

Designing healthcare spaces to improve teamwork and patient outcomes: a systems approach

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In 2000, the Institute of Medicine's landmark report, 'To Err is Human,' identified serious and systemic concerns throughout the healthcare system [1]. The summary called for a systems-based approach to move care towards a culture of safety. Teamwork between clinicians is widely acknowledged to improve patient care outcomes – quality and safety – as well as healthcare worker outcomes, such as burnout, retention and satisfaction [2–5].

To date, there has been little consideration of how to design environments to support teamwork in health care settings. A recent systematic literature review found that the spaces and places where care is provided, referred to as the built environment, play an important role as a part of the larger system that shapes clinician teamwork [6].

This article will propose a health design framework that illustrates the interdependent factors, or systems, that shape and support health care teamwork [7]. The Design of Systems for Teamwork (DST) model, proposed here, builds on multiple previous frameworks, including Donabedian's Structure Process Outcome model, the Systems Engineering Initiative for Patient Safety human factors model, the Ecology of Clinical Teamwork and the Big Five, which explains core components of teamwork [6,8–10].

The DST model proposed here consists of six interdependent structural factors (Fig. 1). They are: organization (e.g. organizational culture and leadership); person (e.g. clinical team members); physical environment (e.g. space of care); tasks (e.g. care activities); tools and technology (e.g. information and communication technology) and an additional factor of time (e.g. synchronicity and shift work). Time is added here because the original authors found that teams that worked synchronously, had designated meeting times, or longer tenure working together appeared to have more effective teamwork [6]. Furthermore, shift change is of critical importance for healthcare teams [11,12].

Each of these factors is designed and works together as an underlying structure impacting the process of clinical teamwork. Five core components of clinical teamwork

can be simplified down to include leadership, monitoring, support, adaptability and team orientation [8]. They work together to create functional teams that support clinical care quality and the wellbeing of clinical staff [8].

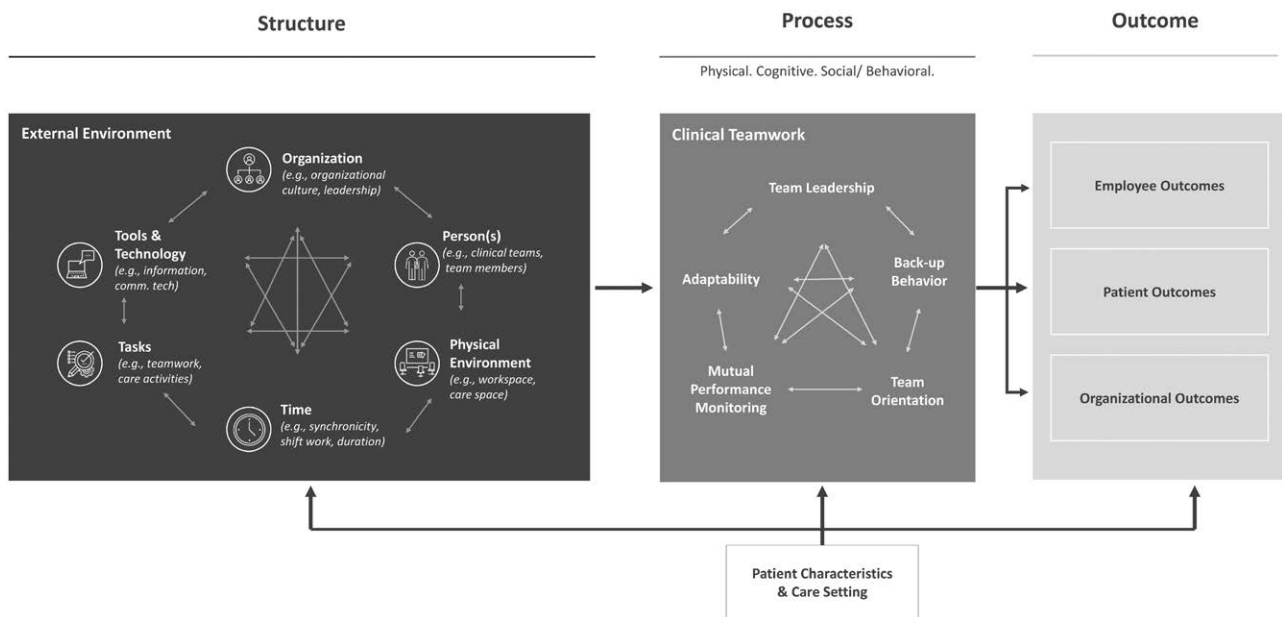
The places where health care is delivered make up an important and often forgotten structural factor influencing health care teamwork. The following section is an overview of recent findings of how these spaces, often referred to as the built or physical environment, work as a part of the larger system to support or hamper clinical teamwork and provides concrete examples from practice.

A recent literature review exploring how the physical environment relates to clinical teamwork identified four design characteristics – proximity, visibility, territoriality and sufficient space/crowding [6].

Proximity is the degree to which people are near one another in physical space. The proximity between staff team members was correlated significantly with high-performing teams and the frequency of staff interaction. Interprofessional staff reported lacking a sense of belonging to a team when they felt physically separated. Having a common area for medical providers and nurses led to improvements in perceived communication and teamwork, while the inverse was found to exacerbate professional challenges in nurse–physician communication and teamwork [13,14]. For instance, designing a shared team space where allied health, physicians, and nurses can naturally run into one another or easily find each other can foster collaboration.

