICU under supervision of critical care consultants including <ul style="list-style-type: none"> <li>✓ Tube changes</li> <li>✓ Suctioning method</li> <li>✓ Asepsis</li> <li>✓ Stoma care</li> <li>✓ Feeding technique</li> <li>✓ Use of speech valve and facilitating communication with the family</li> <li>✓ Management of complications as and when occurring, e.g., desaturation, bleeding from stoma site, difficulty in change of tube</li> </ul>

management, with emphasis on nursing care of tracheostomized patients. The sessions included recognition of tubal blockages, regular tracheostomy suctioning technique

**Table 1** continued

<b>After 4 months intensive training</b>	
Tracheostomy assessment of all trainees	Included: <ul style="list-style-type: none"> <li>✓ 10 subjective long-answer questions</li> <li>✓ 15 multiple-choice questions</li> <li>✓ Viva voce</li> <li>✓ Skill testing</li> </ul>
Score >70 %	Certified as 'Tracheostomy Care Nurse'
<b>Follow-up</b>	
Retraining session monthly	Includes: <ul style="list-style-type: none"> <li>✓ 1 h classroom session</li> <li>✓ 1 h patient bedside</li> </ul>
Reassessment quarterly	
Weekly mega-rounds in tracheostomized patients in wards	Includes: <ul style="list-style-type: none"> <li>✓ Bedside rounds</li> <li>✓ One-to-one discussion among tracheostomy care nurses and critical care consultants</li> <li>✓ Family counselling sessions</li> </ul>
Monthly tracheostomy high-tea	All tracheostomy care nurses and critical care consultants have informal group discussions <ul style="list-style-type: none"> <li>✓ Long-stay tracheostomized patients are detailed</li> <li>✓ Practical problems being faced by nurses are addressed</li> <li>✓ Any tracheostomy-related event is also discussed</li> </ul>

maintaining asepsis, tracheostomy cuff pressure monitoring and maintenance of appropriate cuff pressures, stoma care, identifying local site infections, feeding, speech therapy, and communication with tracheostomized patients and how and when to change the tracheostomy tubes. Hands-on training with practical training mannequins was also provided. After 4 months of intensive training, a written assessment and a skill test was conducted in November 2011, and 37 nursing professionals who could score more than 70 % were certified as a 'Tracheostomy Care Nurse'. Thereafter, the area allocation of these specialized nurses was redefined to ensure that at least one of these tracheostomy care nurses was present in each ward during each shift to perform additional services as a tracheostomy care nurse. The tracheostomy care nurse is actively involved in the management of ward patients with a tracheostomy until the time of decannulation or discharge from the hospital. The job responsibilities of a tracheostomy care nurse are detailed in Table 2.

**Table 2** Job responsibilities of 'Tracheostomy Care Nurse'

<ul style="list-style-type: none"> <li>• Daily bedside rounds of tracheostomized patients</li> <li>• Performing a bedside check of the tracheostomy tube, the oxygen delivery system, working suction unit, the spare emergency tracheostomy tube and emergency equipment</li> <li>• Cuff-pressure checks</li> <li>• Management of secretions, whenever needed</li> <li>• Stoma care in all shifts</li> <li>• Tube change, as required</li> <li>• Discuss daily tracheostomy care issues with the critical care clinicians, patient, and family</li> <li>• Assesses the patient's ability to tolerate a speaking valve (i.e., assess level of consciousness, airway protection, phonation)</li> <li>• Coordinates family meetings and educates the family about tracheostomy care before discharge</li> <li>• Additional responsibility to train other nursing staff in tracheostomy care, in their allocated areas</li> </ul>
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To strengthen this program, the retraining sessions were conducted regularly as an on-going program with quarterly reassessments after certification. On a monthly basis, tracheostomy meetings were organized, which were an informal interaction between the critical care consultants and the tracheostomy care nurses. During these meetings, practical problems being faced by the tracheostomy nurses and the special needs for long-stay tracheostomized patients were discussed, and appropriate measures to minimize such problems were planned and implemented.

To formally assess the impact of this program on the outcome of tracheostomized patients, a study was planned. The hospital ethics committee approved the study protocol. Comparative data from two periods were taken. A control group, which included patients who had a tracheostomy from January to November 2011 before the implementation of the tracheostomy care nurse program (pre-intervention period) and the study group from December 2011 to October 2012 after implementation of the program (post-intervention period). All adult patients with a tracheostomy tube in situ who were transferred from the ICU to any noncritical care area were included in the study. For all the patients, data were collected through manual chart review, which included the daily doctor's progress notes, procedure notes, tracheostomy change, and nursing assessment notes per shift. For the post-intervention group, data were correlated with a separate tracheostomy record register maintained by the nursing supervisors.

