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Original Article

Assessing Primary Care Blood Pressure Documentation for Hypertension Management During the COVID-19 Pandemic by Patient and Provider Groups

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ABSTRACT

Background: Primary care electronic medical record (EMR) data can be used to identify, manage, and screen hypertension cases. However, this approach relies on completeness and accessibility of documented blood pressure (BP) values. With the large switch to virtual care due to the COVID-19 pandemic, we assessed BP documentation in primary care EMRs during the pandemic, across patient and physician groups.

Methods: Hypertension-related visits were identified during the pre-pandemic (January 2017 to February 2020) and pandemic (March 2020 to December 2021) periods from a primary care EMR database in Ontario, Canada. Clustered logistic regression models were used to analyze the relationship of physician and patient characteristics with an outcome variable of documented BP. A chart review of 3200 hypertension visits without a BP recorded in structured data fields was conducted to determine if BP was recorded in progress notes.

RÉSUMÉ

Contexte : Les données des dossiers médicaux électroniques (DME) provenant des soins primaires peuvent être utilisées pour détecter, prendre en charge et dépister les cas d'hypertension. Cependant, cette approche dépend de l'accessibilité et de l'exhaustivité des valeurs de pression artérielle (PA) consignées aux dossiers. Étant donné l'important passage aux soins virtuels attribuable à la pandémie de COVID-19, nous avons évalué la façon dont la PA avait été consignée dans les DME de soins primaires pendant la pandémie, parmi des groupes de patients et de médecins.

Méthodologie : Les consultations liées à l'hypertension pendant les périodes pré-pandémique (de janvier 2017 à février 2020) et pandémique (de mars 2020 à décembre 2021) ont été recueillies d'une banque de données de DME de soins primaires en Ontario (Canada). Des modèles de régression logistique regroupée ont été utilisés pour

Over the past several decades, electronic medical records (EMRs) have helped improve clinical documentation and patient outcomes.[1-3] A particular strength of primary care EMRs has been the capture of blood pressures (BPs) for hypertension management, which has both patient-level and system-level utility.[1,4-8] To provide the best clinical care for patients, an important factor is that BP be consistently measured and documented in structured fields to efficiently screen for hypertension and generate patient-level summary statistics, which includes tracking BP over time.[6] Structured data are entered in predefined templates or fields, which can be easily processed, searched, and identified.[9-11] Unstructured data provide information that is not available in a predefined format, such as clinical notes, progress reports, and other narrative documents.[7,8] Although unstructured data contain valuable clinical information, variables in this format are harder to identify and analyze in an efficient automated manner.[7] For secondary use, the accuracy of case definitions that use BP measurements (eg, methods for identifying patients with hypertension), in addition to prevalence and incidence rates, may be impacted negatively if these assessments are not captured accurately and recorded appropriately. Therefore, the insights gained from EMR data are contingent

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Results: Pre-pandemic, 75.7% of hypertension-related visits (113,966 of 150,511) had a BP recorded in structured documentation, but this significantly decreased to 36.4% (26,660 of 73,239) during the pandemic (odds ratio [OR] = 0.18, 95% confidence interval [CI]: 0.18-0.19). For virtual visits, 14.3% (6357 of 44,572) had a documented BP, vs 74.0% (20,056 of 27,089) for in-person visits. Chart review found that 55.9% of hypertension visits had no associated BP in structured documentation, but did have a BP recorded in the progress note. Male providers, compared to female providers, were less likely to record BPs pre-pandemic (OR = 0.45, 95% CI: 0.32-0.63) and during the pandemic, for both virtual visits (OR = 0.48, 95% CI: 0.32-0.71) and in-person visits (OR = 0.46, 95% CI: 0.33-0.64).

Conclusions: BP documented in primary care EMRs declined during the pandemic, most likely due to high rates of virtual visits impacting hypertension detection and management.

**analyser le lien entre les caractéristiques des médecins et de patients et une variable de résultats des PA consignées. Une revue des dossiers portant sur 3200 consultations pour hypertension sans consignation de la PA dans les champs de données structurés a été effectuée afin de déterminer si la PA avait été notée dans les notes d'évolution.

