Fall 2023 **Human Factors in Healthcare Systems**

Instructor: Dr. Priya Pennathur
Office Address: A 241 Engineering Building
Telephone: 915-747-7956
Office Hours: Mondays 3 pm – 5 PM or by appointment. My email is prpennathur2@utep.edu. I usually respond to emails within a day when I am in town, and during weekdays. It may take a bit longer when I am traveling, and during weekends.

Course Website: Blackboard

Meeting Times: Tuesdays from 6:00 PM – 8:50 PM
Location: Physical Science Building 222A

Course Description

This graduate course examines healthcare systems design with a human factors lens. Healthcare work involves complex, high consequence and high-risk goals requiring communication and coordination among many stakeholders, interaction with complex technologies and real-time decision-making. The course will include current research readings, in-class discussions on healthcare human factors, and a research project.

Course Goals

By the end of this course, you will learn about:

- A broad set of healthcare system issues examined from a human factors standpoint
- Tools and techniques for addressing human factors design challenges in healthcare systems

Course Topics

- Overview of Human Factors in Healthcare Systems
- Human Error and Patient Safety
- Conceptual Frameworks and Methods in Human Factors for Healthcare
- Health Information Technology
- Macroergonomics in Healthcare
- Physical Ergonomics and Physical Environment in Healthcare
- Job and Organization Design
- Teamwork in Healthcare
- Design and Evaluation of Healthcare Systems

Course Expectations

- Read and understand the research articles critically and reflectively.
- Participate and contribute to class discussions, by including your thoughtful ideas and opinions, with due respect for your peers' ideas.
- Bring additional insights and opinions by sharing other resources, articles or ideas that you are aware of.
- Be open to other ideas, reflect on them, and challenge them constructively.
- Be punctual and courteous in attending the class sessions, and in submitting assignments on time.

Course Grade Assignments

- Reading Assignments and Participation in Class Discussions (35%)
- Online discussion (10%)
- Mid point presentation (5%) and Mid point paper (15%)
- Final paper (25%) and presentation (10%)

Description of Assignments

<u>Reading Assignments and Participation in Class Discussions (35%)</u>

The majority of class time will be spent in discussing research articles. Class discussions will help bring out varied perspectives on the research issues, as well as provide a forum for critically and thoughtfully thinking about the human factors challenges in healthcare.

There will be 2 components to every discussion:

1. Leading discussions for 3 articles in class and 1 online discussion.
2. Every student will read and prepare for discussion every class.

I will post discussion questions for every article on Blackboard couple of days prior to the assigned date for discussion.

There will be a discussion lead for each article. Each student is required to choose and lead 3 in-class discussions and 1 online discussion over the course of the semester. There will be a sign-up sheet provided to you for choosing the articles.

The discussion lead should be prepared to summarize the article, and facilitate discussion based on the questions I post in Blackboard. The discussion lead is expected to be ready with well-thought out responses for the discussion questions, any additional sources about the topic and facilitate peers to discuss the questions. Written response to the questions I post is not required. I will provide a discussion rubric first week of classes. This rubric will be used to grade your engagement in discussions.

For each article we will discuss in class that day, each student should complete and bring to class a written document (limit: one page) containing the following elements:

1. 2 to 3 sentence summary of each article (can be a bulleted list).
2. 2 interesting questions or thoughts that came to you while reading the article (can be a bulleted list).

This written sheet should be provided to me or uploaded on blackboard prior to beginning of class. The intent of this exercise is for you to read each article and prepare for discussion. You will be using this written sheet to guide your discussion.

We will spend approximately 25-30 minutes per article during class. You are encouraged to consult other external sources/readings as relevant to help steer the discussions.

The written document, generation of discussion questions and participation in discussions will all count towards your reading assignment and participation grade. A breakdown of grades for each category is shown below.

- Written document/summary = 5 pts per class session * 10 in-class sessions = 50 pts
- Leading discussions = 3 articles * 15 pts = 45 points
- Participation in discussion = 5 pts per class session * 10 in-class sessions = 50 points

Online Discussion (10%)

Each student will lead and moderate an online discussion of 1 reading assignment. Details will be provided closer to the assigned date.

Projects and Presentations

Each team will be assigned a project relevant to the healthcare and human factors area. More than half of the grade and time will be used for these projects. Specifics about the project will be provided in class. The project elements will generally include:

- Research Question or Problem (problem description will be provided to you)
- Human Factors background or literature review relevant to the problem
- Data collection methods
- Data analysis
- Findings and conclusions
- Discussion/Solutions/Interventions and Design Implications

Note that depending on the specifics and scope of the project opportunity, the structure will slightly vary. Once the project ideas are finalized, we will revisit the project elements.

Mid-point paper (15%)

Mid-point paper is a mechanism to help you complete most sections of the final project report mid-way through the project. The mid-point report should be about 20 double spaced pages in length (excluding figures, tables, references, appendices). **Mid-point paper is due on Oct 31st, 2023.**The mid-point report should include the following components:

Introduction/Problem Statement
Introduce the problem, setting, and your specific questions in this review. You should be addressing specific questions/gaps in your literature review. Provide the rationale for the study. Describe briefly what you will write in the rest of the paper (a mini map for what the readers can expect to see).

Literature Review Research Design and Methods

Describe your research design, any conceptual or theoretical frameworks you are using to conduct your literature search and review. Think of what you will search for, what you will include and exclude, and how you will filter your results, and how you will make sense of and synthesize your literature. Include references for the methods if any.

