Comparison of the management and control of hypertension by public and private primary care providers in Shenzhen, China

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ABSTRACT

Background: The Chinese government has designated primary care as the cornerstone for addressing the public health challenges posed by hypertension. In urban China, primary care is usually delivered by either publicly- or privately-owned community health centers (CHCs), and whether these CHCs can achieve the same population health objectives remains unknown. This study aimed to compare management and control of hypertension by public versus private primary care providers.

Methods: A face-to-face, cross-sectional patient survey was performed on-site at 12 CHCs in Shenzhen, China (3 privately owned and 9 publicly owned). A total of 1046 hypertensive patients were selected via systematic sampling methods and completed the survey. Information regarding primary care management, anti-hypertensive drug treatment and compliance, and blood pressure was recorded.

Results: Compared with hypertensive patients enrolled from private CHCs, those from public CHCs were more likely to be managed by CHCs (84.6% vs. 61.6%; odds ratio [OR] = 2.594, 95% confidence interval [CI]: 1.730–3.891), to take anti-hypertensive drugs (87.5% vs. 66.8%; OR = 3.193, 95%CI: 1.995–5.110), and to adhere to physicians' advice (91.5% vs. 82.5%; OR = 1.930, 95%CI: 1.0002–3.717). However, hypertension control rates did not differ significantly between public and private CHCs (48.3% vs. 37.6%; P > 0.01, tested by multiple logistic regression models).

Conclusions: Public CHCs showed better performance for the management of hypertensive patients compared with private CHCs, although there is room for improvements for both types of CHCs. Initiation of interventions to motivate primary care providers in both public and private CHCs to comply with hypertension management guidelines is recommended.

1. Introduction

Hypertension is one of the most pervasive public health problems worldwide, including in China. It is predicted that, by 2025, 1.56 billion adults will be living with hypertension globally [1]. A current population-based screening study showed that the age- and sex-standardized prevalence of hypertension is 37.2% among Chinese adults aged 35–75 years [2]. Following recommendations from the World Health Organization, primary care was designated by the Chinese government as the cornerstone for addressing the public health challenges caused by hypertension [3].

In urban areas of China, primary care is mainly provided by community health centers (CHCs). Chronic disease management is intended to be one of the key services delivered by CHCs. The Chinese guidelines for hypertension management indicate that health records should be established for hypertensive patients enrolled from CHCs, those from public CHCs were more likely to be managed by CHCs (84.6% vs. 61.6%; odds ratio [OR] = 2.594, 95% confidence interval [CI]: 1.730–3.891), to take anti-hypertensive drugs (87.5% vs. 66.8%; OR = 3.193, 95%CI: 1.995–5.110), and to adhere to physicians' advice (91.5% vs. 82.5%; OR = 1.930, 95%CI: 1.0002–3.717). However, hypertension control rates did not differ significantly between public and private CHCs (48.3% vs. 37.6%; P > 0.01, tested by multiple logistic regression models).

Conclusions: Public CHCs showed better performance for the management of hypertensive patients compared with private CHCs, although there is room for improvements for both types of CHCs. Initiation of interventions to motivate primary care providers in both public and private CHCs to comply with hypertension management guidelines is recommended.

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population health [6], whether CHCs of differing ownership (public vs. private) can achieve the same population health objectives remains unknown.

The city of Shenzhen is among the most important economic powerhouses of China and is located in the Pearl River Delta region. The city includes 10 districts, covering a total area of 1997.3 square kilometers. In 2016, approximately 11.4 million people were living in Shenzhen, with approximately 69% being migrants [7]. In the same year, the prevalence of hypertension was estimated to be 20% [8]. Shenzhen is one of the cities pioneering CHCs in China. The Shenzhen government proposed a CHC-management pattern that involves ownership and guidance by the district governments with management and operation by public hospitals. Public hospital-managed CHCs act as non-independent entities; they are similar to outreach clinics of public hospitals, offering public health service packages and medical services to the public. They are allowed to make a profit as a financially self-sufficient institution, because they are not part of the government sector. However, they commonly receive government subsidies through their host hospitals, which further allocates funding to the CHCs.

However, due to limited government funding for healthcare, private institutions or individuals also are encouraged to establish CHCs, and such privately-owned and managed CHCs are independent of the government and hospital sectors. They are financially self-sufficient and receive only limited government funding. Both public and private CHCs are required to adhere to the national guidelines for the standard service provision set by the Ministry of Health. In 2016, 91.4% of CHCs were managed by public hospitals and 8.6% were privately owned [9].

