

# Health Environments Research & Design Journal

## The Representational Function of Clinic Design: Staff and Patient Perceptions of Teamwork

Journal:	<i>Health Environments Research &amp; Design Journal</i>
Manuscript ID	HERD-20-0050.R1
Manuscript Type:	Research Manuscript
Keywords:	teamwork, visibility, Patient/person-centered care, Ambulatory care centers, clinic layout
Abstract:	<p><b>Objective:</b> This study empirically investigates the relationships between visibility attributes and both patients' and staff members' teamwork experiences.</p> <p><b>Background:</b> Teamwork among healthcare professionals is critical for the safety and quality of patient care. While a patient-centered, team-based care approach is promoted in primary care clinics, little is known about how clinic layouts can support the teamwork experiences of staff and patients in team-based primary clinics.</p> <p><b>Methods:</b> This paper measured teamwork perceptions of staff members and patients at four primary care clinics providing team-based care. Visual access to staff workstations from both staff and patient perspectives were analyzed using VisualPower tool. The relationships between teamwork perception and visibility attributes were analyzed for each entity: staff members and patients.</p> <p><b>Results:</b> The results showed that the visual relationships among staff members and those between staff members and patients have significant associations with overall perceptions of teamwork. While clinics providing more visual connections between staff workstations reported higher teamwork perception of staff members, patient perceptions of staff teamwork were inversely related to the number of visual connections between patients and staff workstations.</p> <p><b>Conclusions:</b> The findings of the study provide implications for designing team-based primary care clinics to enhance the teamwork experience of both staff members and patients, which is also applicable to teamwork perceptions in other settings where both inhabitants and visitors are main user groups of the spaces. This study illustrates representational function of space: organizations can emphasize their values via layout design by regulating what they show to inhabitants or visitors.</p>

SCHOLARONE™  
Manuscripts

## VISIBILITY AND TEAMWORK PERCEPTION

1

## The Representational Function of Clinic Design: Staff and Patient Perceptions of Teamwork

Ambulatory care clinics are moving toward team-based care staffing models using nationally promoted programs such as TeamSTEPPS (Clancy & Tornberg, 2007; King et al., 2008; Sheppard, Williams, & Klein, 2013) and Patient-Centered Medical Home (PCMH; Jackson et al., 2013; National Committee for Quality Assurance, n.d.). More than 12,000 practices currently provide team-based care with PCMH recognition (National Committee for Quality Assurance, n.d.). As new facilities are constructed to handle the increasing volume of primary care visits in the United States (projected to be 565 million visits by 2025; Petterson et al., 2012), there is a growing need to better understand the features that contribute to effective team-based design strategies in such facilities.

While facility design, as part of the healthcare system, can promote the transformation of the care model to team-based care (Larry, David, Suzan, Susan, & Frank, 2003; Peavey & Cai, 2018), its role as a strategy for improving staff teamwork experiences and patient perceptions of teamwork (two key desired outcomes of the team-based care model) has not yet been evaluated. Previous studies have examined the effect of the built environments on teamwork in general—see Gharaveis, Hamilton, and Pati (2017) and Peavey and Cai (2018) for extensive reviews of environmental factors impacting teamwork in healthcare settings—but few have examined the role of spatial properties in staff teamwork perceptions in healthcare settings (Gharaveis, Hamilton, Pati, & Shepley, 2018; Gharaveis, Pati et al., 2019; Gharaveis, Shepley, Hamilton, Pati, & Rodiek, 2019; Stroebel et al., 2019).

The patient is a critical stakeholder in team-based care (Ficarra, 2010; Patient-Centered Primary Care Collaborative, n.d.; Schottenfeld et al., 2016), but most studies solely focus on the perspective of the caregivers (Shoemaker et al., 2016), ignoring the “patient perspective” in

## VISIBILITY AND TEAMWORK PERCEPTION

2

teamwork (Henry et al., 2013; Mercer et al., 2008; Shoemaker et al., 2016). This perspective is crucial, as patients can view a lack of coordination and communication as potentially unsafe (Rathert, Brandt, & Williams, 2012), especially among providers (Henry et al., 2013), and patient perception of teamwork may impact overall patient satisfaction (Henry, Rooney, Eller, Vozenilek, & McCarthy, 2014). To the authors' knowledge, there are no studies that have examined the role of spatial properties in patient perceptions of staff teamwork.

