How do family physicians measure blood pressure in routine clinical practice?

National survey of Canadian family physicians

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Abstract

Objective To describe the techniques currently used by family physicians in Canada to measure blood pressure (BP) for screening for, diagnosing, and treating hypertension.

Design A Web-based cross-sectional survey distributed by e-mail.

Setting Stratified random sample of family physicians in Canada.

Participants Family physician members of the College of Family Physicians of Canada with valid e-mail addresses.

Main outcome measures Physicians' self-reported routine methods for recording BP in their practices to screen for, diagnose, and manage hypertension.

Results A total of 774 valid responses were received, for a response rate of 16.2%. Respondents were similar to nonrespondents except for underrepresentation of male physicians. Of 769 respondents, 417 (54.2%) indicated that they used manual office BP measurement with a mercury or aneroid device and stethoscope as the routine method to screen patients for high BP, while 42.9% (330 of 769) reported using automated office BP (AOBP) measurement. The method most frequently used to make a diagnosis of hypertension was AOBP measurement (31.1%, 240 of 771), followed by home BP measurement (22.4%, 173 of 771) and manual office BP measurement (21.4%, 165 of 771). Ambulatory BP monitoring (ABPM) was used for diagnosis by 14.4% (111 of 771) of respondents. The most frequently reported method for ongoing management was home BP monitoring (68.7%, 528 of 769), followed by manual office BP measurement (63.6%, 489 of 769) and AOBP measurement (59.2%, 455 of 769). More than three-quarters (77.8%, 598 of 769) of respondents indicated that ABPM was readily available for their patients.

Conclusion Canadian family physicians exhibit overall high use of electronic devices for BP measurement, However, more efforts are needed to encourage practitioners to follow current Canadian guidelines, which advocate the use of AOBP measurement for hypertension screening, ABPM and home BP measurement for making a diagnosis, and both AOBP and home BP monitoring for ongoing management.

EDITOR'S KEY POINTS

- Hypertension is typically diagnosed and managed in the primary care setting and it is one of the most common reasons for visits to family physicians in Canada. Accurate blood pressure (BP) measurement is the foundation of optimal screening, diagnosis, and treatment of hypertension. This study aimed to understand the techniques family physicians use to measure BP.

- Many family physicians continue to use suboptimal manual BP measurement to screen for hypertension and more than half use techniques for diagnosis that are not recommended by the Canadian Hypertension Education Program (CHEP). For example, while more than three-quarters of respondents reported that ambulatory BP monitoring (ABPM) was readily available, only 14.4% used ABPM to diagnose hypertension, as recommended by CHEP.

- Diagnosis of hypertension should be made using 24-hour ABPM, whenever feasible; otherwise home BP measurement should be performed according to the CHEP protocol.

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Comment les médecins de famille mesurent-ils la pression artérielle dans la pratique clinique courante?

Sondage national auprès des médecins de famille canadiens

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Résumé

Objectif Décrire les techniques actuellement utilisées par les médecins de famille au Canada pour mesurer la pression artérielle (BP) aux fins de dépistage, de diagnostic et de traitement de l'hypertension.

Conception Un sondage transversal sur le web, distribué par courriel.

Contexte Un échantillon aléatoire stratifié de médecins de famille au Canada.

Participants Les médecins de famille membres du Collège des médecins de famille du Canada ayant des adresses de courriel valides.

Principaux paramètres à l'étude Les méthodes habituelles utilisées par les médecins pour consigner la PA dans leur pratique dans le but de dépister, de diagnostiquer et de prendre en charge l'hypertension, telles que rapportées par les intéressés.

