

## Brief Original Contribution

# One-Year Routine Opportunistic Screening for Hypertension in Formal Medical Settings and Potential Improvements in Hypertension Awareness Among Older Persons in Developing Countries: Evidence From the Study on Global Ageing and Adult Health (SAGE)

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Hypertension is a leading risk factor in the global disease burden. Limited hypertension awareness is a major determinant of widespread gaps in hypertension treatment and control, especially in developing countries. We analyzed data on persons aged 50 years or older from 6 low- and middle-income countries participating in the first wave (2007–2010) of the World Health Organization's Survey of Global Ageing and Adult Health (SAGE). Our estimates suggest that just 1 year of routine opportunistic hypertension screening during formal visits to medical-care providers could yield significant increases in hypertension awareness among seniors in the developing world. We also show that eliminating missed opportunities for hypertension screening in medical settings would not necessarily exacerbate existing socioeconomic differences in hypertension awareness, despite requiring at least occasional contact with a formal health-care provider for obtaining a hypertension diagnosis. Thus, routine opportunistic screening for hypertension in formal medical settings may provide a simple but reliable way to increase hypertension awareness. Moreover, the proposed approach has the added advantage of leveraging existing resources and infrastructures, as well as facilitating a direct transition from the point of diagnosis to subsequent expert counseling and clinical care for newly identified hypertension patients.

chronic disease; developing countries; health awareness; health-care quality; health education; hypertension; screening

Abbreviations: SAGE, Study on Global Ageing and Adult Health; WHO, World Health Organization.

Hypertension is one of the leading risk factors in the global burden of disease, with the majority of hypertensive persons living in the developing world (1, 2). There are numerous easy-to-use and low-cost diagnostic devices for detecting hypertension (3–5), as well as safe and effective low-cost treatments for cost-effective hypertension management (1, 6–8), even in low-resource settings; yet many persons with raised blood pressure in developing countries are unaware of their condition. Such unawareness constitutes a major barrier to hypertension treatment and control and puts these persons at increased risk for cardiovascular disease and death (9–14).

While there appears to be no well-accepted agreement on how to best increase hypertension awareness in a simple but

reliable way, previous studies have suggested that a lack of routine blood pressure checking during formal health-care visits may be an important reason for the often low levels of hypertension awareness in the developing world (2, 15). Public health agencies in many developed countries recommend routine opportunistic screening for hypertension during regular health-care visits (16–18), often achieving relatively high rates of diagnosis and treatment as a result (19–21). By contrast, routine opportunistic hypertension screening during health-care visits is much less common in developing countries, where levels of hypertension awareness, treatment, and control are typically much lower. At the same time, the potential of routine opportunistic screening for increasing

hypertension awareness in developing-country settings seems largely unknown (22).

In this study, we quantified the potential impact of 1-year routine opportunistic hypertension screening in formal medical settings in increasing hypertension awareness among persons aged 50 years or older from 6 developing countries. We explored the potential impact of a simple but reliable short-term supply-side health-system intervention on rates of hypertension diagnosis among older persons, who are at increased risk of hypertension compared with younger adults. In addition, we also studied the likely impact of such a potential screening program on sociodemographic differences in hypertension awareness and assessed its likely implications for sociodemographic inequalities in access to hypertension diagnosis.

## METHODS

We analyzed data on persons aged 50 years or older from the first wave (2007–2010) of the World Health Organization's (WHO) Study on Global Ageing and Adult Health (SAGE). SAGE collects nationally representative data from 6 low- and middle-income countries (China, India, Ghana, Mexico, Russia, and South Africa) with a particular focus on persons aged 50 years or older. SAGE employs multistage clustered sampling, stratified by region and location. To account for the effects of sample selection and stratification, SAGE includes individual-level survey weights, which were computed using recent population estimates from national statistical offices. SAGE was approved by WHO's Ethical Review Committee and local institutional review boards at each study site. Country-specific response rates in the first wave of SAGE ranged from 53% in Mexico to 93% in China.

