Research Article

Universal Coverage of Hypertension Treatment Services in Malaysia Is Still an Elusive Goal

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Abstract—An analysis of population coverage of hypertension treatment services can be used to make inferences about the performance of primary care services within health systems. Malaysia, an upper middle-income country, has a well-established primary care system but one that favors rural populations and provision of services for maternal and child health and infectious diseases. Demographic factors including rapid aging, urbanization, as well as lifestyle changes characteristic of a modernizing society have led to an increase in noncommunicable diseases, including hypertension. In this article, we used data from a nationally representative household health survey to develop service coverage indicators for hypertension screening and treatment services. The age-standardized prevalence of hypertension was estimated to be 33.9% (95% confidence interval [CI], 33.9, 33.9). Only 39.0% (95% CI, 37.5, 40.6) of adults with hypertension had been diagnosed by a medical practitioner, 35.7% had been on treatment, and 9.6% had blood pressure controlled under treatment. The diagnosis, treatment, and controlled treatment coverage were higher for older persons compared to younger persons. There were no differences in the diagnosis and treatment coverage between urban and rural areas and between ethnic groups. However, controlled treatment coverage was higher among Chinese and those living in urban areas. Our findings suggest that primary care services in Malaysia may need to intensify health education activities to promote screening services. There is also a need to reprioritize activities to provide regular community health screening of adults and increase access to affordable primary care services, especially in the urban areas.

INTRODUCTION

Hypertension has been identified as the risk factor with the highest contribution to global disease burden in 2010.¹ If left
untreated or if poorly controlled, persons with hypertension are at higher risk of a myriad of life threatening conditions, including ischemic heart disease and stroke, both of which are among the leading causes of premature mortality globally. The global number of people with uncontrolled hypertension increased between 1980 and 2010, due not just to a combination of population growth and aging but also to lifestyle factors and inadequate treatment. However, detection and clinical management of hypertension are not reliant on expensive technology and can usually be carried out at the primary care level. Assessing population coverage of hypertension treatment services can therefore help to make inferences about the performance of primary care services within health systems. This is especially so if an element of treatment quality can be incorporated into the process. The World Health Organization has recommended the inclusion of hypertension treatment success as an indicator to monitor universal health coverage (UHC) for essential health services, and similar measures have been used to guide health system reforms in countries such as China and Mexico.

Malaysia is an upper middle-income country located in the Asia Pacific region. The country is a federation made up of 13 states and three federal territories, located on the Malay Peninsula as well as the Island of Borneo. In 2010, Malaysia was home to 28 million people from different ethnic and cultural backgrounds. The main ethnic groups were Malays (50.1% of the population), Chinese (22.6%), orang asli or indigenous tribes (11.8%), and Indians (6.7%). Economic development over the past few decades has enabled the country to make good progress toward UHC, although evidence for this has been piecemeal. The country has yet to develop a comprehensive and consistently applied UHC monitoring framework beyond recording coverage indicators for certain tracer conditions, such as primary childhood vaccinations and deliveries by skilled birth attendants. Tracer indicators have focused attention on these services and have historically been used as markers for progress but may no longer be adequate because they do not target medical conditions of increasing disease burden in the country or provide indications of service quality. Moreover, in Malaysia, where the distribution of health status and health care use may favor more well-off groups, coverage indicators incorporating service quality are needed to understand health disparities across geographical areas or sub-populations defined by socioeconomic status or ethnic backgrounds.

In tandem with economic development, Malaysian society has been gradually aging. By 2010, the proportion of the country’s population aged 65 years and above had risen to 5.0%, from 3.5% in 1980, and is projected to increase to 14.5% in 2040. Malaysian society has also been undergoing lifestyle changes related to a shift from a more traditional agricultural-based society to greater urbanization. Both factors have contributed to an increasing health burden from noncommunicable diseases (NCDs) such as hypertension and diabetes. It has been estimated that nearly one in three adults aged 18 years and above had hypertension: 32.2% (95% confidence interval [CI], 31.6, 32.8) in 2006, 32.7% (95% CI, 31.6, 33.7) in 2011, and 30.3% (95% CI, 29.3, 31.2) in 2015. The prevalence of diabetes among those in the same age group increased from 11.5% (95% CI, 11.2, 12.0) in 2006 to 15.2% (95% CI, 14.3, 16.1) in 2011 and 17.5% (95% CI, 16.6, 18.3) in 2015.

