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# Nurse-Managed Hypertension Care in Primary Health Care Centers in Region Stockholm and Its Association With Blood Pressure Control and Key Indicators for Contractual Follow-Up

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## ABSTRACT

The study aimed to investigate if primary health care centers (PHCCs) offering nurse-managed hypertensive care differ from PHCCs with other types of hypertension care regarding blood pressure levels and other key indicators. In this cross-sectional study of the hypertension care given in PHCCs in Stockholm County (now called Region Stockholm), we included all 227 PHCCs in the region. To assess the extent of nurses' involvement in the PHCCs hypertension care, a questionnaire was distributed to all PHCCs in Region Stockholm. Data on blood pressure levels was collected from a primary health care quality system (Primary Care Quality). Data on key indicators regarding follow-up was obtained from the Region Stockholm database on follow-up (LUD). Blood pressure levels and LUD-data were then analyzed with regards to whether the PHCC had nurse-managed hypertension care or not. Our analysis comprised 119 267 patients diagnosed with hypertension registered in any of the regions 227 PHCCs. Of the 81 PHCCs that responded to the questionnaire, 55 reported having nurse-managed hypertension care, and 26 were classified as having non-nurse managed hypertension care, while 146 were classified as unknown type of hypertension care. There were no differences in patients reaching desired blood pressure levels between nurse-managed and non-nurse-managed hypertension care. Nurse-led hypertension care units were on par with the other types of PHCCs. Thus, nurse-led hypertension care seems to be as safe and effective as other types of hypertension care in PHCCs.

Charlotte Ivarsson and Per Wändell contributed equally to this study.

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## 1 | Introduction

As individuals age, the prevalence of hypertension increases, with more than 60% of individuals aged 60 years and older worldwide experiencing hypertension [1]. The effective management of hypertension poses a worldwide challenge and currently falls short of achieving optimal outcomes. Notably, a substantial portion of individuals affected by elevated blood pressure either go undetected, are diagnosed as hypertensive but do not undergo treatment [2], or undergo treatment without attaining the blood pressure targets stipulated in established guidelines. It is also noteworthy that only half of those diagnosed and treated for hypertension successfully reach a blood pressure below 140/90 mmHg [3, 4], and even less the target blood pressure of <130/80.

Primary health care (PHC), where most patients are treated, plays a central role in hypertension management, which includes both comprehensive lifestyle interventions and pharmacotherapy aimed at preventing cardiovascular events [5]. Essential components of hypertensive care encompass guidance on lifestyle modifications, optimization of antihypertensive medications, holistic cardiovascular risk management, and the addressing of dyslipidemia and abnormal glucose tolerance [1]. However, the management of hypertension differs in PHC centers (PHCCs) in Sweden which might lead to inequity in care [6].

A growing body of evidence indicates the necessity for a multidisciplinary approach to enhance treatment adherence in hypertensive care, encompassing task sharing among healthcare professionals beyond physicians [7]. The implementation of team-based care and organizational strategies within PHC has been shown to influence blood pressure control [8–10]. Placing increased emphasis on nurse-managed care has the potential to significantly impact the management of hypertension and the regulation of blood pressure, with greater reductions in blood pressure [9, 11, 12]. Comparable results have been noted in individuals with diabetes undergoing treatment in PHC settings. Within diabetes care, the provision of nurse-managed care is associated with reductions in systolic blood pressure, enhanced adherence to protocols, increased frequency of follow-up, and ongoing patient education [13]. The utilization of nurse-managed outpatient care, characterized by explicit written protocols has shown to yield good results for managing chronic conditions such as hypertension and diabetes [14, 15], even if there is insufficient evidence that this leads to better hard clinical outcomes such as cardiovascular diseases.

The management and treatment of individuals with hypertension constitute a multifaceted process, and while both nurses and physicians participate in the care of hypertensive patients, a research gap exists regarding whether a structured involvement of nurses influences the outcomes of hypertensive care. We have recently shown that nurse-managed hypertensive care is similar to standard care when it comes to cardiovascular pharmacotherapy, with more registered lifestyle advice according to recommendations [6]. Yet, blood pressure levels and quality of care were not available on an individual level. In response to this knowledge deficit, we hypothesized that nurse-managed care has better hypertension care. Our aim in current study was to

examine whether nurse-managed hypertension care at PHCCs was associated with better control of hypertension through blood pressure levels and other key indicators between PHCC.