The goal of SAGE is to provide comparable longitudinal data on aging from different geographic regions in the developing world. To this end, SAGE collects comprehensive individual- and household-level information on respondents' sociodemographic characteristics, health (including anthropometric factors, performance tests, and biomarkers), use of health-care services, social networks, and well-being. SAGE thus responds to the increasing demand for local data with which to monitor and study aging in the developing world, including the challenges of increasing chronic disease burdens. A more detailed description of SAGE can be obtained from WHO and the published literature (23–26).

During the SAGE wave 1 interview, 3 blood pressure measurements were obtained by trained interviewers using a Boso Medistar Wrist Blood Pressure Monitor (model S; Bosch and Sohn GmbH & Company KG, Jungingen, Germany) on the left-hand wrist (24). Similar wrist blood pressure measurement devices have been validated in the literature and found to be reliable as long as the measurement device is positioned at heart level (11, 12, 27). Measurements were taken in a seated position. Respondents were asked to relax, to not cross their legs, and to maintain their arm level with the heart. The 3 measurements were taken at least 1 minute apart (12, 24). If study participants without self-reported hypertension diagnoses had elevated blood pressure measurements during the survey, the study protocol instructed the interview team to recommend a follow-up visit with the participant's normal health-care provider (e-mail correspondence with the SAGE

team). Observations with fewer than 2 recorded blood pressure measurements were discarded from our sample.

We classified respondents as having hypertension if they reported ever having been diagnosed with high blood pressure (hypertension) or if the mean of the last 2 systolic or diastolic blood pressure measurements was greater than or equal to 140 mm Hg or 90 mm Hg, respectively. Respondents were considered to be unaware of their hypertension if 1) they did not report ever having been diagnosed with high blood pressure (hypertension) but 2) were classified as having hypertension based on the survey's own blood pressure measurements. We considered respondents with hypertension to be treated if they reported having received any medications or other treatment for hypertension (including weight loss or dietary change programs) during the last 12 months. Finally, respondents with hypertension were classified as having achieved blood pressure control if they were 1) classified as hypertensive but 2) had mean systolic or diastolic blood pressure measurements less than 140 mm Hg or 90 mm Hg, respectively.

Respondents were classified as having had recent contact with a formal health-care provider if they reported having made at least 1 visit to a physician, nurse, or hospital during the last 12 months. Missed opportunities for hypertension diagnosis were defined as the proportion of hypertensive persons who had had any contact with a formal health-care provider during the last 12 months but were nonetheless unaware of their hypertension. Potential awareness of hypertension was defined as the sum of actual awareness and missed opportunities.

After deleting observations with missing information on any item used in the analysis, we obtained a final analytical sample of 26,675 individuals. Country-specific sample sizes ranged from 1,649 (Mexico) to 9,857 (China). Web Table 1 (available at <http://aje.oxfordjournals.org/>) presents country-specific sample mean values for selected respondent characteristics.

We employed proportion estimation with survey weights using STATA 12 SE software (StataCorp LP, College Station, Texas) to compute rates of hypertension prevalence, awareness, treatment, and control, as well as missed opportunities for hypertension diagnosis and potential awareness. We also fitted multivariable logit models for actual and potential awareness among respondents with hypertension to assess sociodemographic differences in these outcomes. The explanatory variables for these multivariable models comprised respondents' age, sex, level of urbanicity, education (country-specific tertiles), and permanent household income (country-specific tertiles), as well as health insurance status.

## RESULTS

The prevalence of hypertension ranged from 38.2% in India to 79.3% in South Africa (Table 1). Hypertension awareness among persons with raised blood pressure ranged from 25.1% in Ghana to 76.0% in Russia and was between 40% and 50% in China, India, Mexico, and South Africa. Treatment rates among persons with hypertension ranged from 21.4% in Ghana to 72.2% in Russia. Estimated rates of hypertension control ranged from 5.7% in Ghana to 27.6% in India.

Rates of hypertension treatment and control were considerably higher among persons who were aware of their condition than among those reporting no previous diagnosis.