This study aimed to compare the performance of public and private CHCs for the management and control of hypertension. The prevalence rates of depression among hypertensive patients treated by the two types of CHCs were also evaluated.

2. Methods

Ethics approval

The ethics committee of Shenzhen University General Hospital, Shenzhen University approved the study. Written informed consent was obtained from the participants before survey administration.

2.1. Study design, sampling and procedures

Between March and September 2017, a face-to-face, cross-sectional patient survey was performed on-site at 12 CHCs in Shenzhen, China. CHCs were chosen as study settings using a multistage random sampling method. In the first stage, Longhua District (one of the 10 districts in Shenzhen) was selected by employing a simple random sampling method. Secondly, the names of the CHCs for the six sub-districts in Longhua were obtained from the Health Bureau. Using simple random sampling methods, two CHCs were randomly selected from each of the six sub-districts. Finally, a total of 12 CHCs were chosen, among which, 3 were privately owned and 9 were publicly owned. We conducted an on-site survey according to a method that we have published previously [10] (for the questionnaire please reference supplementary file: Survey questionnaire for hypertensive patients in Shenzhen). A total of 1046 primary care users who had diagnosed hypertension or an elevated blood pressure (>140/90 mmHg) completed the face-to-face interview survey which was performed by trained interviewers. The participants were patients with previous hypertension, either treated or untreated.

2.2. Variables

BP measurements were administered. BP was measured by calibrated mercury sphygmomanometers according to the protocol recommended by the Chinese national guidelines for hypertension management. Two measurements were performed with an interval of 1–2 min. Means of two measurements were recorded. Hypertension control was defined as the achievement and maintenance of blood pressure levels below 140 and 90 mmHg for systolic blood pressure (SBP) and diastolic blood pressure (DBP), respectively. The respondents were then dichotomized into two categories: controlled (SBP <140 mmHg and DBP <90 mmHg) and uncontrolled (SBP >140 mmHg or DBP >90 mmHg).

The 5-Item World Health Organization Well-Being Index (WHO-5) is a questionnaire used to measure wellness that can discriminate between individuals with and without mental disorders. It consists of five items, and each item indicates the degree of positive well-being during the past 2 weeks according to a 6-point scale ranging from 0-none of the time to 5-all of the time. The details of the questionnaire are provided in Table 1. A total raw score is calculated by adding the scores for the five items. The total raw score ranges from 0–25, with higher scores indicating better well-being. We translated each raw score to a percentage score, ranging from 0 to 100% by multiplying the raw score by 4. The WHO-5 has been shown to have good diagnostic accuracy for the detection of depression [11], with a cut-off score for depression of <50.

The participants were asked whether their hypertension was under management by a CHC (1 = yes, 2 = no). The participants also were asked whether they were currently taking anti-hypertensive drugs (1 = yes, 2 = no). Drug compliance was assessed by asking the participants whether they were taking anti-hypertensive drugs regularly as advised by physicians (1 = yes, 2 = no). Covariates related to socioeconomic status (SES) were also recorded (Table 2).

2.3. Statistical analyses

We performed descriptive statistical analysis of the participants' sociodemographic status including age, sex, education, occupation, duration of hypertension, family history of hypertension, and registration. The descriptive statistics for management and control of hypertension are also presented. The relationships between CHC ownership type and the management and control of hypertension were identified by Chi-square tests and multiple logistic regression models. All models were adjusted for age, sex, education, occupation, duration of hypertension, family history of hypertension, and registration. Odds ratios (ORs) with 95% confidence intervals (95%CIs) are reported. All P-values < 0.05 were considered statistically significant. Descriptive statistics, Chi-square tests, and multiple regression analyses were performed using SPSS 20.0 software (SPSS, Inc., Chicago, IL, USA).

2.4. Patient and public involvement statement

The analyses were based on data from population-based surveys. Hypertensive patients were recruited for data collection. However, the patients were not involved in the study design and we will not be able to disseminate the study results to them.