To fill this gap, **this study focuses on how both staff and patient perception of staff teamwork relates to clinic layout, in particular the visibility of staff work spaces.** Previous studies in various settings have identified visibility between employees as one of the critical spatial attributes that affect teamwork by reminding employees of their colleagues' existence, increasing co-awareness, and encouraging communication (Cai & Zimring, 2012; Gharaveis et al., 2018; Gharaveis, Pati, et al., 2019; Gharaveis, Shepley, et al., 2019; Heerwagen, Kampschroer, Powell, & Loftness, 2004; Lu & Zimring, 2012; Markhede & Koch, 2007; Rashid, Kampschroer, & Zimring, 2006). Corresponding to such findings, this study investigates relationships between visual access of staff work areas and teamwork perception of both staff and patients.

### Representational Function of Space

Built environments have representational and symbolic functions, expressing organizational culture and values (Berg & Kreiner, 1990; Elsbach & Bechky, 2007; Vilnai-Yavetz, Rafaeli, & Yaacov, 2005). Symbolic aspects of physical settings such as office and furniture arrangements have been found to be associated with the psychological outcomes of employees, such as higher satisfaction (Hatch, 1990), higher job satisfaction and perceived performance (Kim & Jung, 2015), and nurses' higher job satisfaction and lower job stress

## VISIBILITY AND TEAMWORK PERCEPTION

3

(Parish, Berry, & Shun Yin, 2008). From physical properties of a building and workspace, employees can also discern the organization's dedication to connections among departments (Thurm, 2005) and whether the organizational culture is less formal and more innovative (McElroy & Morrow, 2010).

Visitors, too, garner cues about an organization's values from physical environments (Baldry, 1997; Bitner, 1992; Kotler, 1974; Parish et al., 2008), as visitors experience not only the service the organization provides but also the physical setting of the organization (Bitner, 1992). For example, Bitner (1990) found a significant association between the appearance of the physical environment (organized vs. disorganized) and customer perception of service quality.

Extending existing theory on the representational function of built environments, we propose that **what patients see during their visits and what staff members see during their workdays—as regulated by clinic design—conveys organizational values of the clinic, such as teamwork, to both populations.**

### Clinic Design for Team-based Care

As Hillier, Hanson, and Peponis (1984) note, features of the built environment regulate relationships among different groups of inhabitants and between inhabitants and visitors. Clinic layouts and the use of space determine what patients can see during their visits and what staff members see throughout their workdays.

Healthcare organizations constructing or renovating team spaces face a broad array of options in planning team-based clinic layouts. Most team-based clinic layouts provide shared team work spaces, but their layouts vary significantly in terms of how they impact staff and patient interpersonal relationships. For instance, Kaiser Permanente's patient-centered "Next-Gen Medical Offices" expose staff team areas to patients (Bluestein, 2016). In contrast, the U.S.

## VISIBILITY AND TEAMWORK PERCEPTION

4

Department of Veterans Affairs (VA) has adopted a totally different layout type called the “onstage and offstage” that visually disconnects staff team areas and patients (U.S. Department of Veterans Affairs, 2016). Such distinct layout options provide different spatial experiences to patients and staff members.

A recent study comparing the two layouts (staff workstations exposed to patients vs. hidden from patients) found that staff members in the onstage/offstage layout reported improved operational efficiency with better workflow, shorter travel distances, frequent communication, and reduced wait times (Freihoefer, Kaiser, Vonasek, & Bayramzadeh, 2017). While this study provides critical insight into the role of clinic design in healthcare outcomes and efficiency, how these layouts and their spatial attributes could impact teamwork experiences remains unclear.

**Research Questions**

Previous studies, mostly in non-clinical workspace settings, have reported that visual connections between employees positively affect teamwork and communication (Cai & Zimring, 2012; Heerwagen, Kampschroer, Powell, & Loftness, 2004; Lu & Zimring, 2012; Markhede & Koch, 2007; Rashid, Kampschroer, & Zimring, 2006). Also, recent studies in emergency departments identified visibility as an important factor affecting staff teamwork and collaboration (Gharaveis et al., 2018; Gharaveis, Pati, et al., 2019; Gharaveis, Shepley, et al., 2019).

