Adhikari et al., Prim Health Care 2019, 9:1
DOI: 10.4172/2167-1079.1000319

Primary Health Care: Open Access

Review Article Open Access

Association between Primary Health Care Access and Acute Care Utilization for Hypertension: A Systematic Review

Kamala Adhikari[1]*, Hena Qureshi[1], Amy Metcalfe[1,2], Robin L Walker[1,3], Ceara T Cunningham[1,3], Kerry McBrien[1,4] and Paul E Ronksley[1]

[1]*Department of Community Health Sciences, University of Calgary, Calgary, Alberta, Canada*
[2]*Department of Obstetrics and Gynecology, University of Calgary, Calgary, Alberta, Canada*
[3]*Alberta Health Services, Alberta, Canada*
[4]*Department of Family Medicine, University of Calgary, Calgary, Alberta, Canada*

Abstract

Background: Ambulatory Care Sensitive Conditions (ACSC) are chronic conditions for which hospitalizations can potentially be avoided through timely and effective primary health care; one of these is hypertension. However, the association between primary health care access and ACSC hospitalizations is not consistent in the literature. We conducted a systematic review to assess the association between primary health care access and hospitalizations or emergency department visits using hypertension as the ACSC of interest.

Methods: We searched two electronic databases (Medline and Embase) from inception to September 2017 to identify all observational studies evaluating the association between primary health care access and acute care utilization (hospitalizations or emergency department visits) for patients diagnosed with hypertension. Results were synthesized narratively. Study quality was assessed using components of the Newcastle Ottawa Scale and the Downs and Black Checklist.

Results: Our search strategy yielded 5,123 abstracts; 3 met all inclusion criteria. Two studies found a positive association between primary health care access (the number of primary care visits or general practitioner density) and hospitalization rates for hypertension, while the other study found increases in general practitioner density resulted in a reduction in hospitalization rates for hypertension. Study metrics and quality varied substantially across the selected studies. No studies adjusted for system-level factors or severity of hypertension.

Conclusions: There is limited and inconclusive evidence on the relationship between access to primary health care and acute care utilization for hypertension. Further research, including adjustment for disease severity and key confounders is required to elucidate this relationship.

Keywords: Ambulatory care sensitive conditions; Primary health care; Hypertension; Emergency department visits; Hospitalization

Background

Timely and effective outpatient care can help avoid a hospitalization through disease control and prevention [1]. A disproportionate number of these potentially avoidable hospital admissions occur in people with chronic conditions [2]. Many chronic conditions can be managed effectively in Primary Health Care (PHC) with the right medical screening, monitoring, management and follow-up [3-6]. These chronic conditions are known as Ambulatory Care Sensitive Conditions (ACSCs). The concept of ACSCs was first developed in the United States to identify hospitalizations that could potentially be avoided with access to appropriate ambulatory or PHC in the community [5,7]. Now internationally recognized and widely used across countries as a health care quality indicator, hospitalizations and emergency department visits for ACSCs represent a proxy measure of access to and quality of PHC for patients with ACSCs [2,8,9]. In theory, if timely access and effective PHC is provided to patients with ACSCs, the onset of complications and risk of acute care episodes could be reduced [7,8,10]. Thus, it has been hypothesized that greater access to PHC could potentially lower the hospitalization rates for ACSCs.

However, this expected association between PHC access and ACSC hospitalizations is not strongly supported by evidence [7,10-14]. There are conflicting findings with respect to the association between PHC access and hospitalizations for ACSCs; however, there are few systematic studies of this association. To our knowledge, there has only been one systematic review assessing the association between access to PHC and risk of hospitalization among people with diabetes [4]. This review found inconclusive evidence to support the theory that PHC access is associated with reduced ACSC hospitalizations. It is unknown how generalizable these results are to other ACSCs, such as hypertension, asthma, congestive heart failure or chronic obstructive pulmonary disease.

