Research and Applications

Do nurses document all discussions of patient problems and nursing interventions in the electronic health record? A pilot study in home healthcare

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ABSTRACT

Objective: To assess the overlap of information between electronic health record (EHR) and patient–nurse verbal communication in home healthcare (HHC).

Methods: Patient–nurse verbal communications during home visits were recorded between February 16, 2021 and September 2, 2021 with patients being served in an organization located in the Northeast United States. Twenty-two audio recordings for 15 patients were transcribed. To compare overlap of information, manual annotations of problems and interventions were made on transcriptions as well as information from EHR including structured data and clinical notes corresponding to HHC visits.

Results: About 30% (1534/5118) of utterances (ie, spoken language preceding/following silence or a change of speaker) were identified as including problems or interventions. A total of 216 problems and 492 interventions were identified through verbal communication among all the patients in the study. Approximately 50.5% of the problems and 20.8% of the interventions discussed during the verbal communication were not documented in the EHR. Preliminary results showed that statistical differences between racial groups were observed in a comparison of problems and interventions.

Discussion: This study was the first to investigate the extent that problems and interventions were mentioned in patient–nurse verbal communication during HHC visits and whether this information was documented in EHR. Our analysis identified gaps in information overlap and possible racial disparities.

Conclusion: Our results highlight the value of analyzing communications between HHC patients and nurses. Future studies should explore ways to capture information in verbal communication using automated speech recognition.

Key words: home healthcare, information overlap, verbal communication, clinical note, electronic health records, nursing informatics

LAY SUMMARY

During home healthcare (HHC) visits, nurses are actively engaged in verbal communication with their patients, and they document information in electronic health records (EHRs) based on verbal communication with patients and objective observations. However, not all obtained information may be documented in the EHR. Thus, this study aimed to assess the overlap of information between EHR and patient–nurse verbal communication in HHC. We recorded patient–nurse verbal communications during HHC visits in one of the largest HHC organizations in the Northeast Unites States. Among those, 22 audio recordings for 15 patients were transcribed for analysis. To compare the overlap of information, transcriptions, as well as EHR data corresponding to HHC visits, were annotated manually for problems and interventions. About 30% of utterances (ie, spoken language preceding/following silence or a change of speaker) were identified as including problems or interventions. Approximately 50.5% of the problems and 20.8% of the interventions discussed during the verbal communication were not documented in the EHR. Preliminary results showed that statistical differences between racial groups were observed in a comparison of problems and interventions. An identified gap in information overlap and racial disparities highlighted the value of analyzing verbal communications between patients and nurses in HHC.

INTRODUCTION

The demand for home healthcare (HHC) has increased with the aging of the population, leading HHC to become one of the fastest-growing settings of outpatient healthcare in the United States.[1] Approximately 5 million patients received HHC services from about 12 000 home care agencies across the United States in 2016,[2] and the number of people receiving HHC is expected to continue to increase.[3] HHC aims to stabilize and improve clinical conditions, elevate comfort levels, promote self-management skills, support family caregivers, and enhance care coordination.[4]

During HHC visits, nurses, who are usually the primary home care coordinator, are actively engaged in verbal communication with their patients. A verbal communication includes not only medical history taking, assessment, and problem-oriented communication, but also everyday conversation, such as small talk. Nurses document information in electronic health records (EHRs) in the form of structured data or clinical notes based on verbal communication with patients and objective observations during HHC visits. EHR serves as the primary conduit for information sharing on demographics, medical history between interdisciplinary health care providers.[5] Nevertheless, all obtained information may not be documented in EHR. In one previous qualitative study, 10 encounters with complex patients in a primary care setting were analyzed to examine the extent to which patient–physician communications and EHR documentation overlapped was examined.[6] The study found that social and emotional issues were less likely to be documented.[6] However, there is limited knowledge of the content of patient–nurse verbal communications in the HHC, and which aspects nurses document or do not document during HHC visits.

To address these knowledge gaps, the purpose of this study was to assess information overlap between patient–nurse verbal communications and EHR documentation (ie, clinical notes and structured data). Specifically, this study aimed to (1) assess what problems or interventions were discussed during HHC visits and (2) examine the information overlap between patient–nurse verbal communication and EHR documentation.