In line with such findings, this study investigates the representational role of clinic design—especially visual access to staff work areas—on teamwork perceptions of both staff members and patients, postulating that staff members may have better teamwork when they can see each other. Furthermore, similar to the results of Bitner’s (1990) customer service satisfaction study, it is expected that patients seeing staff work areas and staff members working

## VISIBILITY AND TEAMWORK PERCEPTION

5

together may allow patients to perceive the value of teamwork in the clinics. This study examines the impact of the same visual content (seeing staff workstations) on two populations (patients and staff members) in four clinics and postulates that visual access to staff members, represented by staff workstations, has positive effects on both populations' perceptions of teamwork in the clinics.

### Methods

#### Settings

This study investigates four team-based primary care clinics (Figures 1 and 2), selected from a pool of clinics recommended by two healthcare organizations that advocate for team-based care (the organizations oversee those clinics). The four clinics the authors chose (two clinics from each organization) (a) had shared team spaces where care team members, including providers, physically work together; (b) used varying team-based clinic layouts reflecting the current debate in the field; and (c) had readily available facility floorplans and access to staff members and patients.

[Place Figures 1 and 2 approximately here.]

The layouts of the four clinics varied, especially in location and the visual exposure levels of team spaces. Clinic A's open team space was centrally located, within close distance of other exam rooms; thus, space was visually exposed to patients. On the other hand, Clinic D's team room was visually and physically separated from patients. Clinics A, B, and C all had open and enclosed team areas, while Clinic D had a relatively enclosed team area (Table 1). These differing clinic layout types generate different interfaces between staff members and patients, which are the focus of this study. Several differences between the clinics (beyond the clinic layouts) were not controlled in this study, including their larger organizations, operational

## VISIBILITY AND TEAMWORK PERCEPTION

6

culture, and available technology; this study specifically created an opportunity to investigate the four clinics while acknowledging the differences between them beyond built environments.

[Place Table 1 approximately here.]

This paper is a part of larger study investigating the role of spatial attributes on teamwork experiences, including staff backstage communication [Anonymous, 2019a] and face-to-face communication patterns [Anonymous, 2019b], in primary care clinics. As part of the study, this paper focuses on the relationships between visual attributes and teamwork perceptions of staff members and patients.

### **Visual Relationships: Staff-Staff and Staff-Patient Relationships**

This paper identifies two visual relationship variables: the visual exposure of staff members' workstations to (1) other staff members (staff-staff variable) and (2) patients (staff-patient variable). For the two variables, the content of visibility is the same (the staff workstation), but the agents of the visibility are different (only staff members vs. only patients). The staff-staff variable measures how many other staff workstations each staff member can see from their workstations, and the staff-patient variable quantifies how many staff workstations patients can see on their way to their exam rooms. These two variables were analyzed using the VisualPower tool (Lim, Kim, & Zimring, 2019), which quantifies visual relationships between specific locations. All specific locations were represented with points. Each staff workstation was represented with one point, and patient paths from the waiting room to all exam rooms with the shortest distance were represented with a set of points at 1-foot intervals.

### **Outcome Measurements**

The research team visited each clinic twice between June and November of 2017. A preliminary visit for collecting contextual information through initial observations and interviews

## VISIBILITY AND TEAMWORK PERCEPTION

7 was

followed by a data collection visit for conducting qualitative observations and paper-based surveys for measuring teamwork perceptions of staff members and patients.

**Observations.** Team areas and overall clinic areas of each clinic were observed for 2–3 weekdays. Exam rooms where sensitive patient care occur were excluded from observations for patient privacy. Locations and specifics of staff-staff or staff-patient interactions were recorded through quantitative and qualitative observation techniques. First, as part of the larger study, behavior mapping observations were conducted recording location of individuals with their roles, postures, communication counterparts, and associated devices. This study focuses on staff-patient interaction data from the larger data set (please see [Anonymous, 2019b] for further information regarding behavior mapping observations). Also, interactions and associated data that were not captured during behavior mapping observations were qualitatively recorded.

