JMIR Publications
The Leading eHealth Publisher

Integrating Nurses' Perspectives into Nursing Summary Design: A Co-Design Approach

Suhyun Park, Jenna L. Marquard, Robin R. Austin, Christie L. Martin, David S. Pieczkiewicz, Connie W. Delaney

Submitted to: Journal of Medical Internet Research
on: November 19, 2024

Preprint
JMIR Publications

Disclaimer: © The authors. All rights reserved. This is a privileged document currently under peer-review/community review. Authors have provided JMIR Publications with an exclusive license to publish this preprint on it's website for review purposes only. While the final peer-reviewed paper may be licensed under a CC BY license on publication, at this stage authors and publisher expressively prohibit redistribution of this draft paper other than for review purposes.

Table of Contents

Preprint
JMIR Publications

Integrating Nurses' Perspectives into Nursing Summary Design: A Co-Design Approach

Suhyun Park[1*] PhD, RN; Jenna L. Marquard[2*] PhD, FACMI; Robin R. Austin[2*] PhD, DNP, DC, NI-BC, FAMIA, FNAP; Christie L. Martin[2*] PhD, MPH, RN-BC, LHIT-HP; David S. Pieczkiewicz[3*] PhD; Connie W. Delaney[2*] PhD, RN, FACMI, FAAN, FNAP

[1]The University of Texas Health Science Center at Houston Cizik School of Nursing Houston US
[2]University of Minnesota School of Nursing Minneapolis US
[3]University of Minnesota Institute for Health Informatics Minneapolis US
[*]these authors contributed equally

Corresponding Author:
Suhyun Park PhD, RN
The University of Texas Health Science Center at Houston
Cizik School of Nursing
6901 Bertner Ave.
#557
Houston
US

Preprint JMIR Publications

Abstract

Background: Although electronic health record nursing summaries aim to provide a concise overview of patient data, they often fall short of meeting nurses' information needs, leading to underutilization. This gap arises from a lack of involvement of nurses in the design of health information technologies.

Objective: The purpose of this co-design study was to solicit insights from nurses regarding nursing summary design considerations, including key information types and the preferred design prototype.

Methods: We recruited clinical nurses (N = 33) practicing in inpatient units at a university hospital in the Midwest. We used images from a simulated nursing summary to generate visual card versions of the 46 information types currently included in an electronic health record nursing summary. Participants evaluated the relevance of each information type card to the nursing summary and indicated their preferred arrangement of the information type on a summary layout. After participants evaluated the information type cards, debriefing interviews were conducted to explore their rationales for the desired content and its arrangement.

Results: The participants demonstrated a high level of engagement in the co-design process. On average, all 33 participants included 61% (n = 28) of the total information types (n = 46). The most frequently included cards were unit specimen (lab), activity, diet, and hospital problems. Participants most frequently preferred adjacency of the following pairs: activity and diet (paired by 26 participants; 79%) and notes to physicians and notes to treatment team (paired by 25 participants; 76%). Participants preferred arranging the cards to improve information accessibility, focusing on key information types.

Conclusions: Involving nurses in the co-design process may result in more useful and usable designs, thereby reducing the time required to navigate nursing summaries. Future work should include refining and evaluating prototypes based on the designs created by the nurses. Clinical Trial: NA

(JMIR Preprints 19/11/2024:68906)
DOI: https://doi.org/10.2196/preprints.68906

Preprint Settings

1) Would you like to publish your submitted manuscript as preprint?

✓ **Please make my preprint PDF available to anyone at any time (recommended).**
Please make my preprint PDF available only to logged-in users; I understand that my title and abstract will remain visible to all users.

Only make the preprint title and abstract visible.
No, I do not wish to publish my submitted manuscript as a preprint.

2) If accepted for publication in a JMIR journal, would you like the PDF to be visible to the public?

✓ **Yes, please make my accepted manuscript PDF available to anyone at any time (Recommended).**
Yes, but please make my accepted manuscript PDF available only to logged-in users; I understand that the title and abstract will remain v
Yes, but only make the title and abstract visible (see Important note, above). I understand that if I later pay to participate in <a href="http

Preprint JMIR Publications

Original Manuscript

Preprint
JMIR Publications

Integrating Nurses' Perspectives into Nursing Summary Design: A Co-Design Approach

Abstract

Background: Although electronic health record nursing summaries aim to provide a concise overview of patient data, they often fall short of meeting nurses' information needs, leading to underutilization. This gap arises from a lack of involvement of nurses in the design of health information technologies.

Objective: The purpose of this co-design study was to solicit insights from nurses regarding nursing summary design considerations, including key information types and the preferred design prototype.