Health care in Malaysia is provided by a mixed system of public and private providers, and screening and treatment for hypertension and diabetes are carried out in both sectors, especially by primary care providers. The public sector primary care delivery model found in the country can trace its roots to the rural health services of the 1960s, which the government gradually built up after the country’s independence from British rule in 1957. This system provided care to the rural population via a series of clinics of increasing complexity, from small community clinics to large health centers providing comprehensive primary care services. Private primary care providers, usually working in single-doctor clinics, worked outside of this system, mainly in urban areas, but nonetheless complemented the public system by providing services to those who could afford their higher fees. This rural–urban provider distribution still exists today, with the provision of primary care services in rural areas dominated by public-sector facilities and private primary care providers being more prominent in urban areas. With its wide network of providers, public primary care services serve as a foundation for UHC in the country today. However, there is now a need to reorient their services from maternal and child health services (MCH) and management of infectious diseases, which were the health needs of rural communities in the early years, to NCDs, which are a major health concern in the country today.

In this article, we demonstrate how data from a nationally representative household health survey can be used to develop service coverage indicators for hypertension screening and treatment services. Using these indicators, we also examine coverage disparities by urban or rural residence and ethnic and income groupings. Such information can inform policy debates on needed health system reforms not just in Malaysia but also in other countries with similar well-established primary care systems in need of reorientation to cater to the health demands of an aging society.
MATERIALS AND METHODS

Data Sources
We used data from the 2011 National Health and Morbidity Survey (NHMS), a nationwide household health survey conducted by Malaysia’s Ministry of Health (MoH) in 2011.20 Multiple rounds of the (cross-sectional) NHMS have been carried out since 1986, and the latest publicly available data come from the 2011 round of the survey. The primary purpose of these surveys is to obtain information on health status, risk factors, and health-seeking behaviors of the Malaysian population. The 2011 NHMS used a stratified two-stage sampling design with two levels of stratification to create a representative sample of rural and urban populations for each state. The survey included 28,498 individuals, but we analyzed data from the 17,446 individuals who were aged 20 years and above for this study. The 2011 NHMS collected information that permitted an examination of the respondents’ awareness of a diagnosis of hypertension and their treatment status. The survey also collected data on the type of health facility where the respondent usually sought treatment. As part of the NHMS, each respondent had two electronic readings of systolic (SBP) and diastolic blood pressures (DBP) taken 15 minutes apart. The average of these readings was used to help determine whether respondents who did not have a prior diagnosis of hypertension had the condition and, if they were known hypertensives, whether their condition had been controlled by medication. Respondents were classified as persons with hypertension if they had been told by a medical practitioner that they had hypertension, reported that they were receiving medication for hypertension, their SBP was 140 mmHg or higher, or their DBP was 90 mmHg or higher. The 2011 NHMS also examined whether respondents had diabetes mellitus and collected a single capillary blood glucose reading. Respondents were classified as persons with diabetes if they were told by a medical practitioner that they had diabetes, reported that they were receiving medication for diabetes, their fasting capillary blood glucose reading was 6.1 mmol/L or more, or their nonfasting blood glucose reading was more than 11.1 mmol/L.

Coverage Indicators
Diagnosis coverage for hypertension was estimated as the proportion of persons with hypertension who reported having been told by a medical practitioner that they had hypertension or who reported that they were receiving medication for hypertension. Treatment coverage was estimated as the proportion of persons with hypertension who reported receiving medication for hypertension.