**Staff teamwork survey.** Staff teamwork perception was measured using four items from the Teamwork in Medical Office Survey on Patient Safety Culture (Agency for Healthcare Research and Quality, 2017). All available staff members during the visits were asked to answer the survey, and the number of available staff members across clinics varied depending on the size and schedule of the clinics. A total of 88 staff responses from four clinics were collected, and a total of 83 valid responses (with response rates of 88%, 58%, 79%, and 56%, in Clinics A, B, C, and D, respectively) were analyzed after excluding invalid responses such as unanswered questionnaires or answers from participants who were not staff members of the clinic. The four teamwork items reported high construct validity (Cronbach's  $\alpha = .843$ ).

**Patient teamwork survey.** Patient perception of teamwork was measured using an adapted version of the Patients' Insights and Views Observing Teams (PIVOT) Survey (Henry et al., 2013). The authors deleted six items from the 16-item PIVOT Survey and added six newly

1  
2  
3 VISIBILITY AND TEAMWORK PERCEPTION 8 written items to better focus on spatial  
4  
5 aspects of teamwork experiences. Patients were asked to answer whether they agreed or  
6  
7 disagreed with multiple statements regarding staff teamwork (e.g., I liked the way the team  
8  
9 worked together, I knew who was in charge) on a 5-point Likert scale. After surveying patients  
10  
11 at Clinics A and B, two newly written items were deleted to improve validity and readability of  
12  
13 the instruments. As a result, the survey included a total of 14 items and showed high internal  
14  
15 consistency (Cronbach's  $\alpha = .908$ ).  
16  
17

18  
19 In each clinic, 50–60 patient participants were targeted for statistical analysis. A total of  
20  
21 235 responses from four clinics were collected, and a total of 205 valid patient responses were  
22  
23 analyzed after excluding invalid responses such as unanswered surveys. The number of  
24  
25 responses from Clinic C was lower than that of the other clinics due to Clinic C's lower volume  
26  
27 of patient appointments during the data collection visit (Clinic C has an overall lower enrolled  
28  
29 patient population, as shown in Table 1).  
30  
31

### 32 **Statistical Analysis**

33  
34  
35 The relationships between the visual relationship variable and teamwork perception for  
36  
37 both staff members and patients were assessed by following multiple steps. First, the tendency  
38  
39 between visibility variables and teamwork perception was plotted together using Microsoft  
40  
41 Excel. Then, the means of teamwork perception levels were compared across clinics using a  
42  
43 nonparametric Kruskal-Wallis H Test (since the data was not normally distributed), and the  
44  
45 relationships were tested with correlation analysis using SPSS 22 (IBM, n.d.). This process was  
46  
47 conducted twice separately for the two different populations.  
48  
49  
50

## 51 **Results**

### 52 **Visual Relationship Variables**

53  
54  
55  
56  
57  
58  
59  
60

## VISIBILITY AND TEAMWORK PERCEPTION

9

The results of the two visibility variables are summarized as the mean and the ratio values for each clinic in Table 2. Clinic D has the highest value for the staff members' visibility, but patients on their paths to exam rooms could rarely see staff workstations. Clinics A and C have relatively high values for both staff-staff and staff-patient visual connections. Clinic B has low values for both visibility variables. Visibility levels at each location—staff workstations for staff-staff visibility (Figure 3) and patient paths for staff-patient visibility (Figure 4)—are illustrated using a greyscale gradient, from black (higher values) to white (lower values).

[Place Table 2, Figures 3 and 4 approximately here.]

**Teamwork Perception**

As shown in Table 3, both staff members and patients of all four clinics reported relatively high teamwork perception scores (higher than 4 on a scale of 1 to 5). The range of the staff members' and patients' teamwork perception scores are 0.80 and 0.28, respectively. Clinic D reported the highest scores for both staff and patient teamwork perception scores, and Clinics B and C scored the lowest for the staff members' and patients' perspectives, respectively.

[Place Table 3 approximately here.]

**Relationships Between Visibility Levels and Teamwork Perceptions**

While we expected visual access to staff workstations to have similar positive impacts on staff and patient teamwork perceptions, the results reported two distinct relationships.