Methods: We recruited clinical nurses (N = 33) practicing in inpatient units at a university hospital in the Midwest. We used images from a simulated nursing summary to generate visual card versions of the 46 information types currently included in an electronic health record nursing summary. Participants evaluated the relevance of each information type card to the nursing summary and indicated their preferred arrangement of the information type on a summary layout. After participants evaluated the information type cards, debriefing interviews were conducted to explore their rationales for the desired content and its arrangement.

Results: The participants demonstrated a high level of engagement in the co-design process. On average, all 33 participants included 61% (n = 28) of the total information types (n = 46). The most frequently included cards were *unit specimen (lab)*, *activity*, *diet*, and *hospital problems*. Participants most frequently preferred adjacency of the following pairs: *activity* and *diet* (paired by 26 participants; 79%) and *notes to physicians* and *notes to treatment team* (paired by 25 participants; 76%). Participants preferred arranging the cards to improve information accessibility, focusing on key information types.

Conclusion: Involving nurses in the co-design process may result in more useful and usable designs, thereby reducing the time required to navigate nursing summaries. Future work should include refining and evaluating prototypes based on the designs created by the nurses.

Keywords: Electronic health records, Interview, Nurses, User-computer interface, Co-design

Preprint JMIR Publications

Introduction

Background

Ineffective communication among clinicians, particularly during handoffs, is a leading cause of sentinel events, such as falls and delays in treatments.[1] Given time constraints, nurses review vast amounts of patient information in electronic health records (EHRs) at the beginning of each shift; thus, effective tools for summarizing patient information are crucial.[2] Nursing summaries in EHRs are intended to provide a concise overview of essential patient data (e.g., vital signs, intake/output, weight) on a single page, but rigid and incomplete formats have led to underutilization,[3] resulting in nurses developing highly variable methods, such as paper notes, for summarizing patient information.

End-users are involved in the EHR development phase to prevent low usability and support optimal EHR utilization.[4] Co-design (or participatory design) has gained attention as a strategy to integrate stakeholder viewpoints, bridging the gap between tools and users' needs to ensure the long-term adoption of tools.[5] Co-design aims to actively involve potential user groups in designing tools and interventions, leveraging their lived experiences to tailor outputs to their expressed needs and preferences, while aligning with existing workflows and available resources.[6] In healthcare, co-design has been applied across various settings and user groups, including in the creation of predictive analytics dashboards and decision support systems to enhance care quality and client outcomes in aged care.[6] Co-design has also been used to examine clinical nurses' general ideas about information display design in a nursing summary[2] and to develop a mobile health application to assist patients with obesity in self-managing their preparation for elective surgery.[7]

The use of information cards as a tool for stakeholder engagement is an approach adopted by designers to structure the co-design ideation process.[8,9] Card sorting, a prevalent user-centered design technique, actively involves participants categorizing labeled cards based on criteria that most resonate with them.[10] Card sorting offers numerous benefits, including facilitating the organization of complex information into intuitive groupings, promoting consensus building among diverse user groups, enhancing the user experience by ensuring content and functionality are logically structured, and providing valuable insights into users' preferences and priorities.[11] Although this study did not focus specifically on the creation of subgroups of information types, we integrated key principles from card sorting, such as labeling and analyzing the arrangement of cards, to inform nursing summary design strategies. The design strategies informed by nurse users' input could streamline navigational pathways, thereby reducing cognitive load. This aligns with the goals of the National Burden Reduction Collaborative (NBRC), which unites healthcare organizations, federal agencies, and standards organizations to reduce clinical burden nationwide.[12]

Problem Statement

Nurses' participation in EHR design is often limited, despite their role as key users.[2,13] A deeper understanding of their unique requirements and suggestions for EHR design is needed. Recognizing the pivotal role of end-user involvement in design,[5] we used a co-design activity to examine nurses' perspectives on the use and arrangement of information types (e.g., vital signs, intake/output, weight) within an existing EHR vendor's nursing summary. Specifically, the co-design activity aimed to gain insights into nurses' perspectives on nursing summary design, including which information types to include and how to arrange the information types.

Methods

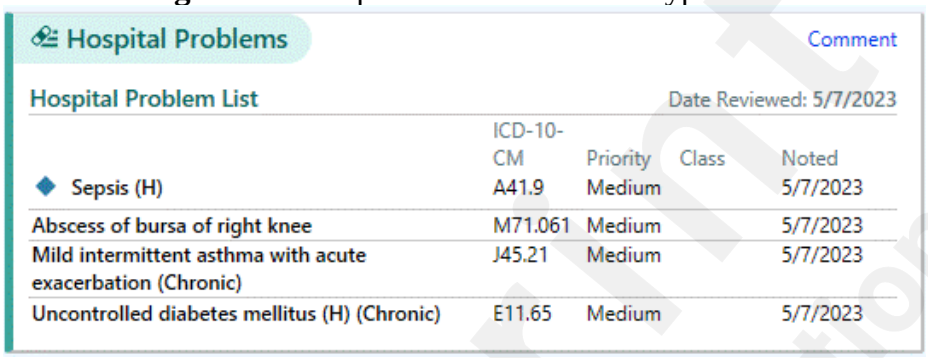
Participants and Recruitment

We recruited participants from 5 adult medical-surgical or intermediate care units at an academic medical center. To be included, participants must have had at least 12 months' experience as a registered nurse. We excluded nurses who were not in frontline patient care, such as nurse educators, nurse managers, and nurse research coordinators. Recruitment was facilitated by nurse managers, who distributed email flyers providing details about the study.

