Community health workers can be trained to measure blood pressure: experience from India

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Abstract

Hypertension afflicts an estimated one third of the adult population in Member countries of South-East Asia. Its effective control and treatment depends on a proper diagnosis, for which measurement of the blood pressure is a critical factor. However, a large number of those with hypertension go untreated as they are not diagnosed. To bring down the large diagnostic gap, it is imperative that we improve access to blood pressure measurement for the general population. One of the ways to do this is to empower community-based health workers (CHWs) to undertake this task. To test the feasibility and validity of using CHWs to measure blood pressure, we trained 169 CHWs to take blood pressure using digital devices. This training was a part of the noncommunicable disease (NCD) risk scoring that they were to carry out in the 200–250 households allocated to them. The workers were trained at four different urban and rural sites in and around Delhi, and consisted of accredited social health activists, peer educators and lay volunteers residing in these areas. The workers were supervised by a team of experienced supervisors using a standard observation checklist, which included the steps for blood pressure measurement as taught during the training. These supervisors also measured the blood pressure of the subjects themselves, taking care to follow all the steps. Assessment showed that asking the person to rest for 10 minutes before taking the measurement was the least followed step at three of the four sites; other steps were more scrupulously followed in more than 90% of the measurements observed. Comparison of the blood pressure readings between workers and supervisors showed that the workers consistently had a slightly higher reading (mean difference <4 mmHg). However, the correlation coefficient between their readings was consistently high (>0.8). Using 140/90 mmHg and 160/100 mmHg as cut-offs for grade I and grade II hypertension, respectively, the agreement ranged between 79% and 90%, and kappa coefficient was rated as moderate or good. Our results show that CHWs can contribute to NCD prevention and control by successfully undertaking blood pressure measurement as part of their job responsibilities. This skill would help them in fulfilling other routine tasks, such as blood pressure monitoring of antenatal women.

Introduction

Hypertension is the leading cause of mortality in the world.[1] An estimated one third of the adult population in Member countries of South-East Asia suffers from hypertension.[2] Its effective control and treatment depends on a proper diagnosis, for which measurement of the blood pressure (BP) is a critical step. However, data show that there is a big diagnostic gap in these countries.[2] If this gap is to be bridged, it is important that we improve access to BP measurement for the general population.

One of the ways that access to health services has been improved in many areas, such as infectious diseases and reproductive health, is to empower community-based health workers

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(CHWs) to undertake some tasks. In the area of noncommunicable diseases (NCDs), the ability of CHWs to undertake these tasks has not been properly evaluated, except perhaps for the diagnosis of cervical cancer by visual inspection by grass-roots workers.[3] BP measurement is one of the tasks that could be considered for inclusion in the job responsibilities of CHWs. In many countries, auxiliary nurse midwives (ANMs) measure the BP as a part of the antenatal care package they provide. Thus, the concept of an allied health professional measuring BP is well established and one could consider delegating this task to CHWs, though their level of competence is lower than that of ANMs.

Previously, proper measurement of BP was considered a highly technical and difficult task, as it involved auscultation with a stethoscope. It also invited resistance from the medical fraternity. However, with improvement in technology and the availability of digital BP devices, it is now possible to consider delegating this job to CHWs. However, before actually recommending this, it is important to implement this strategy and evaluate their performance in a controlled setting. We undertook this exercise as a part of the research to address NCDs in India by strengthening primary health care. The study was funded by the Indian Council of Medical Research.

Methods

The study was conducted at four sites in the National Capital Region of Delhi. The four sites were rural and urban Ballabgarh (by the All India Institute of Medical Sciences), urban Delhi in Nandnagari (by St Stephen's Hospital) and slums of Sangam Vihar (by the Association for Health Environment and Development). A total of 169 CHWs were trained across these four sites. In rural Ballabgarh and Nandnagari, we worked with accreditated social health activists (ASHAs), who are part of the cadres of the National Urban and Rural Health Missions. In the other sites, the trainees were mainly volunteers. In Sangam Vihar, the volunteers were peer educators who had earlier been involved in HIV/AIDS counselling.

Their training on NCDs was comprehensive and included different tasks such as assessment of risk, assessment and interventions at the community level, and referring suspected disease cases and bringing them to the health facility. The workers were trained for two days in batches of about 20 each. BP measurement was part of the risk assessment module and was taught on day one of the training. The workers were first told the steps of BP measurement and why each of the steps was important. Next, measurement of BP was demonstrated to them more than once. Then the workers were paired and asked to take each others' BP readings twice. Their technique of BP measurement was closely observed and they were corrected by the trainers if they went wrong. On day two of the training, the BP measurement exercise was repeated, this time in groups of four workers. This was done to familiarize them with the element of variability among subjects. Next, some steps of BP measurement were deliberately demonstrated incorrectly and the workers were asked to identify where the trainers were making mistakes.