METHODS

Study population

Data were collected for patients of the largest nonprofit HHC organization in the Northeast between February 16, 2021 and September, 2021. All study participants provided informed consent prior to participating in the study. We recruited interested nurses from the participating HHC organization via email invitation. The study re-

search assistant obtained nurse participant consent after providing information about the study's purpose, possible risks, and benefits. Nurses signed the informed consent form, then were oriented to use the audio recording device. The research assistant recruited patients via telephone by contacting patients assigned to recruited nurses prior to HHC visits and explaining the purpose, risks, and benefits of the study. Once they verbally consented, the research assistant mailed the consent form for the patient's records. Patients and nurses received gift cards as a token of appreciation for their participation in the study. The study was approved by the Visiting Nurse Service of New York Institutional Review Board (IRB # E20-003; Approval Date: November 23, 2021).

During the study, 5 nurses audio-recorded their HHC encounters with 44 patients using 2 audio recording devices (ie, Saramonic Blink500 Pro B2 Pro and Sony ICD-TX6). These 2 devices were selected based on their high ratings for functionality and usability compared to other audio-recorders. Details for evaluating the usability and functionality are available in our previous study.[7] Using these devices, 127 patient–nurse encounters for the 44 patients were recorded.

Study dataset #1: Nurse–patient verbal communication

Manual transcription of all 127 verbal communications (∼60 h) was not feasible due to cost and time required to process such a large amount of data. For this analysis, we aimed to generate a purposeful sample of informative recordings. To accomplish this, we assessed each recording for information richness (ie, verbal communications where at least 4 problems were discussed) and recording quality (ie, little background noise, echo, or other interruptions). As a result, we selected 22 recordings representing 15 unique patients. The selected audio recordings were transcribed by a human expert transcriber. The transcription included speaker type identification (eg, speaker 1, speaker 2), timestamps, and content at the utterance level (ie, spoken language preceding/following silence or a change of speaker). The authors identified and marked the type of the speaker in transcriptions (eg, patient, nurse) by reviewing the content of the transcription.

Study dataset #2: EHR

All information documented in the EHR during the selected audio-recorded HHC visits was retrieved and reviewed. This information was extracted from 3 data sources:

1. The Outcome and Assessment Information Set (OASIS): OASIS is a standard assessment tool for HHC,[8] which is mandated by Center for Medicare and Medicaid Services upon admission and at the end of each HHC episode (ie, the set of services provided

to treat a clinical condition or procedure). OASIS data include a comprehensive assessment of over 100 patient characteristics in the following areas: sociodemographics, physiologic conditions, comorbidities, medication management, neurocognitive/behavioral status, and functional status.[9,10] This study used OASIS version D released in 2019.

2. Visit-level structured assessment and nursing interventions data: these data were extracted from established care pathways documentation templates integrated into the EHR.

3. Narrative clinical notes: approximately, 130 clinical notes (for 15 patients) were extracted from HHC visits since there could have been more than 1 clinical note created per visit. In addition to nurses' notes, physical and occupational therapists' and social workers' notes were included in the data. There were 2 types of clinical notes: (1) visit notes detailing the patient's condition and the treatment provided during the HHC visit (total $n = 72$) and (2) care coordination notes detailing the communication between clinicians and other administrative health tasks (total $n = 55$).

Identifying health problems and nursing interventions

Health problems or nursing interventions (ie, "problems and interventions") were identified using the Omaha System (https://www.omahasystem.org/), which is a widely used set of standardized terminology to document clinical information in community-based care.[11] In this study, the Omaha System was used to analyze the clinical information because it provides a comprehensive and holistic description of health concepts to improve communication and to improve clinical care.[12] In the Omaha System, 42 problems (eg, income, health care supervision, circulation) are grouped into 4 domains (environmental, psychosocial, physiological, and health-related behavior), accompanied by 335 specific signs/symptoms (eg, uninsured medical expenses, inconsistent source of healthcare, irregular heart rate). In addition, the Omaha System includes 4 categories of interventions (ie, "Teaching, Guidance, and Counseling," "Treatments and Procedures," "Case management," and "Surveillance"), accompanied by 76 specific targets (eg, dressing change/wound care, signs/symptoms-physical, medication action/side effects, stress management).