Résultats : Avant la pandémie, la PA avait été consignée dans une documentation structurée pour 75,7 % (113 966 sur 150 511) des consultations pour hypertension, mais cette proportion a chuté considérablement à 36,4 % (26 660 sur 73 239) pendant la pandémie (rapport des cotes [RC] = 0,18; intervalle de confiance [IC] à 95 % : 0,18-0,19). Pour ce qui est des consultations virtuelles, la PA a été consignée dans 14,3 % (6357 sur 44 572) des cas, comparativement à 74,0 % (20 056 sur 27 089) pour les consultations en personne. Une analyse des dossiers a révélé que pour 55,9 % des consultations pour hypertension, aucune mesure de PA ne figurait dans la documentation structurée, mais qu'une valeur de PA avait toutefois été consignée dans les notes d'évolution. Les professionnels de la santé masculins, comparativement aux femmes, ont été moins susceptibles de consigner les valeurs de PA avant la pandémie (RC = 0,45; IC à 95 % : 0,32-0,63) et pendant la pandémie, tant lors des consultations virtuelles (RC = 0,48; IC à 95 % : 0,32-0,71) que des consultations en personne (RC = 0,46; IC à 95 % : 0,33-0,64).

Conclusions : L'inscription des valeurs de PA dans les DME de soins primaires a décliné pendant la pandémie, fort probablement en raison de la proportion élevée de consultations virtuelles, ce qui a eu une incidence sur la détection et la prise en charge de l'hypertension.

on the documentation by healthcare providers and the capacity and usability of the EMR software architecture.[7,8]

The ongoing COVID-19 pandemic disrupted several healthcare services, including hypertension management.[12-14] A study from the US found that the mean number of monthly home BP readings increased significantly during the COVID-19 pandemic, from 7.3 to 9.3 per month, from January, 2019 to March, 2020, compared to April to August, 2020.[14] Another study found that in US primary care clinics, for 60,757 individuals who had BP recorded pre-COVID-19 (March 2019 to February 2020), over a quarter did not have any BP measurements recorded during the pandemic (March 2020 to February 2021).[13] Similarly, another study conducted in the US found that, from February to November 2020, a substantial decrease occurred in the number of BP measurements, with 15.6% of the patients not having BP measurements during this time.[12] The pandemic also resulted in a significant shift from in-person visits to virtual visits for primary care in several countries.[7,15-19] An international study conducted in 9 countries found that although Canada, Australia, and the US did not offer a substantial volume of virtual visits pre-pandemic, during the pandemic, the proportions of virtual visits were 77.0%, 41.8%, and 27.5%, respectively in those countries.[18] Countries with existing virtual clinic infrastructure, as indicated by those that offered virtual visits pre-pandemic, also had a significant increase in the proportion of virtual visits during the pandemic, as seen in Norway, the United Kingdom, and Sweden.[18]

Although research has outlined a change in BP documentation during the pandemic, to date, no studies have investigated the impact of virtual care on hypertension management during the pandemic. Research on BP documentation practices that have been conducted in a Canadian context is scarce. Furthermore, both pre-pandemic and during the pandemic, no studies investigated differences in the documentation of BP across different patient and physician groups. One possibility is that the clinical documentation of certain patient and/or physician groups is more impacted by the shift to virtual care. BPs entered in the EMR in the structured field are readily accessible for automated analysis. BPs entered in clinical notes, although sufficient for clinical purposes when reading the notes, are not amenable to automated analysis or evaluation within EMR graphing functions for assessment of changes over time. Although BPs during visits for hypertension appointments should be documented in structured fields, they could be documented elsewhere, or not at all, and we suspected that virtual visits were highly likely to not have documented BPs. This lack of documentation can result in certain patient groups experiencing a greater reduction in care and being unintentionally excluded from quality improvement initiatives, policies, and research, owing to their data being incomplete and/or unavailable for secondary use. Thus, an evaluation of the capture of BP measurements in primary care EMR databases during virtual visits across different patient and physician groups is needed. The purpose of this study was to assess the impact of the COVID-19 pandemic on hypertension management in primary care.

Material and Methods

Study design

This retrospective observational study used primary care EMR data to assess BP documentation during virtual care visits for hypertension during the pandemic, across patient and physician characteristics. Data from the EMR system

were used to investigate rates of virtual care for hypertension and BP documentation in structured fields, as well as to identify patient and physician characteristics associated with documentation. BP documentation in structured fields was assessed pre-pandemic (January 2017 to February 2020) and during the pandemic (March 2020 to December 2021).

Setting and database

The study used data from the University of Toronto Practice-Based Research Network (UTOPIAN) Data Safe Haven, an EMR database that contains clinical records from family medicine clinics in Ontario, Canada. UTOPIAN consists of records from family physicians who have consented to sharing their EMR data for the purposes of research and quality improvement.[20] Currently, the UTOPIAN database has data from 3 different EMR software vendors: PS Suite, Accuro, and OSCAR EMR.