Résultats Au total, 774 réponses valides ont été reçues, ce qui représente un taux de réponse de 16,2%. La répartition des répondants par rapport aux non-répondants était semblable, sauf pour une sous-représentation des hommes médecins. Parmi 769 répondants, 417 (54,2%) ont indiqué qu'ils utilisaient un sphygmomanomètre manuel au mercure ou anéroïde et un stéthoscope pour mesurer la pression comme méthode habituelle pour dépister la haute PA chez les patients, tandis que 42,9% (330 sur 769) ont signalé se servir d'une mesure automatisée de la PA en clinique (MAPAC). La méthode la plus souvent utilisée pour poser un diagnostic d'hypertension était la MAPAC (31,1%, 240 sur 771), suivie par la mesure de la PA à domicile (22,4%, 173 sur 771) et la mesure manuelle de la PA en clinique (21,4%, 165 sur 771). Le monitorage ambulatoire de la PA (MAPA) servait au diagnostic pour 14,4% (111 sur 771) des répondants. La méthode la plus souvent mentionnée pour la prise en charge constante était la mesure de la PA à domicile (68,7%, 528 sur 769), suivie par la mesure manuelle de la PA en clinique (63,6%, 489 sur 769) et la MAPAC (59,2%, 455 sur 769). Plus des 3/4 (77,8%, 598 sur 769) des répondants ont indiqué que le MAPA était facilement accessible pour leurs patients.

Conclusion Dans l'ensemble, les médecins de famille canadiens utilisent amplement des tensiomètres électroniques pour la mesure de la PA. Toutefois, il faut déployer plus d'efforts pour encourager les médecins à se conformer aux lignes directrices canadiennes actuelles, qui préconisent le recours à la MAPAC pour le dépistage de l'hypertension, au MAPA et à la mesure de la PA à domicile pour poser un diagnostic, et l'utilisation à la fois de la MAPAC et de la mesure de la PA à domicile pour la prise en charge sur une base continue.

POINTS DE REPÈRE DU RÉDACTEUR

- L'hypertension est habituellement diagnostiquée et prise en charge en soins primaires et elle compte parmi les raisons les plus fréquentes de consulter un médecin de famille au Canada. La mesure exacte de la pression artérielle (PA) représente le fondement du dépistage, du diagnostic et du traitement optimaux de l'hypertension. La présente étude visait à connaître les techniques utilisées par les médecins de famille pour mesurer la PA.

- De nombreux médecins de famille continuent d'utiliser une mesure manuelle sous-optimale de la PA pour le dépistage de l'hypertension, et plus de la moitié d'entre eux utilisent des techniques de diagnostic qui ne sont pas recommandées par le Programme éducatif canadien sur l'hypertension (PECH). Par exemple, même si plus des 3/4 des répondants ont signalé que le monitorage ambulatoire de la PA (MAPA) était facilement accessible, seulement 14,4% d'entre eux se servait du MAPA pour diagnostiquer l'hypertension, comme le recommande le PECH.

- Le diagnostic de l'hypertension devrait être posé par un MAPA sur 24 heures, dans la mesure du possible; autrement, la mesure de la PA à domicile devrait être faite selon le protocole du PECH.

Cet article a fait l'objet d'une révision par des pairs.
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High blood pressure (BP) is the leading global risk factor for death and disability, contributing to 9.4 million deaths and 162 million years of life lost in 2010.[1] In Canada, 7.5 million people are living with hypertension and an additional 7.4 million people have BP in the prehypertensive range.[2] Hypertension was responsible for more than $13 billion annually in direct and indirect health care costs to the Canadian health care system in 2010.[3] Further, hypertension is typically diagnosed and managed in the primary care setting and it is one of the most common reasons for visits to family physicians in Canada.[4]

Accurate BP measurement is the foundation of optimal screening, diagnosis, and treatment of hypertension. The development of accurate electronic sphygmomanometers during the past few decades has dramatically improved our ability to diagnose and manage patients with hypertension.

In 2015, the Canadian Hypertension Education Program (CHEP), the organization responsible for the annual development and dissemination of updated, evidence-based hypertension guidelines, made 4 recommendations for BP measurement and the diagnosis of hypertension.[5] These recommendations addressed in-office and out-of-office BP assessment, including 24-hour ambulatory BP monitoring (ABPM) and home BP measurement. One of the key recommendations was that manual office BP measurement should *not* be used to diagnose hypertension. Instead, physicians should use electronic devices, with automated office BP (AOBP) measurement being preferred as the most accurate technique for recording BP in the office setting. The CHEP recommendations for optimal measurement of BP for screening, diagnosis, and management of hypertension are summarized in **Table 1**.