The 22 transcripts from selected audio recordings were manually annotated by 2 researchers who are experts in HHC and informatics (JS and DS) for the presence of problems and interventions mentioned during verbal communications. The annotations were made at the utterance level. The problems with actual signs/symptoms and interventions with targets were annotated with one or more categories of the Omaha System. Inter-rater agreement between annotators was good (Fleiss' Kappa = 0.77) and all discrepancies were resolved through several consensus group meetings with a senior author (MT).

Lastly, information from both clinical notes and OASIS/visit-level structured data corresponding to the HHC visits was annotated with problems and interventions. Following individual analysis, 2 researchers (JS and MT) met to discuss the content of the datasets. Any disagreements regarding the presence of problems and interventions in EHR were resolved during research team meetings. All annotation tasks were performed using Microsoft Excel 2016.

Comparison of presence of information in the different dataset

Information overlap in the different datasets (ie, verbal communications, clinical notes, and structured data) was evaluated and compared. The difference in proportion of presence of problems or interventions between verbal communications and documentation in EHR was compared. Additionally, based on the trends identified during the analysis, analysis of variance (ANOVA) was used to determine the overlap of information by race, and post-hoc Tukey honestly significant difference (HSD) tests were used to determine which pairs of groups were significantly different.[13] In all analyses, *P* values less than .05 were considered statistically significant. All analyses were implemented using R software version 4.1.0 (Foundation of Statistical Computing, Vienna).

RESULTS

Cohort demographics

Table 1 presents cohort demographics. Data on 15 patients are included in this study. The average age of the patients was 67.3 years (range 40.5–93.8 years) and 53% were male. Approximately 60% of the patients were White, 33% were Black patients, and 7% were Asian. More than 80% of patients had Medicare or Medicare/Medicaid dual eligibility. Two-thirds of all patients were living with others, and all patients took 5 or more medications. The most common diagnoses were hypertension, chronic pulmonary disease, and diabetes (73%, 40%, and 33%, respectively). Furthermore, 33% of the encounters were for postoperative care following surgery.

Problems and interventions identified in patient–nurse verbal communications

The average length of audio-recorded verbal communication was 22 min (range 9–46.2 min) with an average of 245 utterances (range 76–562) per communication. Of 5118 total utterances, 46.4% were mentioned verbally by patients and 53.6% by nurses. About 30% (1534/5118) of utterances were identified as including problems or interventions. Of these utterances including problems or interventions, 73.2% were mentioned by nurses, and 26.8% by patients. More specifically, 68.3% (302/442) of the problems were mentioned by patients, whereas 89.3% (1060/1187) of the interventions were mentioned by nurses.

During HHC visit, an average of 10 different problems (range 4–23) and 22.4 different interventions (range 8–49) were identified. Therefore, among all patients a total of 216 problems and 492 interventions were identified during HHC visits. The most frequent problems mentioned during verbal communications were classified as "Circulation," "Skin," and "Medication regimen." More than 60% of "Circulation" problems involved signs/symptoms related to 'edema' and 'abnormal blood pressure readings.' More than 50% of "Skin" problems involved 'skin lesions/pressure ulcers' and 'drainage.' One-half of "Medication regimen" problems pertained to 'not following suggested dosage/schedule' and 'evidence of side effects/adverse reactions.' The most common interventions were classified as "Surveillance," followed by "Teaching, Guidance, and Counseling." Among interventions, 'signs/symptoms-physical,' 'medication administration,' and 'dressing change/wound care' were the most frequent targets for "Surveillance." The most frequent aim of "Teaching, Guidance, and Counseling" was medication education including 'medication action/side effects,' 'medication administration,' and 'medication coordination/ordering.' Other recurrent focuses of "Teaching, guidance, and counseling" included 'signs/symptoms-physical,' 'dietary management,' and 'dressing change/wound care.' See Table 2 for details. Table 2 is extended in Supplementary Appendices S1 and S2, illustrating specific signs/symptoms of problems and targets of intervention.