One ACSC that has not been systematically reviewed in the context of PHC access and hospitalization rate is hypertension. Hypertension is one of the most common chronic conditions with a global prevalence of about 40 percent in adults over the age of 25 [15]. Health care spending for the management of hypertension and related complications is also high (estimated to be 10% of all health care spending) [16,17]. Moreover, the majority of patients with hypertension are managed in primary care and hypertension is the most common reason for patients to visit their primary care provider in Canada [13,15]. Therefore, this systematic review examines the association between PHC access and hospitalizations or emergency department visits for hypertension in an adult population.

***Corresponding author:** Kamala Adhikari, MSc, PhD, Department of Community Health Sciences, University of Calgary, 3330 Hospital Drive NW, Calgary, T2N 4N1, Alberta, Canada, E-mail: kamala.adhikaridahal@ucalgary.ca

Received: December 24, 2018; **Accepted:** January 08, 2019; **Published:** January 15, 2019

Citation: Adhikari K, Qureshi H, Metcalfe A, Walker RL, Cunningham CT, et al. (2019) Association between Primary Health Care Access and Acute Care Utilization for Hypertension: A Systematic Review. Prim Health Care 9: 319. doi: 10.4172/2167-1079.1000319

Methods

Data sources and search strategy

This review followed a pre-specified protocol and in accordance to Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) reporting guidelines (See Additional File 1) [18]. The search of online databases included Medline: 1950 through September 2017 and Embase: 1980 through September 2017 with no restriction on language or date. We also searched reference lists of relevant articles, conference proceedings from the North American Primary Care Research Group Annual Conference for the past 3 years and contacted experts in the field regarding missed, ongoing or unpublished studies.

Our literature search combined three main concepts. To identify the relevant exposure, the first Boolean search was done using the term "OR" to explode (search by subject heading) and map (search by key words) "primary health care" or "primary care" or "primary care access" or "primary care resourcing" or "general practitioner*" or "physician*"or "family doctor" or "GP use". To capture hypertension, the second Boolean search used the term OR to explode and map "ambulatory care sensitive condition*" or "hypertension" or "chronic condition*". We did not limit our search to hypertension given that some studies report on multiple conditions. Finally, to identify relevant outcomes, a third Boolean search was done using the term OR to explode and map "hospitalization" or "hospital admission" "emergency ward" or "emergency visit*" or "emergency service use". These three search categories were then combined using the Boolean operator "AND" (See Additional File 2).

Study selection

Two individuals independently reviewed all identified abstracts for eligibility. All abstracts reporting on the association between PHC access and hospitalization and/or emergency department visits for any ACSC (with or without stratification by hypertension) were selected for full text review. This stage was intentionally broad. The same reviewers then performed full text review of articles. Articles were retained for the systematic review if they met all of the following criteria: (i) study population (adults ≥18 years old); (ii) exposure (PHC access – including either a direct or indirect measure of primary care access, e.g., PHC visit frequency or PHC practitioner density); (iii) outcome (hospitalization or emergency department visit for hypertension); and (v) study design (observational studies: cohort, case-control, cross-sectional and ecological).

Any disagreement in abstract review and/or study inclusion was resolved through discussion between the two reviewers and, when necessary, a third reviewer (PR). Agreement between the two reviewers was evaluated using Cohen's Kappa statistic.

Data extraction and quality assessment

Two reviewers independently extracted data using a standardized data extraction template. This included study characteristics (author, year, data sources, sample size, study design) and population characteristics (age, sex, income, location of residence and comorbidities). We also extracted details of exposure and outcome variables–PHC access indicator and measurement, hypertension-related hospitalizations and/or emergency department visits. Any disagreement in the data extraction was resolved through discussion between the two reviewers and, when necessary, a third reviewer (PR).