3. Results

The mean age of the participants was 55.5 years. The majority were male (59.8%), migrants (85.5%), and employed (55.0%). The mean duration of hypertension was 6.1 years. Almost half of the participants (45.6%) had a family history of hypertension. Compared with the participants from private CHCs, those from public hospital-owned CHCs were more likely to be younger (mean age 54.6 vs. 58.3 years, P < 0.001, Chi-square test), to be male (62.7% vs. 50.2%, P = 0.001, Chi-square test), to be the local residents (15.8% vs. 10.3%, P = 0.04, Chi-square test), to be employed (61.5% vs. 33.0%, P < 0.001, Chi-square test), and to not have a family history of hypertension (41.7% vs. 24.4%, P < 0.001, Chi-square test; Table 3).

Approximately three-fourths (71.6%) of the participants were under primary care management. The anti-hypertensive drug treatment rate was 82.9% across all participants, and the drug compliance rate was high, at 89.8%. However, less than a half (45.9%) of the participants achieved
blood pressure control targets. According to the WHO-5 results, 10.7% of the participants had depression (Table 4). Table 4 shows the differences in the management and control of hypertension between public and private CHCs. The participants from publicly-owned CHCs were more likely to be managed by CHCs (74.6% vs. 61.6%, \( P < 0.001 \)), to take anti-hypertensive medications (87.5% vs. 66.8%, \( P < 0.001 \)), to adhere to physician's suggestions (91.5% vs. 82.5%, \( P < 0.01 \)), and to achieve blood pressure control targets (48.3% vs. 37.6%, \( P < 0.01 \)), while also being less likely to have a depressive disorder (8.5% vs. 18.2%, \( P < 0.001 \)) compared with their counterparts from private CHCs. After adjustment for sociodemographic factors, statistically significant differences still remained in the primary care management rate (OR = 2.594, 95% CI: 1.730, 3.891), drug treatment rate (OR = 3.193, 95% CI: 1.995, 5.110), drug compliance (OR = 1.930, 95% CI: 1.000, 3.717), and prevalence of depression (OR = 0.577, 95% CI: 0.337, 0.988).

4. Discussion

The present study compared the management and control of hypertension between individuals who received treatment from public and private primary care providers in Shenzhen, China. Differences in the prevalence of depression and its relationship with hypertension control also were evaluated. We found that hypertensive patients enrolled from public CHCs were more likely to be managed by CHCs, to take anti-hypertensive drugs, and to adhere to physicians' advice in comparison to their counterparts enrolled from private CHCs. However, we observed no statistically significant difference in hypertension control rates.

Table 1. Five-item world health organization well-being index (WHO-5).

| No. | Over the last 2 weeks | Answers                           |
|-----|-----------------------|-----------------------------------|
|     |                       | All of the time | Most of the time | More than half of the time | Less than half of the time | Some of the time | At no time |
| 1   | I have felt cheerful and in good spirits |                     |                   |                            |                           |                 |
| 2   | I have felt calm and relaxed             |                     |                   |                            |                           |                 |
| 3   | I have felt active and vigorous          |                     |                   |                            |                           |                 |
| 4   | I woke up feeling fresh and rested       |                     |                   |                            |                           |                 |
| 5   | My daily life has been filled with things that interest me |                     |                   |                            |                           |                 |

Table 2. Covariates recorded in the current study.

| Covariates                  | Categories                                      |
|-----------------------------|-------------------------------------------------|
| Age                         | 1 = 18–44 years, 2 = 45–60 years, 3 = >60 years |
| Education                   | 1 = primary school and below, 2 = middle school, 3 = high school or equivalent, 4 = 3-year college and above |
| Duration of hypertension since diagnosis | Years                                               |
| Occupation                  | 1 = employed, 2 = unemployed                      |
| Family history of hypertension | 1 = yes, 2 = no, 3 = unknown                        |
| Registration                | 1 = locals, 2 = migrants, which refers to internal migrants who do change their official household registration to their new place of residence. |

Table 3. Socioeconomic characteristics of the participants enrolled from public and private CHCs.