The primary objective in the treatment of persons with hypertension is to reduce their blood pressure to lower cardiovascular mortality and morbidity. Several clinical trials have shown that the lower blood pressure levels are, regardless of baseline blood pressure, the higher the protection against adverse cardiovascular outcomes.21 However, the question of whether there exists a DBP threshold below which risks of adverse events increases (the blood pressure J-curve) has yet to be conclusively answered.22,23 In general practice, medical practitioners provide treatment with an aim to reduce blood pressures below target blood pressure levels. These targets vary according to the patient’s cardiovascular risk factors and have changed over time in line with available evidence advocating higher or lower blood pressures for persons with different cardiovascular risk factors.24 At the time of the 2011 NHMS, the Malaysian clinical practice guideline (CPG) for management of hypertension advised that blood pressure be brought down below 140/90 mmHg for the general population and 130/80 mmHg for those with concomitant diabetes.25 Thus, in this analysis, controlled treatment coverage for hypertension was estimated as the proportion of persons with hypertension who reported receiving medication and whose blood pressure readings were below 130/80 mmHg for those with diabetes and 140/90 mmHg for those without. Throughout, prevalence estimates by urban/rural and ethnic sub-populations were age standardized to the Malaysian population in 2010, because the country’s latest population census was carried out that year.7

Statistical Analysis
We used concentration curves and concentration indices to assess income disparities of persons with hypertension who were diagnosed, treated, or having controlled blood pressure under treatment.26 Concentration curves plot the cumulative proportion of persons with diagnosed or treated hypertension on the y-axis against cumulative proportion of persons with hypertension ranked by household income on the x-axis. In this analysis, household income was adjusted by household size. If household income was not associated with a patient with hypertension being diagnosed or treated, then the concentration curve would lie on a 45° line running from the left-hand corner of the graph to the right-hand corner. If persons with diagnosed or treated hypertension were concentrated among the poor (or rich), the curve would lie above (or below) the 45° line. The higher (or lower) the curve is from this line, the greater the concentration among the poor (or rich). This income disparity is quantified using the concentration index. The concentration index is defined in relation to the concentration curve and is twice the area between...
the concentration curve and the 45° line. The value of the index ranges from -1 to 1, where positive (negative) values indicate distributions that favor the rich (or poor). The index takes on a value of 0 if there are no income disparities in the distribution of persons with diagnosed or treated hypertension.

We also used multiple logistic regression methods to examine the relationship between diagnosis, treatment, and controlled treatment coverage of hypertension and gender, age, body mass index (BMI), ethnicity, household income, educational level, urban residence, and residence in the peninsula or the states of Sabah or Sarawak, located on the island of Borneo.

All analyses accounted for the sampling design and were conducted using STATA 13.1 (Stata Corp, College Station, TX).

**Ethical Approval for Conduct of the Study**

This study was registered with the National Medical Research Registry of Malaysia (Registration No. NMRR-14-1350-19314) and approved by its Ethics Committee. It was also approved by the University of Malaya Medical Centre Medical Research Ethics Committee (Registration No. 201401-0688).

**RESULTS**

About one third of adults aged 20 years and older in Malaysia had hypertension (Table 1). The prevalence of hypertension was higher in rural areas compared to urban areas. Across ethnic groups, prevalence was highest among the indigenous tribes, followed by Malays, Indians, and Chinese, respectively. In general, prevalence was higher among men compared to women, with the exception of Malay women, who had higher prevalence than Malay men. We also found that 15.5% (95% CI, 15.4, 15.5) of adults had diabetes and, unlike hypertension, prevalence was higher among urban populations. Indians had the highest prevalence of diabetes (25.4%; 95% CI, 25.3, 25.4) and also the highest prevalence of having the two conditions concurrently (14.0%; 95% CI, 13.9, 14.1).

Overall, only 39.0% (95% CI, 37.5, 40.6) of the population with hypertension had been diagnosed by a medical

| Age-Standardized Prevalence, % (95% CI) | Men | Women | Total |
|---------------------------------------|-----|-------|-------|
| **Hypertension**                      |     |       |       |
| National                              | 34.99 (34.96–35.02) | 32.66 (32.64–32.69) | 33.91 (33.89–33.93) |
| Urban                                 | 34.77 (34.74–34.81) | 31.22 (31.19–31.25) | 33.06 (33.03–33.08) |
| Rural                                 | 35.49 (35.44–35.55) | 36.48 (36.43–36.54) | 36.03 (35.99–36.07) |
| Malay                                 | 34.70 (34.66–34.75) | 36.06 (36.02–36.10) | 35.45 (35.42–35.48) |
| Chinese                               | 33.26 (33.20–33.31) | 24.14 (24.09–24.19) | 28.76 (28.73–28.80) |
| Indian                                | 36.22 (36.11–36.33) | 27.20 (27.10–27.30) | 31.75 (31.67–31.82) |
| Indigenous tribes                     | 42.94 (42.83–43.04) | 39.53 (39.44–39.62) | 41.29 (41.22–41.35) |