Data Collection

Participants were individually invited to a shared research space from August to September 2023. We used a nursing summary from a simulated patient case on a training platform that mirrored the EHR system used by the recruiting hospital. Since the hospital had used the Epic EHR system (Epic Systems, Verona, Wisconsin, United States) since 2011, we assumed all participants were familiar with its layout. The summary included 46 information types (e.g., vital signs, intake/output, weight). We printed and cut out cards for each information type so the participants could move them around as they liked. Each information type card used a consistent design, including a colored boundary, heading, and optional content (Figure 1). See Supplementary File 1 for the full original nursing summary layout.

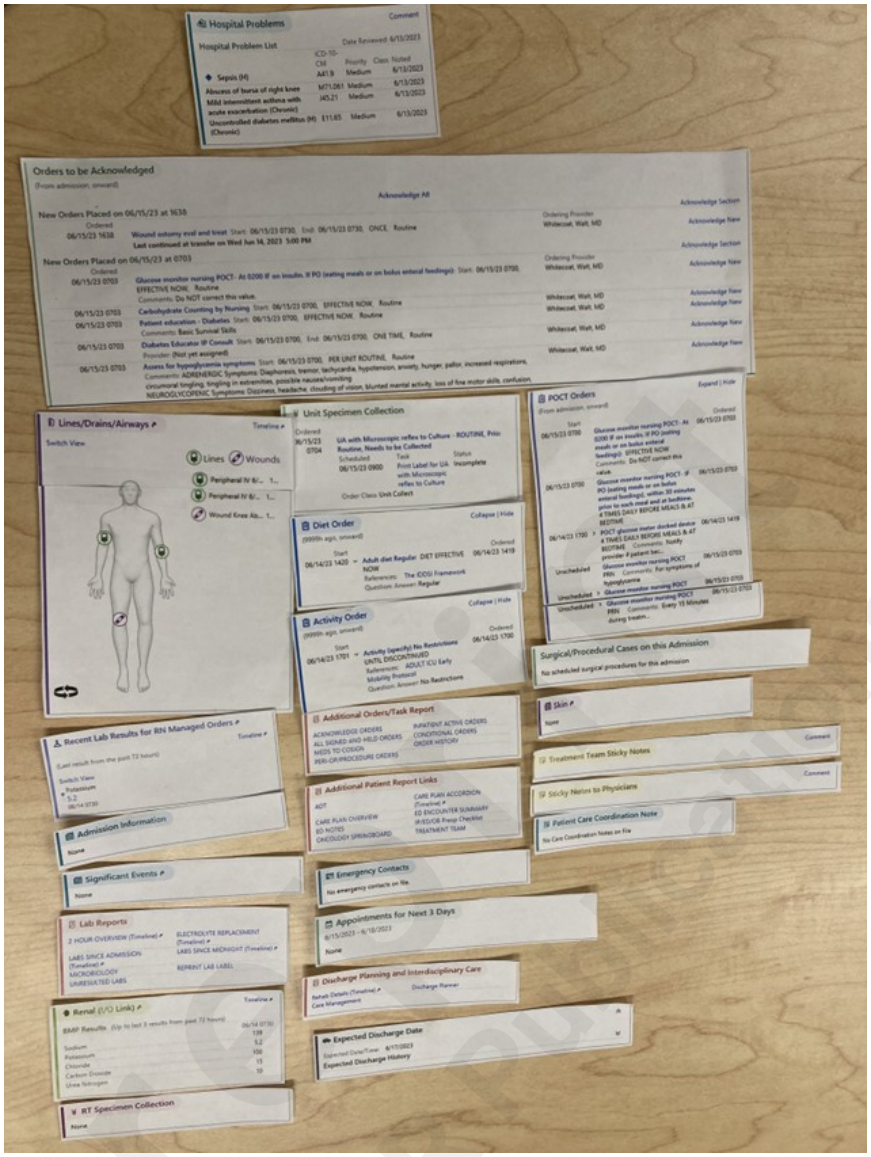
Figure 1. Example of an Information Type Card