Sections reviewing the literature
The goal of the literature review section is to describe what is known about the topic in the field, what the current “gaps” are”, and what you are synthesizing from your review. The literature review should be comprehensive enough to cover the most important literature that is relevant to your study, but should be concise and focused enough to bring out the significance of your questions.

References – include your citations

Appendix – any work in progress documents (like diagrams)

Mid-point presentation (5%)

Mid-point presentation should include the elements in the mid-point paper. Plan to present your work for about 20 minutes. There will be 5 minutes for questions. **Mid-point presentations will be held on Oct 31st, 2023.**

Final paper (25%)

Final paper should be in a publishable form and content, with approximately 25-30 double spaced pages. It is due by **Dec 5th, 2023**. No exceptions will be allowed.

Final paper should include all of the elements in the mid-point paper [will vary depending on the structure] and the following:

Abstract: Describe the major components of your project within 250 words. Include problem statement, brief rationale, methods used and findings.

Findings/Conclusions: Results from your study need to be described in this section. Describe statistics (for a quantitative study) and/or major themes (mostly qualitative) you obtained in the study. Describe what you conclude based on your review. Discuss future work.

Discussion/Solutions/Interventions/Design Implications: Depending on your project, you may have prototyped a new design or may suggest a new design for a system component; you may have new implications for how something ought to be designed based on the findings from your review; you may suggest new interventions or process changes in the system for improvement: these aspects need to be described in this section. Additionally, provide an interpretation of your results in terms of what it means in the real system. Answer the “so what?” question and tie the discussion to literature wherever appropriate.

The elements already in the mid-point paper should be revised/improved or updated based on feedback you obtained or change in your plans.

Final Presentation (10%)

Final presentation will be held on Dec 5th, 2023. Please plan a presentation for 30 minutes, with 10 minutes for questions.

Attendance

Regular attendance is expected. As the nature and format of the course requires interactive discussion, students are expected to attend all classes. Classes will begin on time. If there is a genuine need for absence, please contact Dr. Pennathur well in advance, and please inform your team of your absence.

Grading Scale

A:91-100
B:81-90
C:71-80
D:61-70
F:≤ 60

Tentative Class Schedule

Week	Date	Topic	Assignment (due dates)
1	Aug 29th	Introduction Basic overview of human factors in healthcare Human Error and Patient Safety in Healthcare Sign-up for reading assignment discussion lead Form teams	
Note: Leading Discussion Questions and Preparing Written Summaries Begin next week, Sep 5.			
2	Sep 5	Human Error and Patient Safety in Healthcare Discussion	
3	Sep 12	Conceptual Frameworks and Methods in Human Factors for Healthcare Discussion Project Discussion	
4	Sep 19th	Conceptual Frameworks and Methods in Human Factors for Healthcare Discussion	
5	Sep 26	Physical Environment in Healthcare Online-discussion Project: Team Meeting with Instructor I Guest Lecture TBA	
6	Oct 3rd	Macroergonomics in Healthcare Discussion	
7	Oct 10	Health Information Technology and Human Interaction Discussion	
8	Oct 17	Health Information Technology and Human Interaction Discussion	
9	Oct 24	Health Information Technology and Human Interaction Discussion	
10	Oct 31	Physical Ergonomics in Healthcare Online-discussion Mid-point presentations Guest Lecture TBA	Mid-point paper due Mid-point presentations
11	Nov 7	Teamwork in Healthcare Discussion	
12	Nov 14	Organizational Design: Online Discussion Project: Team Meeting with Instructor II Guest Lecture	
13	Nov 21	Trending Topics in Healthcare Human Factors	
14	Nov 28	Trending Topics in Healthcare Human Factors	
15	Dec 5	Final Presentations	Final presentations due and Final Report Due

Reading Assignments (Articles/Links will be posted in Blackboard before first class)

Week 1 is Introductory Session. No readings or discussion questions are assigned for week 1. I will discuss and present summaries of main topics from the articles below for week 1.

Week 1 (Aug 29th) **(Pennathur)**
Overview of HF in Healthcare and Patient Safety

J. Gosbee (2002). Human factors engineering and patient safety. Quality and Safety in Healthcare, 11, 352-354.

L. L. Leape (1997). A systems analysis approach to medical error. Journal of Evaluation in Clinical Practice, 3, 3, 213-222.

L. L. Leape (1994). Error in medicine. JAMA, 272(23): 1851-1857.

A. M. Bisantz (2008). Cognitive engineering applications in healthcare. Frontiers of Engineering, National Academy of Engineers, 39-47, Washington, DC.

Schiff G, Shojania KG. Looking back on the history of patient safety: an opportunity to reflect and ponder future challenges. *BMJ Qual Saf*. Published online October 8, 2021:bmjqs-2021-014163. doi:10.1136/bmjqs-2021-014163

Additional articles: (not for discussion)

Weinger, M. B., & Gaba, D. M. (2014). Human factors engineering in patient safety. *Anesthesiology: The Journal of the American Society of Anesthesiologists*, *120*(4), 801-806.

Valdez, R. S., Brennan, P. F., & Ramly, E. (2010). *Industrial and systems engineering and health care: critical areas of research* (p. 97). Agency for Healthcare Research and Quality, US Department of Health and Human Services.

Human Error and Patient Safety in Healthcare

V. J. Gawron et al. (2006). Medical error and human factors engineering: Where are we now? American Journal of Medical Quality, 21(1), 57-67.