## 2 | Material and Methods

In this cross-sectional study of the hypertension care given in PHCCs in Region Stockholm, we included all PHCCs with a contractual agreement with the region. In order to evaluate the organization of hypertension care within PHCCs, a digital questionnaire was distributed to the operations managers of all PHCCs in the specified region. The aim was to gather data concerning the level of engagement provided by nurses, focusing particularly on assessing whether the PHCC had implemented nurse-managed hypertension care or not. Data for each PHCC regarding blood pressure levels and key indicators for follow-up was then collected and analyzed based on if the unit had nurse-managed hypertension care or not.

### 2.1 | Questionnaire

A digital questionnaire (see Supplementary file 1) was employed to investigate the presence or absence of nurse-managed hypertension care within PHCCs. The questionnaire was created and administered through Webropol, a web-based survey platform. Given the absence of a standardized definition for nurse-managed hypertension care in the region, inquiries were formulated to delineate the characteristics associated with such care. Prior to dissemination, the digital questionnaire underwent a pilot test with a select group of healthcare professionals.

In May 2021, a hyperlink to the questionnaire was disseminated via email to all PHCCs in Region Stockholm. To encourage participation, two follow-up emails were sent in May and August as reminders. The questionnaire responses enabled the categorization of PHCCs into three groups: those with nurse-managed hypertension care, those with non-nurse-managed hypertension care, and those with unknown care status due to non-response. Subsequently, blood pressure levels and follow-up indicators for each PHCC were analyzed based on these defined categories.

### 2.2 | Definition of Nurse-Managed Hypertension Care

In this study, the characterization of nurse-managed hypertension care was based on two criteria. Primarily, it was contingent upon whether PHCCs had a specific routine, denoting a structured organizational arrangement specifying roles, responsibilities, timing, and procedures for individuals with hypertension. This determination was derived from their response to the question: “Does the primary health care center have a specific care flow for individuals with hypertension?”. Secondly, it was contingent upon the existence of a specific booking system or the assignment of a designated nurse for the management of patients with hypertension, as indicated by responses to the questions: “Does the primary health care

center have a specific booking system (calendar) for individuals with hypertension, where they can book appointments with a nurse?” or “Has the primary health care center designated a specific nurse to take care of individuals with hypertension?”. If either of these two criteria were not satisfied, hypertension care was categorized as non-nurse-managed. The classification has previously been used to study if the pharmacotherapy and lifestyle advice differ between nurse-managed hypertension care and other forms of hypertensive care on an individual level [16].

## 2.3 | Data on Blood Pressure and Indicators for Follow-up

Blood pressure data were sourced from the Primary Care Quality database (PvQ), a national quality system devised for the PHC care context, utilized for ongoing follow-up and quality enhancement initiatives [17]. Participation in this quality system is optional for PHCCs, and a substantial majority in the region opt to engage, with 198 out of 227 PHCCs being enrolled.

Key indicators, including systolic and diastolic blood pressure, were computed based on average values for each PHCC. The data on blood pressure levels were collected at the operational level for each PHCC by May 31, 2021. Specifically, we employed two indicators for analysis: HT02L1, denoting the number of patients with hypertension and blood pressure  $\leq 140/90$  mmHg, and HT02L2, representing the number of patients with hypertension and blood pressure  $< 140/90$  mmHg. Both thresholds were used, as a disproportionately high fraction, of all patient has the exact value of 140 mmHg systolic or 90 mmHg diastolic blood pressure documented, referred to as digit preference [18]. The most recent blood pressure measurement in all individuals with any registered hypertension diagnosis in the past 5 years, including only individuals with a registered blood pressure in the electronic patient record at the primary care center the past 18 months were included in the analysis.

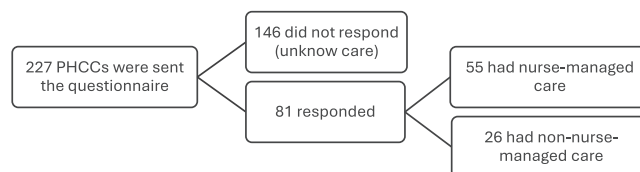
To find broader data relevant for the care of individuals with hypertension we used the LUD-database. The LUD-database contain key figures and indicators for contract follow-up, provided by Region Stockholm for each PHCC (see Supplementary file 2). The data was collected in December 2021.