Table 1. Characteristics of study population

Characteristic	Total patients ($n = 15$), N (%)
1. Demographics	
Age	Average age of 67.3 years (range 40.5–93.8)
Sex	
Male	8 (53)
Race	
White	9 (60)
Black	5 (33.3)
Asian	1 (6.7)
2. Socioeconomic status	
Type of insurance	
Dual eligibility	1 (6.7)
Medicare "Fee For Service" only	5 (33.3)
Any managed care	6 (40)
Other (eg, private)	3 (20)
Living condition	
Living with others (congregate or with other)	10 (66.7)
3. Current condition	
Active diagnoses	
Hypertension	10 (73.3)
Chronic pulmonary disease	5 (40)
Diabetes	4 (33.3)
Renal failure	2 (13.3)
Cardiac arrhythmias	3 (20)
Cancer	3 (20)
4. Risk for hospitalization	
History of falls in the past 12 months	2 (13.3)
Multiple emergency department visits in the past 6 months	1 (6.7)
Decline in mental, emotional, or behavioral status	1 (6.7)
Currently taking 5 or more medications	15 (100)
5. Integumentary	
Having at least 2 unhealed pressure ulcer at stage II or higher	1 (6.7)
Having surgical wound	4 (33.3)

Additional problems identified from EHR

There were 13 other problems not discussed verbally that were identified in EHR, either in the clinical notes or the OASIS/visit-level structured data. These problems were classified as "Neglect," such as being inappropriately left alone, "Communications with Community Resources," such as being unable to use/having inadequate communication equipment/devices, "Respiration," such as a cough or abnormal breathing patterns, or "Neuromusculoskeletal Function," such as gait/ambulation disturbance.

Comparison of information overlap between the datasets

Table 3 presents the proportion of problems and interventions in the different datasets. A total of 229 identified problems throughout the HHC visits were accounted for in 94.3% of the patient–nurse verbal communications, and 52.4% in the EHR (ie, 28% in clinical notes; and 39.7% in structured data). Also, 5.7% of problems were not discussed, but were documented by the nurse in the EHR. Of the 494 interventions, 99.6% were mentioned verbally, and 79.3%

were documented in the EHR (ie, 59.2% in clinical notes and 45.1% in structured data).

Approximately 50.5% of the problems mentioned verbally during the verbal communications were not documented in the EHR and 20.8% of the interventions were not documented in the EHR (neither in clinical notes or structured data). Overall, 29.9% of problems and interventions verbally discussed during HHC visits were not captured in the EHR. A frequently discussed but seldomly documented problem in the EHR was classified as "Health care supervision," followed by "Medication regimen"; while the intervention was "Case Management," followed by "Teaching, Guidance, and Counseling," especially pertaining to dietary management and medication actions/side effects. Below are examples of information overlap between the datasets.

Example 1. Discussed problems/interventions that were documented in the EHR.

- Patient–nurse verbal communication: Nurse's statement "Show me how you walk. You feel now ... [Intervention: Surveillance—gait training]." Patient's statement "I can't get in a car. I can't move. I can walk, but I need a walker [Problem: Neuromusculoskeletal function—decreased muscle strength]"
- These communications were documented as "Pt (patient) ambulates with a walker. Not steady on both feet yet." in a clinical note. In addition, the structured data reflected the information as "Functional Indicate Musculoskeletal Assessment: Decreased Strength in What Extremities" and "Does Decreased Strength Exist? Lower Bilateral Extremities."

Example 2. Verbally discussed problems/interventions that were documented in clinical notes, but not in the structured data.

- Patient–nurse verbal communication: Nurse's statement "the recommendation is there are grades of protein in terms of its heaviness. So the most heaviest is the red meat. So going down, second heaviest would be, say, chicken and fish ... [Intervention: Teaching, Guidance, and Counseling—dietary management]."
- These verbal communications were documented as "Patient was instructed about heart-healthy diet and weight loss." in the clinical note. However, no information was documented in the structured data.

Example 3. Verbally discussed problems/interventions that were not documented in the EHR

- Patient–nurse verbal communication: Patient's statement "Actually, I'm not even going there anymore because it's a pain in my ass" [Problem: Health care supervision—fails to return as requested to health care provider]"
- These verbal communications were not reflected in the clinical notes or structured data.

Variation in the information overlap by race

Table 4 depicts the comparison of problems and interventions by race. There were statistically significant differences between racial groups in the length of verbal communications, length of utterances, amount of identified problems/interventions in verbal communications, and proportion of problems/interventions not documented in EHR (all P values <.05).