Study population and variables

The population included all patients who had at least one family physician visit with a diagnosis code of hypertension (International Classification of Diseases, 9th revision, code 401) as the reason for the visit, from January 1, 2017 through December 31, 2021. The visit was the primary unit of analysis. Hypertension visits were assessed pre-pandemic (January 2017 to February 2020) and during the pandemic (March 2020 to December 2021) for structured BP entries. Patient sex and age were extracted directly from the EMR. Patient postal codes were used to determine neighborhood before-tax income quintiles and rurality (urban vs rural) based on the Statistics Canada Postal Code Conversion File.[21] Physician sex and years of practice (based on year of medical school graduation), as well as clinic-level information, were also extracted directly from the EMR. In the pandemic period, the Ontario Health Insurance Plan (OHIP) codes to indicate virtual visits, introduced March 14, 2020,[18] were used to identify whether hypertension visits were conducted virtually. Given that pre-pandemic virtual visits were not included within the publiclyfunded health system, visits were rarely conducted virtually ($< 1\%$),[18] and they were not captured accurately; hence, hypertension visits conducted virtually pre-pandemic were not assessed.

To identify whether BP was documented in unstructured progress notes, a random sample of approximately 10% of hypertension visits (3200), for which unstructured progress notes were available (60% of hypertension visits), that occurred during the pandemic and did not have structured BP measures were reviewed using manual chart abstraction. Two medically trained chart abstractors reviewed the progress notes of patient charts to identify whether BP was recorded.

Statistical analysis

Descriptive statistics were conducted to report the monthly number of hypertension visits with a BP measurement, pre-pandemic and during the pandemic period. In the pandemic period, results were stratified by delivery format (virtual vs in-person). Clustered logistic regression models were used to analyze the relationship of physician-level factors (years of practice and sex) and patient-level factors (age, sex, rurality, neighbourhood income) with the binary outcome variable of BP documented for pre-pandemic, virtual pandemic, and in-person pandemic hypertension visits. Another logistic regression model was conducted to analyze the relationship between physician-level and patient level-factors and the outcome if hypertension visits were conducted virtually. Clustering was done to account for potential multiple observations for providers and patients. The final models also included crossed random effects for providers and patients, to account for the fact that providers and patients were not nested within each other and for the possibility of correlations between different physician-patient pairs. Odd ratios, 95% confidence intervals, and *P*-values were reported for the final regression models, with $P < 0.05$ reported as significant.

Ethics approval

This study was approved through the University of Toronto (40943) and the Women's College Hospital (2022-0102-E) research ethics boards.

Results

During the study period, 223,750 hypertension visits took place across 86 sites, 343 providers, and 64,420 patients (Table 1). In the pre-pandemic period, 150,511 hypertension visits took place, and 73,239 hypertension visits took place during the pandemic. No differences were found for patient, physician, and neighbourhood characteristics for the overall sample, between the pre-pandemic and pandemic periods.

Pre-pandemic, 75.7% of hypertension visits (113,966 of 150,511) had a BP documented in structured fields, but this

Table 1. Patient, provider, and neighbourhood characteristics

Characteristic	Pre-pandemic, %	Pandemic, %
Patient-level		
Age, y		
≤ 49	13.6	15.3
50–64	31.6	32.7
65–79	35.6	35.5
≥ 80	19.1	16.5
Sex		
Female	53.4	54.4
Male	46.6	45.6
Rurality		
Rural	6.6	6.0
Urban	91.7	92.7
Missing	1.7	1.3
Income quintile		
5 (highest)	24.0	24.2
4	17.7	17.9
3	16.6	16.8
2	18.2	18.3
1 (lowest)	20.9	20.6
Missing	2.6	2.2
Physician-level		
Years of practice		
≤ 10	23.9	24.0
11–25	41.4	41.2
≥ 26	34.7	34.8
Sex		
Female	61.5	61.7
Male	38.5	38.3

Overlap is present between pre-pandemic and pandemic period for sites, providers, and patients.

level decreased during the pandemic, with only 36.4% of hypertension visits (26,660 of 73,239) having a BP documented in structured fields. Compared to the pre-pandemic period, hypertension visits in the pandemic period had lower odds of having structured documentation of BPs (odds ratio [OR] = 0.18, 95% confidence interval [CI]: 0.18-0.19, $P < 0.0001$). In the pandemic period, 60.9% of hypertension visits (44,572 of 73,239) were conducted virtually, ranging from 36.4% to 93.6% across the months from March 2020 to December 2021 (Fig. 1). During the pandemic, only 14.3% of virtual hypertension visits (6357 of 44,572) had an accompanying BP documented in structured fields, compared to 74.0% for in-person hypertension visits (OR = 0.58, 95% CI: 0.56-0.60, $P < 0.0001$).