| Variables                        | Public CHCs No. (%) | Private CHCs No. (%) | P* | Total No. (%) |
|----------------------------------|---------------------|----------------------|----|--------------|
| Age (years), mean (SD)           | 54.6 (11.5)         | 58.3 (10.4)          | -0.001 | 55.5 (11.3) |
| 18-44                            | 150 (19.7)          | 22 (9.4)             |    | 172 (17.3)  |
| 45-60                            | 364 (47.8)          | 112 (47.9)           |    | 476 (47.8)  |
| >60                              | 248 (32.5)          | 100 (42.7)           |    | 348 (34.9)  |
| Sex                              |                     |                      | 0.001 |               |
| Male                             | 470 (62.7)          | 114 (50.2)           |    | 584 (59.8)  |
| Female                           | 280 (37.3)          | 113 (49.8)           |    | 393 (40.2)  |
| Education                        |                     |                      | 0.005 |               |
| Primary school and below         | 198 (24.9)          | 85 (36.6)            |    | 283 (27.6)  |
| Middle school                    | 284 (35.7)          | 75 (32.3)            |    | 359 (35.0)  |
| High school and equivalent       | 212 (26.7)          | 50 (21.6)            |    | 262 (25.5)  |
| Three-year college and above     | 101 (12.7)          | 22 (9.5)             |    | 123 (12.0)  |
| Registration                     |                     |                      | 0.040 |               |
| Locals                           | 118 (15.8)          | 23 (10.3)            |    | 141 (14.5)  |
| Migrants                         | 629 (84.2)          | 201 (89.7)           |    | 830 (85.5)  |
| Occupation                       |                     |                      | -0.001 |               |
| Employed                         | 484 (61.5)          | 77 (33.0)            |    | 561 (55.0)  |
| Unemployed                       | 303 (38.5)          | 156 (67.0)           |    | 459 (45.0)  |
| Year of hypertension             | 6.2 (6.2)           | 5.8 (5.4)            | 0.719 | 6.1 (6.0)   |
| Family history                   |                     |                      | -0.001 |               |
| Yes                              | 348 (44.9)          | 106 (48.0)           |    | 454 (45.6)  |
| No                               | 323 (41.7)          | 54 (24.4)            |    | 377 (37.9)  |
| Unknown                          | 104 (13.4)          | 61 (27.6)            |    | 165 (16.6)  |

Notes: Data represent n(%), except for mean age. Percentages are among patients treated in each type of CHC.
* Chi-square test or independent two-sample t-tests where appropriate.
achieved by the public and private CHCs. The prevalence of depression was higher though among hypertensive patients enrolled from private CHCs than among those enrolled from public CHCs. Our analysis indicated that hypertension control was a factor associated with the prevalence of depression.

Overall, our findings suggested that management of hypertension was performed better by publicly-owned CHCs than by privately-owned CHCs. Our study indicated that public primary care providers have stronger and better policy implementation, e.g., clinical guidelines for hypertension management and control [12]. The higher drug treatment and adherence rates in public CHCs compared with private CHCs may be due to the different population structures. The participants from private CHCs were younger and less likely to have co-morbidities than those receiving treatment from public CHCs, healthcare providers may not have perceived pharmaceutical therapy as necessary if a patient’s blood pressure was marginal and could be managed through lifestyle initiatives. Additional research has indicated that private CHCs are less attractive to staff with a higher education level than public ones due to the absence of a quota system, which was also a reason for outflow of health workers from private CHCs. Staff turnover has been shown to be a barrier to hypertension treatment and adherence [16].

In the present study, the hypertension control rates did not differ significantly between publicly- and privately-owned CHCs. With respect to the relationship between the management pattern of CHCs and hypertension control, the current literature includes mixed findings. Consistent with our findings, a study by Wang et al., which was conducted in 29 cities across China, showed no significant difference in the hypertension control rates between publicly- and privately-owned CHCs [17]. However, a study by Guo et al. [18], which was performed in Guangdong province, found that the hypertension control rate achieved by privately-owned CHCs was higher than that achieved by publicly-owned CHCs. Still yet, a study by Wong et al. [12] showed that compared with privately-funded CHCs, government-funded CHCs were more likely to achieve optimal BP control, irrespective of whether anti-hypertensive drugs were initiated. These conflicting findings across studies may imply that the performance of CHCs depends more on the management skills of local governments than on the type of ownership.

The overall hypertension control rate in this study was not as high as expected, despite high drug treatment and adherence rates, which indicate that the management process was good overall. Many other factors influencing hypertension control were not accounted for by the current study, such as lifestyle modifications, co-morbidities, among others. Further studies are warranted to investigate the underlying causes for the low control rates.