L.L. Leape and D. M. Berwick. (2005). Five years after To Err is Human: What have we learned? Journal of American Medical Association, 293: 2384-2390.

Cook et al., Operating at the Sharp End: The Human Factors of Complex Technical Work and its Implications for Patient Safety

Makary, M. A., & Daniel, M. (2016). Medical error-the third leading cause of death in the US. *BMJ: British Medical Journal (Online)*, *353*.

Budnitz DS, Shehab N, Lovegrove MC, Geller AI, Lind JN, Pollock DA. US Emergency Department Visits Attributed to Medication Harms, 2017-2019. *JAMA*. 2021;326(13):1299. doi:10.1001/jama.2021.13844

Additional articles: (not for discussion)

Woods and Cook, (2002). Nine steps to move forward from error. Cognition, Technology and Work, 4:137-144.

Xie, A., & Carayon, P. (2015). A systematic review of human factors and ergonomics (HFE)-based healthcare system redesign for quality of care and patient safety. *Ergonomics*, *58*(1), 33-49.

Note: Leading Discussion Questions and Preparing Written Summaries Begin.

Week 2 (Sep 5)
Human Error and Patient Safety in Healthcare

de Vries, E. N., Ramrattan, M. A., Smorenburg, S. M., Gouma, D. J., & Boermeester, M. A. (2008). The incidence and nature of in-hospital adverse events: a systematic review. *Quality and safety in health care*, *17*(3), 216-223.

Croskerry, P. (2003). The Importance of Cognitive Errors in Diagnosis and Strategies to Minimize them, Academic Medicine, 78(8).

Hignett, S., Albolino, S., & Catchpole, K. (2018). Health and social care ergonomics: patient safety in practice.

Panagioti, M., Khan, K., Keers, R. N., Abuzour, A., Phipps, D., Kontopantelis, E., ... & Ashcroft, D. M. (2019). Prevalence, severity, and nature of preventable patient harm across medical care settings: systematic review and meta-analysis. *bmj*, *366*.

Bates, D. W., & Singh, H. (2018). Two decades since to err is human: an assessment of progress and emerging priorities in patient safety. *Health Affairs*, *37*(11), 1736-1743.

Additional articles: (not for discussion)

Reason, J. (1995) Understanding adverse events: human factors. Quality in Health Care, 4:80-89.

Croskerry, P. (2014). Bias: a normal operating characteristic of the diagnosing brain. *Diagnosis*, *1*(1), 23-27.

Rothschild et al al., (2005). The Critical Care Safety Study: The incidence and nature of adverse events and serious medical errors in intensive care, Critical Care Medicine, 33(8).

Lohmeyer, Q., Schiess, C., Garcia, P. D. W., Petry, H., Strauch, E., Dietsche, A., ... & Hofmaenner, D. A. (2023). Effects of tall man lettering on the visual behaviour of critical care nurses while identifying syringe drug labels: a randomised in situ simulation. *BMJ Quality & Safety*, *32*(1), 26-33.

Kim, Y., Son, J., & Jang, W. (2023). Usability Study on Patient Monitoring Systems: An Evaluation of a User Interface Based on User Experience and Preference. *Medical Science Monitor: International Medical Journal of Experimental and Clinical Research*, *29*, e938570-1.

Week 3 (Sep 12)
Conceptual Frameworks and Methods in Human Factors

Sittig and Singh, 2010. A new socio-technical model for studying health information technology in complex adaptive healthcare systems. Quality and Safety in Healthcare, 19(Suppl 3): i68-i74.

Carayon, P., Wooldridge, A., Hoonakker, P., Hundt, A. S., & Kelly, M. M. (2020). SEIPS 3.0: Human-centered design of the patient journey for patient safety. *Applied ergonomics*, *84*, 103033.

Zheng, K., Ratwani, R. M., & Adler-Milstein, J. (2020). Studying workflow and workarounds in electronic health record–supported work to improve health system performance. *Annals of internal medicine*, *172*(11_Supplement), S116-S122.

Jaspers, 2009. A comparison of usability methods for testing interactive health technologies: Methodological aspects and empirical evidence. International Journal of Medical Informatics, 78, 340-353.

Holden, R. J., & Karsh, B. T. (2010). The technology acceptance model: its past and its future in health care. *Journal of biomedical informatics*, *43*(1), 159-172.

Additional articles: (not for discussion)
Unertl et al., 2010. Traversing the many paths of workflow research: developing a conceptual framework of workflow terminology through a systematic literature review. Journal of American Medical Informatics Association, 17:265-273.

Holden, R. J., Carayon, P., Gurses, A. P., Hoonakker, P., Hundt, A. S., Ozok, A. A., & Rivera-Rodriguez, A. J. (2013). SEIPS 2.0: a human factors framework for studying and improving the work of healthcare professionals and patients. *Ergonomics*, *56*(11), 1669-1686.

Carayon, P., Hundt, A. S., Karsh, B. T., Gurses, A. P., Alvarado, C. J., Smith, M., & Brennan, P. F. (2006). Work system design for patient safety: the SEIPS model. *BMJ Quality & Safety*, *15*(suppl 1), i50-i58.

Guerlain et al., 2005. Assessing team performance in the operating room: Development and use of a "back-box" recorder and other tools for the intraoperative environment. Journal of American College of Surgeons, 200(1).

Week 4 (Sep 19th)
Conceptual Frameworks and Methods in Human Factors

Carayon, P., Kianfar, S., Li, Y., Xie, A., Alyousef, B., & Wooldridge, A. (2015). A systematic review of mixed methods research on human factors and ergonomics in health care. *Applied ergonomics*, *51*, 291-321.