| **Diabetes**                          |     |       |       |
| National                              | 16.26 (16.24–16.29) | 14.71 (14.69–14.74) | 15.46 (15.45–15.48) |
| Urban                                 | 17.02 (16.99–17.04) | 14.71 (14.68–14.74) | 15.82 (15.80–15.84) |
| Rural                                 | 14.68 (14.63–14.72) | 14.96 (14.92–15.01) | 14.81 (14.78–14.84) |
| Malay                                 | 17.37 (17.33–17.40) | 17.36 (17.33–17.40) | 17.33 (17.30–17.35) |
| Chinese                               | 13.78 (13.74–13.82) | 9.90 (9.87–9.94)    | 11.79 (11.76–11.82) |
| Indian                                | 28.06 (27.96–28.17) | 22.67 (22.57–22.76) | 25.35 (25.28–25.42) |
| Indigenous tribes                     | 12.03 (11.96–12.10) | 9.19 (9.13–9.26)    | 10.61 (10.56–10.65) |

| **Hypertension and diabetes**         |     |       |       |
| National                              | 9.50 (9.48–9.52) | 9.27 (9.26–9.29) | 9.37 (9.36–9.38) |
| Urban                                 | 10.00 (9.98–10.02) | 9.21 (9.19–9.23) | 9.59 (9.57–9.60) |
| Rural                                 | 8.40 (8.37–8.44) | 9.56 (9.53–9.60) | 8.98 (8.96–9.00) |
| Malay                                 | 9.82 (9.79–9.85) | 11.39 (11.37–11.42) | 10.59 (10.57–10.61) |
| Chinese                               | 8.44 (8.41–8.47) | 5.99 (5.96–6.01) | 7.20 (7.18–7.22) |
| Indian                                | 16.30 (16.21–16.39) | 11.69 (11.61–11.76) | 13.99 (13.93–14.05) |
| Indigenous tribes                     | 8.00 (7.94–8.06) | 6.14 (6.09–6.19) | 7.08 (7.04–7.12) |

*CI indicates confidence interval.*

**TABLE 1.** Prevalence of Hypertension and Diabetes Among Adults 20 Years and Above, Malaysia 2011
practitioner and thus had been made aware of their condition (Table 2). The hypertensive status of the rest was detected through blood pressure readings taken during the survey. About 91.5% of patients with hypertension who had been diagnosed prior to the survey were on medication to control their blood pressure but only 26.9% of those receiving medication had their blood pressure under control. There were no significant differences in diagnosis and treatment coverage between urban and rural areas or between ethnic groups. However, the proportion of patients with hypertension under treatment whose blood pressure was under control was higher in the urban areas and among the Chinese sub-population.

The prevalence of hypertension increased with age: 17.9% (95% CI, 16.9, 19.0) among those aged 20 to 40 years, 46.4% (95% CI, 44.9, 47.9) among those aged 40 to 60 years, and 71.7% (95% CI, 69.4, 73.8) among those aged 60 years and above. However, because of their smaller population share, individuals aged 60 years and above make up only 25.8% (95% CI, 24.2, 27.1) of persons with hypertension in Malaysia. The coverage indicators also demonstrate an age gradient in which coverage for diagnosis, treatment, and controlled treatment for hypertension were higher for older persons compared to younger persons (Figure 1). Similarly, the proportions of individuals diagnosed with hypertension who received treatment and the proportion of those treated who had their blood pressure under control were slightly higher for older persons. About 95.4% of those aged 60 years and above who had been diagnosed with hypertension had received treatment, with 28.4% of those treated achieving controlled blood pressure. The findings for those aged 40 to 60 years were 92.3% and 23.3%, respectively, and for those aged 20 to 40 years, 80.4% and 35.4%, respectively.

The prevalence of hypertension was lower in the northeast and central regions of Peninsular Malaysia, namely, the states of Kelantan, Terengganu, and Pahang (Figure 2). However, coverage indicators differed across the states in the country with no specific relationship to the burden of disease (Figure 3). Diagnosis coverage ranged between 47.8% (95% CI, 41.2, 54.5) in Malacca and 30.9% (95% CI, 26.2, 35.6) in Perlis, both located in the west coast of the Peninsula. These two states also had the highest and lowest treatment and controlled treatment coverage, respectively.