Our study also found that the prevalence of depression was 10.7% among hypertensive patients receiving treatment from primary care providers, and this rate is lower than those reported by previous studies. A meta-analysis performed by Li et al. [19] reported that, in China, the prevalence of depression among hypertensive patients is 28.5%. However, they also noted that the prevalence rate in clinical studies was higher than that in community samples [19]. Nonetheless, our estimated prevalence of depression is higher than that among the general population. According to WHO statistics, approximately 4.4% of the global population had depression in 2015 [20]. Newale and Bachani suggested that the two most common co-morbidities in depressive patients are hypertension and diabetes [21]. Our current study indicates that optimal blood pressure control is negatively associated with occurrence of depression. Thus, our findings imply that blood pressure control is a crucial and common underlying determinant for depression.

Our study has several limitations. First, the generalizability of study findings was limited. Although a systematic sampling approach can effectively replicate a random sampling method [22], this approach is not statistically random. In addition, the representativeness of samples might be limited due to omitting an estimation of sample size and size effect. Second, the self-reported information might be subject to recall bias. However, quality control was through the entire survey, for example, the survey was performed by extensively trained interviewers. Third, some unmeasured confounders may not be accounted for by the current study, although adjustment was made for some socioeconomic confounders in multivariable regression models. Fourth, case-mix bias may have been introduced by the lack of co-morbidity data for hypertensive patients.

Table 4. Primary care management and control of hypertension by public and private CHCs.

| Variables      | Public CHC No. (%) | Private CHC No. (%) | OR (95%CD) | Total No. (%) |
|---------------|-------------------|--------------------|------------|--------------|
| PC management |                   |                    |            |              |
| Yes           | 672 (84.6)        | 143 (61.6)**       | 2.594 (1.730, 3.891)** | 815 (79.4) |
| No            | 122 (15.4)        | 89 (38.4)          | 211 (20.6) |              |
| Drug treatment|                   |                    |            |              |
| Yes           | 693 (87.5)        | 153 (66.8)**       | 3.193 (1.995, 5.110)** | 846 (82.9) |
| No            | 99 (12.5)         | 76 (33.2)          | 175 (17.3) |              |
| Drug compliance|                  |                    |            |              |
| Yes           | 626 (91.5)        | 124 (82.5)**       | 1.930 (1.002, 3.717)* | 758 (89.8) |
| No            | 58 (8.5)          | 27 (17.5)          | 86 (10.2)  |              |
| BP control    |                   |                    |            |              |
| Yes           | 387 (48.3)        | 88 (37.6)**        | 1.218 (0.834, 1.778) | 475 (45.9) |
| No            | 414 (51.7)        | 146 (62.4)         | 560 (54.1) |              |
| Depression    |                   |                    |            |              |
| Yes           | 68 (8.5)          | 43 (18.2)**        | 0.577 (0.337, 0.988)* | 111 (10.7) |
| No            | 734 (91.5)        | 193 (81.8)         | 927 (89.3) |              |

Notes: Data represent n(%). Percentages are among patients treated in each type of CHC.
|x| Chi-square tests. * P < 0.05; ** P < 0.01; *** P < 0.001.
|1| Multiple logistic regression models adjusted for age, sex, education, occupation, duration of hypertension, family history of hypertension, and registration for dependent variables of PC management, drug treatment and drug compliance, while for dependent variables of BP control and depression, variables of PC management, drug treatment and drug compliance were added for controlling for.
Fifth, we performed sensitivity analysis with only valid data included since the lack of homogeneity in the number of the different variables regarding the total sample size. Similar findings were found. Data are not shown but can be provided upon request. Sixth, caution should be made when comparing our findings with that of previous studies regarding the current status (characteristics) of CHCs. Last, but not the least, the cross-sectional nature of this study prevents us from establishing a causal inference relationship between CHC ownership type and hypertension management and control.

5. Conclusions

In conclusion, we found that based on patients' perception publicly-owned CHCs in China offered better performance for the management of hypertensive patients than did privately-owned CHCs. However, there is room for improvement for both types of CHCs, and interventions to motivate primary care providers to comply with hypertension management guidelines should be beneficial. Such guidelines have the potential to improve the process of care and patient health outcomes when acted upon. Our study implies that factors contributing to anti-hypertensive treatment rates and adherence should be investigated from both providers' and patients' perspectives, and in turn, comprehensive strategies should be launched to realize improvements. Further studies are warranted to address the underlying causes of the relationship between hypertension control and depression.

Declarations

Author contribution statement

Haitao Li: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Hui Xia: Conceived and designed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Lichange Rao: Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Data availability statement

Data included in article/supplementary material/referenced in article.

Declaration of Interests Statement

The authors declare no conflict of interest.

Additional information

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