Ulmer FF, Lutz AM, Müller F, Riva T, Bütikofer L, Greif R. Communication Patterns During Routine Patient Care in a Pediatric Intensive Care Unit: The Behavioral Impact of In Situ Simulation. 2021;00(00):7.

Fu, Y., Hu, Y., & Sundstedt, V. (2022). A systematic literature review of virtual, augmented, and mixed reality game applications in healthcare. *ACM Transactions on Computing for Healthcare (HEALTH)*, *3*(2), 1-27.

Weinger et al., 2003. Retrospective data collection and analytical techniques for patient safety studies, Journal of Biomedical Informatics, 36:106-119.

Valdez, R. S., McGuire, K. M., & Rivera, A. J. (2017). Qualitative ergonomics/human factors research in health care: Current state and future directions. *Applied Ergonomics*, *62*, 43-71.

Additional articles: (not for discussion)

Stone, R. J. (2018). Blending the Best of the Real with the Best of the Virtual: Mixed Reality Case Studies in Healthcare and Defence. In *Augmented Reality and Virtual Reality* (pp. 277-293). Springer, Cham.

Rauschnabel, P. A., Felix, R., Hinsch, C., Shahab, H., & Alt, F. (2022). What is XR? Towards a framework for augmented and virtual reality. *Computers in human behavior*, *133*, 107289.

Gaba, D. M. (2007). The future vision of simulation in healthcare. *Simulation in Healthcare*, *2*(2), 126-135.

Fletcher et al., 2003. Anaesthetists' non-technical skills (ANTS): evaluation of a behavioral marker system. British Journal of Anesthesia, 90(5): 580-588.

Gordon, M., Darbyshire, D., & Baker, P. (2012). Non-technical skills training to enhance patient safety: a systematic review. *Medical education*, *46*(11), 1042-1054.

Henriksen et al., 2009. The human factors of home health care: A conceptual model for examining safety and quality concerns. Journal of Patient Safety, 5(4).

Catchpole, K., Neyens, D. M., Abernathy, J., Allison, D., Joseph, A., & Reeves, S. T. (2017). Framework for direct observation of performance and safety in healthcare.

Mackenzie and Xiao. Video techniques and data compared with observation in emergency trauma care. Quality and Safety in Health Care. 2003.

Week 5 (Sep 26th) Online Discussion

Physical Environment and Healthcare Issues

Koomen, E., Webster, C. S., Konrad, D., van der Hoeven, J. G., Best, T., Kesecioglu, J., ... & Kappen, T. H. (2021). Reducing medical device alarms by an order of magnitude: A human factors approach. *Anaesthesia and Intensive Care*, *49*(1), 52-61.

Ulrich, R. S., Bogren, L., Gardiner, S. K., & Lundin, S. (2018). Psychiatric ward design can reduce aggressive behavior. *Journal of Environmental Psychology*, *57*, 53-66.

Yen, P. Y., Kellye, M., Lopetegui, M., Saha, A., Loversidge, J., Chipps, E. M., ... & Buck, J. (2018). Nurses' time allocation and multitasking of nursing activities: a time motion study. In *AMIA annual symposium proceedings* (Vol. 2018, p. 1137). American Medical Informatics Association.

Reiling, J., Hughes, R. G., & Murphy, M. R. (2008). The impact of facility design on patient safety. *Patient safety and quality: An evidence-based handbook for nurses*.

Nordin, S., Swall, A., Anåker, A., von Koch, L., & Elf, M. (2021). Does the physical environment matter?-A qualitative study of healthcare professionals' experiences of newly built stroke units. *International Journal of Qualitative Studies on Health and Well-Being*, *16*(1), 1917880.

Additional articles: (not for discussion)

Henriksen et al., 2008. The role of the physical environment in crossing the quality chasm. The Joint Commission Journal on Quality and Patient Safety, 33(11).

Hendrich, A., Chow, M. P., Skierczynski, B. A., & Lu, Z. (2008). A 36-hospital time and motion study: how do medical-surgical nurses spend their time? *The Permanente Journal*, *12*(3), 25.

Van der Schaaf, P. S., Dusseldorp, E., Keuning, F. M., Janssen, W. A., & Noorthoorn, E. O. (2013). Impact of the physical environment of psychiatric wards on the use of seclusion. *The British Journal of Psychiatry*, *202*(2), 142-149.

Rayo, M. F., & Moffatt-Bruce, S. D. (2015). Alarm system management: evidence-based guidance encouraging direct measurement of informativeness to improve alarm response. *BMJ Qual Saf*, *24*(4), 282-286.

Tseng LP, Chuang MT, Liu YC. Effects of noise and music on situation awareness, anxiety, and the mental workload of nurses during operations. *Applied Ergonomics*. 2022;99:103633. doi:10.1016/j.apergo.2021.103633

Michel, O., Garcia Manjon, A. J., Pasquier, J., & Ortoleva Bucher, C. (2021). How do nurses spend their time? A time and motion analysis of nursing activities in an internal medicine unit. *Journal of Advanced Nursing*, *77*(11), 4459-4470.

Week 6 (Oct 3rd)
Macroergonomics in Healthcare

Carayon, P., Karsh, B. T., Gurses, A. P., Holden, R. J., Hoonakker, P., Schoofs Hundt, A., ... & Wetterneck, T. B. (2013). Macroergonomics in health care quality and patient safety. *Reviews of human factors and ergonomics*, *8*(1), 4-54.