The importance of how BP is measured was a key feature of the recently published Systolic Blood Pressure Intervention Trial (SPRINT),[6] which demonstrated a clear benefit in terms of reduced cardiovascular morbidity and mortality in higher-risk, older patients randomized to a target systolic BP of less than 120 mm Hg compared with the usual target of less than 140 mm Hg. This trial also generated considerable discussion related to the use of AOBP measurement. This method involves using a fully automated, oscillometric sphygmomanometer (such as the Omron 907XL used in SPRINT) to record multiple BP readings with the patient resting quietly and alone, without health professionals or research staff being present.

In view of the important advances in BP measurement and consequent changes in the CHEP recommendations during the past few years, the College of Family Physicians of Canada (CFPC), in partnership with Hypertension Canada, was interested in understanding the techniques family physicians in Canada currently use to record BP in the office for screening for and diagnosing hypertension and for managing patients with this condition. Accordingly, we developed and administered a short online survey aimed at members of the CFPC in order to obtain information on current methods of BP measurement in primary care in Canada.

METHODS

The survey was conducted between April 21 and May 9, 2016, using FluidSurveys online software. A personalized invitation e-mail message to participate in the survey was sent on behalf of the CFPC and Hypertension Canada in either French or English, and included a link to a language-specific survey. The CFPC had a total of 34 598 members (as of April 30, 2016), including 27 033 with valid e-mail addresses in their membership database profiles. An additional 1210 (4.5%) members were excluded from the final sampling frame owing to their privacy requests (627 female [51.8%] and 583 [48.1%] male members). The invitation was e-mailed to a random, stratified sample (by province, age, sex, and language preference) of 4772 CFPC members, generated from the membership list. The personalized link took participants to an informed consent page that provided more information about the survey, assured

Table 1. Techniques recommended by CHEP to measure BP for screening, diagnosis, and management of hypertension: *Regardless of the technique used, it is essential that the recommended procedures for BP measurement be followed.*

BP MEASUREMENT METHOD	SCREENING	DIAGNOSIS	MANAGEMENT
Manual BP measurement in the office with mercury or aneroid device	Not recommended	Not recommended	Not recommended
AOBP	Recommended (1st choice)	Not recommended	Recommended (1st choice)
Pharmacy BP measurement or electronic BP kiosks	Recommended (2nd choice)	Not recommended	Recommended (2nd choice)
ABPM	Not recommended	Recommended (1st choice)	Not recommended
Home BP monitoring	Recommended (2nd choice)	Recommended (2nd choice)	Recommended (2nd choice)

ABPM—ambulatory blood pressure monitoring, AOBP—automated office blood pressure, BP—blood pressure, CHEP—Canadian Hypertension Education Program.

confidentiality, and required clicking on the *Agree* button before access to the survey was granted. Two reminder e-mails were sent at 1 and 2 weeks after the initial invitation to increase the response rate.

Survey instrument

The short questionnaire (8 questions including 3 demographic questions) was developed by the authors who jointly have expertise in family medicine, survey methodology, and BP measurement. The first question asked, "In patients being screened for high blood pressure, what is the routine method used to measure blood pressure in your practice?" and provided 4 fixed choices and 1 open-ended response. The fixed choices were as follows: manual BP in the office with mercury or aneroid device; AOBP using BpTRU, Omron 907XL, or Microlife WatchBP Office (Welch Allyn ProBP 2400); other patient-activated electronic devices in the office; and pharmacy BP measurement or electronic BP kiosks in the office. Respondents could also specify other methods or devices used.

The second question asked, "Once a routine screening BP suggests that hypertension may be present, what is the usual method for measuring blood pressure in your practice to make a diagnosis of hypertension?" In addition to the choices available for the first question, 2 more choices were available: ABPM (24-hour BP monitoring) and home BP monitoring. The available choices for the first 2 questions were mutually exclusive. The third question asked, "In patients taking antihypertensive treatment (lifestyle or medications), what are the routine methods used to measure blood pressure in your practice?" Respondents were allowed to select multiple answers from among the same options as those available for question 2. The fourth question asked, "Do you have readily available access to Ambulatory Blood Pressure Monitoring (ABPM) for your patients?" If respondents answered yes, they were asked to indicate where ABPM was available. The remaining 3 questions asked about the respondents' province or territory, the population primarily served by their practices, and their year of graduation from medical school. The bilingual questionnaire is available from the principal author (J.K.) upon request.