**Staff-staff visual connections and staff members' teamwork perception.** As illustrated in Figure 5, staff-staff visual relationships and staff teamwork perception show a fairly linear relationship with the positive slope. The nonparametric Kruskal-Wallis H Test showed statistically significant differences in teamwork perception scores between the four clinics,  $\chi^2(3) = 23.094$ ,  $p < .001$ , with a mean rank teamwork score of 33.43, 23.47, 38.61, and 55.21 for

## VISIBILITY AND TEAMWORK PERCEPTION

10

Clinics A, B, C, and D, respectively. The post hoc multiple pairwise comparisons using Dunn's (1964) procedure and a Bonferroni correction revealed that the staff teamwork perception score of Clinic D (mean rank = 55.21) is significantly higher than those of Clinic A (mean rank = 33.43) ( $p = .018$ ) and Clinic B (mean rank = 23.47) ( $p < .001$ ). The Eta Squared was reported to be  $\eta^2 = .254$ , indicating that the differences between clinics explain 25% of the total variance. Furthermore, Pearson correlation analysis confirmed the positive linear relationship between the levels of staff-staff visual relationship and staff teamwork perception,  $r = .914$ ,  $p = .043$  (1-tailed). In summary, staff members in clinics where they could see more of other staff workstations reported higher teamwork perception scores.

[Place Figure 5 approximately here.]

**Staff-patient visual connections and patients' teamwork perception.** Contrary to the expectation that patients in clinics where they could see more of staff work areas (e.g., Clinics A and C) would report higher teamwork perception scores, these patients reported slightly lower teamwork perception scores (Figure 6). The Kruskal-Wallis H Test reported statistically significant differences between the levels of patient teamwork perception scores ( $\chi^2(3) = 10.277$ ,  $p = .016$ ), with a mean rank teamwork score of 86.29, 108.26, 91.08, and 118.39 for Clinics A, B, C, and D, respectively, and with a small effect size ( $\eta_p^2 = .036$ ). Specifically, the post hoc pairwise comparison analysis confirmed the differences between Clinics A and D (adjusted  $p = .018$ ). The Pearson correlation analysis confirmed the negative linear relationship ( $r = -.942$ ,  $p = .029$ , 1-tailed).

[Place Figure 6 approximately here.]

## Discussion

### Differential Effects of Visibility on Staff and Patient Teamwork Perception

## VISIBILITY AND TEAMWORK PERCEPTION

11

This study investigated representational function of clinic layout and found differential effects of visual interfaces on teamwork perceptions of staff members and patients. While both entities reported linear tendencies in relation to visual interfaces, staff members and patients surprisingly showed opposite patterns. **Staff members reported higher teamwork perception in clinics where more staff workstations were visually connected, and patients reported higher teamwork perception in clinics where staff workstations were less visually exposed to patients.**

Showing staff work areas to patients may not necessarily increase patients' perception of teamwork and may actually decrease patients' perception of teamwork with a small effect. There are several possible explanations for the unexpected finding. First, it is possible that what patients saw was physically divided team rooms in clinics rather than visually connected staff workstations. For instance, team areas in Clinic A were physically subdivided while they were visually connected (on average, 34.1% of other staff workstations are visible at staff workstations). Patients may have perceived these as separated areas rather than a larger, visually connected staff team space.

Another contributing factor is that patients are not always aware of individual team members' roles and tasks. During the interview, a staff member in Clinic A stated that some patients (who were waiting to be taken care of) complained that staff members working at their workstations were not helping them. When patients wait for a specific role of staff member (e.g., a rooming nurse), they may perceive that some other staff members working at their workstations (e.g., RNs or administrators) are not working as a team to take care of the patients. While the teamwork of patient care occurs in various dynamics, patients' views of teamwork may be centered on their own interactions with staff members.

## VISIBILITY AND TEAMWORK PERCEPTION

12

Another plausible explanation is that there are stronger visual contents—such as staff interactions or conflicts—that affect patients’ teamwork perception. What patients actually see and experience during their visits depends on individual circumstances, which may have a stronger effect on the patients’ perception of staff teamwork than does visual access to staff workstations regardless whether they are occupied or unoccupied. According to the behavior mapping observation data, the observed occupancy rates of the clinics were 50%, 20%, 18%, and 46% in Clinics A, B, C, and D, respectively. As shown in Figure 6, Clinics A and C reported similar levels of teamwork and visibility levels, though their occupancy rates were significantly different. Such data indicates that it is not the occupancy rate of the staff workstations that may affect patients’ perception; patients may acknowledge that patient care activities occur not only at staff workstations but also in exam rooms or other clinic areas.