Holden, R. J., Valdez, R. S., Schubert, C. C., Thompson, M. J., & Hundt, A. S. (2017). Macroergonomic factors in the patient work system: examining the context of patients with chronic illness. *Ergonomics*, *60*(1), 26-43.

Holden, R. J., Eriksson, A., Andreasson, J., Williamsson, A., & Dellve, L. (2015). Healthcare workers' perceptions of lean: A context-sensitive, mixed methods study in three Swedish hospitals. *Applied ergonomics*, *47*, 181-192.

Ginsburg, L. R., Chuang, Y. T., Blair Berta, W., Norton, P. G., Ng, P., Tregunno, D., & Richardson, J. (2010). The relationship between organizational leadership for safety and learning from patient safety events. *Health services research*, *45*(3), 607-632.

Additional articles: (not for discussion)

Mohr et al., 2002. Creating effective leadership for improving patient safety. Quality Management in Health Care, 11(1), 69-78.

Edmondson, A. 2003. Speaking up in the operating room: How team leaders promote learning in interdisciplinary action teams. Journal of Management Studies, 40:6.

Week 7 (Oct 10th)
Health Information Technology and Human Interaction

Kim, M. O., Coiera, E., & Magrabi, F. (2017). Problems with health information technology and their effects on care delivery and patient outcomes: a systematic review. *Journal of the American Medical Informatics Association*, *24*(2), 246-250.

Ash, J. S., Berg, M., & Coiera, E. (2004). Some unintended consequences of information technology in health care: The nature of patient care information technology system-related errors. Journal of the American Medical Informatics Association, 11(2), 104-112.

Ludwick, D. A., & Doucette, J. (2009). Adopting electronic medical records in primary care: lessons learned from health information systems implementation experience in seven countries. *International journal of medical informatics*, *78*(1), 22-31.

Mazur, L. M., Mosaly, P. R., Moore, C., & Marks, L. (2019). Association of the Usability of Electronic Health Records With Cognitive Workload and Performance Levels Among Physicians. *JAMA network open*, *2*(4), e191709-e191709.

Week 8 (Oct 17th)
Health Information Technology and Human Interaction

Poon, E. G., Keohane, C. A., Yoon, C. S., Ditmore, M., Bane, A., Levtzion-Korach, O., ... & Churchill, W. W. (2010). Effect of bar-code technology on the safety of medication administration. *New England Journal of Medicine*, *362*(18), 1698-1707.

Truitt, E., Thompson, R., Blazey-Martin, D., Nisai, D., & Salem, D. (2016). Effect of the implementation of barcode technology and an electronic medication administration record on adverse drug events. *Hospital pharmacy*, *51*(6), 474-483.

van der Veen, W., Taxis, K., Wouters, H., Vermeulen, H., Bates, D. W., van den Bemt, P. M., ... & Mangelaars, I. (2020). Factors associated with workarounds in barcode-assisted medication administration in hospitals. *Journal of Clinical Nursing*, *29*(13-14), 2239-2250.

Montague, E. (2010). Trust in medical technology by patients and healthcare providers in obstetric work systems. Behavior and Information Technology, 29(5), 541-554.

Additional articles: (not for discussion)

D. W. Bates and A. A. Gawande. (2003). Improving safety with information technology, The New England Journal of Medicine, 348: 2526-34.

Cook, R. I., & Woods, D. D. (1996). Adapting to new technology in the operating room. Human Factors, 38(4), 593-613.

E.G. Poon, A.K. Jha, M. Christino, M.M. Honour, R. Fernandopulle, B. Middleton, J. Newhouse, L. Leape, D.W. Bates, D. Blumenthal, and R. Kaushal. (2006). Assessing the level of healthcare information technology adoption in the United States: a snapshot, BMC Medical Informatics and Decision Making, 6:1.

Week 9 (Oct 24)
Cognitive Aspects of Health Information Technologies

C. Nemeth, M. O'Connor, P. A. Klock, and R. Cook. Cognitive artifacts implications for healthcare information technology: Revealing how practitioners create and share their understanding of daily work. Advances in Safety Volume 2, www.ahrq.gov/downloads/pub/advances/vol2/Nemeth.pdf

Hettinger, A. Z., Roth, E. M., & Bisantz, A. M. (2017). Cognitive engineering and health informatics: applications and intersections. *Journal of Biomedical Informatics*, *67*, 21-33.

Y. Xiao. (2005). Artifacts and collaborative work in healthcare: methodological, theoretical and technological implications of the tangible. Journal of Biomedical Informatics, 38: 26-33.

Furniss, D., Masci, P., Curzon, P., Mayer, A., & Blandford, A. (2015). Exploring medical device design and use through layers of distributed cognition: how a glucometer is coupled with its context. *Journal of biomedical informatics*, *53*, 330-341.

Additional articles: (not for discussion)

Boyle, J. G., Walters, M. R., Jamieson, S., & Durning, S. J. (2023). Distributed cognition: Theoretical insights and practical applications to health professions education: AMEE Guide No. 159. *Medical Teacher*, 1-11.

Hazlehurst, B., Gorman, P. N., & McMullen, C. K. (2008). Distributed cognition: an alternative model of cognition for medical informatics. *International journal of medical informatics*, *77*(4), 226-234.

V. L. Patel and L. M. Currie (2005). Clinical cognition and biomedical informatics: Issues of patient safety. International Journal of Medical Informatics, 74, 869-885.