Visibility in this context is the degree to which healthcare team members can see one another within a given space. Higher levels of visibility between team members were positively connected to clinician teamwork. The absence of visibility between peers was linked to staff feeling a sense of isolation, reduced peer support, knowledge sharing and informal mentorship. Visibility between team members was viewed as especially important in high-acuity, high-stress situations, when digital communication may be inadequate for supporting communication and

Fig. 1



Systems Design for Teamwork Framework. Shows how the underlying structure of a system impacts the processes, namely teamwork, and the ultimate outcomes related to patient, staff and organization. Adapted from the Ecology of Clinician Teamwork framework [2].

coordination when nonverbal cues are essential. Floor plans or unit layouts that maximize visibility between team members may therefore have benefit coordination or care and teamwork. For instance, at Banner University Medical Center in Phoenix, Arizona, the design team at HKS maximized clear sightlines to support ease of communication and coordination [6]; see Fig. 2).

Territoriality is the extent to which a space or physical area is recognized or understood to belong to a particular party or group and not considered a public domain. Interprofessional health team members in shared space helped to support informal care communications, interprofessional models of care and team-handoffs. However, these benefits could be lost if the spaces were in a hard-to-reach location or if the purpose of the space became blurred by a particular subset of team members taking ownership. For instance, team workrooms designed for multi-professional teams can be taken over by one group of staff, and all others were essentially blocked from using it.

Sufficient space and crowding help shapes one's feelings and comfort working. While sufficient space is the perceived amount of space one needs, crowding is the stress state that accompanies inadequate space to seek privacy, avoid stressors, or regulate boundaries with others. Quality health care requires both focused task-work and teamwork activities, including focused team meetings, individual work, and adaptable care coordination. For instance, team members that feel it is impossible to focus, chart, provide strong handoffs or dictations, may be frustrated by completely open space, especially when

that space does not provide enough computers, chairs or workspaces for increases in staff that occur at shift change.

As we design systems to support patient care and health care worker teams, it is vital to consider each attribute of a system we are designing and how they work inter-dependently to support or hamper patient care, clinical outcomes and staff well being. The joint challenges of SARS-Cov-2, and health inequities related to access to high-quality care based on race, income and geographic location, compel us to rethink established ways of working and use systems design to create spaces where we all feel cared for, well-tolerated and welcomed [15].

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

References

- 1 Kohn LT, Corrigan JM, Donaldson MS; Institute of Medicine (US) Committee on Quality of Health Care in America. To err is human: Building a safer health system. *Report of the Institute of Medicine*. Washington (DC): National Academy Press; 2000.
- 2 L'Ciou J, Masiello I, Ponzer S, Farrokhnia N. Can interprofessional teamwork reduce patient throughput times? A longitudinal single-centre study of three different triage processes at a Swedish emergency department. *BMJ Open* 2018; **8**:e019744.
- 3 Schneider A, Wehler M, Weigl M. Effects of work conditions on provider mental well-being and quality of care: a mixed-methods intervention study in the emergency department. *BMC Emerg Med* 2019; **19**:1.
- 4 Freund Y, Goulet H, Leblanc J, Bokobza J, Ray P, Maignan M, et al. Effect of systematic physician cross-checking on reducing adverse events in the emergency department: the CHARMED cluster randomized trial. *JAMA Intern Med* 2018; **178**:812–819.
- 5 Duncan MJ, Rashid M, Vandelanotte C, Cutumisu N, Plotnikoff RC. Development and reliability testing of a self-report instrument to measure

- the office layout as a correlate of occupational sitting. *Int J Behav Nutr Phys Act* 2013; **10**:16.
- 6 Peavey E, Cai H. A systems framework for understanding the environment's relation to clinical teamwork : a systematic literature review of empirical studies. *Environ Behav* 2018; **Online Fir**:1–35.
 - 7 Corfield AR, Cowan GM. Human factors and systems in emergency departments. *Eur J Emerg Med* 2011; **18**:183–185.
 - 8 Salas E, Sims D, Burke S. Is there a "Big Five" in teamwork? *Small Gr Res* 2005; **36**:555–599.
 - 9 Donabedian A. Evaluating the quality of medical care. *Milbank Q* 1966; **44**:166–203.
 - 10 Carayon P, Hundt AS, Karsh B, Gurses AP, Alvarado CJ, Smith M, et al. Work system design for patient safety: the SEIPS model. *Qual Saf Heal Care* 2006; **15** (Suppl_1):i50–i58. <http://qualitysafety.bmj.com/lookup/doi/10.1136/qshc.2005.015842>
 - 11 Fernandez R, Kozlowski SW, Shapiro MJ, Salas E. Toward a definition of teamwork in emergency medicine. *Acad Emerg Med* 2008; **15**:1104–1112.
 - 12 Kalisch BJ, Begeny S, Anderson C. The effect of consistent nursing shifts on teamwork and continuity of care. *J Nurs Adm* 2008; **38**:132–137.
 - 13 Dean M, Gill R, Barbour JB. "Let's Sit Forward": investigating interprofessional communication, collaboration, professional roles, and physical space at emergicare. *Health Commun* 2016; **31**:1506–1516.
 - 14 Weaver AL, Hernandez S, Olson DM. Clinician perceptions of teamwork in the emergency department: does nurse and medical provider workspace placement make a difference? *J Nurs Adm* 2017; **47**:50–55.
 - 15 Baggio S, Iglesias K, Hugli O, Burnand B, Ruggeri O, Wasserfallen JB, et al. Associations between perceived discrimination and health status among frequent emergency department users. *Eur J Emerg Med* 2017; **24**:136–141.