**Table 1.** Rates of Hypertension Prevalence, Awareness, Treatment, and Control, as Well as Missed Opportunities for Hypertension Diagnosis and Potential Awareness, Among Adults Aged 50 Years or Older ( $n = 26,675$ ), Study on Global Ageing and Adult Health, 2007–2010<sup>a</sup>

Outcome	Country											
	China ( $n = 9,857$ )		Ghana ( $n = 3,883$ )		India ( $n = 5,683$ )		Mexico ( $n = 1,649$ )		Russia ( $n = 3,041$ )		South Africa ( $n = 2,562$ )	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Hypertension prevalence <sup>b</sup>	61.0	58.2, 63.9	59.1	56.6, 61.7	38.2	36.0, 40.4	62.5	55.1, 69.8	74.3	69.8, 78.8	79.3	76.5, 82.2
Hypertension awareness <sup>c</sup>	47.0	42.5, 51.4	25.1	22.1, 28.0	49.1	45.1, 53.0	48.7	40.1, 57.2	76.0	70.2, 81.8	42.0	37.6, 46.5
Treatment among all persons with hypertension <sup>d</sup>	40.4	35.7, 45.1	21.4	18.6, 24.3	37.3	34.2, 40.4	38.4	29.9, 46.8	72.2	66.2, 78.3	38.2	33.9, 42.4
Control among all persons with hypertension <sup>e</sup>	10.6	8.1, 13.1	5.7	4.4, 7.2	27.6	24.3, 30.8	15.6	10.2, 20.9	14.8	11.4, 18.1	8.9	6.8, 11.1
Treatment among persons with hypertension awareness <sup>f</sup>	86.4	83.6, 89.1	85.4	82.1, 88.6	76.1	71.8, 80.3	78.9	69.2, 88.5	95.1	93.5, 96.7	91.3	87.6, 95.0
Control among persons with hypertension awareness <sup>g</sup>	22.6	18.4, 26.8	22.9	18.6, 27.2	56.2	51.2, 61.2	32.0	22.4, 41.6	19.4	15.0, 23.8	21.3	16.8, 25.8
Missed opportunities for hypertension diagnosis <sup>h</sup>	26.4	23.2, 29.7	37.0	34.1, 39.9	32.6	29.0, 36.3	17.6	11.8, 23.5	11.8	8.7, 15.0	31.1	27.1, 35.0
Potential awareness if missed opportunities were eliminated <sup>i</sup>	73.4	69.5, 77.3	62.1	58.9, 65.3	81.7	78.6, 84.8	66.3	55.6, 77.0	87.8	84.1, 91.5	73.1	69.2, 76.9

Abbreviations: BP, blood pressure; CI, confidence interval; SAGE, Study on Global Ageing and Adult Health.

<sup>a</sup> All estimations employed survey weights provided by the SAGE investigators.

<sup>b</sup> Percentage of persons in the total population who reported a hypertension diagnosis, reported having received hypertension treatment in the last 12 months, or had elevated mean BP measurements (mean systolic BP  $\geq 140$  mm Hg or mean diastolic BP  $\geq 90$  mm Hg) at the time of the survey.

<sup>c</sup> Percentage of persons who reported a hypertension diagnosis among all persons classified as having hypertension.

<sup>d</sup> Percentage of persons who reported having received treatment for hypertension in the past 12 months among all persons classified as having hypertension.

<sup>e</sup> Percentage of persons with no elevated mean BP measurement among all persons classified as having hypertension.

<sup>f</sup> Percentage of persons who reported having received treatment for hypertension in the past 12 months among all persons who reported a hypertension diagnosis.

<sup>g</sup> Percentage of persons with no elevated mean BP measurement among all persons who reported a hypertension diagnosis.

<sup>h</sup> Percentage of persons with no self-reported hypertension diagnosis who had had contact with a formal health-care provider during the last 12 months among all persons classified as having hypertension.

<sup>i</sup> Actual awareness + missed opportunities for diagnosis.

Hypertension treatment rates among persons who reported a previous diagnosis of hypertension ranged from 76.1% in India to 95.1% in Russia, while their hypertension control rates ranged from 19.4% in Russia to 56.2% in India. Corresponding treatment and control rates for persons who were unaware of their condition were zero by definition.

Reflecting a large number of missed opportunities for hypertension diagnosis, Table 1 also highlights that 1-year routine opportunistic screening for hypertension during all formal medical encounters could have increased hypertension awareness among all persons with hypertension by a number of percentage points, ranging from 11.8 percentage points in Russia to 37.0 percentage points in Ghana. Thus, 1-year routine opportunistic screening for hypertension during all formal health-care visits could have produced substantial increases in hypertension awareness, with potential rates of hypertension awareness between 62.1% (Ghana) and 87.8% (Russia).