Bisantz, A. M., Pennathur, P. R., Guarrera, T. K., Fairbanks, R. J., Perry, S. J., Zwemer, F., & Wears, R. L. (2010). Emergency department status boards: A case study in information systems transition. *Journal of Cognitive Engineering and Decision Making*, *4*(1), 39-68.

Nemeth, C., Blomberg, J., Argenta, C., Serio-Melvin, M. L., Salinas, J., & Pamplin, J. (2016). Revealing ICU cognitive work through naturalistic decision-making methods. *Journal of Cognitive Engineering and Decision Making*, *10*(4), 350-368

Week 10 (Oct 31) Online Discussion

Physical Ergonomics and Healthcare Systems

Ray, P. K., & Saha, E. (2017). Ergonomic Performance Measurement and Evaluation for Worksystems in Healthcare. In *Advances in Human Factors and Ergonomics in Healthcare*(pp. 329-342). Springer International Publishing.

Janowitz, I. L., Gillen, M., Ryan, G., Rempel, D., Trupin, L., Swig, L., ... & Blanc, P. D. (2006). Measuring the physical demands of work in hospital settings: design and implementation of an ergonomics assessment. *Applied ergonomics*, *37*(5), 641-658.

Warming et al., 2009. Musculoskeletal complaints among nurses related to patient handling tasks and psychosocial factors – based on logbook registrations. Applied Ergonomics, 40: 569-575.

Andersen, L. L., Burdorf, A., Fallentin, N., Persson, R., Jakobsen, M. D., Mortensen, O. S., ... & Holtermann, A. (2014). Patient transfers and assistive devices: prospective cohort study on the risk for occupational back injury among healthcare workers. *Scandinavian journal of work, environment & health*, 74-81.

Noble, N. L., & Sweeney, N. L. (2017). Barriers to the Use of Assistive Devices in Patient Handling. *Workplace Health & Safety*, 2165079917697216.

Additional articles: (not for discussion)

Lin, F., Song, C., Xu, X., Cavuoto, L., & Xu, W. (2016, June). Sensing From the Bottom: Smart Insole Enabled Patient Handling Activity Recognition Through Manifold Learning. In *Connected Health: Applications, Systems and Engineering Technologies (CHASE), 2016 IEEE First International Conference on* (pp. 254-263). IEEE.

A. Nelson et al. (2003). Preventing nursing back injuries: Redesigning patient handling tasks. AAOHN Journal, 51(3), 126-134.

Kumar et al., 2003. A biomechanical analysis of loads on x-ray technologists: a field study. Ergonomics, 46(5): 502-517.

Tullar, J. M., Brewer, S., Amick, B. C., Irvin, E., Mahood, Q., Pompeii, L. A., ... & Evanoff, B. (2010). Occupational safety and health interventions to reduce musculoskeletal symptoms in the health care sector. *Journal of occupational rehabilitation*, *20*(2), 199-219.

McCaughey, D., Kimmel, A., Savage, G., Lukas, T., Walsh, E., & Halbesleben, J. (2016). Antecedents to workplace injury in the health care industry: A synthesis of the literature. *Health care management review*, *41*(1), 42-55.

Week 11(Nov 7)
Teamwork in Healthcare

Weaver, S. J., Dy, S. M., & Rosen, M. A. (2014). Team-training in healthcare: a narrative synthesis of the literature. *BMJ Qual Saf*, *23*(5), 359-372.

Rosen, M. A., Dietz, A. S., Yang, T., Priebe, C. E., & Pronovost, P. J. (2014). An integrative framework for sensor-based measurement of teamwork in healthcare. *Journal of the American Medical Informatics Association*, *22*(1), 11-18.

Valentine, M. A., Nembhard, I. M., & Edmondson, A. C. (2015). Measuring teamwork in health care settings: a review of survey instruments. *Medical care*, *53*(4), e16-e30.

Salas, E., Cooke, N. J., & Rosen, M. A. (2008). On teams, teamwork, and team performance: Discoveries and developments. *Human factors*, *50*(3), 540-547.

Additional articles: (not for discussion)

Roberts APJ, Webster LV, Salmon PM, et al. State of science: models and methods for understanding and enhancing teams and teamwork in complex sociotechnical systems. *Ergonomics*. Published online December 23, 2021:1-27. doi:10.1080/00140139.2021.2000043

Manser, T. (2009). Teamwork and patient safety in dynamic domains of healthcare: a review of the literature. *Acta Anaesthesiologica Scandinavica*, *53*(2), 143-151.

Morey et al., 2002. Error reduction and performance improvement in the emergency department through formal teamwork training: evaluation results of the MedTeams project. Quality of Care, Health Services Research, 37(6).

Rosen et al., 2008. A measurement tool for simulation-based training in emergency medicine: The simulation module for assessment of resident targeted event responses (SMARTER) approach. Simulation in Healthcare, 3(3).

Week 12(Nov 14) Online Discussion
Job and Organizational Design in Healthcare Systems

Caruso, C. C. (2014). Negative impacts of shiftwork and long work hours. *Rehabilitation Nursing*, *39*(1), 16-25.

Welp, A., Meier, L. L., & Manser, T. (2015). Emotional exhaustion and workload predict clinician-rated and objective patient safety. *Frontiers in psychology*, *5*, 1573.

Temte, J. L., Beasley, J. W., Holden, R. J., Karsh, B. T., Potter, B., Smith, P., & O'Halloran, P. (2020). Relationship between number of health problems addressed during a primary care patient visit and clinician workload. *Applied Ergonomics*, *84*, 103035.