The average verbal communication time during HHC visits was longer for White patients than for other groups (24 min for white patients, 22.9 min for Asian patients, and 20.3 min for Black

Table 2. Proportions of problems and interventions identified in patient–nurse verbal communications ($n = 22$)

Category	N (%)
Problems	
Circulation	36 (16.7)
Skin	31 (14.4)
Medication regimen	22 (10.2)
Pain	19 (8.8)
Neuro-musculo-skeletal function	18 (8.3)
Respiration	16 (7.4)
Health care supervision	14 (6.5)
Nutrition	9 (4.1)
Mental health	8 (3.7)
Communication with community resources	5 (2.3)
Vision	5 (2.3)
Bowel function	4 (1.9)
Communicable/infectious condition	4 (1.9)
Sleep and rest patterns	4 (1.9)
Digestion-hydration	3 (1.4)
Hearing	3 (1.4)
Genito-urinary function	2 (0.9)
Neglect	2 (0.9)
Oral health	2 (0.9)
Personal care	2 (0.9)
Substance use	2 (0.9)
Growth and development	1 (0.5)
Interpersonal relationship	1 (0.5)
Neighborhood/workplace safety	1 (0.5)
Residence	1 (0.5)
Social contact	1 (0.5)
Total	216 (100)
Interventions	
Surveillance	231 (47.1)
Teaching, guidance, and counseling	136 (27.8)
Treatments and procedures	71 (14.5)
Case management	52 (10.6)
Total	490 (100)

patients). In general, Black and White patients discussed more problems and interventions than Asian patients (problems: 10.7 for Black patients, 9.9 for White patients, and 6.5 for Asian patients; interventions: 22.6 for Black patients, 22.7 for White patients, and 18.5 for Asian patients). There were no statistically significant differences in the problems and interventions discussed between Black and White patients. More than twice as many problems that were discussed verbally but not documented in the EHR were among Black patients than others, while this occurred the least among White patients (65.3% for Black patients, 38.5% for Asian patients and 32.8% for white patients). Furthermore, "Medication regimen" issues were often not documented in the EHR for Black patients. Supplementary Appendices S3 and S4 presented the frequency of information overlap by race.

DISCUSSION

This study was the first to investigate which problems and interventions were mentioned in the patient–nurse verbal communications during HHC visits, and evaluated whether this information was documented in the EHR. We labeled problems and interventions mentioned in patient–nurse verbal communications using the Omaha System standardized terminology. In previous studies,[14–16] more generic tools such as the Roter Interaction Analysis System

(RIAS) tool[17] were commonly used to label and analyze patient–healthcare provider verbal communication. The RIAS tool includes broad categories, such socio-emotional (eg, showing concern, agreeing with the patient, empathizing) and task-oriented categories (eg, giving information and asking questions). However, the RIAS tool is limited to analyzing only how health care providers and patients interact (eg, question-asking, verbal attentiveness), and does not identify specific healthcare provider relevant problems and interventions provided. Thus, this study has a novel aspect in that it encodes communications using the clinically, commonly used Omaha system, which provided sufficient representation to capture patient's problems and nursing interventions during HHC.[11]

Overall, problems and interventions comprised of only 30% of all spoken utterances. The most frequently discussed problems were classified as "Circulation," "Skin," and "Medication regimen," which is consistent with the patients' characteristics; 93.3% of patients had cardiovascular issues (including hypertension and cardiac arrhythmia), 40% of patients had integumentary problems, and all patients took 5 or more medications. Accordingly, the problems related to these categories were more likely to be discussed during HHC visits. The most frequently provided interventions identified through the verbal communication were classified as "Surveillance" and "Teaching, Guidance, and Counseling." The reason for this could be that determining which treatment is needed begins with a comprehensive assessment of each HHC patient. In addition, this is consistent with the notion that the HHC encounter is a "meeting between experts" where dialogue shapes the therapeutic relationship and reflects responsibilities between patients and health care providers.[18] Although fewer "Treatments and Procedures" were mentioned, it can be assumed that verbalizing these interventions was not necessary, as they are more actionable interventions than others, hence they are less likely to appear in speech.