Variation in hypertension-related hospitalization or emergency department visits may be confounded by a number of different factors. Specifically, patient, provider and health care system level factors may influence the association between PHC access and hospitalizations or emergency department visits [8,10,14,19]. Thus, we recorded whether studies adjusted for these factors when examining the association between PHC access and hypertension-related hospitalizations or emergency department visits. These included demographic characteristics, comorbidities and severity of hypertension at the patient level; quality of care indicators (such as frequency and accuracy of blood pressure measurement, presence of measured weight, whether health education was provided, medication management, laboratory investigations) at the provider level; and variations in insurance status or categorization as public or private systems at the health care system level.

Study quality was assessed using a component-based approach from two commonly used scales for observational studies, the Newcastle Ottawa Scale [20] and the Downs and Black Checklist [21]. We specifically focused on whether studies adjusted for important confounding variables (such as comorbidities, severity of disease, health care provider and/or system level factors), generalizability of the study (i.e., representativeness of study population to the general population) and whether a clear description of study population characteristics, exposure and outcome variables were provided.

Data synthesis

All studies identified and excluded (with the reason for exclusion) were summarized using a PRISMA flow diagram [18]. We summarized individual study characteristics and key findings using narrative synthesis. We included overall findings of individual studies on the association between PHC access and hospitalizations or emergency department visits for hypertension, type of statistical analysis performed and whether they adjusted for potential confounding variables in the analysis. It was not possible to pool data due to heterogeneity across studies. Instead, we explored the differences across studies and hypothesized potential reasons for these differences.

Results

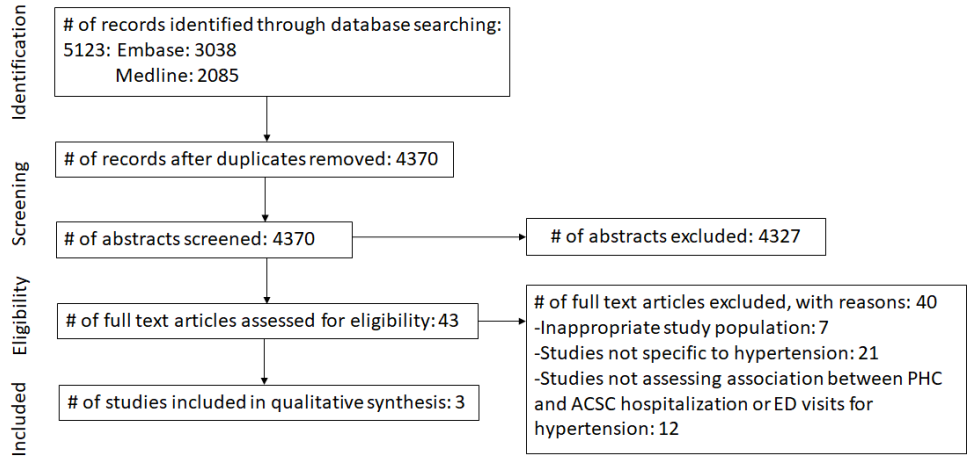
Study selection

The initial search retrieved 5,123 articles. On review of the title and abstracts, 5,080 articles were excluded, leaving 43 articles for full text review. The Cohen's Kappa coefficient between the two reviewers was 0.82 (95% CI: 0.71, 0.92) suggesting moderate agreement during the first stage of abstract screening. On full text review, 39 out of 42 articles were excluded, leaving three articles for the systematic review (Figure 1) [1,22,23]. At this stage, the Cohen's Kappa coefficient between the two reviewers was 1.0.

Study characteristics

Characteristics of studies that met our inclusion criteria are displayed in Table 1. All included studies were published in 2014, with sample sizes ranging from 205,496 to 40,600,000 [1,22,23]. One study used a retrospective cohort design [1], while the other two used ecological designs [22,23]. All three articles used administrative or census data sources from varying timeframes (Table 1). Walker et al. analyzed data from 1994-2008, Freund et al. analyzed data from 2000-2010 and the Burgdork et al. analysis was based on data from 2008.