Petrie, K., Crawford, J., LaMontagne, A. D., Milner, A., Dean, J., Veness, B. G., ... & Harvey, S. B. (2020). Working hours, common mental disorder and suicidal ideation among junior doctors in Australia: a cross-sectional survey. *BMJ open*, *10*(1), e033525.

Landrigan et al., 2004. Effect of reducing interns work hours on serious medical errors in intensive care units. The New England Journal of Medicine, 151: 1838-48.

Additional articles: (not for discussion)

Ahmed, N., Devitt, K. S., Keshet, I., Spicer, J., Imrie, K., Feldman, L., ... & Kulkarni, A. V. (2014). A systematic review of the effects of resident duty hour restrictions in surgery: impact on resident wellness, training, and patient outcomes. *Annals of surgery*, *259*(6), 1041.

Hutter et al., 2006. The impact of the 80-hour resident workweek on surgical residents and attending surgeons. Annals of Surgery, 243(6).

Carayon and Smith, 2000. Work organization and ergonomics. Applied Ergonomics, 31: 649:662.

Keijsers et al., 1995. Performance and burnout in intensive care units. Work and Stress: An International Journal of Work, Health and Organisations, 9(4): 513-527.

Week 13 (Nov 21)
Trending Topics in Healthcare Human Factors

Clack L, Kuster SP, Giger H, Giuliani F, Sax H. Low-hanging fruit for human factors design in infection prevention—still too high to reach? American Journal of Infection Control. 2014;42(6):679-81. doi:10.1016/j.ajic.2014.03.002.

Heiden, S. M., Holden, R. J., Alder, C. A., Bodke, K., & Boustani, M. (2017). Human factors in mental healthcare: A work system analysis of a community-based program for older adults with depression and dementia. *Applied Ergonomics*, *64*, 27-40.

Salwei ME, Carayon P, Wiegmann D, Pulia MS, Patterson BW, Hoonakker PLT. Usability barriers and facilitators of a human factors engineering-based clinical decision support technology for diagnosing pulmonary embolism. *International Journal of Medical Informatics*. 2022;158:104657. doi:10.1016/j.ijmedinf.2021.104657

Sujan, M., Furniss, D., Grundy, K., Grundy, H., Nelson, D., Elliott, M., ... & Reynolds, N. (2019). Human factors challenges for the safe use of artificial intelligence in patient care. *BMJ health & care informatics*, *26*(1).

Adler-Milstein J, Chen JH, Dhaliwal G. Next-Generation Artificial Intelligence for Diagnosis: From Predicting Diagnostic Labels to "Wayfinding." *JAMA*. 2021;326(24):2467. doi:10.1001/jama.2021.22396

Additional articles: (not for discussion)

Anderson, J., Gosbee, L. L., Bessesen, M., & Williams, L. (2010). Using human factors engineering to improve the effectiveness of infection prevention and control. *Critical care medicine*, *38*, S269-S281.

Raffa, R. B., Taylor, R., Pergolizzi, J. V., Nalamachu, S., Edwards, E. S., & Edwards, E. T. (2017). Application of human factors engineering (HFE) to the design of a naloxone auto-injector for the treatment of opioid emergencies. *Drug delivery and translational research*, *7*(1), 1-10.

Sax H, Clack L. Mental models: a basic concept for human factors design in infection prevention. Journal of Hospital Infection. 2015;89(4):335-9. doi:10.1016/j.jhin.2014.12.008.

Herlihey, T. A., Gelmi, S., Flewwelling, C. J., Hall, T. N., Bañez, C., Morita, P. P., ... & Hota, S. (2016). Personal protective equipment for infectious disease preparedness: a human factors evaluation. *infection control & hospital epidemiology*, *37*(9), 1022-1028.

Werner, N. E., Jolliff, A. F., Casper, G., Martell, T., & Ponto, K. (2018). Home is where the head is: a distributed cognition account of personal health information management in the home among those with chronic illness. *Ergonomics*, *61*(8), 1065-1078.

Week 14 (Nov 28)
Trending Topics in Healthcare Human Factors

Catchpole, K., Bisantz, A., Hallbeck, M. S., Weigl, M., Randell, R., Kossack, M., & Anger, J. T. (2019). Human factors in robotic assisted surgery: lessons from studies 'in the Wild'. *Applied ergonomics*, *78*, 270-276.

Denning M, Goh ET, Tan B, et al. Determinants of burnout and other aspects of psychological well-being in healthcare workers during the Covid-19 pandemic: A multinational cross-sectional study. Brenner MH, ed. *PLoS ONE*. 2021;16(4):e0238666. doi:10.1371/journal.pone.0238666

Melnick, E. R., Dyrbye, L. N., Sinsky, C. A., Trockel, M., West, C. P., Nedelec, L., ... & Shanafelt, T. (2020, March). The association between perceived electronic health record usability and professional burnout among US physicians. In *Mayo Clinic Proceedings* (Vol. 95, No. 3, pp. 476-487). Elsevier.

Finkelstein JB, Tremblay ES, Van Cain M, et al. Pediatric Clinicians' Use of Telemedicine: Qualitative Interview Study. *JMIR Hum Factors*. 2021;8(4):e29941. doi:10.2196/29941

Agnisarman, S. O., Madathil, K. C., Smith, K., Ashok, A., Welch, B., & McElligott, J. T. (2017). Lessons learned from the usability assessment of home-based telemedicine systems. *Applied ergonomics*, *58*, 424-434.