The remaining 70% of utterances contained "small talk," responses to questions (eg, "all right," "yes" etc.) and clinical assessments within a normal range (hence they were not coded as problems). These aspects of the verbal communications can reinforce behaviors, provide confirmation, and facilitate both physical and emotional interaction between nurses and patients. In addition, these verbal communications are important for patients to ensure they were heard, and their recommendation was carefully considered. Overall, these verbal communications are important not just for nurses, but for all health care providers since they affect patient outcomes by improving therapeutic alliances and enhancing patients' empowerment and agency.[19]

In total, about one-third of problems and interventions were mentioned during the verbal communications but were not documented in the EHR, with more than twice as many problems (50.5%) not documented compared to interventions (20.8%). Although thorough documentation in the EHR helps to create consistent clinical care,[20] it is not feasible to document all aspects of HHC visits in the EHR given a time-constrained practical clinical environment.[21,22] We hypothesize that some reasons for missing documentation include nurses' considering the described health problems as "not significant" (eg, the observed objective signs were mild even though patients discussed those problems during the verbal communication).[23] Moreover, some additional rich information is lost while entering the information in the standardized assessment tools within the EHR.[24] However, some of the identified problems ("Healthcare supervision" such as "fails to return as requested to health care provider") should have been documented because they could be indicative of deterioration in HHC.[25] Nurses also did not

Table 3. Proportion of problems and interventions documented in different datasets

	Identified problems or interventions through HHC visits	Verbal communication	Clinical notes	Structured EHR data	All EHR (clinical notes and/or structured data)	Discussed verbally but not documented in EHR[a]
# of problems	229	216 (94.3%)	64 (28%)	91 (39.7%)	120 (52.4%)	50.5% (109/216)
# of interventions	492	490 (99.6%)	291 (59.2%)	222 (45.1%)	390 (79.3%)	20.8% (102/490)
Total	721	706 (97.9%)	355 (49.2%)	313 (43.4%)	510 (70.7%)	29.9% (211/406)

EHR: electronic health record; HHC: home healthcare.

[a]"Discussed verbally but not documented in EHR" referred to information gap between verbal communication and documentation.

Table 4. Comparison of problems or interventions by race

	Race	Mean	Standard deviation	Minimum	Maximum	ANOVA comparison	Tukey HSD test	
							Black	White
Length of verbal communication (minutes)	Asian	22.89	2.1	20.75	25.03	*	*	*
	Black	20.3	7.9	11.05	32.75			*
	White	24.3	8.8	10.58	46.23			
Utterance of verbal communication	Asian	233.5	15.5	218	249	*	*	*
	Black	214	103.9	114	405			**
	White	277.38	108.6	90	562			
Identified problems through verbal communications	Asian	6.5	1.5	5	8	*	*	*
	Black	10.71	5.3	4	22			NS
	White	9.85	6	2	23			
Identified interventions through verbal communications	Asian	18.5	4.5	14	23	*	*	*
	Black	22.57	12.5	11	49			NS
	White	22.69	10	8	45			
Proportion of problem not documented in EHR (%)	Asian	38.46	1.3	37.5	40	**	**	**
	Black	65.33	24.0	11.11	88.89			***
	White	32.81	23.6	0	84.62			
Proportion of intervention not documented in EHR (%)	Asian	27.62	5.9	14.29	26.1	*	*	**
	Black	23.42	20.6	0	62.5			*
	White	18.64	13.1	0	43.33			

Note: Statistical analysis was conducted using one-way ANOVA and *post hoc* Tukey HSD tests.

ANOVA: analysis of variance; EHR: electronic health record; HSD: honestly significant difference; NS: not statistically significant.

P-value < .05, **P-value < .01, ***P-value < .0001.

document important interventions, such as teaching about medication actions/side effects, or case management activities (ie, arranging for primary care provider follow-up). Lack of such documentation creates incomplete descriptions of patients' conditions and inadequately captures nursing interventions that were provided. Further research to determine practical solutions is needed to improve consistency in documenting important problems and interventions in the EHR.

Previous studies have identified racial and ethnic disparities in healthcare as consequences of poor communication between health care providers and patients, insufficient data collection in EHRs, and inadequate response to patients' needs.[26] For more equitable healthcare, data must be collected from patients that are comprehensive, accurate, and nonbiased.[27] Importantly, we also found potentially concerning differences in information overlap between verbal communication and EHR documentation among patients of different races. The average length of verbal communication during HHC visits was longer for White patients than for other races. For Black patients, although more problems were discussed, the verbal communications were shorter. Specifically, "Circulation" problems such as "abnormal blood pressure reading" or "edema" were frequently discussed with Black patients, but they were infrequently documented in the EHR compared to

White patients (information overlap in the EHR: 92.9% vs 36.4%). Given that the prevalence of hypertension is higher in Black patients compared to White patients (41% vs 27%),[28] abnormal blood pressure readings were frequently discussed, but infrequently documented.