RESULTS

Of the 4773 invitations to participate, 26 were returned to sender: 23 were automatically generated absence messages and 3 were from members who were not actively practising. Out of 830 surveys started, 56 were incomplete or abandoned before being fully completed. The final usable number of completed surveys was 774, which corresponds to a 16.2% response rate (774 of 4773). Using the CFPC membership database, the respondents and nonrespondents were compared and were found to be similar (P values $>.05$) in terms of preferred language of communication (87.9% vs 89.2% preferred communication in English, respectively), age (mean [SD] of 46.6 [11.6] vs 46.6 [11.2] years), years as a member of the CFPC (mean [SD] of 12.1 [9.9] vs 12.4 [9.4] years), and year of graduation from medical school (mean [SD] 1997 (12.6) vs 1996 [11.5]) but not in terms of sex (41.6% vs 50.8% were male, $\chi^2_1=22.0$, $P<.001$). A more detailed description of the survey respondents is shown in **Table 2**.

More than half of respondents (54.2%, 417 of 769) indicated that they used manual BP measurements with a mercury or aneroid device as the routine method to screen patients for high BP in their practices, while 42.9% (330 of 769) reported routinely using AOBP measurement for this purpose. The method most frequently used to confirm a diagnosis of hypertension after routine BP screening suggested that hypertension might be present was AOBP measurement (31.1%, 240 of 771), followed by home BP monitoring (22.4%, 173 of 771) and manual BP measurement (21.4%, 165 of 771). Only 14.4% (111 of 771) of respondents reported using ABPM for this purpose.

The next question asked about the routine methods used to monitor BP in patients taking antihypertensive treatment and allowed respondents to select multiple options. The most frequently reported method was home BP monitoring (68.7%, 528 of 769), followed by manual office BP measurement (63.6%, 489 of 769) and AOBP measurement (59.2%, 455 of 769). More than a third of respondents indicated that they used electronic BP kiosks (36.2%, 278 of 769) in pharmacies for that purpose. **Table 3** shows more detailed responses to these questions.

More than three-quarters (77.8%, 598 of 769) of respondents indicated that ABPM was readily available for their patients. Respondents indicated that ABPM was most frequently available in local hospitals (45.2%, 270 of 597) or local noninvasive vascular testing laboratories (33.0%, 197 of 597). For those respondents who indicated that ABPM was readily available, almost 1 in 5 respondents indicated that it was available in their practices (19.8%, 118 of 597).

DISCUSSION

It is encouraging that more and more family physicians in Canada are moving away from manual office BP measurement as the preferred method for screening, diagnosing, and treating their patients with hypertension. However, it is somewhat discouraging that more accurate methods of BP recording such as AOBP measurement, ABPM, and home BP monitoring are not used

Table 2. Demographic and practice characteristics of respondents

CHARACTERISTIC	N (%)
Male sex (N = 774)	322 (41.6)
Communication in English preferred (N = 774)	680 (87.9)
Age, y* (N = 774)	
• < 35	148 (19.1)
• 35–44	213 (27.5)
• 45–54	198 (25.6)
• 55–64	174 (22.5)
• ≥ 65	41 (5.3)
Population primarily served by your practice (N = 772)	
• Inner city	81 (10.5)
• Urban or suburban	408 (52.8)
• Small town	127 (16.5)
• Rural	117 (15.2)
• Geographically isolated or remote	24 (3.1)
• Other	15 (1.9)
Province of practice (N = 755)	
• British Columbia	137 (18.1)
• Alberta	123 (16.3)
• Saskatchewan	31 (4.1)
• Manitoba	29 (3.8)
• Ontario	275 (36.4)
• Quebec	86 (11.4)
• Newfoundland and Labrador	19 (2.5)
• Prince Edward Island	4 (0.5)
• Nova Scotia	23 (3.0)
• New Brunswick	23 (3.0)
• Yukon	1 (0.1)
• Northwest Territories	3 (0.4)
• Nunavut	1 (0.1)
Year of graduation from medical school† (N = 773)	
• Before 1980	73 (9.4)
• 1980–1989	150 (19.4)
• 1990–1999	191 (24.7)
• 2000–2009	183 (23.7)
• 2010 or later	176 (22.8)

*Mean (SD) age was 46.6 (11.6) years.
†Mean (SD) year of graduation was 1997 (12.7).

more frequently in routine clinical practice, especially when it comes to AOBP measurement for screening and ABPM and home BP monitoring for the diagnosis of hypertension. The ongoing management of hypertension seems to be relying on a variety of BP measurement techniques, with home monitoring, manual office BP measurement, and AOBP measurement being used by more than half of respondents. However, the different methods are not being used in accordance with the CHEP guidelines. For example, despite more than three-quarters of respondents indicating that ABPM was readily available for their patients, only 14.4% reported using ABPM for hypertension diagnosis, as recommended by CHEP.