It is also possible that patient satisfaction levels affect their teamwork perception. Studies have reported that teamwork-related constructs such as teamwork culture (Meterko, David, & Young, 2004) and staff responsiveness and communication (Andaleeb, 2001) are significantly associated with patient satisfaction. Discontent patients may generally give lower ratings for staff teamwork; however, this is an unsupported assumption that this study did not investigate.

Another potential explanation is that other process factors may have stronger impacts on the patients’ teamwork perception. Among three clues that Berry, Wall, and Carbone (2006) described in relation to customers’ service experience, functional clues (e.g., the quality of patient care) and humanic clues (e.g., the behavior of staff members) that were not controlled in this study may have had stronger effects on patients’ teamwork experiences than the mechanic clues (e.g., the clinic and team room designs) did.

**Openness of Team Area and Staff-Patient Encounters**

## VISIBILITY AND TEAMWORK PERCEPTION

13

While openness of team areas was associated with lower teamwork perception by patients, the openness of staff work areas to patients may support patient experiences by allowing more encounters with staff members, as Karp et al. (2019) described. During our observations, multiple interactions between patients and staff members were observed as a result of staff-patient visual relationships.

For instance, Figure 7 illustrates locations of all observed interactions between patients and staff members during the entire observation period. As shown in the figure, multiple interactions between patients and staff members occurred around the visually exposed nurse workstation area in Clinic A. When patients arrived and left the clinic, they interacted with multiple staff members (e.g., rooming nurses at the visually exposed nurse workstation area), not with an individual staff member (e.g., a front desk person or a provider). In Clinic A, which had both high staff-staff and staff-patient visual connections, staff members seemed to be able to collaboratively support patients. In one instance, when a patient came out of the exam room after seeing a provider, the patient asked a clarifying question to a rooming nurse who was sitting at the visually exposed nurse station (e.g., “I need to know the names of physical therapists that the doctor recommended”). The rooming nurse did not have an answer for the question; to support the patient, a group of staff members quickly gathered around the nurse workstation to collaboratively give an answer to the patient. This collaboration was enabled because the patient could see the rooming nurse in the team area (staff-patient visual relationship) and because the other staff members could also see the interaction between the patient and the rooming nurse and offer their help (staff-staff visual relationship).

[Place Figure 7 approximately here.]

**Significance and Implications**

## VISIBILITY AND TEAMWORK PERCEPTION

14

1  
2  
3  
4  
5 This study identifies specific visibility metrics as descriptors of the clinical layout for  
6 teamwork. The quantifiable metrics can be applied to various types of clinic layouts, enabling  
7 evaluation of clinic layouts (regardless of their types) for teamwork. The underlying significance  
8 of this study is that it investigates both staff members and patients in the same clinics for their  
9 teamwork experiences. Especially, the finding that the same visual contents may have different  
10 effects on the two groups highlights the importance of understanding perspectives of multiple  
11 stakeholders during the design process. Lastly, the findings of this study provide preliminary  
12 insights into how the openness of team spaces is associated with patients' teamwork experiences.  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22

23 This study provides design implications. For team-based clinic design, it is important to  
24 provide less-exposed work areas to staff members and, at the same time, provide visible work  
25 areas for staff-patient interactions. In other words, it is not desired to make all staff work areas  
26 open or closed to patients. While not all staff work areas need to be blocked from patients (which  
27 may hinder some staff and patient interactions that were observed in Clinic A), not visually  
28 exposing the entire staff team area and thus allowing staff members to have private interactions  
29 away from patients would likely bring value to staff members' and patients' experiences.  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39

40 While the findings of this study are not favorable to the more open team clinic layouts,  
41 they are not conclusive since this study focused on teamwork perceptions and did not investigate  
42 other staff and patient experiences. Instead, the findings illustrate a general design implication  
43 that organizations can emphasize their values (such as teamwork-based, patient-centered care)  
44 via careful design of what they present to inhabitants and visitors. Even small cues such as the  
45 appearance of an office (e.g., neat or disorganized) has an impact on visitors' perceptions of the  
46 organization (Bitner, 1990; Ibelle, 2004), suggesting that organizations should control what  
47 visitors can see instead of opening everything for their view, as Goffman (1959) noted. Clinic  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## VISIBILITY AND TEAMWORK PERCEPTION

15

layouts that allow visitors to perceive and know the existence of shared and visually connected team spaces rather than showing all staff work areas may better convey a collaborative image of the clinic. Providing a spatial layout where visitors can perceive and see the organizational values and have positive interactions with employees is critical for a positive visitor experience.