The data collected included age, sex, admitting diagnosis, indication for tracheostomy, type of tracheostomy, discharge from ICU, dates of tube changes, staff doing tube changes, tracheostomy-related complications, readmission to ICU, discharge from hospital, and outcome.

To objectively assess the impact of our project, the outcomes of interest were as follows:

1. Complications related to tracheostomy care
2. Readmissions to ICU
3. Decannulations
4. Average length of stay

Statistical analysis was performed using the SPSS system, version 16. Patient characteristics at baseline were summarized using proportions or means and standard deviation (SD) as appropriate. The outcomes of interest were analyzed statistically using Student *t* test or the Wilcoxon rank-sum test to compare clinical variables between the pre-intervention and post-intervention groups for normally and nonnormally distributed data, respectively. A *p* value of <0.05 was considered statistically significant.

**Results**

On interpretation of the data, a total of 189 patients were transferred from the ICU to noncritical areas with tracheostomy in situ during the study period, 82 during the pre-intervention period and 107 during the post-intervention period (Fig. 1). The demographic profile of the study patients is similar in both groups, as shown in Table 3. During the pre-intervention period, 20 of 82 patients died, whereas during the post-intervention period, 24 of 107 patients died (*p* > 0.05) (Table 4). On analysis of the data, during the pre-intervention period, 28 (34.1 %) had complications including bleeding in 6 patients, stoma infection in 4, and tube blockages leading to hypoxia in 16 patients (Fig. 2). Of these patients, 2 had accidental decannulation. During the post-intervention period, 7 patients (6.5 %) had complications, which included bleeding in 3, infection in 2, and tube obstruction in 2 patients. This difference in complications during the two periods was statistically significant (*p* < 0.05).

During the pre-intervention period, 20 patients (24 %) required readmission to the ICU from the ward because of one of the tracheostomy-related complications, whereas

**Table 3** Demographic profile

	Pre-intervention period	Post-intervention period	<i>p</i> value	
Age (years ± SD)	52.13 ± 13.65	52.44 ± 13.10	0.865	NS
Sex (male:female) ( <i>n</i> )	46:36	64:43	0.357	NS
Indications of tracheostomy ( <i>n</i> )				
Prolonged ventilation	61	80	0.268	NS
Inability to clear secretions	8	7		
Low GCS	8	6		
Difficult weaning	5	14		
Type of tracheostomy ( <i>n</i> )				
Surgical	9	14	0.418	NS
Percutaneous	73	93		
Diagnosis [ <i>n</i> (%)]				
Neurological problems	46 (56.10 %)	65 (60.75 %)	0.972	NS
Respiratory symptoms	11 (13.41 %)	15 (14.02 %)		
Neurosurgical problems	7 (8.54 %)	8 (7.48 %)		
Postsurgical patients	4 (4.88 %)	4 (3.74 %)		
Cardiology	2 (2.44 %)	3 (2.80 %)		
Nephrology	2 (2.44 %)	1 (09.3 %)		
Gastroenterology	7 (8.54 %)	6 (5.61 %)		
Miscellaneous	3 (3.66 %)	5 (4.67 %)		

GCS Glasgow coma scale, NS nonsignificant

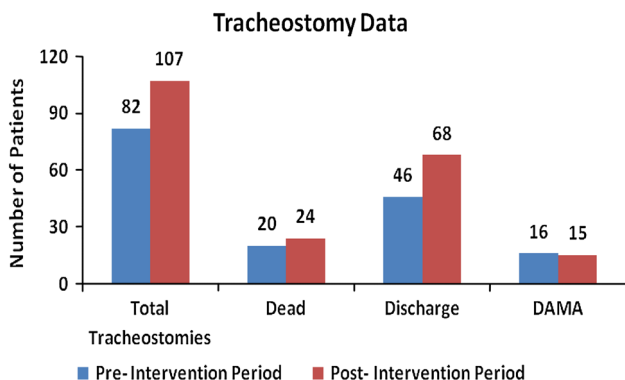
only 2 patients (<2 %) needed readmission to the ICU during the post-intervention period (*p* < 0.05).

There was an increase in the number of decannulations from 16 % to 25 % during the two study periods, but this difference was statistically not significant (*p* > 0.05). Of 82 patients, 13 could be decannulated during the pre-intervention period whereas 27 of 107 patients could be decannulated in the post-intervention period.

The average length of hospital stay (ALOS) for tracheostomized patients during the pre-intervention period was 36 days, which decreased to 27 days during the post-intervention period, which was also statistically significant (*p* < 0.05). Improvement in ALOS was a secondary outcome measure, indirectly related to improved nursing care.