First, each participant reviewed each information type card to determine whether it was important enough to be included in the summary. Participants then arranged the included cards they wanted to present in the nursing summary on a desk to develop their preferred layout for the nursing summary screen. We clarified that the focus of the study was on determining the relevance of specific types of information (i.e., social determinants of health) in the context of a nursing summary and arranging them, rather than the graphical design or the content of the information within the cards. We photographed each participant's design output for subsequent analysis. Figure 2 shows an example of a design output created by one participant. Following the activity, a debriefing interview was conducted to collect feedback, and each conversation was audio-recorded for subsequent transcription and analysis. Participants were prompted with the following guided questions:

- Explain your reasoning process in relation to the design layout.
- Discuss any specific considerations you made regarding information arrangement.
- Offer any additional comments on your design.

Figure 2. Example of a Design Output



Ethical Considerations

The study protocol was approved by the Institutional Review Board of the university. The principal investigator provided verbal and written information about the study to the participants and obtained verbal consent.

Data Analysis

We assessed the significance of each information type by quantifying the number of nurses who chose to include the information type card in the design output. We then analyzed which information type cards nurses tended to place next to each other in their design output, providing insights into the cohesive grouping of information.[11] Analysis of the debriefing interviews yielded overarching themes about what guided participants' designs.

Results

Sample Characteristics

The characteristics of the 33 participants are presented in Table 1. More than half (57.6%) of the participants were 25-44 years old, 84.8% were female, 75.8% were White, and none were Hispanic. Most nurses included in this analysis had at least a baccalaureate degree related to nursing (90.8%). The participants generally had fewer years of nursing experience and worked fewer hours compared to a representative sample of national nurses (median = 13 years and median = 37 hours, respectively).[14]

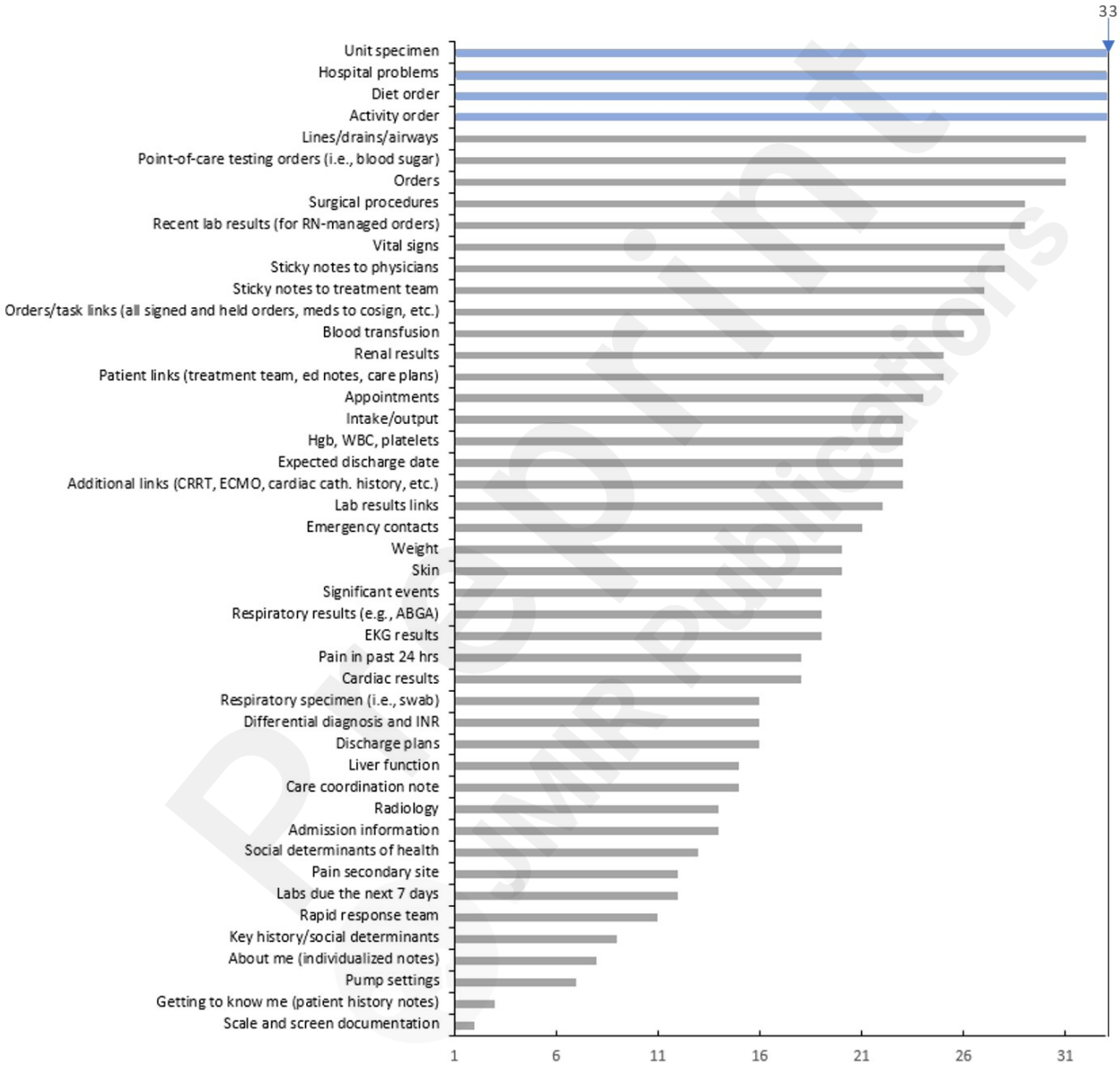
Table 1. Baseline characteristics of the participants (N =33)