The project was cleared by the Institute's Ethics Committee. Once the training was over, they were asked to work in the houses assigned to them (200–250 houses per worker). Supervisors who visited them had considerable experience in risk assessment and measurement, and had earlier been involved in the NCD risk factor surveys. They used a checklist to observe these workers and identified how many of the steps told during the training were being followed by the workers. The results are expressed as mode (most frequently reported observation). The supervisors also measured the BP of the subject themselves, taking care to follow all the steps correctly and compared their measurement with that of trained research workers using a correlation coefficient and the standard definition of grade I hypertension (systolic BP $\geq$140 mmHg or diastolic BP $\geq$90

mmHg) and grade II hypertension (systolic BP $\geq$160 mmHg or diastolic BP $\geq$100 mmHg).[4] We tested for significance of agreement using the kappa coefficient.

Results

The background characteristics of the workers are given in Table 1. In rural Ballabgarh, all the CHWs were women, most of them were married and only about a quarter of them were educated till class 12 or more. In the three other areas, about a quarter of CHWs were men and less than 50% were married. In urban Delhi, among the peer educators, youth volunteers/ASHAs, about 40% were educated till class 12 or beyond; this figure was much higher for volunteers in urban Ballabgarh (70%). The annual family income of the CHWs across the four sites was comparable, with only about 25% of workers reporting family incomes beyond INR 125 000 per annum.

***Table 1.** Background characteristics of the community health workers*[a]

	Rural Ballabgarh (*N*=70)	Urban Ballabgarh (*N*=40)	Sangam Vihar (*N*=29)	Nandnagari (*N*=30)
Men	0	25.0	17.2	30.0
Married	92.9	40.0	48.3	40.0
Education $\geq$12th grade	21.4	70.0	37.9	40.0
Self-income >INR 60 000 / year	1.6	6.8	16.0	18.1
Family income >INR 125 000/ year	22.9	24.9	20.0	27.3

[a] All values are percentages.

The workers were assessed on how closely they followed the five steps to measure the BP. Asking the person to rest for 10 minutes before taking the measurement was the least followed step at three of the four sites (except Nandnagari, where it was placing the hand on a table). Other steps were more scrupulously followed in more than 90% of the measurements observed (Table 2).

***Table 2.** Compliance of community health workers with the steps involved in measurement of blood pressure*

Steps in the measurement of blood pressure Number of observations	Rural Ballabgarh (*N*=316)	Urban Ballabgarh (*N*=94)	Sangam Vihar (*N*=86)	Nandnagari (*N*=122)
Participant asked to sit quietly and rest for 10 min	54.7%	63.8%	50%	86.1%
Right arm of the participant placed on arm of chair/flat surface (to support it)	87.0%	96.8%	89.5%	64.7%
Clothing on arm removed/rolled up	98.4%	98.9%	93.0%	89.3%
Cuff positioned 2–3 fingers above elbow	98.7%	95.7%	98.8%	92.6%
Level of cuff same as that of heart	96.8%	93.6%	94.1%	94.2%
Overall number of correct steps followed out of five (mode)	4	5	5	5

Table 3 depicts the mean systolic and diastolic values obtained by the CHWs and the supervisors observing them. The workers consistently recorded a slightly higher reading than that of the supervisors. However, on an average, the difference was less than 4 mmHg. The correlation between readings was consistently high (Pearson correlation coefficient >0.8). In risk assessments, BP values are taken as high or low based on cut-offs. Using 140/90 mmHg and 160/100 mmHg as cut-offs (for hypertension grades I and II), the agreement ranged between 79% and 90%, and the kappa coefficient was rated as moderate or good.

Discussion

Our study shows that CHWs can be trained to measure BP at participants' homes using digital devices. Their measurements were not too different from those recorded by trained research staff.