**Discussion**

The management and care of patients with a tracheostomy in situ requires specialist knowledge [8]. Insufficient skill

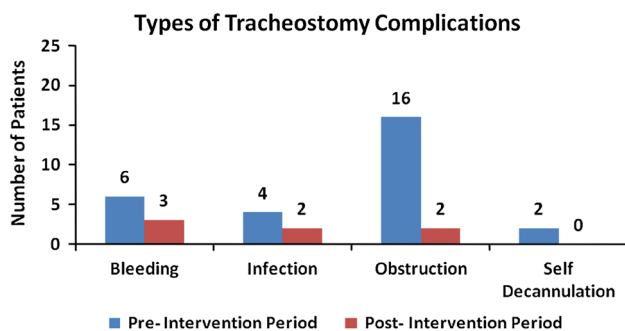


**Fig. 1** Summary of tracheostomy patients during two periods. DAMA discharge against medical advice

**Table 4** Tracheostomy patients data and outcomes during two periods

	Pre-intervention period	Post-intervention period	<i>p</i> value	
Total tracheostomies ( <i>n</i> )	82	107		
Dead	20	24	0.507	NS
Discharge	46	68	0.187	NS
DAMA	16	15	0.208	NS
Decannulations	13	27	0.082	NS
Complications	28	7	0.000	Sig
Readmissions to ICU	20	2	0.000	Sig
ALOS hospital (days ± SD)	36 ± 36.88	26.9 ± 17.55	0.027	Sig
ALOS ICU (days ± SD)	25.01 ± 32.19	20.98 ± 13.17	0.242	NS

DAMA discharge against medical advice, ICU intensive care unit, ALOS average length of stay, SD standard deviation, NS nonsignificant, Sig significant

**Fig. 2** Comparative data of complications during two periods

and experience of staff caring for a tracheostomy may lead to suboptimal care and increased morbidity [9]. Paul and colleagues [5], in a literature review from database searches from 1998 to 2009, concluded that staff education is widely recommended to healthcare professionals who care for tracheostomized patients on an infrequent basis. Despite statements that general ward nurses should be able to care for patients with tracheostomy tubes, recent research has shown a poor level of knowledge among ward nurses leading to inevitable, potentially serious complications [10–12]. Few authors have discussed the potential benefits of tracheostomy specialist nurses, but published evidence of their existence and formal evaluation of existing services is sparse [2, 6, 13]. There are very few reports on dedicated tracheostomy services and their effect on outcomes in patients admitted to hospital.

This study was designed to analyze the impact of a specialized tracheostomy care nurse program on outcomes.

The principal reason for devising the tracheostomy care nurse program was to improve tracheostomy care in non-critical areas, as most of the morbidity and mortality of tracheostomized patients in wards was attributed to inappropriate tracheostomy care. As one of the major problem highlighted during clinical meets, there was a perceived need for dedicated tracheostomy services in the wards. Discharge from the hospital or overall mortality depends upon the underlying clinical condition and is not affected by the intervention. We also found no statistical difference in discharge or death rate during the two study periods in our study. The main findings of our study were that the specialist tracheostomy service resulted in fewer complications, fewer readmissions to ICU as a result of tracheostomy-related complications, and decreased average length of hospital stay. The number of decannulations increased nonsignificantly. The decrease in complication rates could be attributed to the tracheostomy care nurse program, wherein efficient tracheostomy care significantly contributed to improved nursing care and fewer complications. Also, it signified that tracheostomy care nurses could better manage the complications including emergency tube changes and hypoxia in allocated areas. It was also observed that there was a decrease in number of calls from noncritical areas to the critical care consultants for tracheostomy changes.

Norwood and colleagues [6] described a respiratory therapist-led team that followed patients from tracheostomy tube placement in the ICU through to discharge from hospital. They reported a significant decrease in all tracheostomy-related complications in the post-service group as compared to the pre-service group ( $p = 0.031$ , Fisher's exact test). Mestral et al. [2] have also shown in a study group of 86 patients that standardized care provided by a specialized multidisciplinary tracheostomy team was associated with fewer tracheostomy-related complications. Although they did not find a significant difference in all the complications, they reported a decrease in incidence of tubal blockage (5.5 % vs. 25 %,  $p = 0.016$ ) and calls for respiratory distress (16.7 % vs. 37.5 %,  $p = 0.039$ ) in the wards. Our results are consistent with their findings of decreased complications from 34 % to 6.5 % ( $p < 0.05$ ), although in contrast to other studies, we did not have a multidisciplinary team. Pandian et al. [14] recently reported a decrease in complications such as bleeding and physiological disturbances, but no difference in infection rates or length of stay, with a multidisciplinary team.