Characteristic	N (%)
Age (y)	
18-24	9 (27.2%)
25-44	19 (57.6%)
45-64	5 (15.1%)
≥65	0
Sex, n (%)	
Male	5 (15.1%)
Female	28 (84.8%)
Other	0
Race	
Black or African American	5 (15.1%)
White	25 (75.8%)
Asian	2 (6%)
Native American/Alaskan	0
Other	0
Prefer not to say	1 (3%)
Ethnicity	
Hispanic or Latinx	0
Non-Hispanic	33 (100%)
Other	
Relationship status	
Single	14 (42.4%)
Married	14 (42.4%)
Partnered	2 (6%)
Divorced	2 (6%)
Separated	1 (3%)
Highest nursing degree	
Diploma	3 (9.1%)
BSN	28 (84.8%)
MS/MSN	2 (6%)
PhD/DNP	0
Median hours worked per week	36
Median years of RN experience	4
Median years of using EHRs	4

Card Frequency

On average, participants included 28 of the 46 information type cards in their design outputs. Notably, all participants (n = 33) included *unit specimen, hospital problems, diet,* and *activity* in their design output (Figure 3). However, certain information type cards were included less frequently: fewer than 50% of participants included 15 of the information type cards, and fewer than 10 participants included *key history/social determinants* (n = 9), *About me/individualized notes* (n = 8), *IV pump settings* (n = 7), *patient history notes* (n = 3), and *scale and screen documentation* (n = 2).

Figure 3. Frequency of Included Cards



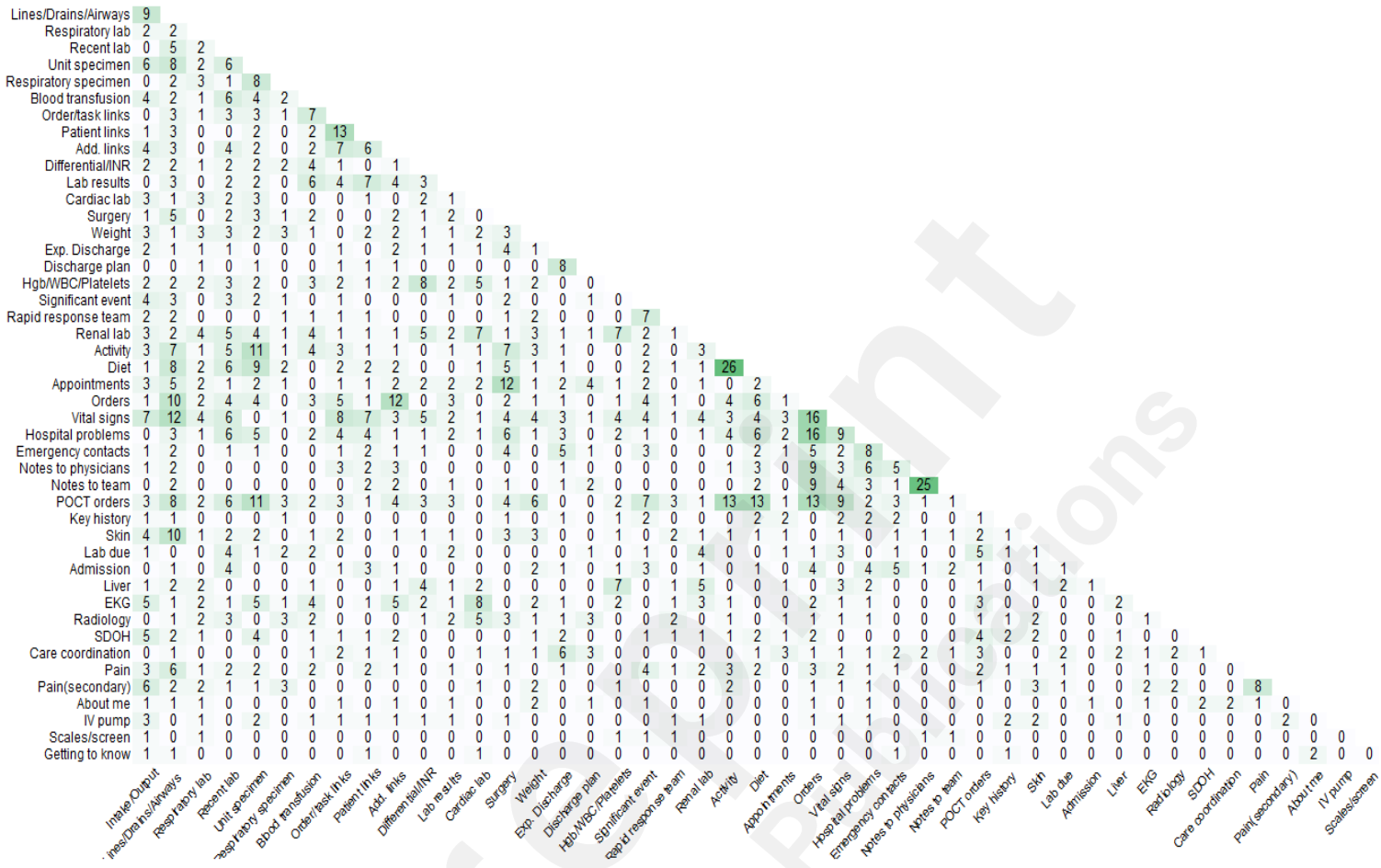
Abbreviation.CRRT: continuous renal replacement therapy; ECMO: extracorporeal membrane oxygenation; INR: international normalized ratio; EKG: electrocardiogram; ABGA: arterial blood gas analysis