Figure 1 outlines the monthly proportions of in-person and virtual visits for hypertension visits, and the proportion of visits missing structured BP documentation across the pre-pandemic and pandemic periods. With the onset of the pandemic and the uptake of hypertension visits conducted virtually, the proportion of hypertension visits missing BPs with structured documentation correspondingly increased. April 2020 had the highest proportion of hypertension visits conducted virtually (93.6%; Figs. 1 and 2), with only 10.5% of total hypertension visits having a BP documented in the structured variable format (Fig. 2A). Throughout the pandemic period, less than 20% of monthly virtual hypertension visits had a documented BP (Fig. 2B).

Virtual care for hypertension management across patient and physician groups

Table 2 outlines the results from the clustered logistic regression analysis for whether hypertension visits were conducted virtually during the pandemic period across patient and physician groups. Patients who had virtual visits during the pandemic were more likely to be older (age 50-64 years [OR = 1.13, 95% CI: 1.06-1.20, $P < 0.001$], 65-79 years [OR = 1.14, 95% CI: 1.06-1.21, $P < 0.001$], or 80+ years [OR = 1.19, 95% CI: 1.11-1.29, $P < 0.001$], relative to patients aged <49 years). Patients from higher neighbourhood income quintiles were also more likely to have virtual visits (highest income quintile [OR = 1.22, 95% CI: 1.14-1.30, $P < 0.001$] relative to lowest income quintile). Providers with more years of practice (≥26 years) were less likely to conduct a virtual visit (OR = 0.71, 95% CI: 0.55-0.92, $P = 0.012$), relative to providers with ≤10 years of practice).

Structured BP documentation across patient and physician groups

All patient subgroups experienced a substantial decrease in structured BP documentation from the pre-pandemic to the pandemic period. Compared to female physicians, male physicians were less likely to have visits with structured BPs during the pre-pandemic period (OR = 0.45, 95% CI: 0.32-0.63, $P < 0.0001$), and for both virtual (OR = 0.48, 95% CI: 0.32-0.71, $P = 0.0004$) and in-person (OR = 0.46, 95% CI: 0.33-0.64, $P < 0.0001$) visits during the pandemic (Table 3). Similarly, physicians with more years of practice (≥26 years) were less likely to have visits with structured BPs during the pre-pandemic period (OR = 0.63, 95% CI: 0.40-0.98, $P = 0.040$), for both virtual (OR = 0.46, 95% CI: 0.28-0.78, $P = 0.003$) and in-person (OR = 0.46, 95% CI: 0.30-0.72, $P < 0.0001$) visits during the pandemic (Table 3).

Chart abstraction to assess unstructured BP documentation

Of the 3200 abstracted charts, 3047 (95.2%) were found to be valid progress notes (documented entries regarding patient care and services provided that day). Of the 3047 valid progress notes, 2361 (77.5%) were a virtual visit, and 644 (21.1%) were an in-person visit. For 42 visits (1.4%), the documentation of whether they were virtual or in-person visits was unclear. A total of 55.9% of hypertension visits had a BP value recorded in the unstructured progress notes (Fig. 3). For the virtual visits, 49.3% had a BP value recorded in the unstructured progress notes. For in-person visits, 80.1% had a BP recorded in the unstructured progress notes. An additional