### TABLE 2. Diagnosis, Treatment, and Controlled Treatment Coverage of Hypertension Among Adults 20 Years and Above, Malaysia 2011

|                      | Men                              | Women                           | Total                           |
|----------------------|----------------------------------|---------------------------------|---------------------------------|
| **Coverage, % (95% CI)** |                                  |                                 |                                 |
| Diagnosis coverage   |                                  |                                 |                                 |
| National             | 35.04 (32.79–37.28)              | 43.41 (41.38–45.45)             | 39.04 (37.51–40.56)             |
| Urban                | 35.09 (32.22–37.97)              | 43.09 (40.43–45.75)             | 38.80 (36.82–40.77)             |
| Rural                | 34.90 (31.71–38.10)              | 44.08 (41.12–47.03)             | 39.58 (37.39–41.78)             |
| Malay                | 35.27 (32.36–38.19)              | 43.19 (40.58–45.79)             | 39.35 (37.39–41.30)             |
| Chinese              | 38.68 (33.85–43.52)              | 47.76 (43.00–52.52)             | 42.48 (39.04–45.92)             |
| Indian               | 38.88 (30.54–47.22)              | 42.79 (35.38–50.21)             | 40.63 (34.96–46.30)             |
| Indigenous tribes    | 31.90 (25.44–38.35)              | 42.39 (36.22–48.55)             | 36.92 (32.41–41.44)             |
| Treatment coverage   |                                  |                                 |                                 |
| National             | 32.33 (30.11–34.54)              | 39.44 (37.45–41.42)             | 35.72 (34.23–37.22)             |
| Urban                | 31.25 (28.18–34.33)              | 40.66 (37.75–43.57)             | 36.06 (33.92–38.19)             |
| Rural                | 32.76 (29.92–35.60)              | 38.83 (36.24–41.43)             | 35.57 (33.63–37.51)             |
| Malay                | 32.61 (29.74–35.48)              | 38.62 (36.08–41.15)             | 35.70 (33.79–37.61)             |
| Chinese              | 36.41 (31.61–41.20)              | 44.61 (39.90–49.33)             | 39.84 (36.43–43.25)             |
| Indian               | 36.64 (28.36–44.92)              | 40.96 (33.62–48.29)             | 38.57 (32.96–44.19)             |
| Indigenous tribes    | 26.91 (20.84–33.00)              | 39.23 (33.21–45.26)             | 32.81 (28.48–37.15)             |
| Controlled treatment coverage |                                  |                                 |                                 |
| National             | 9.40 (7.89–10.90)                | 9.82 (8.60–11.03)               | 9.60 (8.62–10.58)               |
| Urban                | 10.23 (8.23–12.23)               | 10.92 (9.26–12.57)              | 10.55 (9.23–11.87)              |
| Rural                | 7.34 (5.70–8.99)                 | 7.57 (6.06–9.08)                | 7.46 (6.34–8.58)                |
| Malay                | 8.08 (6.34–9.83)                 | 7.67 (6.35–8.99)                | 7.87 (6.78–8.96)                |
| Chinese              | 12.88 (9.05–16.72)               | 15.92 (12.46–19.38)             | 14.15 (11.50–16.80)             |
| Indian               | 9.45 (5.46–13.45)                | 10.79 (7.63–14.85)              | 10.05 (7.19–12.91)              |
| Indigenous tribes    | 8.49 (4.80–12.18)                | 9.17 (5.76–12.59)               | 8.82 (6.29–11.34)               |

*CI indicates confidence interval.
Although there was no income disparity among persons with hypertension who had been diagnosed or treated, the distribution of those whose blood pressure had been controlled with treatment showed a concentration among the rich. The concentration index for diagnosis coverage was 0.0168 (95% CI, -0.0061, 0.0397) and for treatment coverage was 0.0199 (95% CI, -0.0047, 0.0444); neither index was statistically different from 0. However, the concentration index for controlled treatment coverage was 0.0958 (95% CI, 0.0303, 0.1613), indicating a pro-rich distribution. These features can be seen in Figure 4, where the concentration curves for those who had been diagnosed, those who were receiving treatment, and those with controlled blood pressure under treatment moved progressively further below the 45° line.

