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REFERENCES

1. PHI. Workforce data center. 2020 <https://phinational.org/policy-research/workforce-data-center/>
2. King WC, Rubinstein M, Reinhart A, Mejia R. COVID-19 vaccine hesitancy January-may 2021 among 18–64 year old US adults by employment and occupation. *Prev Med Rep.* 2021;24:101569.
3. Hittle B, Agbonifo N, Suarez R, Davis KG, Ballard T. Complexity of occupational exposures for home health-care workers: nurses vs. home health aides. *J Nurs Manag.* 2013;24(8):1071-1079.
4. World Health Organization. Report of the SAGE working group on Vaccine Hesitancy. 2014. http://www.who.int/immunization/sage/meetings/2014/october/SAGE_working_group_revised_report_vaccine_hesitancy.pdf
5. Brunson EK, Schoch-Spana M, Working Group on Readying Populations for COVID-19 Vaccine. A social and behavioral research agenda to facilitate COVID-19 vaccine uptake in the United States. *Health Secur.* 2020;18(4):338-344.
6. Pew Research Center Science & Society. U.S. Public Now Divided Over Whether To Get COVID-19 Vaccine. 2021. <https://www.pewresearch.org/science/2020/09/17/u-s-public-now-divided-over-whether-to-get-covid-19-vaccine/>
7. Schoch-Spana M, Brunson E, Chandler H, et al. Recommendations on how to manage anticipated communication dilemmas involving medical countermeasures in an emergency. *Public Health Rep.* 2018;133(4):366-378.
8. Schoch-Spana M, Brunson EK, Long R, et al. The public's role in COVID-19 vaccination: human-centered recommendations to enhance pandemic vaccine awareness, access, and acceptance in the United States. *Vaccine.* 2021;39(40):6004-6012. doi:10.1016/j.vaccine.2020.10.059
9. Doornekamp L, van Leeuwen L, van Gorp E, Voeten H, Goeijenbier M. Determinants of vaccination uptake in risk populations: a comprehensive literature review. *Vaccines (Basel).* 2020;8(3):480. doi:10.3390/vaccines8030480
10. Niznik JD, Harrison J, White EM, et al. Perceptions of COVID-19 vaccines among healthcare assistants: a national survey. *J Am Geriatr Soc.* 2022;70(1):8-18. doi:10.1111/jgs.17437

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Electronic health record enhancements that increased capture of home blood pressures among geriatric patients during pandemic-era virtual visits

INTRODUCTION

Blood pressure (BP) control effectively prevents cardiovascular disease in late life.¹ However, health-system responses to the COVID-19 pandemic disrupted office-based hypertension care² and shifted care delivery to telemedicine via phone or video.³ Despite limited pre-existing evidence for telemedicine-based hypertension management,⁴ the pandemic catapulted its use to the broader population of those aged ≥ 65 years, most of whom have hypertension.⁵ Older patients disproportionately had poorer access to telehealth during the pandemic^{6,7} due to preexisting technological disparities and a greater prevalence of sensory impairment.⁸ At

a multisite geriatric primary care practice that serves >5000 older patients, we report our experience with documenting home BPs (HBPs) during the first 18 months of the pandemic across three enhancements to the provider interface in the electronic health record (EHR).

METHODS

We studied BP data associated with early-pandemic telehealth visits from March 2020 to October 2021. In the baseline period (Time 1, March–August 2020), healthcare regulations required our physicians to directly visualize the

patient or caregiver using the BP cuff on video to enter as the valid video-visit HBP; medical assistants aided with virtual rooming but did not record HBPs. In Time 2 (September 2020–January 2021), physicians had access to a dedicated HBP field in the EHR for video visits only. Time 3 (February–October 2021) included two EHR enhancements: the HBP field became available in phone visits; additionally, physicians were allowed to enter any patient-reported HBPs (i.e., direct visualization on video was not required) for phone and video visits. Physician providers were educated about each EHR change via email tutorials, department presentations, and by disseminating information about these enhancements to medical assistants.