## 2.4 | Covariates

Data on blood pressure and indicators for follow-up was adjusted with regards to the size and socio-economic status of PHCCs.

In Sweden, all necessary health care is tax-funded, covering all legal residents. Services are provided by the region and residents in Region Stockholm chooses a fixed PHCC to be registered with. This enabled adjustment to size for each PHCC.

For socio-economic adjustment, Care Need Index (CNI) of the PHCC was used [19]. This index is a tool that uses socio-economic conditions to identify risk of illness. CNI is used by the region to calculate each PHCCs remuneration, where PHCCs in areas with a lower socio-economic status are reimbursed with a higher remuneration. These socio-economic conditions are:



**FIGURE 1** | Primary Health Care Centers (PHCCs) responding to the questionnaire.

- Age over 65 years and living alone,
- Foreign born (Eastern Europe, Asia, Africa, and South America),
- Unemployed or in action, 16–64 years,
- Single parent with children 17 years of age or younger,
- Person one year or older who has moved into the area,
- Low educated, 25–64 years,
- Age younger than 5 years.

## 2.5 | Analysis

The key indicators are described by mean (standard deviation) and median (min, max). Quantile regression models for the 50th percentile (median) was used to analyze the difference between unknown care non-nurse-managed and nurse-managed hypertension care for the key-indicators for follow-up (LUD) (detection rate, hypertension, diagnosis rate, prevalence hypertension, nurse visits, avoidable in-patient care occasions) adjusted for size of PHCC and CNI, as these may confound the association between nurse-managed care and the quality of the hypertensive care. Similar adjusted quantile regression models were used to analyze blood pressure at the two levels  $< 140/90$  and  $\leq 140/90$  mmHG, separately. Quantile regression was chosen to be able to use data with non-normality in the residuals. All analyses were conducted in R, version 4.1.3.

## 3 | Results

### 3.1 | Questionnaire

The questionnaire was sent to 227 PHCCs, of which 81 responded (36%) (Table 1). Out of the PHCCs that responded to the questionnaire, 67 (83 %) had a specific routine regarding the management of individuals with hypertension, and of these 55 had a specific routine and a specific booking system and/or a designated nurse, that is, nurse-managed hypertension care.

Thus, based on our definition, 55 of the responding PHCCs had nurse-managed hypertension care, 26 had non-nurse-managed hypertension care. PHCCs who did not respond to the questionnaire ( $n = 146$ ) are reported as having unknown care (Figure 1).

### 3.2 | Blood Pressure Levels

Data on blood pressure could be gathered from 87% of all PHCCs ( $n = 198$ ) in Region Stockholm, that is, among those connected

**TABLE 1** | Results of the digital questionnaire (81 responses).

	Yes	No
Does the primary health care center have a specific care flow for individuals with hypertension? <i>The term “care flow” refers to whether the PHCC has a specified organization for the management of individuals with hypertension—who does what, when and how.</i>	83% ( <i>n</i> = 67)	17% ( <i>n</i> = 14)
Does the primary health care center have a specific booking system (calendar) for individuals with hypertension, where they can book appointments with a nurse?	52% ( <i>n</i> = 42)	48% ( <i>n</i> = 39)
Has the primary health care center designated a specific nurse to take care of individuals with hypertension	62% ( <i>n</i> = 50)	38% ( <i>n</i> = 31)

**TABLE 2** | Differences in blood pressure levels, adjusted to size of PHCC and socio-economic relation (CNI) using quantile regression.

	Unknown care Median	Non–nurse-managed hypertension care Median ( <i>p</i> value)	Nurse-managed hypertension care Median ( <i>p</i> value)
Proportion with blood pressure < 140/90 mmHg	0.43	0.44 (0.88)	0.45 (0.30)
Proportion with blood pressure ≤ 140/90 mmHg	0.57	0.58 (0.72)	0.59 (0.06)

Note: *p* values are differences versus unknown medical care.

to PvQ. Number of observations was largest in unknown care (*n* = 1459), versus in nurse-managed care (*n* = 556) and non–nurse-managed care (*n* = 285). No differences in blood pressure levels and organization were seen regarding the different thresholds (<140/90 or ≤140/90 mmHg). Please see Table 2, Blood pressure (PvQ).