A number of factors were found to be associated with being diagnosed with hypertension or being treated: namely, gender, older age groups, pre-obese and obese individuals, and individuals belonging to the three richest income quintiles (Table 3). In contrast, factors found to be associated with having controlled blood pressure under treatment were gender, belonging to an older age group, being Chinese, belonging to the richest income quintile, and residing in an urban area.
Although most persons receiving treatment for hypertension reported that they usually obtained treatment from primary care providers, either public (49.7% of all those receiving treatment) or private clinics (22.6%), about a quarter reported receiving treatment from hospitals (Figure 5). A small number also frequented private pharmacies (1.5%) and practitioners of traditional, herbal, or complementary medicines (0.3%). Persons receiving treatment for hypertension reported the highest preference for public clinics in both urban and rural settings. However, preference for treatment in public clinics was more marked for those residing in rural areas—66.9% of rural patients with hypertension receiving treatment preferred public clinics compared to 42.0% of urban patients with hypertension receiving treatment.

**DISCUSSION**

The findings of this article reveal gaps in providing screening and treatment services for adults with hypertension in Malaysia. We found that only 39.0% of adults with hypertension had been diagnosed. Although 91.5% of those who had been diagnosed reported to have received medication for hypertension, only 26.9% of those treated had their blood pressure brought under control. Our findings for Malaysia are generally higher than those for low- and middle-income countries but lower than those for high-income countries. A systematic review conducted on studies in 26 high-income countries, including the United Kingdom and Singapore, showed that 67.0% of patients with hypertension had been diagnosed, 55.6% of those diagnosed received treatment, and 50.4% of those treated achieved controlled blood pressures in 2010.27 Similar findings for 64 low- and middle-income countries were 37.9%, 29.0%, and 26.3%, respectively. Nevertheless, our findings provide insight into the challenges of delivering primary care services in Malaysia today.

There are many potential reasons why adults do not use screening services for hypertension. Unlike many other medical conditions, hypertension is often a silent disease that does not announce itself until patients develop complications from the disease. Thus, detection of high blood pressure in a seemingly healthy person, requires that person to appreciate the value of health screening services to the extent that he will utilize such services. It can be argued that provision of information to the public to increase awareness of the disease and its prevention and treatment is an essential element of the management of hypertension at the primary care level. In Malaysia, the MoH has taken a leading role to disseminate health information to the public. Health education is integrated into provision of services at all public clinics where patients are routinely reminded and encouraged to adopt healthy lifestyles. In addition, the MoH has been conducting annual healthy lifestyle campaigns since 1991 in an effort to encourage the public to avoid modifiable risk factors that can lead to development of diseases such as hypertension and diabetes.28 However, despite the importance of public health education in reducing disease burden in the country, the MoH does not appear to have placed very high priority on such activities. In 2009, expenditures for health education amounted to only 3% of the total operating expenditures of the public health program or 0.6% of the entire MoH annual expenditures.29

Health education and promotion aside, uptake of hypertension screening and treatment services can be improved only if facilities providing such services are available and accessible to the public. Over time, the public primary care network of clinics in Malaysia have expanded significantly,
TABLE 3. Logistic Regression Model Assessing Factors Associated with Being Diagnosed as Hypertensives, Being Treated and Having Controlled Blood Pressure Under Treatment, Malaysia 2011
and by 2010 there were 2,886 clinics or 10.2 clinics per 100,000 population.\textsuperscript{30} Although the basic primary health care structure, especially in rural areas, did not change drastically, the demographics of the country did. By 2010, 71.0\% of the country’s population was living in urban areas.\textsuperscript{7} Development of public primary care clinics in urban areas lagged far behind the increasing urban demand for care. In 2010, there was only one public clinic per 100,000 urban population compared to 20 private clinics for the same number of people.\textsuperscript{17} Public clinics are funded by the government through taxation and user fees are minimal. On the other hand, services provided by private clinics are more expensive and, unless patients are sponsored by their employers, they need to pay out-of-pocket for care received. The government acknowledged that affordable primary care may not be readily available to the urban population, especially the poor. In the tabling of 2010 National Budget in parliament, the prime minister announced the policy decision to establish a new category of public clinics, referred to as 1Malaysia clinics, specifically to target the urban poor.\textsuperscript{31} These clinics are not comparable to the larger and better resourced primary care health centers in the public sector. Each clinic is usually manned by one allied health worker who is trained to provide a limited range of health care services but includes screening and management of hypertension. The siting of these clinics in areas with large urban populations was intended to improve accessibility, but by 2015, there were only 334 such clinics built throughout the country to complement existing public clinics in urban areas.\textsuperscript{9}