Manual office BP recording with a calibrated sphygmomanometer can be very accurate if performed properly, but there is widespread concern about its accuracy in "real-life" clinical settings.[7,8] Because of poor measurement techniques that include both clinician and patient factors, such as the use of uncalibrated sphygmomanometers, zero-digit bias (ie, readings rounded off to the nearest zero), and patient-clinician interaction during readings such as talking, the resulting manual BP readings done in routine clinical practice are often imprecise and inconsistent.[9-14]

Because of these concerns surrounding the accuracy of manual office BP, some countries, notably the United Kingdom, went as far as to recommend that 24-hour ABPM should be the preferred method for diagnosing hypertension.[15] In Canada, CHEP offers evidence-based recommendations to standardize the measurement of BP in routine clinical practice. The group first recommended ABPM for diagnosis in 2005,[16] AOBP measurement for office BP assessment in 2011,[17] and AOBP measurement as the preferred method for BP assessment in the office in 2016.[18] Using AOBP measurement is preferable to conventional BP measurement in routine clinical practice because it is not subject to the white-coat effect, with readings having a statistically significantly stronger relationship to awake ambulatory and home BP measurements.

We were only able to identify 3 somewhat relevant surveys in the published literature. This is partly because AOBP measurement was introduced fairly recently and because none of the surveys explicitly asked about routine BP measurement for screening for, diagnosing, and managing hypertension. A 2002 mail survey of 25 606 physicians from Brazil (response rate 14.1%) asked about their practices and behaviour regarding BP measurement and the diagnosis of hypertension. That study reported that 67.8% of respondents used an aneroid device, 14.6% a mercury column device, and 1.8% an automated device.[19] A small 2013 study of 54 (response rate 51%) practising community family physicians from the Department of Family Medicine at St Joseph's Healthcare Hamilton in Ontario reported that BP measurement was a shared responsibility (physician, nurse, assistant) in 50% of the family practices. Blood pressure was measured manually in 63% of the offices, was measured using an automated device in 22%, and 15% used both.[20] Finally, a survey of Japanese physicians who attended educational seminars

Table 3. Measurement of BP to screen for, diagnose, and manage hypertension in family practice

BP MEASUREMENT METHOD	IN PATIENTS BEING SCREENED FOR HIGH BP WHAT IS THE ROUTINE METHOD USED TO MEASURE BP IN YOUR PRACTICE? N (%) (N = 769)	ONCE ROUTINE SCREENING SUGGESTS HYPERTENSION MIGHT BE PRESENT, WHAT IS THE USUAL METHOD FOR MEASURING BP IN YOUR PRACTICE TO MAKE A DIAGNOSIS? N (%) (N = 771)	IN PATIENTS TAKING ANTIHYPERTENSIVE TREATMENT (LIFESTYLE OR MEDICATIONS) WHAT ARE THE ROUTINE METHODS USED TO MEASURE BP IN YOUR PRACTICE? N (%)* (N = 769)
Manual BP measurement in the office with mercury or aneroid device	417 (54.2)	165 (21.4)	489 (63.6)
AOBP using BpTRU, Omron 907XL, or Microlife WatchBP Office (Welch Allyn ProBP 2400)	298 (38.8)	229 (29.7)	416 (54.1)
Other patient-activated electronic devices in the office	32 (4.2)	11 (1.4)	63 (8.2)
Pharmacy BP measurement or electronic BP kiosks	1 (0.1)	18 (2.3)	278 (36.2)
ABPM (24-h BP monitoring)	0 (0.0)	111 (14.4)	177 (23.0)
Home BP monitoring	0 (0.0)	173 (22.4)	528 (68.7)
Other methods or devices	21 (2.7)	64 (8.3)	20 (2.6)
In concordance with CHEP recommendations	331 (43.0)†	284 (36.8)‡	673 (87.5)§

ABPM—ambulatory blood pressure monitoring, AOBP—automated office blood pressure, BP—blood pressure, CHEP—Canadian Hypertension Education Program.