Card Adjacency

Figure 3 shows the number of participants who placed each pair of information type cards next to each other in their design. Darker shading was used to highlight cells where two information type cards were located next to each other more frequently. The pairs of information type cards located next to each other most frequently were *activity* and *diet* (n = 26; 79%), followed by *notes to physicians* and *notes to treatment team* (n = 25; 76%). Other pairs of cards that were placed next to each other included *orders* and *hospital problems* (n = 16; 48%) and *orders* and *vital signs* (n=16;

48%). *Orders* and *hospital problems* and *orders* and *vital signs* are not located next to each other in the current EHR design.

Figure 4. Item-by-item Matrix of Card Adjacency



Interview Findings

Table 2 presents themes, subthemes, and exemplary quotes derived from the debriefing interviews. The participants emphasized the importance of readability in their design choices, opting for a layout that facilitates top-to-bottom reading of key information based on priority. They noted that grouping related information together would facilitate information scanning. They also prioritized identifying immediate action items (e.g., physicians' orders) over delving into patient characteristics, such as social determinants of health. Owing to the typical time constraints needed to review patient information at the beginning of a shift, participants removed redundant information cards that hindered a swift and effective patient overview. Last, beyond the given design layout, participants provided design-related commentaries, pointing out that some information types required unnecessary clicks to get to the desired information, which limited usability.

Table 2. Common Themes, Subthemes, and Supporting Quotes from Debriefing Sessions

Themes	Subthemes	Quotes
Improving information accessibility	Key information positioned upward	"I have it from top to bottom. So it's the least important thing towards the bottom." [P11]
		"Diet is not as important, so I kept it going to the bottom." [P24]

		“I usually place it at the top of the page, not necessarily because it's important, but because it needs to be visible for everyone to see…Otherwise, no one else will notice it. Not everyone will scroll down." [P4] “Most important would be at like the top, in a top-down order.” [P1] "I like that the orders are at the top because they're the most important; they're what the doctor wants us to be doing with the patient.” [P9]
	Proximity of similar information	“I want lab results in the same spot.” [P24] “That'd be nice if they were together. Orders around orders. Orders can stick together.” [P1]
Focusing on key information types	Go-to action items over background details	"I believe that social determinants of health are important. However, during my admission process, I do not check the social determinants of health. It is crucial for social workers and us to better understand the patient, but it is not my initial priority. When I first receive patients, I do not check the social determinants of health." [P26] “I always want to know what orders are because these would be done right away.” [P22]
	Removing redundancy	“The additional report things have a fall risk timeline, but then there's a fall risk injury (information card). I just feel like it's totally redundant.” [P22] “The card, ‘Getting to know me,’ I feel like this was redundant with ‘About me.’ I honestly never use this.” [P5]
Easy-to-use design	Unnecessary steps to the desired information	“We cannot see the treatment team unless we do another click here and check the treating team.” [P26] “...a lot of people have a hard time with, like, everything's here but you have to click a lot to get out of here, right? If there's a transfusion order, this shouldn't be bold or an asterisk (on the order name). There should be an order you need to give blood or something that you could click on… Why do you need extra things to press?” [P22]