PHC access was measured using the number of primary care provider visits (within a specific timeframe) or density (number of general practitioners for a given population). Walker et al. defined PHC access as the number of primary care provider visits one year



Abbreviations: PHC: Primary Health Care; ACSC: Ambulatory Care Sensitive Conditions; ED: Emergency Department

Figure 1: PRISMA flow diagram.

Author and Date Published (Country)	Study Design (Date)	Sample Size	Data Source	Description of Measure for Primary Health Care Access	Hospital Identification of Hypertension	Description of Measure for Hospitalization or ED visits
Primary Care Provider Access as Measured by Number of Visits						
Walker et al. 2014 [1] (Canada)	Retrospective Cohort Study (1994-2008)	460930	Alberta Administrative health databases (Alberta health insurance registry, hospital discharge abstracts, physician billing claims and ambulatory care classification system)	Number of PCP visits with uncomplicated hypertension as the reason for visit (following the year after diagnosis for hypertension and before hospitalization) Grouped by 0 visits, 1-4 visits and ≥5 visits	ICD-9 codes 401.x, 402.x, 403.x, 404.x, or 405.x before 2002. ICD-10 codes I10.x, I11.x, I12.x, I13.x, or I15.x after 2002.	Hospitalization rate per 10000 prevalent hypertensive and ED visit per 10000 prevalent hypertensive
Primary Care Provider Access as Measured by Density						
Burgdorf et al. [22] (Germany)	Ecological Study (2008)	406 counties and urban districts (≈100000 population/county or urban district) Population total of 40600000	German population statistics (Federal Institute for Research on Building, Urban Affairs and Spatial Development)	General Practitioners per 100000 population	ICD-10 codes I10 and I11.9	Hospitalization rate per 100000 population at district level
Freund et al. [23] (Germany)	Ecological Study (2000-2010)	205496	Federal Statistical Office and the Gesundheitsberichter-reporting of the Federation	General Practitioners per 100000 population	ICD-10 Codes I10-I15	Number of hospitalization cases annually per 100000 population in the years 2000-2010

Abbreviations: ED: Emergency Department

Table 1: Study characteristics of identified articles.

after diagnosis of hypertension and before ACSC hypertension hospitalization [1]. Burgdork et al. and Freund et al. defined PHC access as the number of general practitioners per 100,000 population [22,23]. The ACSC hypertension hospitalization identification codes used in the Walker et al. study were International Classification of Disease (ICD) Version 9 and ICD-10, while Burgdork et al. and Freund et al. used ICD-10. Walker et al. and Burgdork et al. used rate of hospitalization as the outcome measure while Freund et al. measured the outcome as annual hospitalization cases for each additional family doctor per 100,000 populations.

Association between access to primary health care and acute care utilization

The association between access to PHC and acute care utilization is displayed in Table 2. Walker et al. found a statistically significant association between PHC access and hospitalizations or emergency department visits – as the number of hypertension-related primary care provider visits increased, the rate of ACSC hospitalizations or emergency department visits for hypertension also increased [1]. Freund et al. found that for each additional family doctor per 100,000 inhabitants, annual hospitalization cases increased by a factor of 5 [23]. Whereas, Burgdorf et al. found the inverse relationship; a one-unit increase in general practitioner density was associated with a 0.4% and 0.5% reduction in the rate of hospitalizations for women and men, respectively [22].