*Respondents were directed to select all options that applied.

†CHEP recommends AOBP measurement or other patient-activated electronic devices in the office, pharmacy BP measurement, or home BP measurement.

‡CHEP recommends ABPM or home BP measurement.

§CHEP recommends AOBP measurement or other patient-activated electronic devices in the office, pharmacy BP measurement, or home BP measurement.

on hypertension in 2004 to 2005 (n=2190, response rate 89.8%) and 2007 to 2008 (n=3416, response rate 87.7%) reported that by far most were using mercury (75.5% and 68.1% in the first and second groups, respectively) and aneroid (3.6% and 5.3%) sphygmomanometers to measure patients' casual clinic BP. Only 20.7% in the first group and 29.0% in the later group used automatic or electronic sphygmomanometers.[21]

The prevalence of hypertension in Canada, at approximately 20% of the adult population, has remained relatively unchanged during the past 30 years. During the same time period, Canada has made impressive advances and currently has the highest reported national rates of awareness, treatment, and control of high BP in the world.[22] This is owing to the success of CHEP in dissemination and implementation of hypertension recommendations, high uptake of these recommendations by family physicians, and Canadian leadership in developing, evaluating, and implementing new techniques to improve the accuracy of BP measurement, especially around 24-hour ABPM and AOBP measurement. Despite these advances, there is room for improvement. It is estimated that as many as 1 in 3 patients who have been diagnosed with hypertension have white-coat hypertension, and a similar number of people living with hypertension have masked hypertension.[23] The diagnosis and management of hypertension in Canada can be further improved if more accurate and valid techniques for BP measurement are widely implemented and used according to guideline recommendations. The relatively low use of ABPM for diagnosis of hypertension, despite its availability, can be partially accounted for by the costs and low reimbursement fees. The SPRINT trial results, if not accompanied by the widespread adoption of AOBP measurement in clinical practice, might increase the risk of adverse events if BP targets are based on manual office BP readings. In order to increase the use of AOBP measurement for hypertension screening, ABPM and home BP monitoring for making a diagnosis, and both AOBP measurement and home BP monitoring for ongoing management, it is imperative that financial barriers at the physician and patient levels be removed.

Limitations

Our response rate, while low, is consistent with similar online surveys.[24] There has been a steady downward trend in clinicians' response rates to surveys,[25] with some physicians going as far as adopting an office policy of not participating in surveys of any kind.[26] Although the respondents appear to be similar to the nonrespondents, the number of characteristics available for this comparison was very small. Therefore, it is possible that physicians who completed the survey were more interested, and perhaps more progressive as far as BP recording is concerned, and that might be skewing our results toward more accurate BP measurement alternatives.

As with most self-reported data, there is also a possibility of social desirability bias leading respondents to select options that are seen as more appropriate and that do not necessarily reflect actual practices. Further, the wording of "routine method of BP measurement" used in our questionnaire might have caused some confusion and perhaps "usual" or "primary" method of BP measurement would have been more appropriate.

Conclusion

Accurate measurement of BP is the cornerstone of appropriate diagnosis and treatment of hypertension. Blood pressure varies throughout the day and is subject to change depending on the psychological state of the patient, the location of the assessment, the clinician, and the method used for obtaining readings. Canadian family physicians continue to use suboptimal manual BP measurement to screen for hypertension and more than half use techniques for diagnosis that are not recommended by CHEP. More efforts are needed to encourage Canadian family physicians to increase the use of AOBP measurement for hypertension screening. Diagnosis of hypertension should be made using 24-hour ABPM, whenever feasible; otherwise home BP measurement should be performed according to the CHEP protocol. Failure to do so risks misclassifying a considerable number of patients as having hypertension when their BP is actually normal. Regardless of the technique used, it is essential that the recommended procedures for BP measurement be followed for screening, diagnosing, and managing patients with hypertension.

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Contributors
All authors participated in the concept and design of the study, analysis and interpretation of the data, and drafting and revising the manuscript and all approved the manuscript submitted.

Competing interests
None declared

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