Our results are in agreement with those of previous studies. A study by Adams et al. among unpaid volunteers in a population-based survey showed that those who do not necessarily have a health professional background are able to take the BP and anthropometric measurements accurately and reliably in a population health survey, provided they receive adequate training and support.[5] Reidpath et al. conducted a validation study on BP measurement by CHWs using digital BP measurement devices, as in our study. BP readings by non-health workers were more reliable than those taken by qualified health workers. There was no significant difference between the readings taken by qualified health workers and those taken by non-health workers for systolic BP. Measurements by non-health workers were, on average, 5–7 mmHg lower than those of qualified health workers.[6]

Table 3. *Agreement of blood pressure values between community health workers (CHWs) and trained research workers*

No. of observations	Rural Ballabgarh (*N*=316)	Urban Ballabgarh (*N*=94)	Sangam Vihar (*N*=86)	Nandnagari (*N*=122)
Mean systolic blood pressure (in mmHg)				
As measured by CHW	129.39±14.44	131.83±18.29	127.89±22.26	125.81±12.62
As measured by supervisor	126.04±13.90	130.51±20.18	124.52±23.33	124.83±11.41
Mean difference	–3.35±4.71	–1.32±11.38	–3.37±11.63	–0.97±3.26
Pearson correlation	0.945	0.831	0.871	0.969
Mean diastolic blood pressure (in mmHg)				
As measured by CHW	81.09±8.04	81.14±12.03	78.54±12.93	74.93±9.58
As measured by supervisor	79.25±8.74	80.13±12.02	77.83±13.06	77.84±13.06
Mean difference	–1.84±3.94	–1.00±6.41	–0.70±6.46	–0.89±5.65
Pearson correlation	0.899	0.857	0.877	0.810
Classification of blood pressure status[a]				
Overall agreement (kappa)	88.8% (0.346)	78.7% (0.472)	89.4% (0.636)	85.5% (0.646)

[a] Grade I hypertension (systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥90 mmHg) and grade II hypertension (systolic blood pressure ≥160 mmHg or diastolic blood pressure ≥100 mmHg)

In another study, which used a sphygmomanometer and stethoscope for measurement of BP, 172 health-care workers were divided into four groups (63 general practitioners, 25 clinical and 25 surgical specialists, and 59 nurses) and evaluated in a two-part test. In the first part (practical), the

examinee had to follow all the steps recommended by the American Heart Association to get a passing score. In the second part (theoretical, which came next to avoid influencing the practical), the examinee had to answer correctly 7 of 10 questions based on the American Heart Association's guidelines to obtain a passing score. The highest accepted variation in systolic and diastolic pressures between examinee and observer was ±4 mmHg. None of the examinees followed the American Heart Association's recommendations. Sixty-three per cent of systolic and 53% of diastolic readings were out of range. All of the groups were notably inaccurate in the practical test. Only 3% of the general practitioners and 2% of the nurses obtained reliable results. The clinical specialists obtained the best results in the theoretical test compared with the other groups with 60% correct answers, while the nurses had the lowest results, with only 10% correct answers.[7]

A study from Spain found that, of 25 lay persons trained as observers, 14 were comparable to professionals in terms of both the estimated validity of the BP measurement and estimated interobserver variability (100% of the observers complied with the criteria recommended for professional health-care workers), even though the training given to the former was in no way more comprehensive than or distinct from that recommended for professional health-care workers in community studies.[8]

The strengths of our study were the large number of volunteers, the diverse background of the CHWs and the large number of times they were observed by the supervisors. The weakness was the use of trained and experienced research workers as a gold standard. However, as seen by other studies, doctors are not necessarily the best gold standards. The fact that the supervisors measured the BP after the workers could have resulted in their obtaining lower BP values, as the second reading is often lower than the first. It must be noted that a single measurement of high BP by these workers is not sufficient for initiation of treatment, and serves only as a screening tool. Such patients are referred to a primary health-care clinic for further management by qualified doctors. These workers can be subsequently used to follow up these patients for monitoring their compliance with treatment as well as their BP levels.

Before this exercise is recommended as a standard practice, other non-technical issues need to be addressed. This would include the total workload of CHWs, incentives and other similar issues. The feedback from the CHWs was that they felt more appreciated by the community by providing this service, which was a felt need of the community. In addition, if this practice is introduced, it will result in a large number of new patients being identified for lifelong treatment. Therefore, CHWs can be recommended for undertaking this responsibility only after health systems are strengthened to be able to take on the load of these patients, both clinically and in terms of drug availability.

Given the large diagnostic gap that exists for hypertension in developing countries and the fatal consequences of untreated hypertension, it is imperative that countries strengthen their primary health-care systems to address this issue. While opportunistic screening should be initiated at the earliest among patients attending health facilities, outreach services would also be required to ensure high coverage. With the availability of digital devices, measuring the BP has become more feasible. Our results call for inclusion of BP measurement as one of the job responsibilities of CHWs for NCD prevention and control. In addition, other strategies to prevent hypertension such as population-level salt reduction must be urgently considered.

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