For patients with hypertension (defined by a curated health-system registry) and receiving primary care in our multisite geriatrics practice, we analyzed EHR encounter data for all virtual visits, collecting data on the type (telephone vs. video) and correct entry of the encounter BP (present vs. absent in the EHR vitals flowsheet). We plotted weekly summary statistics for visual inspection, then used one-way analysis of variance to compare the proportion of correct HBP entry between the three time periods. Second, we conducted a structured chart review of a randomized sample of virtual visits in patients with uncontrolled HTN. This more detailed portion of the project investigated: 1) whether providers had documented the patients' recent HBP anywhere within the encounter note, even though it was not entered into the EHR vitals flowsheet; and 2) for patients without an available HBP, whether there was a documented plan for obtaining HBPs after the visit.

This research was reviewed by the University of Michigan Institutional Review Board and deemed not to be regulated human subjects research.

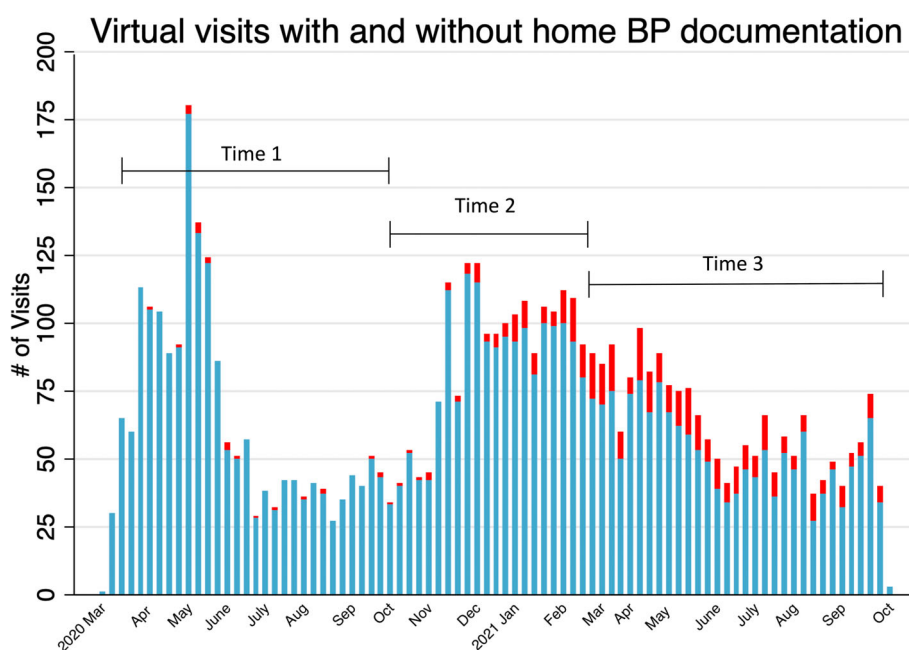
RESULTS

Our clinic completed 5675 virtual visits (among 2426 unique patients) from March 2020–October 2021, of which only 444 visits (7.8%) had properly entered HBPs into the EHR. BP entry significantly improved after the HBP data field was added to video visits (from 1.2% of 1847 visits in Time 1 to 4.8% of 1632 visits in Time 2, $p < 0.001$, Figure 1). Allowing the entry of HBPs, along with adding the HBP field to telephone visits, led to further improvement (14.5% entry of 2196 visits in Time 3, $p < 0.001$). The structured chart review consisted of 167 visits; most (146 or 87%) did not have properly entered BPs into the EHR vitals flowsheet, of which only 39 (27%) had HBPs documented within the text of the encounter note. Only 11 (6.6%) included a plan within the note text to obtain further BPs (home or clinic) after the visit.