The change in the country’s demographics is not restricted to just the balance between urban and rural populations alone because the country’s population is also gradually aging. Public-sector primary care services have hitherto been focused on combating infectious diseases as well as providing MCH services.\textsuperscript{19} However, with a gradually aging society, public-sector primary care services need to reorient toward tackling the increasing burden of NCDs. Thus far, though public as well as private clinics provide screening services for NCDs, including hypertension, such services have been done opportunistically, where persons attending clinics for other purposes were invited to be screened.\textsuperscript{19} The MoH has yet to embark on systematic community-wide health screening, which requires extensive resources to ensure that all eligible adults in the country receive health screening services at regular intervals. This is in stark contrast to provision of MCH services, where pregnant mothers and infants are provided with health cards to track receipt of antenatal services and childhood vaccinations and home visits by health personnel can be arranged to attend to house-bound mothers. Similarly, systems are in place to register and track clinical management of those diagnosed with tuberculosis and to trace and screen their contacts. The high childhood vaccination rates of over 98\% in 2015 (with the exception of a measles, mumps, and rubella vaccination rate of 93\%) are in part testament to primacy of MCH services in the delivery of primary care services in Malaysia today.\textsuperscript{9}

The reliance on opportunistic health screening in public clinics may explain why diagnostic coverage of hypertension is higher among women (because they are more likely to attend MCH services) and among older persons aged 60 years and above (because they are more likely to attend for minor ailments). Public clinics, most of which operate during office hours, may also be more accessible to older persons, who are less likely to be formally employed. Thus, with respect to hypertension screening and treatment services, it would appear that older persons have been better served by the public clinics compared to younger persons.

In response to the increasing burden of NCDs in the country, the MoH released a national policy in 2010, which included several strategies to prevent and control NCDs.\textsuperscript{32} These strategies covered areas such as improving prevention, clinical management, patient compliance, interagency cooperation, research, capacity building, and regulations. The policy highlights provision of cardiovascular disease screening services by community volunteers.\textsuperscript{19} Since 2010, the MoH has rolled out several programs to train volunteers to disseminate information promoting healthy lifestyles as well as conduct rudimentary health screening services, including taking blood pressure and blood glucose readings to screen for hypertension and diabetes. These volunteers would then refer those suspected of having these conditions to clinics for management. However, it is difficult to gauge the impact of such initiatives on the disease burdens of hypertension and diabetes because the numbers of volunteers trained and adults screened are small in comparison to the adult population in the country. From 2010 to 2014, it was reported that only 12,843 volunteers had been trained and 31,434 adults screened for NCD risk factors.\textsuperscript{33}

Improving the uptake of hypertension screening services in Malaysia will increase the identification of patients with hypertension and, as our study has shown, once diagnosed, most patients with hypertension would be treated. However, there remains the issue of ensuring that those who are treated achieve controlled blood pressure. There is no consensus as to the acceptable coverage target for effective blood pressure control for patients with hypertension who are receiving treatment. Lacking a universal target, it should be acceptable for a middle-income country like Malaysia to set as a target the coverage achieved by high-income countries. It was
reported that in 2010, 28.4% of patients with hypertension receiving treatment in 26 high-income countries achieved controlled blood pressure levels.27 This is far higher than the 9.6% found by us in Malaysia.