### 3.3 | Indicators for Follow-up

Descriptive data on key figures and indicators for follow-up (LUD) are shown in Table 3, while quantile regression was used to adjust data in Table 4. There was a somewhat higher detection rate, and higher rates of visits to registered nurses in nurse-managed hypertensive care compared to unknown type of care, but no significant differences compared to non–nurse-managed care. There were no statistically significant differences between detection rate of hypertension, prevalence of hypertension, or avoidable in-patient care.

## 4 | Discussion

The main findings were that nurse-managed hypertension PHCCs showed a slightly higher diagnosis rate of hypertension, and higher rates of visits to registered nurses, while there were no differences in desirable blood pressure levels, detection rate, prevalence of hypertension, or episodes of avoidable in-patient care.

High blood pressure is one of the leading risk factors accounting for millions of deaths globally, together with other important risk factors such as smoking, high fasting plasma glucose and high BMI are leading [20]. Even if treatment goal fulfillment has improved over years, a recently published Swedish study found that treatment goal below 140/90 mmHg was reached in 52% [21].

In comparison, in the beginning of 2022, 45% of the residents in Region Stockholm with a hypertension diagnosis reached a blood pressure below 140/90 mmHg (PvQ) [17]. High blood pressure is estimated to contribute to and explain 18% of all deaths in Region Stockholm [22]. The treatment of persons with high blood pressure is therefore an urgent task, imposed on PHC, who in Sweden has the main responsibility for the care and follow up of individuals with hypertension. Earlier published reviews have found that nurse-managed care could lead to similar or in some cases better outcomes of care of some conditions in PHC, including slightly better blood pressure outcomes [15, 23]. This is not surprising, as nursing aims to foster self-care by encouraging patients to engage in activities independently that contribute to the enhancement of their health. However, one review concluded that there is insufficient evidence that this will decrease the outcome burden of cardiovascular diseases [15]. Certainly, teamwork is important, in taking advantage of the skills of different professions. We found no important differences between PHCCs with nurse-managed hypertension care compared to PHCCs with other types of care. One important finding was that PHCCs with nurse-managed hypertension care showed good rates with no differences against non–nurse-managed PHCC care of desirable blood pressure levels, detection rate of hypertension, prevalence of hypertension, or episodes of avoidable in-patient care in parity with other types of PHCCs. This is in line with a previous study that we conducted where we found just as good cardiovascular pharmacotherapy and a higher level of registered recommended lifestyle advice in nurse-managed hypertension care [16]. Moreover, when we previously analyzed those who receive lifestyle advice according to recommendations versus those who do not have such advice registered; the pharmacotherapy was more thorough and according to treatment recommendations to a higher degree [24]. Combined, the present study together with the two previous studies that we have conducted suggest that nurse-managed hypertensive care is safe and effective.

**TABLE 3** | Descriptive table for mean (SD) and median [min, max] of the key figures and indicators for follow-up of hypertension in primary health care.

	Unknown care	Non-nurse-managed hypertension care	Nurse-managed hypertension care
Detection rate hypertension			
Mean (SD)	0.796 (0.0741)	0.812 (0.0612)	0.822 (0.0591)
Median [min, max]	0.801 [0.451, 0.917]	0.809 [0.648, 0.911]	0.828 [0.658, 0.931]
Diagnosis rate			
Mean (SD)	0.978 (0.0317)	0.981 (0.0382)	0.987 (0.0181)
Prevalence hypertension			
Mean (SD)	0.162 (0.0438)	0.167 (0.0447)	0.164 (0.0484)
Median [min, max]	0.161 [0.0488, 0.337]	0.159 [0.0964, 0.284]	0.155 [0.0375, 0.328]
Visits to registered nurses			
Mean (SD)	0.225 (0.0712)	0.240 (0.0661)	0.266 (0.0633)
Median [min, max]	0.224 [0.0410, 0.449]	0.233 [0.130, 0.400]	0.260 [0.164, 0.427]
Avoidable in-patient care occasions			
Mean (SD)	0.185 (0.0562)	0.170 (0.0345)	0.187 (0.0457)
Median [min, max]	0.172 [0.0580, 0.383]	0.174 [0.103, 0.248]	0.185 [0.0769, 0.304]

**TABLE 4** | LUD key figures and indicators for follow-up (LUD), adjusted in a quantile regression model for size of PHCC and socio-economic relation (CNI), with first model unknown care as referents, and in second model non-nurse-managed care as referents.