Some of these gaps may be explained by nurses' clinical judgment of the specific health condition. For example, the chronically high blood pressure may have improved from previous visits, or perhaps it was being treated with continuous medications; therefore, nurses did not consider it necessary to document abnormal blood pressure in the EHR since this was not a new-onset issue. In addition, nurses might have not documented "edema" because the symptom was not considered severe based on their clinical judgment. However, this symptom should be further investigated in order to distinguish mild "edema" from "angioedema", which is more common in Black patients and could be a serious side effect of hypertensive medications.[29] Regardless of these potential explanations, the differences in information overlap between verbal communications and EHR documentation by race are concerning, especially given racial and ethnic disparities in US health care access and quality.[30–32] Our findings contribute to the knowledge about racial disparities in communication patterns between patients and nurses and documentation quality.

Clinical implications and future research

Our findings showed that approximately one-third of the pertinent clinical information was not documented in the EHR. Further research is needed to determine the specific barriers that prevent thorough documentation. HHC nurses might need more education about how to adequately document problems and interventions in the EHR. HHC EHR templates and standardized assessment tools should be examined for information coverage on specific issues that were found to be frequently underdocumented. Additionally, the potential of racial disparities in documentation should be studied with a larger sample and in depth to understand the underlying factors. Further steps may need to address the factors in clinical practice to improve health care equity and patient outcomes.

Our findings also show that utilizing information from verbal communications can provide important insights about underdocumented patient problems and nursing interventions. To decrease clinician burnout and cognitive load associated with a high documentation burden,[33,34] automated voice recognition technologies can potentially be used to "listen" to patient-health care provider verbal communications and create clinical documentation in the EHR. This complimentary approach can potentially reduce clinical documentation burden and capture important aspects of healthcare with minimal information loss.[35] Future studies should explore using automated speech recognition to extract problems and interventions from clinical communications. These important insights can also potentially help to improve the identification of patients at risk for negative outcomes (eg, hospitalization or emergency department visits) via predictive analytics.

Limitations

Some limitations should be taken into account when interpreting the results. Due to the exploratory nature of this study, the sample size was small, which affects the generalizability of the results. The data were collected from patients who received HHC services by a single HHC organization in the same geographic region, which limits the generalizability of the results because of the possibility of organization-specific practical behavioral patterns (eg, protocol during HHC visits). There could have been other unmeasured data sources within the HHC organization (eg, emails between providers) that may have increased the information overlap, but were not examined in this study. Depending on the reason for the HHC visit, the nurse–patient verbal communication might be affected (eg, if a patient is receiving HHC to treat surgical wounds, the nurse will focus on wound-specific information during the verbal communication). Further limitations are attributable to the nurses' individual practices, which were not considered in this study, since documentation behaviors reflect nurses' knowledge, perception, and attitude toward the patients. Because the analysis of this study did not adjust for nurse clustering, the differences could be attributed to individual practices rather than racial differences in patients.

CONCLUSIONS

Our findings highlight the value of analyzing communications between patients and HHC nurses.[36] We identified gaps in information overlap between different datasets, with up to 50% of verbally discussed patient problems missing from nurses' EHR documentation. We also observed racial differences in information overlap between datasets, which highlights potential health care disparities negatively affecting patient care. Future research is needed to iden-

tify barriers to comprehensive documentation and to capture verbal information using automated speech recognition to reduce gaps in information overlap and improve patient outcomes.

AUTHOR CONTRIBUTIONS

Study concept and design: JS, MZ, MT; acquisition of data: JS, MZ, DS, SV, SS; analysis and interpretation of data: JS, MZ, MVMcD, ZK, MT; drafting of the manuscript: JS, MZ, MVMcD, ZK, MT; critical revision of the manuscript of important intellectual content: all authors.

SUPPLEMENTARY MATERIAL

Supplementary material is available at *JAMIA Open* online.

CONFLICT OF INTEREST STATEMENT

None declared.

DATA AVAILABILITY

Data available on request due to privacy/ethical restrictions: The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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