Web Table 2 shows adjusted odds ratios from country-specific multivariable logit models for actual and potential hypertension awareness among respondents with elevated blood pressure. These estimates quantify existing sociodemographic differences in hypertension awareness and gauge the

potential impact of eliminating missed opportunities for diagnosis on these sociodemographic differences in awareness. Holding other characteristics fixed, actual hypertension awareness was generally higher among older persons, women, persons from urban areas, and persons with higher education, higher income, and health insurance. Potential awareness generally showed similar sociodemographic patterns as actual awareness. A within-country comparison of the relative sizes of the estimated odds ratios for actual and potential awareness showed a largely mixed pattern across sociodemographic characteristics and countries. On the one hand, routine health care–based hypertension screening seems to reduce the female–male and urban–rural differences in hypertension awareness. However, it may also occasionally exacerbate income- and insurance-related socioeconomic differences in hypertension awareness in some countries.

## DISCUSSION

Several studies have demonstrated sizable gaps in hypertension awareness, treatment, and control across different health systems in both developed and developing countries

(28), including the SAGE countries (11, 12). While these studies identified low levels of awareness as a key barrier to comprehensive hypertension treatment and control, they often offered only limited guidance on how to increase hypertension awareness in a simple yet reliable way.

Our estimates show that just 1 year of routine opportunistic hypertension screening during formal visits to health-care providers could lead to significant increases in hypertension awareness among older persons from various low- and middle-income countries. Our estimates further suggest that such a health care-based strategy may not necessarily exacerbate existing sociodemographic differences in hypertension awareness, despite relying on access to formal health care for obtaining a new diagnosis. This perhaps surprising finding may stem from the higher rates of undiagnosed hypertension among lower sociodemographic groups. Specifically, the combination of higher rates of undiagnosed hypertension and lower access to formal health care among lower sociodemographic groups appears to result in comparable yields of new diagnoses from opportunistic health care-based hypertension screening programs and therefore does not seem to exacerbate socioeconomic differences in hypertension awareness. Nonetheless, maximizing overall hypertension awareness and alleviating sociodemographic differences in hypertension diagnosis would require considerable extra effort to reach underserved populations without access to health care. While improving the quality of screening within the existing health systems appears relatively efficient and more easily achievable in the short run, the potential impact of opportunistic screening on improving general hypertension awareness in an equitable way will be highest if access to health care is expanded to underserved groups. Generally, our findings provide further support for recent efforts to expand health care-based routine opportunistic hypertension screening in low- and middle-income settings, including some SAGE countries (29–35).

Our study had several limitations. First, we used respondents' self-reports and interviewer-based blood pressure measurements from wrist monitors during a single interview, which may have resulted in misclassification and bias due to potential measurement inaccuracies. Second, our study considered (among others) the hypothetical outcome of potential hypertension awareness if all missed opportunities for hypertension diagnoses during 1 year were eliminated—a measure which provides an important conceptual benchmark but may not always be feasible in practice. Third, our research does not provide any evidence on the cost-effectiveness of the proposed health care-based screening approach, especially in the face of potentially important competing health system pressures in low-resource settings. Fourth, our study only demonstrates a potentially large yield for routine opportunistic hypertension screening in medical settings; it does not provide evidence on the screening intervals that would be optimal if routine screening during all medical encounters were infeasible. Finally, increased hypertension screening may lead to major improvements in population health risk only if increased awareness leads to effective hypertension treatment and control, which is often not the case.

Despite being less comprehensive than organized population-based hypertension screening, routine opportunistic screening for hypertension in formal medical settings can significantly

increase hypertension awareness in low- and middle-income countries. Moreover, routine opportunistic hypertension screening in formal medical settings may be easier to implement and more reliable than other screening programs that cannot leverage the existing infrastructures and human resources of formal medical settings (2, 15). Improved diagnosis of hypertension in medical settings would also allow for a relatively straightforward transition from hypertension diagnosis to subsequent clinical care (2, 15). As a result, this strategy might produce substantial improvements in hypertension treatment and control, as well as large reductions in mortality, at a relatively moderate cost (36).

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