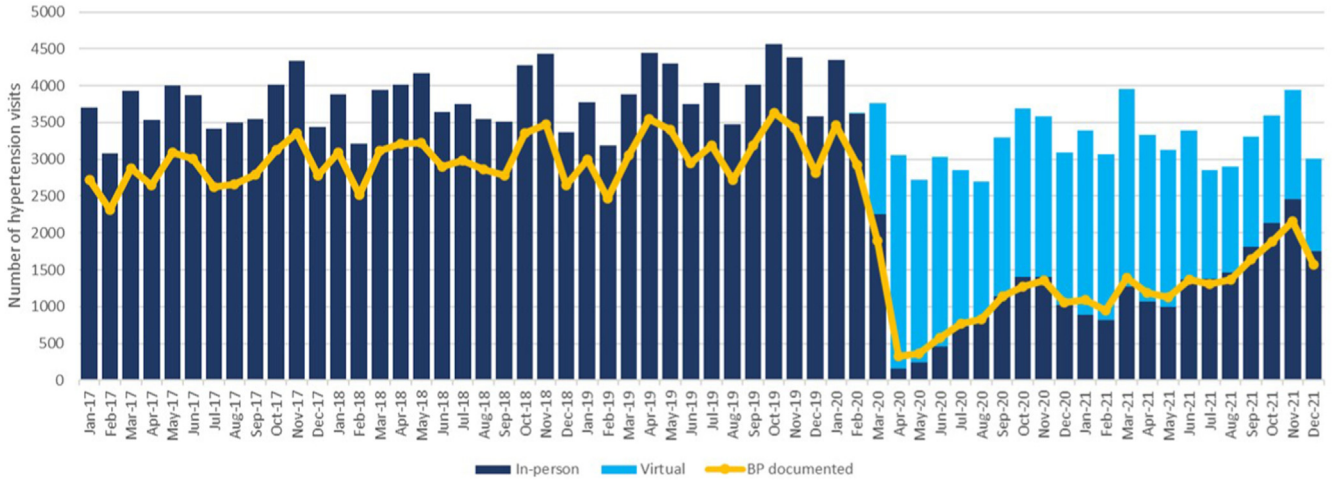

Figure 1. Number of monthly in-person and virtual hypertension visits, and associated number of blood pressure (BP) measurements documented in structured fields. Apr, April; Aug, August; Dec, December; Feb, February; Jan, January; Jun, June; Jul, July; Mar, March; Nov, November; Oct, October; Sep, September; 17, 2017; 18, 2018; 19, 2019; 20, 2020; 21, 2021.