Quality assessment

Study quality varied across the three studies as displayed in Table 3. Only Walker et al. described study population characteristics such as age, sex, income and location of residence (urban *vs.* rural). All three

Author and Date Published (Country)	Type of analysis (reporting of results)	Outcome Results of Study; Confidence Interval	Association of PHC access with avoidable hospitalizations	Statistical Adjustments
Walker et al. [1] (Canada)	Stratification by PCP visits	0 PCP visits= 5.74 hospitalizations/10000; 95% CI, 4.72-6.98 1-4 PCP visits= 6.83 hospitalizations/10000; 95% CI, 5.83-7.99 ≥5 PCP visits= 11.73 hospitalizations/10000; 95% CI, 9.28-14.82 0 PCP visits = 15.9 ED visits/10000; 95% CI, 13.8-8.2 1-4 PCP visits = 20.5 ED visits/10000; 95% CI, 18.5-22.8 ≥5 PCP visits = 16.9 ED visits /10000; 95% CI, 13.5-21.1	(Significant increase in PHC access=increase in ACSC hospitalizations)	Age, sex, income, region of residence, and comorbidities (Adjusted rates were similar to unadjusted rates)
Burgdorf et al. [22] (Germany)	Linear Regression Analysis assessing effect of per unit change in GP density on hospitalization rates stratified by gender	Women: A one unit change in GP density causes hospitalization to decrease by -0.004 Men: A one unit change in GP density causes hospitalization to decrease by -0.005	(Significant increase in PHC access=decrease in ACSC hospitalizations)	Sex, income, employment, and region of residence
Freund et al. [23] (Germany)	Bayesian Spatial Analytic Regression Model	Increase in 5 hospitalization cases annually for each additional family doctor per 100000 inhabitants; 95% CI, (1-10)	(Significant increase in PHC access=increase in ACSC hospitalizations)	Age

Abbreviations: PHC: Primary Health Care; PCP: Primary Care Practitioner; ED: Emergency Department; GP: General Practitioner; ACSC: Ambulatory Care Sensitive Condition

Table 2: Association between primary health care access and acute care use for hypertension.

Author	Characteristics of study population described	Generalizability	Adequate description of exposure variable	Adequate description of outcome variable	Adjusted for severity of hypertension	Adjusted for the health care system and provider level factors	Appropriateness of statistical test
Walker et al. [1]	Yes	Yes	Yes	Yes	No	No	Yes
Burgdorf et al. [22]	No	Yes	Yes	Yes	No	No	Yes
Freund et al. [23]	No	Yes	Yes	Yes	No	No	Yes

Table 3: Study quality assessment of identified articles.

studies were found to be generalizable to the general population as they were conducted on population-based cohorts. All studies adjusted for patient level confounding variables; Walker et al. adjusted for age, sex, income, location of residence and comorbidities; Burgdorf et al. adjusted for sex, income and location of residence; and Freund et al. adjusted for age only. However, none of the studies adjusted for severity of hypertension (such as diastolic and systolic blood pressure level), system level factors (such as health care system and private or public health insurance status) or provider level factors/quality of care in their analyses.

Discussion

In theory, if appropriate, continuous, comprehensive and coordinated care is not given to patients with an ACSC at the PHC level, the likelihood of an avoidable hospitalization increases [1,2,6,10,24]. This systematic review was conducted to determine if the relationship between indicators of PHC access and hospitalizations or emergency department visits for one ACSC, hypertension, in an adult population was supported in the literature. From the articles identified, 2 out of the 3 articles found that hospitalizations for hypertension increased with increasing access to PHC [1,23]. The other displayed the inverse association; an increase in PHC access was associated with a decrease in hospitalizations for hypertension [22].

The relationship between access to PHC and acute care utilization for ACSC remains uncertain. A recent systematic review on avoidable diabetes-related hospitalizations also found a mixed association between PHC access and diabetes hospitalizations [4]. The majority of articles included in that review reported an inverse association between PHC access and diabetes hospitalization– better access to PHC resulted in fewer diabetes related hospitalizations and some reported a positive association [4]. Similar to our review, different proxy measures of PHC access (mostly ecological measures – the number of general practitioners per population) were used in the included studies. The use of different proxy measures of PHC access can result in mixed findings between PHC access and acute care utilization for ACSC [14]. Furthermore, authors of this review also felt that the evidence was inconclusive due to the limited adjustment for important confounding variables such as disease severity [25,26].