Variable	Unknown care Median	Non-nurse-managed hypertension care Median (p value)	Nurse-managed hypertension care Median (p value)
Unknown care as referents			
Detection rate hypertension	0.80	0.80 (0.93)	0.82 (0.07)
Diagnosis rate	0.99	0.99 (0.69)	1.00 (0.03)
Prevalence hypertension	0.18	0.17 (0.47)	0.17 (0.56)
Visits to registered nurses	0.28	0.27 (0.81)	0.32 (0.00)
Avoidable in-patient care occasions	0.13	0.14 (0.51)	0.15 (0.15)
Non-nurse-managed care as referents			
Detection rate hypertension	0.80 (0.92)	0.80	0.82 (0.18)
Diagnosis rate	0.99 (0.68)	0.99	1.00 (0.48)
Prevalence hypertension	0.18 (0.46)	0.17	0.17 (0.84)
Nurse (registered nurses) visits	0.28 (0.81)	0.27	0.32 (0.08)
Avoidable in-patient care occasions	0.13 (0.52)	0.14	0.15 (0.61)

One factor of importance when measuring blood pressure is the presence of “white coat hypertension” [25, 26]. Blood pressure measured by doctors tend to be higher than by nurses [27]. However, within this study we don’t have access to if the blood pressures were measured by doctors or nurses. As “white coat hypertension” is well known at PHCCs, it is most common that blood pressures measured by nurses is the base for a diagnosis of hypertension.

There are some limitations with this study. The response rate to the questionnaire was 36%, and answers to the questionnaire were self-reported by the head of each PHCC. The response rate was low and that is common in primary care and the present questionnaire was mailed when primary care centers were occupied with COVID vaccinations, which may have affected the response rate. We did not have access to hard endpoints, such as cardiovascular diseases on PHC-level but this was recently



studied separately on individual level [16]. Both private and public health care centers were included in the analysis [28], which is important for representativity reasons.

In conclusion, we found no great differences between the quality indicators between the different type of PHCCs, and the nurse-managed hypertension care units were on par with the other types of PHCCs. Thus, nurse-managed hypertension care seems to be as safe as other types hypertension care at PHHCs. It is warranted that longitudinal studies are undertaken with results on outcomes such as incident cardiovascular events are compared between nurse-managed hypertensive care and other forms of care, also including health economics as evidence of this is lacking [23].

## Author Contributions

C.I., P.W., M.B., A.N., J.E., J.H., S.L., C.S., and A.C.C. contributed to the conceptualization, methodology, and design of the study. A.C.C. and J.E. performed data curation and formal analysis. C.I., P.W., C.S., and A.C.C. contributed to the visualization and writing of the original draft. All authors contributed to the writing, reviewing and editing of the manuscript.

## Acknowledgments

The authors have nothing to report.

## Ethics Statement

This study was conducted with ethical approval granted by the Swedish Ethical Review Authority, designated under act number 2020-07076. Subsequently, the Stockholm Region provided a dataset comprising pertinent data for the study, having obtained approval from the regional Center for Health Data.

## Consent

The Stockholm Region provided a dataset comprising pertinent data for the study, having obtained approval from the regional Center for Health Data.

## Declaration of Generative AI and AI-Assisted Technologies

Chat-GPT was used to improve language fluency, but not in interpreting results. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

## Conflicts of Interest

The authors declare no conflicts of interest.

## Data Availability Statement

Interested parties can contact the corresponding author for potential collaborations. Data is available from the regional Center for Health Data in Stockholm, for competent researchers with ethical approval for their studies.

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## Supporting Information

Additional supporting information can be found online in the Supporting Information section.