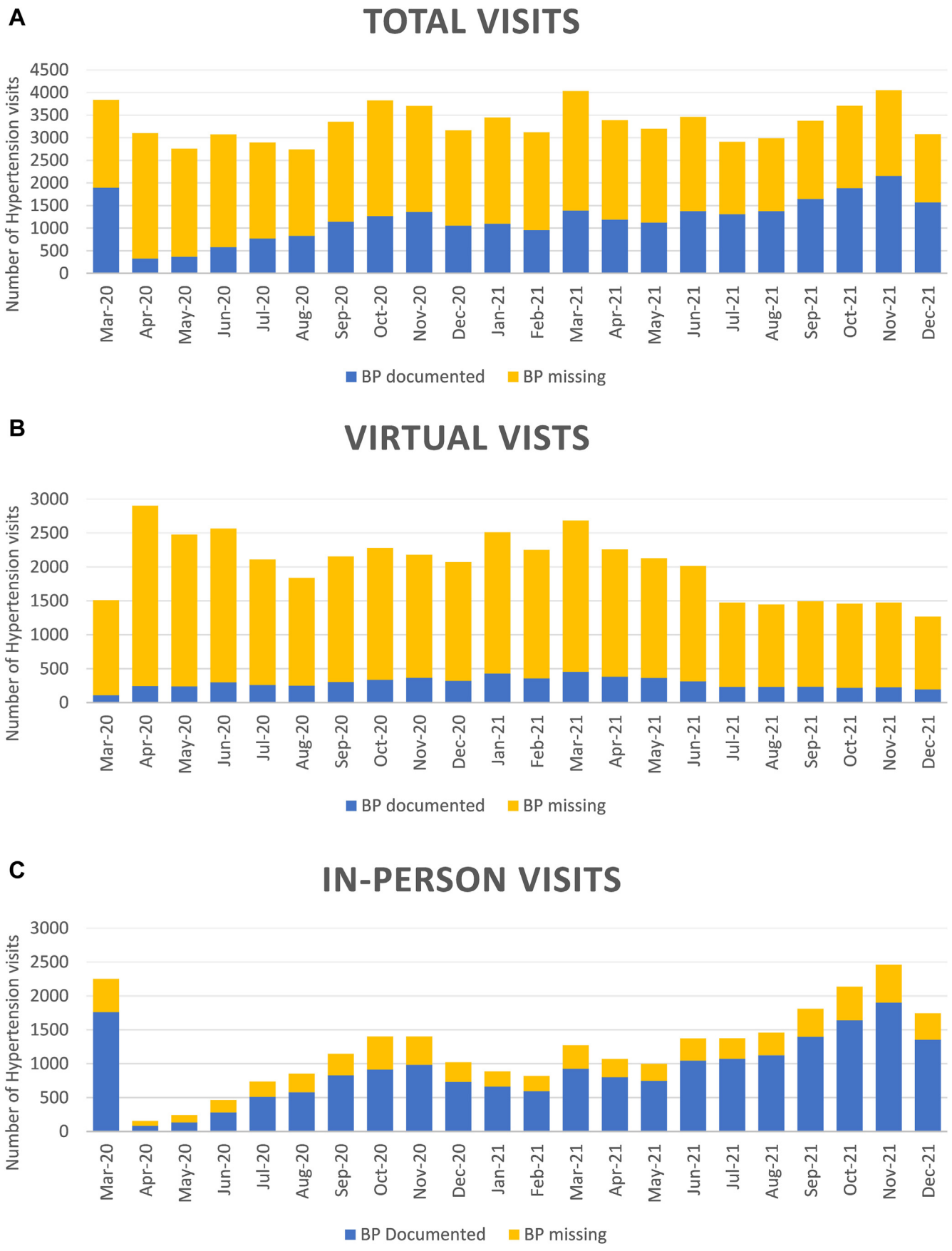

Figure 2. Pandemic monthly number of hypertension visits with structured documentation of blood pressure (BP), reported and missing, for total, virtual, and in-person visits. Apr, April; Aug, August; Dec, December; Feb, February; Jan, January; Jun, June; Jul, July; Mar, March; Nov, November; Oct, October; Sep, September; 20, 2020; 21, 2021.

Table 2. Odd ratios (ORs) reported from clustered regression analysis for whether hypertension visits were conducted virtually during the pandemic period, by patient and physician characteristics

Variable		OR (95% CI); *P*
Patient-level		
	Age, y	
	≤ 49	Ref
	50–64	1.13 (1.06–1.20); < 0.001*
	65–79	1.14 (1.06–1.21); < 0.001*
	≥ 80	1.19 (1.11–1.29); < 0.001*
	Sex	
	Female	Ref
	Male	0.98 (0.94–1.02;); 0.368
	Rurality	
	Urban	Ref
	Rural	1.09 (0.98–1.20); 0.101
	Neighbourhood income quintile	
	1 (lowest)	Ref
	2	1.14 (1.07–1.22); 0.001*
	3	1.21 (1.13–1.30); 0.001*
	4	1.20 (1.12–1.29); 0.001*
	5 (highest)	1.22 (1.14–1.30); 0.001*
Physician-level		
	Years of practice	
	≤10	Ref
	11–25	0.82 (0.64–1.06); 0.13
	≥ 26	0.71 (0.55–0.92); 0.012*
	Sex	
	Female	Ref
	Male	0.81 (0.66–0.99); 0.045*

CI, confidence interval; Ref, referent.
* Significant findings.

75 hypertension visits (69 virtual and 6 in-person) recorded a BP range, a partial BP, and/or mentioned that BP was checked without having any full BP values recorded. A 5% double abstraction found an inter-rater and intra-rater reliability for all abstracted variables of over 91%, and a Cohen's kappa score of over 0.82, suggesting good reliability.

Discussion

Overall, a >50% relative decrease occurred in structured documentation of BP, from the pre-pandemic period to the pandemic period. During the pandemic period, virtual visits were 42% less likely to have a structured documentation of BP, than were in-person visits. Differences across different patient and physician groups for clinical documentation of BP were found both pre-pandemic and during the pandemic.

We saw a decrease in structured BP documentation for the pandemic period compared to pre-pandemic, a finding in line with previous literature investigating BP documentation during the pandemic.[12,13] The shift in data documentation in EMRs and other health administrative databases, particularly incomplete data capture, due to the pandemic, has been documented in other literature.[7,19] However, to our knowledge, no study has investigated the impact of virtual visits on BP documentation in primary care EMR systems. Multiple reasons can potentially explain why we found a decrease in structured BP documentation during virtual visits. One reason could be ease of entry into the structured field. For one of our vendors, BP is entered into the structured field easily from the progress notes by recording it using the nomenclature "bp: ###/###." With the other 2 vendors, clicking on a separate area of the EMR to enter BP into the structured field is required. Physicians may not have the time for this additional step and may instead record BP using free text in the progress note.

Another possible reason is hesitancy to document BP in the structured field if they did not measure it themselves. A third possible reason is that virtual visits tend to be conducted by means of the physician contacting the patient directly. Thus, the involvement of allied health professionals who take BP measurements before the physician-patient encounter is diminished, and such allied health professionals typically enter the BP directly into the structured field, as opposed to generating a progress note solely to document vitals or anthropometric measures. Likely, a combination of both EMR vendor–specific structure and human factors has contributed to the lack of capture of BPs in structured fields, particularly with virtual visits.