Increasing acute care utilization despite high access to PHC may have been influenced by physician payment systems. If physician payment is based on the number of patients examined, which exists in Canada, the frequent physician visits by patients (thus, increased number of PHC visits) may have occurred without actually impacting the quality of care they received. The quality of care provided through PHC plays a role in effectively managing patients with hypertension rather than just looking at quantity of visits or density of primary care providers. Similarly, management of hypertension by a primary care provider is not standardized across practitioners and studies have shown that the use of clinical practice guidelines for blood pressure measurements varies by practitioners [27]. Practitioners have been shown to not aggressively manage hypertensive patients [28-31], often resisting increasing intensity or changing antihypertensive medications even among patients who are having difficulty controlling blood pressure [32]. Thus, inappropriate care may be one underlying cause of increasing acute care utilization despite high access to PHC [3]. Improved management of hypertension treatment may be achieved by broadening treatment settings not only to general practitioners but to other health care providers and facilities that allow patients to monitor their own blood pressure. Studies have shown that pharmacists can

effectively manage hypertension in the primary health care setting through patient education, medication and monitoring [33]. Health care networks in some countries have given pharmacists full range of prescribing privileges to improve health care delivery [34]. These privileges allowed pharmacists to adapt a prescription, prescribe in an emergency or to manage ongoing therapy. With this in mind, a broadened definition of PHC access for hypertension, which includes pharmacy and other settings, may provide a better understanding of how the management of hypertension in an outpatient setting is truly associated with potentially preventable acute care encounters.

We recognize that there are numerous patient, provider and system-level factors that influence the construct of potentially preventable acute care use for ACSC. It is possible that residual confounding may explain the variable results in this review. A key confounder that has been identified as a significant predictor of avoidable hospitalization is disease severity [25,26]. Indeed, patients who access their primary care provider more frequently may be doing so because they are sicker and therefore more likely to present to acute care. Unfortunately, studies were limited by lack of outpatient clinical data (e.g., blood pressure measurements) to adjust for severity of hypertension or other comorbidities within their analysis. Another important potential confounder not adjusted for by many studies, including the previous systematic review on diabetes [4] and our current review, is the presence of multi-morbidity. Patients with additional medical conditions may have higher use of PHC services than those with lower levels of co-morbidity and may be more likely to be hospitalized due to their medical complexity [10,35]. Furthermore, the use of different ICD codes for hypertension or differences in how countries code an encounter within hospital administrative data sources (i.e. most responsible diagnoses coded based on 'reason for admission' versus 'the condition resulting in the greatest resource utilization within an encounter) may partly play a role in the variable findings [36]. This was evident from this current review as the ICD codes used for hypertension in a study that showed an inverse relationship [22] was substantially different from other two studies that showed a positive association [1,23].

This systematic review should be interpreted in light of its strengths and limitations. First, this review used a comprehensive search strategy in addition to consultation with experts in the field and provides valuable insight in the association between PHC access and ACSC hospitalization or emergency department visit for a common chronic condition. Using this information in conjunction with other systematic reviews on the topic of ACSC may help inform whether this concept is truly an effective indicator of primary care quality or whether other metrics should be considered. However, there were a limited number of studies identified in our systematic review and the included studies were heterogeneous. While this prevented us from making clear conclusions on the association between PHC access and potentially preventable acute care use, it highlighted gaps in the literature and areas for improvement in future primary studies on this topic. This includes consideration of severity of disease, comorbidities and measurement of additional provider and system-level factors.

Conclusion

There is limited evidence on the relationship between access to PHC and acute care utilization for hypertension. From our systematic review, the association between PHC access and hospitalizations or emergency department visits for hypertension is inconclusive. Our findings indicate that the concept of ACSC as a measure of access to PHC and the capacity of the system to manage hypertension is questionable. Future studies should adjust for the severity of hypertension, comorbidities and quality of PHC, to elucidate the relationship between access to PHC and acute care utilization for hypertension. This may help determine whether the concept of ACSC is a valid indicator/measure for access to PHC.