Additional articles

Duarte I, Teixeira A, Castro L, et al. Burnout among Portuguese healthcare workers during the COVID-19 pandemic. *BMC Public Health*. 2020;20(1):1885. doi:10.1186/s12889-020-09980-z

De Hert S. Burnout in Healthcare Workers: Prevalence, Impact and Preventative Strategies. *LRA*. 2020;Volume 13:171-183. doi:10.2147/LRA.S240564

Trudel, C., Cobb, S., Momtahan, K., Brintnell, J., & Mitchell, A. (2017). Human Factors Considerations in Designing for Infection Prevention and Control in Neonatal Care–Findings from a Pre-Design Inquiry. *Ergonomics*, (just-accepted), 1-38.

Suresh, G., & Cahill, J. (2007). How "user friendly" is the hospital for practicing hand hygiene? An ergonomic evaluation. *The Joint Commission Journal on Quality and Patient Safety*, *33*(3), 171-179.

Catchpole, K. R., Hallett, E., Curtis, S., Mirchi, T., Souders, C. P., & Anger, J. T. (2018). Diagnosing barriers to safety and efficiency in robotic surgery. *Ergonomics*, *61*(1), 26-39.

Behera, R.K., Bala, P.K., and Dhir, A. (2019). The emerging role of cognitive computing in healthcare: A systematic literature review. *International Journal of Medical Informatics*.

Kushniruk, A. W., & Borycki, E. M. (2019). Big Data Challenges from a Human Factors Perspective. In *Big Data, Big Challenges: A Healthcare Perspective* (pp. 91-99). Springer, Cham.

Flaherty, D., Hoffman-Goetz, L., & Arocha, J. F. (2015). What is consumer health informatics? A systematic review of published definitions. *Informatics for Health and Social Care*, *40*(2), 91-112.

Eames B, Edwards M, Colbran R. Persuasive design techniques and app design recommendations to improve health workforce capability in rural health professionals: what do users want and how does an app help? :27.

Administrative Drops:
At the discretion of the instructor, a student may be dropped from a course because of excessive absences, neglect or lack of effort. A grade of "W" will be assigned before the course drop deadline and a grade of "F" after the course drop deadline. A grade of "F" received due to disciplinary action imposed by the University overrides a grade of "W" received through a student-initiated or faculty drop.

Class Attendance:
The student is expected to attend all class sessions. It is the responsibility of the student to inform each instructor of extended absences. When, in the judgment of the instructor, a student has been absent to such a degree as to impair his or her status relative to credit for the course, a drop for not attending will count toward the State Allowed Six Drop Limit. If you are failing the class at the time of the drop you may also be given a WF designation. Be advised that a drop could adversely impact visa status, financial aid and other programs. As per UTEP rules, you may be asked to show a UTEP ID at any time during class.

Excused Absences for University-Recognized Activities:
Students who will be absent while representing the University in officially recognized University activities (sports, band, professional conferences, etc.) **must notify the Dean of Students not less than ten (10) days prior to the absence**. The Dean of Students will provide the student with a letter of excuse for the professors. It is the student's responsibility to give the letter to the professors prior to the official recognized activity. Students following these procedures will be permitted to make up both assignments and examinations in consultation with faculty.

Students With Disabilities:
If you have a disability and need classroom accommodations, please contact The Center for Accommodations and Support Services (CASS) at 747-5148, or by email to cass@utep.edu, or visit their office located in UTEP Union East, Room 106. For additional information, please visit the CASS website at https://www.utep.edu/student-affairs/cass/.

Academic Integrity:
The University of Texas at El Paso prides itself on its standards of academic excellence. In all matters of intellectual pursuit, UTEP faculty and students must strive to achieve excellence based on the quality of work produced by the individual. In the classroom and in all other academic activities, students are expected to uphold the highest standards of academic integrity. Any form of academic dishonesty is an affront to the pursuit of knowledge and jeopardizes the quality of the degree awarded to all graduates of UTEP.

Any student who commits an act of academic dishonesty is subject to discipline. Academic dishonesty includes, and is not limited to cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another

person, and any act designed to give unfair advantage to a student or the attempt to commit such acts. Proven violations of the detailed regulations, as printed in the *Handbook of Operating Procedures (HOP)*, and available in the Office of Student Life and on the homepage of the Office of Student Life at www.utep.edu/dos, can result in sanctions ranging from disciplinary probation, to a failing grade on the work in question, to a failing grade in the course, to suspension or dismissal, among others.

Engineers are educated professionals, and every engineer is expected to subscribe to a professional canon of ethics. Paramount among these is the canon that engineers shall not affix their signatures to documents that are not their own work. This is also expected of engineering students, whether or not the work is being graded individually or as a group! **If academic dishonesty is suspected or observed, please report it to the instructor -- this will be kept in the strictest confidence.**

- If you are suspected of scholastic dishonesty you may not be directly confronted about your conduct by the instructor or proctor. You will however, be reported to the Office of Student Conduct and Conflict Resolution (OSCCR) and your exam will not be admissible. Your grade in the class may not be available until OSCCR makes a final ruling, this may adversely impact your ability to enroll in other classes or graduation.

- If you miss more than one exam, the instructor may choose to administratively drop you from the class. This may adversely impact a visa and financial aid.

- Scholastic dishonesty on homework, lab assignments and all other class assignments will be held to the same standards and requirements of academic honesty as quizzes and exams.