DISCUSSION

The COVID-19 pandemic has shifted care delivery from the office to the virtual setting, even though ambulatory care in the office has resumed. Telemedicine continues to benefit geriatric patients for whom in-office visits may

FIGURE 1 Number of virtual visits by week from March 2020–February 2021, divided into visits with properly entered home blood pressures (HBPs, red) and those without properly entered BPs (blue). Time 1 (March–August 2020): providers were required to directly visualize the BP meter to enter a valid visit BP. Time 2 (September 2020–January 2021): the HBP field was added to the EHR for video visits. Time 3 (February–October 2021): the HBP field was added for phone visits as well; additionally, providers were allowed to enter recent self-reported BPs.



be impractical, whether due to limitations on ambulation or transportation, accommodation of caregiver schedules, or the complexity of healthcare due to multimorbidity. Our project identified severe gaps in HBP documentation. Providing a dedicated EHR field for HBP and allowing self-reported HBPs were associated with improved HBP entry. Despite these enhancements, HBP documentation rates remain low. Future improvements may include adding clinic-staff workflows requesting HBPs after visits without an HBP, for example, via phone or portal messages. Additional BPs could be collected by creating an EHR interface for patients to enter their HBPs directly into the EHR. Future efforts will also include whether proper BP entry results in decreased medication prescribing and better follow-up BP control for our clinics' older adults.

LIMITATIONS

Concurrent factors outside of EHR enhancements may have contributed to improved HBP documentation. These include patient education on BP self-management as well as additional health-system efforts to improve hypertension care, such as panel management and incentive programs.

AUTHOR CONTRIBUTIONS

Andrew E. Russell, MD, MPH: Conception and design of the work; acquisition of data, analysis, manuscript draft, revision, and submission. Lillian Min, MD, MSHS: Conception and design of the work; acquisition of data, analysis, manuscript draft, revision, and approval. Nadia Khosrodad, MD: acquisition of data, revision, and final approval. Sophie Clark, MD: acquisition of data, revision, and final approval.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

SPONSOR'S ROLE

The sponsor had no role in this work.

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REFERENCES

- Musini VM, Tejani AM, Bassett K, Puil L, Wright JM. Pharmacotherapy for hypertension in adults 60 years or older. *Cochrane Database Syst Rev.* 2019;6(6):CD000028.
- Skeete J, Connell K, Ordunez P, DiPette DJ. Approaches to the Management of Hypertension in resource-limited settings: strategies to overcome the hypertension crisis in the post-COVID era. *Integr Blood Press Control.* 2020;13:125-133.
- Colbert GB, Venegas-Vera AV, Lerma EV. Utility of telemedicine in the COVID-19 era. *Rev Cardiovasc Med.* 2020;21(4):583-587.
- Tucker KL, Sheppard JP, Stevens R, et al. Self-monitoring of blood pressure in hypertension: A systematic review and individual patient data meta-analysis. *PLoS Med.* 2017;14:1-29.
- Osthega Y, Fryar CD, Nwankwo T, Nguyen DT. Hypertension Prevalence among Adults Aged 18 and over: United States, 2017-2018. NCHS Data Brief, no 364. National Center for Health Statistics; 2020.
- Eberly LA, Kallan MJ, Julien HM, et al. Patient characteristics associated with telemedicine access for primary and specialty ambulatory care during the COVID-19 pandemic. *JAMA Netw Open.* 2020 Dec 1;3(12):e2031640. doi:10.1001/jamanetworkopen.2020.31640
- Chen J, Li KY, Andino J, et al. Predictors of audio-only versus video telehealth visits during the COVID-19 pandemic. *J Gen Intern Med.* 2022;37(5):1138-1144. doi:10.1007/s11606-021-07172-y
- Lam K, Lu AD, Shi Y, Covinsky KE. Assessing telemedicine unreadiness among older adults in the United States during the COVID-19 pandemic. *JAMA Intern Med.* 2020;180(10):1389-1391. doi:10.1001/jamainternmed.2020.2671