The decreased number of ICU readmissions that we observed after the establishment of the tracheostomy care nurse program is an important achievement that can be attributed to improved daily tube care, more stringent suctioning protocols, increased awareness of the tracheostomy care nurse of tracheostomy-related issues, better



management of impending problems, and timely tube changes. Although most researchers have not studied the impact of specialized services on ICU readmission, many studies indirectly point to the outcome [2, 15]. Mestral et al. [2] reported that calls for respiratory distress decreased with the availability of specialized multidisciplinary tracheostomy team (16.7 vs. 37.5 %,  $p = 0.039$ ). Although not directly related to tracheostomy care, Ball et al. [15] also showed the impact of a critical care outreach team in decreasing readmissions to ICU (12.4 vs. 6 %).

In our study, we observed a decrease in the average length of hospital stay with the implementation of the tracheostomy care nurse program. Although we did not compare the time to decannulation in our study, we could observe only an insignificant improvement in decannulations, which increased from 16 % to 25 %. This finding may reflect a proactive approach to decannulation after the implementation of the program. In a systematic review of three papers by Garrubba et al. in 2009, it was observed that patients with a tracheostomy tube in situ discharged from an ICU to a general ward who received care from a dedicated multidisciplinary team as compared with standard care showed improvements in time to decannulation, length of stay, and adverse events [9]. In our tracheostomized patients, the average length of hospital stay decreased from 36 to 27 days after the implementation of dedicated tracheostomy care nurse services. Parker et al. showed a similar reduction in mean hospital stay from 50 to 27 days ( $p < 0.0001$ ) after implementation of an interdisciplinary team approach to tracheostomy management in noncritical care areas [16]. Tobin and Santamaria also showed a shorter decannulation time and length of stay with an intensivist-led tracheostomy review team [7]. However, there are contrasting results in literature so far as ALOS is concerned. Pandian and colleagues [14] could not show a positive correlation between dedicated services and length of stay. A recent review and meta-analysis of seven studies by Speed and Harding also concluded that there is insufficient evidence to determine that multidisciplinary tracheostomy teams reduce hospital or ICU unit LOS [17]. This inadequate association might be because dedicated tracheostomy care is unlikely to influence underlying medical problems or disease state.

Making decisions about tracheostomy management requires specialized knowledge. Before the establishment of our institution's tracheostomy care nurse program, variable experience levels existed among the nursing staff responsible for the care of patients with tracheostomy tubes in the wards, which contributed to inconsistent management and the potential for serious complications. Framing a tracheostomy care nurse program created a working group dedicated to tracheostomy care in the noncritical areas. Our study has shown that

the support of a specialist tracheostomy nurse has decreased the number of complications and ICU readmission rates and resulted in more decannulations and reduced length of hospital stay. Although most studies in literature have shown the impact of multidisciplinary tracheostomy teams, our study could show a difference in outcomes with a trained, dedicated tracheostomy nurse alone. This program demonstrates the need for dedicated tracheostomy care nurses and shows how specialist nurses can be cost effective, especially in developing countries. Regular clinical audits and prospective studies can further strengthen such programs. Although a prospective study with a larger population is required, our study shows that closer follow-up and more consistent management provided by a specialized tracheostomy care nurse has a favorable impact on tracheostomy care.

A few limitations of the study need to be acknowledged. A major limitation of our study was the retrospective nature of data collection for the pre-intervention period; therefore, variables cannot be controlled. The data available for comparison might have been limited, which raises the possibility of other factors influencing the study either positively or negatively. The use of routine audit data, rather than specific data collected for research purposes, may also have produced erroneous results. Our small sample size may have also increased the risk of a type 2 error. The interventions undertaken by team members might have varied, possibly for the intervention or the manner in which the intervention was undertaken by the individual and on a particular day. It is however unlikely that one individual or one intervention can be associated with the findings. Rather, the combined effect of the interventions seems to have had a beneficial effect on outcomes. Although a cohort study such as this cannot prove that the intervention was responsible for the change in outcome, the temporal change over a short time period is supportive of cause and effect.

We conclude that the support of a specialist tracheostomy nurse can decrease the complication rates and ICU readmissions, increase the number of decannulations, and reduce the average length of stay. The Tracheostomy Care Nurse maintains a continuity of care from the ICU onward, supporting the patient through to discharge. Such services can improve patient care and result in cost-effectiveness of healthcare resources, especially in developing countries.

**Acknowledgments** The authors offer special thanks and acknowledgement to Lt. Col. Neera Devi, Chief of Nursing Services, the Tracheostomy Care Nurses who have helped create and run the services, the Quality Assurance department, Ms. Chandneet Bindra, DGM and the Capability Management team, and Ms. Namita Bansal, Statistician, SPS Apollo Hospitals, for the data collection and statistical analysis.

**Source of Funding** This service was introduced as a quality initiative program in the hospital, without any additional funding or staff. The Critical care physicians involved in training and the certified tracheostomy care nurses are regular employees of the hospital.

**Conflict of interest** The authors declare that they have no competing interests.

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