The Malaysian CPG for management of hypertension has been developed to aid clinical decision making and to ensure optimum blood pressure control.25 However, there is some evidence to suggest that some doctors may not have adhered to the CPG that could have an effect on patients’ clinical outcomes.34–36 In addition, there is some evidence to suggest that patients themselves may not fully adhere to prescribed medications. A national survey conducted in 2012 showed that 42% of the adults surveyed admitted to have consciously chosen not to take medicines prescribed to them.37 Specifically, a study of patients with hypertension attending public health clinics in a district in Selangor, one of the richest states in the country, revealed good adherence to medication only among 53% of patients surveyed.38 Thus, there may be health provider and patient factors that could have contributed to poor control of blood pressure for patients with hypertension who are receiving treatment in Malaysia.

In addition to health provider and patient factors, certain health system factors could have led to poor control of blood pressure among patients with hypertension. Patients in Malaysia can choose where they seek care and often may visit several health care providers even for the same episode of illness. Although there is widespread use of medical records, whether electronic or paper based, within clinics and hospitals, these are often not portable and transferable between facilities, especially between public and private providers. This situation can make patient follow-up and attainment of adequate blood pressure control with treatment a challenge. Patients who seek treatment for hypertension in public clinics and hospitals in Malaysia are provided with free medications. However, patients may need to buy them from the private sector if they are not available in public facilities. A survey conducted among 20 public hospitals noted that availability of medications was low even for drugs in the MoH Drug Formulary,39 which lists drugs provided for use in MoH facilities. The study further noted that a month’s supply of common medications to treat hypertension purchased from private pharmacies may cost up to two weeks’ wages for the lowest paid public-sector worker in Malaysia, which may not be affordable for those with low incomes and thus contribute to nonadherence to prescribed medications. This may partially explain our finding of a pro-rich distribution among patients with hypertension who achieved controlled blood pressure under treatment.

In addition to more well-off groups, we found that persons with hypertension who were living in urban areas were more likely to have controlled blood pressure under treatment compared to those living in rural areas. Similarly, Chinese patients with hypertension were more likely to have controlled blood pressures. Most Chinese are urban dwellers and have the highest median household incomes among the ethnic groups.7,40 Thus, although availability of low-cost public primary care may be lower in urban areas, more Chinese may be able to afford treatment in private clinics compared to other ethnic groups. Findings from the NHMS 2011 have shown that the Chinese population also has the highest preference for private care in Malaysia among ethnic groups.41 If indeed affordability of treatment for hypertension among urban patients is an important reason for poor control of blood pressure, the government would need to step up the expansion of the network of urban public clinics and increase accessibility to working urban dwellers; for instance, by having longer clinic operating hours. Another possible explanation for better control of blood pressures in urban areas may be that there could be quality differentials in the outcome of treatment for hypertension between public and private clinics. Although it was not within the scope of this study, it is an area that warrants further examination to improve the clinical outcome of treatment for hypertension in Malaysia.

This study has a limitation related to the interpretation of blood pressure readings taken during the survey. A diagnosis of hypertension should be reached based on persistent raised blood pressure readings above 140/90 mmHg taken twice during each of at least two or more clinic visits. Adult participants in the NHMS 2011 had their pressures taken twice, 15 minutes apart, but during the single visit made by survey data collectors. Thus, recordings of blood pressure during the survey may not reflect the actual status of the survey respondents.

**CONCLUSIONS**

More than half of adults with hypertension in Malaysia had not been diagnosed. Once diagnosed, most received treatment, but only a quarter achieved controlled blood pressure. Thus, most patients with hypertension in the country were vulnerable to developing complications either because they were not aware that they had the condition or because they had been inadequately treated. Though coverage of hypertension screening and treatment services was found to be higher among older persons, population aging in Malaysia would mean that the numbers of patients with hypertension and other NCDs would likely continue to rise. The burden of managing this increasing disease burden would be borne mainly by the country’s primary care delivery system. Malaysia has a well-established primary care system that
now needs to focus efforts toward the challenge of managing NCDs. The primary care system needs to intensify community health education activities to increase awareness of disease screening and treatment, provide organized screening services, and provide access to affordable treatment services, especially in urban areas. Malaysia’s situation may not be unique and may be shared by other countries experiencing epidemiological transition away from infectious diseases toward NCDs. In such countries, as in Malaysia, monitoring the population coverage of the diagnosis, treatment, and controlled treatment of hypertension would provide feedback to improve provision of primary care services.

DISCLOSURE OF POTENTIAL CONFLICTS OF INTEREST

No potential conflicts of interest were disclosed.

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