Future research should investigate the underlying causes of decreased documentation of BP during virtual visits, as without well documented BP measurements, individuals may be at increased risk for having uncontrolled hypertension, receiving inappropriate treatment, and receiving poor-quality care, as their BPs are unavailable to conduct targeted screening, detect hypertension, track longitudinal changes, or flag patients for intervention.[1,2,4-6] Furthermore, individuals with incomplete clinical information are more likely to have their data excluded for secondary use, such as quality improvement initiatives, healthcare policies, prevalence rates, and other medical research. If documentation is incomplete for certain groups, secondary use of BP from EMR data would not necessarily be representative of the population, and the needs of vulnerable groups may be unintentionally excluded from healthcare decision-making and quality improvement initiatives.[7,8,22]

Our study found that over 85% of virtual visits for hypertension without a structured documentation of BP had a BP value recorded in the progress notes. Given the large number of hypertension virtual visits during the pandemic, this percentage represents a substantial number of visits for hypertension at which BP was not recorded. Given this lack of documentation, and the fact that virtual visits are likely to continue, future research will apply artificial intelligence methods to investigate whether these BP values with unstructured documentation can be accessed and transformed to BP values that are accessible for automated analysis.

To our knowledge, no previous studies have investigated the association of patient or physician characteristics with data documentation in primary care EMRs. Consistently, we found that physician-level, not patient-level, factors impacted BP documentation, across the pre-pandemic period and during the pandemic period, for both virtual and in-person visits. Thus, no one patient group seemed to be impacted more negatively. However, key differences were seen between physician subgroups in their clinical documentation of BP, pre-pandemic and during the pandemic, for hypertension management. We found that physicians with more years of practice were less likely to document a BP. A study conducted in the US in 2001 found that younger physicians were more likely to be early adopters of interventions, such as online continuing education.[23] Hence, older physicians may be slower in uptake of use of the EMR system, which includes recording BP in structured fields, slower to offer virtual visits, and more likely to be late adopters.

Table 3. Odd ratios (ORs) reported from clustered regression analysis for whether blood pressure was documented, by patient and physician characteristics, for pre-pandemic and pandemic hypertension visits

Variable		Visits with structured blood pressure documentation		
			Pandemic	
		Pre-pandemic	Virtual	In-person
		OR (95% CI); *P*	OR (95% CI); *P*	OR (95% CI); *P*
Patient-level				
	Age; y			
	≤ 49	Ref	Ref	Ref
	50–64	1.09 (1.02–1.16); 0.005*	0.99 (0.91–1.11); 0.889	0.92 (0.82–1.04); 0.172
	65–79	1.06 (1.00–1.13); 0.060	0.95 (0.85–1.05); 0.314	0.87 (0.77–0.98); 0.019*
	≥ 80	0.96 (0.90–1.03); 0.223	0.89 (0.78–0.99); 0.049*	0.83 (0.73–0.96); 0.010*
	Sex			
	Female	Ref	Ref	Ref
	Male	1.09 (1.05–1.13); < 0.0001*	1.03 (0.96–1.10); 0.433	1.10 (1.02–1.19); 0.017*
	Rurality			
	Urban	Ref	Ref	Ref
	Rural	1.12 (1.03–1.23); 0.012*	1.24 (1.05–1.47); 0.010*	1.04 (0.87–1.25); 0.663
	Neighbourhood income quintile			
	1 (lowest)	Ref	Ref	Ref
	2	1.01 (0.95–1.07); 0.716	1.03 (0.92–1.15); 0.578	0.97 (0.86–1.09); 0.576
	3	1.03 (0.97–1.09); 0.382	0.97 (0.86–1.09); 0.585	0.91 (0.80–1.03); 0.130
	4	1.05 (0.99–1.12); 0.102	1.02 (0.92–1.15); 0.622	0.87 (0.76–0.98); 0.026*
	5 (highest)	1.03 (0.96–1.09); 0.379	1.07 (0.96–1.19); 0.212	0.95 (0.84–1.07); 0.417
Physician-level				
	Years of practice			
	≤ 10	Ref	Ref	Ref
	11–25	0.96 (0.63–1.48); 0.869	1.91 (0.55–1.49); 0.705	0.72 (0.48–1.10); 0.131
	≥ 26	0.63 (0.40–0.98); 0.040*	0.46 (0.28–0.78); 0.003*	0.46 (0.30–0.72); < 0.001*
	Sex			
	Female	Ref	Ref	Ref
	Male	0.48 (0.34–0.67); < 0.001*	0.51 (0.34–0.76); < 0.001*	0.49 (0.35–0.68); < 0.001*

CI, confidence interval; Ref, referent.
*Significant findings.