> "I really don't use this summary page that much, because it's just so overwhelming. I guess it's just too many things there that I don't even know, like how to navigate it, which is why I made my system, which is more clicking." [P5]

Discussion

Principal Results

The study highlights the importance of aligning EHR nursing summary design with nurses' cognitive workflows, demonstrating that nurses prioritize and organize information in ways that make sense to them. Concise, relevant information allows nurses to quickly review a patient's status, while strategically grouping related data helps them navigate and interpret complex information more efficiently. The current nursing summary contains overwhelming amounts of information that is often presented ineffectively, necessitating extensive searching to consolidate scattered data. The findings indicate a significant need to remove less relevant information from the summary. Also, nurses emphasized the importance of *unit specimen*, *activity, diet,* and *hospital problems* in their design output, suggesting these are the key information types for patient overviews. Nurses tended to prioritize obtaining information on current problems, daily living status, or treatment plans. Medical history or miscellaneous notes can be a source of information but are not always necessary for the initial patient overview. Our findings are consistent with prior work in which clinicians used a limited number of clinical information concepts at the time of patient admission, suggesting better electronic data management strategies, including the priority display of frequently used clinical concepts.[15]

Participants strategically positioned information cards to align with their cognitive workflow by placing relevant cards adjacent. The adjacency of information often signifies the similarity or relative importance of the information.[16] Previous studies have also emphasized the benefits of placing paired EHR information adjacent to each other on the screen to facilitate user interface navigation.[17–19] Some information pairs nurses identified with high frequency did not align with the current nursing summary layout. For example, *orders* and *hospital problems*, *orders* and *vital signs*, *orders* and *point-of-care-testing order*, and *point-of-care-testing order* and *activity* were frequently located next to each other in the participant designs, but not in the existing layout. In addition to the adjacent placement of relevant information, top-to-bottom organization of information was commonly found in the designs. The placement of items at the top of the screen naturally calls attention to those items.[20] Instead of scrolling down for details on the screen, nurses tended to place good-to-know but not essential information toward the bottom of their designs.

Strengths and Limitations

These findings show the value of co-design—actively involving nurses in the design process—to create an EHR nursing summary that better supports their needs. By prioritizing the most relevant patient information and streamlining the data presentation, the study offers design strategies that could alleviate the EHR burden of navigating from one piece of information to another. The identified design strategies could enhance efficiency and support the NBRC's mission to reduce the overall burdens on healthcare professionals.[12]

While this study successfully identified nurses' information preferences aligning with their workflow, it has limitations. We did not necessarily capture the complete paths and hierarchy nurses navigate to access necessary content. Individual nurses may possess different mental models for processing information, suggesting the need for complementary methods such as a think-aloud approach to provide real-time cognitive insights and a comprehensive understanding of information search and use. Furthermore, since the study used a single patient case from one vendor EHR, the

scope of information types may vary slightly across different patient cases or vendor EHR systems. Factors such as the participants' specific work environment (e.g., surgery unit vs. internal cardiology unit), shift (morning vs. evening), and nursing experience (novice vs. expert) may also influence their priorities and responsibilities, underscoring the importance of considering these variables in future research.

Conclusion

This study provides valuable insights into nurses' preferences and strategies for organizing information in an EHR nursing summary, underscoring the need to redesign the layout based on its practical use. We emphasized the significance of reducing less relevant information and optimizing the layout according to nurses' information priorities. These efforts have the potential to improve the usefulness of the current nursing summary. The direct involvement of nurses as co-designers holds promise for developing user-centered EHR tools that support nursing cognition, decision-making, and workflow.

Acknowledgments – We would like to express our gratitude to the participants for generously sharing their time and experiences. This study was supported by SP's Doctoral Dissertation Fellowship, University of Minnesota and Midwest Nursing Research Society/Council for Advancement of Nursing Science Dissertation Grant (#CON000000104586).
Competing Interest – None