Acknowledgement

Kamala Adhikari is supported by the Vanier Canada Graduate Scholarship and the Alberta Innovates Studentship Award. Hena Qureshi is supported by the SVARE Chair in Health Research Scholarship through the University of Calgary. Amy Metcalfe is supported by a Canadian Institutes of Health Research New Investigator Award.

Competing Interests

The authors declare that they have no competing interests.

Funding

This was an investigator-initiated project. No sources of funding are related to the research reported.

References

1. Walker RL, Chen G, McAlister FA, Campbell NRC, Hemmelgarn BR, et al. (2014) Relationship between primary care physician visits and hospital/emergency use for uncomplicated hypertension, an ambulatory care-sensitive condition. Can J Cardiol 30: 1640-1648.
2. Backus L, Moron M, Bacchetti P, Baker LC, Bindman AB (2002) Effect of managed care on preventable hospitalization rates in California. Med Care 40: 315-324.
3. Johnson T, Patel R, Scott N, Olives T, Smith S, et al. (2015) Access to disease treatment among patients presenting to the emergency department with asthma or hypertension. J Emerg Med 48: 527-535.
4. Gibson OR, Segal L, McDermott RA (2013) A systematic review of evidence on the association between hospitalisation for chronic disease related ambulatory care sensitive conditions and primary health care resourcing. BMC Health Serv Res 13: 336.
5. Pappas G, Hadden WC, Kozak LJ, Fisher GF (1997) Potentially avoidable hospitalizations: Inequalities in rates between US socioeconomic groups. Am J Public Health 87: 811-816.
6. (1998) Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 38. UK prospective diabetes study group. BMJ 317: 703-713.
7. Brown AD, Goldacre MJ, Hicks N, Rourke JT, McMurtry RY, et al. (2001) Hospitalization for ambulatory care-sensitive conditions: A method for comparative access and quality studies using routinely collected statistics. Can J Public Health 92: 155-159.
8. Rizza P, Bianco A, Pavia M, Angelillo IF (2007) Preventable hospitalization and access to primary health care in an area of Southern Italy. BMC Health Serv Res 7: 134.
9. Laditka JN, Laditka SB, Probst JC (2009) Health care access in rural areas: Evidence that hospitalization for ambulatory care-sensitive conditions in the United States may increase with the level of rurality. Health Place 15: 731-740.
10. Sanmartin CA, Khan S, Team LR (2011) Hospitalizations for ambulatory care sensitive conditions (ACSC): The factors that matter: Statistics Canada, Health Information and Research Division.
11. Ansari Z, Laditka JN, Laditka SB (2006) Access to health care and hospitalization for ambulatory care sensitive conditions. Med Care Res Rev 63: 719-741.
12. Krakauer H, Jacoby I, Millman M, Lukomnik JE (1996) Physician impact on hospital admission and on mortality rates in the Medicare population. Health Serv Res 31: 191-211.
13. Clement FM, Chen G, Khan N, Tu K, Campbell NR, et al. (2014) Primary care physician visits by patients with incident hypertension. Can J Cardiol 30: 653-660.
14. Rosano A, Loha CA, Falvo R, van der Zee J, Ricciardi W, et al. (2013) The relationship between avoidable hospitalization and accessibility to primary care: A systematic review. Eur J Public Health 23: 356-360.
15. World Health Organization (2013) A global brief on hypertension: Silent killer, global public health crisis: World Health Day 2013.

16. World Health Organization (2008) World Health Organization 2008-2013 action plan for global strategy for the prevention and control of non-communicable diseases: Prevent and control cardiovascular diseases, cancers, chronic respiratory diseases and diabetes.