We also found consistently that male physicians were significantly less likely to document BP in structured fields, compared to female physicians, both pre-pandemic and during the pandemic. Previous literature also has noted differences in EMR clinical documentation between male and female physicians.[24-27] In general, female physicians spend more time on clinical documentation and in their EMR systems, even though they tend to have fewer patients.[25,26] Female physicians also report higher satisfaction levels than male physicians with the ease of use of medical records system interfaces and the

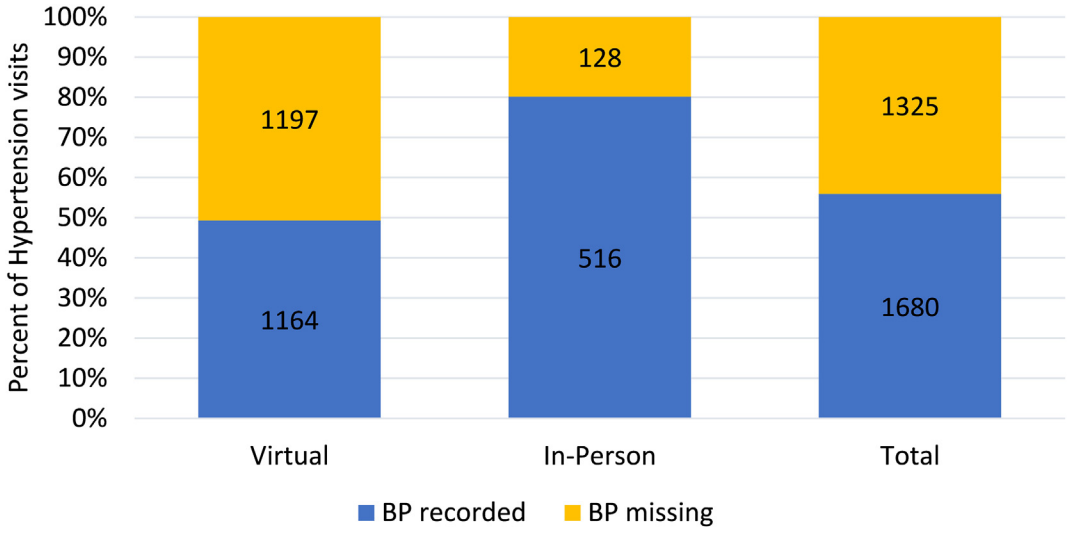

Figure 3. Pandemic availability of blood pressure (BP) documentation in sample of unstructured progress notes for virtual and in-person hypertension visits without structured BP documentation. Note: Cases that could not be identified clearly as virtual or in-person were excluded from the data represented in this figure.

overall usability of EMR systems.[27] These differences in clinical documentation and use of the EMR system between female and male providers may explain the more-complete BP documentation practices of female providers.

Limitations

This study focused on BP capture for hypertension visits conducted with providers from the UTOPIAN database. Hence, findings from this study may not be applicable to other databases or other medical conditions. Hypertension visits were identified using the International Classification of Diseases, 9th revision billing code 401; however, patients visit primary care providers for multiple reasons, and their hypertension may have been assessed, but their visit may not have been billed for hypertension. Last, we were unable to assess why BPs were not documented in virtual visits. We were also unable to assess rates of possession of home BP monitors and whether that impacted BP documentation in the EMR record.

Conclusion

Our study found that with primary care hypertension visits, BP documentation in EMRs decreased substantially during the pandemic. Future research should continue to evaluate changes in the documentation practices of EMR elements across different components, databases, and regions. Additionally, future research should investigate the impact that BP documentation has on patient outcomes. Given that virtual visits will likely continue, future research also should develop strategies and processes to improve BP documentation and develop methods to capture BPs recorded elsewhere in EMR systems. Furthermore, clear differences were seen among physician subgroups in the documentation of BP in the EMR system, in both the pre-pandemic and pandemic periods. Given this, certain groups may be at increased risk of poor-quality care and of being overlooked when data are used for secondary purposes.

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Ethics Statement

This study was approved through the University of Toronto (40943) and the Women's College Hospital (2022-0102-E) research ethics boards.

Patient Consent

The authors confirm that patient consent is not applicable to this article, as this was a retrospective study using de-identified data from an EMR database; therefore, the research ethics boards granted a waiver of consent from patients.

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