Preprint JMIR Publications

References

1. The Joint Commission. Sentinel Event Data Summary. 2024. Accessed November 19, 2024. https://www.jointcommission.org/resources/sentinel-event/sentinel-event-data-summary/
2. Park S, Marquard J. Nurse-centered co-design of an Electronic Health Record nursing summary. *Human Factors in Healthcare*. Published online January 2024:100065. doi:10.1016/j.hfh.2024.100065
3. Staggers N, Clark L, Blaz JW, Kapsandoy S. Why patient summaries in electronic health records do not provide the cognitive support necessary for nurses' handoffs on medical and surgical units: Insights from interviews and observations. *Health Informatics J*. 2011;17(3):209-223. doi:10.1177/1460458211405809
4. Busse TS, Jux C, Laser J, et al. Involving Health Care Professionals in the Development of Electronic Health Records: Scoping Review. *JMIR Hum Factors*. 2023;10:e45598. doi:10.2196/45598
5. Voorend R, Derboven J, Slegers K. Distributed User-Generated Card Based Co-Design: A Case-Study. In: *Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems*. ACM; 2019:1-6. doi:10.1145/3290607.3312815
6. Ludlow K, Westbrook J, Jorgensen M, et al. Co-designing a dashboard of predictive analytics and decision support to drive care quality and client outcomes in aged care: a mixed-method study protocol. *BMJ Open*. 2021;11(8):e048657. doi:10.1136/bmjopen-2021-048657
7. Song T, Yu P, Bliokas V, et al. A Clinician-Led, Experience-Based Co-Design Approach for Developing mHealth Services to Support the Patient Self-management of Chronic Conditions: Development Study and Design Case. *JMIR Mhealth Uhealth*. 2021;9(7):e20650. doi:10.2196/20650
8. Alvarez CP, Martinez-Maldonado R, Buckingham Shum S. LA-DECK: a card-based learning analytics co-design tool. In: *Proceedings of the Tenth International Conference on Learning Analytics & Knowledge*. ACM; 2020:63-72. doi:10.1145/3375462.3375476
9. Kwiatkowska J, Szóstek A, Lamas D. (Un)structured sources of inspiration: comparing the effects of game-like cards and design cards on creativity in co-design process. In: *Proceedings of the 13th Participatory Design Conference on Research Papers - PDC '14*. ACM Press; 2014:31-39. doi:10.1145/2661435.2661442
10. Tankala S, Sherwin K. Card Sorting: Uncover Users' Mental Models. Nielsen Norman Group. February 2, 2024. Accessed April 1, 2024. https://www.nngroup.com/articles/card-sorting-definition/
11. Righi C, James J, Beasley M, et al. Card sort analysis best practices. *Journal of Usability Studies*. 2013;8(3):69-89. https://uxpajournal.org/card-sort-analysis-best-practices-2/
12. Health Data Management. New group hopes to focus efforts to trim clinician burdens. Health Data Management. February 2023. Accessed November 16, 2024. https://www.healthdatamanagement.com/articles/new-group-hopes-to-focus-efforts-to-trim-clinician-burdens
13. Martikainen S, Kaipio J, Lääveri T. End-user participation in health information systems (HIS) development: Physicians' and nurses' experiences. *International Journal of Medical Informatics*. 2020;137:104117. doi:10.1016/j.ijmedinf.2020.104117
14. Melnick ER, West CP, Nath B, et al. The association between perceived electronic health record usability and professional burnout among US nurses. *Journal of the American Medical Informatics Association*. 2021;28(8):1632-1641. doi:10.1093/jamia/ocab059
15. Pickering BW, Gajic O, Ahmed A, Herasevich V, Keegan MT. Data Utilization for

Medical Decision Making at the Time of Patient Admission to ICU*: *Critical Care Medicine*. 2013;41(6):1502-1510. doi:10.1097/CCM.0b013e318287f0c0

16. Wagemans J, Elder JH, Kubovy M, et al. A century of Gestalt psychology in visual perception: I. Perceptual grouping and figure–ground organization. *Psychological Bulletin*. 2012;138(6):1172-1217. doi:10.1037/a0029333
17. Marian AA, Dexter F, Tucker P, Todd MM. Comparison of alphabetical versus categorical display format for medication order entry in a simulated touch screen anesthesia information management system: an experiment in clinician-computer interaction in anesthesia. *BMC Med Inform Decis Mak*. 2012;12(1):46. doi:10.1186/1472-6947-12-46
18. Senathirajah Y. Safer Design - Composable EHRs and Mechanisms for Safety. *Stud Health Technol Inform*. 2015;218(ck1, 9214582):86-92.
19. Zheng K, Padman R, Johnson MP, Diamond HS. An Interface-driven Analysis of User Interactions with an Electronic Health Records System. *Journal of the American Medical Informatics Association*. 2009;16(2):228-237. doi:10.1197/jamia.M2852
20. Senathirajah Y, Kaufman D, Bakken S. The clinician in the driver's seat: part 2 - intelligent uses of space in a drag/drop user-composable electronic health record. *J Biomed Inform*. 2014;52(100970413, d2m):177-188. doi:10.1016/j.jbi.2014.09.008

Preprint JMIR Publications

Supplementary Files

Preprint JMIR Publications

Multimedia Appendixes

Layout of nursing summary.
URL: http://asset.jmir.pub/assets/ae5c1fca35c141b60321d0fa98232156.pdf

Preprint JMIR Publications