17. Cecchini M, Sassi F, Lauer JA, Lee YY, Guajardo-Barron V, et al. (2010) Tackling of unhealthy diets, physical inactivity and obesity: Health effects and cost-effectiveness. Lancet 376: 1775-1784.

18. Moher D, Liberati A, Tetzlaff J, Altman DG, Prisma G (2009) Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. PLoS Med 6: e1000097.

19. Magan P, Alberquilla A, Otero A, Ribera JM (2011) Hospitalizations for ambulatory care sensitive conditions and quality of primary care: Their relation with socioeconomic and health care variables in the Madrid regional health service (Spain). Med Care 49: 17-23.

20. Wells GA, Shea B, O'Connell D, Peterson J, Welch V, et al. (2015) The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomized studies in meta-analyses.

21. Downs SH, Black N (1998) The feasibility of creating a checklist for the assessment of the methodological quality both of randomised and non-randomised studies of health care interventions. J Epidemiol Community Health 52: 377-384.

22. Burgdorf F, Sundmacher L (2014) Potentially avoidable hospital admissions in Germany: An analysis of factors influencing rates of ambulatory care sensitive hospitalizations. Dtsch Arztebl Int 111: 215-223.

23. Freund T, Heller G, Szecsenyi J (2014) Hospitalisations for ambulatory care sensitive conditions in Germany. Z Evid Fortbild Qual Gesundhwes 108: 251-257.

24. World Health Organisation (1986) The Ottawa charter for health promotion.

25. Muenchberger H, Kendall E (2010) Predictors of preventable hospitalization in chronic disease: Priorities for change. J Public Health Policy 31: 150-163.

26. US Department of Health and Human Services (2004) AHRQ quality indicators-guide to inpatient quality indicators: Quality of care in hospitals-Volume, Mortality and Utilization.

27. Daskalopoulou SS, Rabi DM, Zarnke KB, Dasgupta K, Nerenberg K, et al. (2015) The 2015 Canadian hypertension education program recommendations for blood pressure measurement, diagnosis, assessment of risk, prevention and treatment of hypertension. Can J Cardiol 31: 549-568.

28. O'Connor PJ (2003) Overcome clinical inertia to control systolic blood pressure. Arch Intern Med 163: 2677-2678.

29. Oliveria SA, Lapuerta P, McCarthy BD, L'Italien GJ, Berlowitz DR, et al. (2002) Physician-related barriers to the effective management of uncontrolled hypertension. Arch Intern Med 162: 413-420.

30. Cushman WC, Basile J (2006) Achieving blood pressure goals: Why aren't we? J Clin Hypertens (Greenwich) 8: 865-872.

31. Okonofua EC, Simpson KN, Jesri A, Rehman SU, Durkalski VL, et al. (2006) Therapeutic inertia is an impediment to achieving the Healthy People 2010 blood pressure control goals. Hypertension 47: 345-351.

32. Walker R (2013) Hospitalizations for uncomplicated hypertension: An ambulatory care sensitive condition.

33. Tsuyuki RT, Houle SK, Charrois TL, Kolber MR, Rosenthal MM, et al. (2015) Randomized trial of the effect of pharmacist prescribing on improving blood pressure in the community: The Alberta clinical trial in optimizing hypertension (RxACTION). Circulation 132: 93-100.

34. Makowsky MJ, Guirguis LM, Hughes CA, Sadowski CA, Yuksel N (2013) Factors influencing pharmacists' adoption of prescribing: Qualitative application of the diffusion of innovations theory. Implement Sci 8: 109.

35. Lee YJ, Boyd AD, Li JJ, Gardeux V, Kenost C, et al. (2014) COPD hospitalization risk increased with distinct patterns of multiple systems comorbidities unveiled by network modeling. AMIA Annu Symp Proc 2014: 855-864.

36. Quan H, Moskal L, Forster AJ, Brien S, Walker R, et al. (2014) International variation in the definition of 'main condition' in ICD-coded health data. Int J Qual Health Care 26: 511-515.