**Study Limitations and Future Studies**

This study has several limitations. First, the sample size is limited. Only four clinics were investigated, so some statistical analyses were not feasible. While this study found some interesting results, generalizability of the findings needs to be further investigated. Other factors such as organizational culture or care process might also have impacted the perception of teamwork. These factors were not statistically controlled while they were observed and noted in this study. Lastly, this study focused on teamwork perceptions, but other outcomes, particularly in relation to visual properties of clinics, were not investigated. For instance, teamwork experiences of patients, including interactions between staff and patients, may support patient satisfaction but potentially increase medical errors due to interruptions. Future studies with a holistic approach to staff and patient experience may provide a comprehensive picture of the role of different layout types, especially regarding their visual attributes (for instance, open vs. enclosed). Furthermore, future studies conducting design explorations that attempt to find the balance between openness and enclosure with a larger number of clinic layouts are expected for the translation of the findings of this study into design strategies for team-based primary clinics.

## VISIBILITY AND TEAMWORK PERCEPTION

16

## References

- [Anonymous 2019a] Details omitted for double-blind reviewing
- [Anonymous 2019b] Details omitted for double-blind reviewing
- Agency for Healthcare Research and Quality. (2017). Medical office survey on patient safety culture. Retrieved from <http://www.ahrq.gov/professionals/quality-patient-safety/patientsafetyculture/medical-office/index.html>
- Andaleeb, S. S. (2001). Service quality perceptions and patient satisfaction: A study of hospitals in a developing country. *Social Science & Medicine*, 52(9), 1359–1370. doi:10.1016/S0277-9536(00)00235-5
- Baldry, C. (1997). The social construction of office space. *International Labour Review*, 136(3), 365–378. Retrieved from <http://prx.library.gatech.edu/login?url=https://search.proquest.com/docview/224015731?accountid=11107>
- Berg, P. O., & Kreiner, K. (1990). Corporate architecture: Turning physical settings into symbolic resources. In P. Gagliardi (Ed.), *Symbols and artifacts: View of the corporate landscape* (pp. 41–67). New York: Walter de Gruyter.
- Berry, L. L., Wall, E. A., & Carbone, L. P. (2006). Service clues and customer assessment of the service experience: Lessons from marketing. *Academy of Management Perspectives*, 20(2), 43–57. doi:10.5465/amp.2006.20591004
- Bitner, M. J. (1990). Evaluating service encounters: The effects of physical surroundings and employee responses. *Journal of Marketing*, 54(2), 69–82. doi:10.2307/1251871
- Bitner, M. J. (1992). Servicescapes: The impact of physical surroundings on customers and employees. *Journal of Marketing*, 56(2), 57–71. doi:10.2307/1252042
- Bluestein, A. (2016, March 22). Kaiser Permanente designed a health center that puts patients first. Retrieved from <https://www.fastcompany.com/3057404/world-changing-ideas/kaiser-permanente-designed-a-health-center-that-puts-patients-first>
- Cai, H., & Zimring, C. (2012). Out of sight, out of reach: Correlating spatial metrics of nurse station typology with nurses' communication and co-awareness in an intensive care unit. In M. Greene, J. Reyes, & A. Castro (Eds.), *Proceedings of the Eighth International Space Syntax Symposium* (pp. 8039: 1–8039:16). Santiago de Chile: Pontificia Universidad Católica de Chile.

## VISIBILITY AND TEAMWORK PERCEPTION

17

- 1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60
- Clancy, C. M., & Tornberg, D. N. (2007). TeamSTEPPS: assuring optimal teamwork in clinical settings. *American Journal of Medical Quality*, 22(3), 214–217. doi:10.1177/1062860607300616
- Dunn, O. J. (1964). Multiple comparisons using rank sums. *Technometrics*, 6(3), 241–252. doi:10.1080/00401706.1964.10490181
- Elsbach, K. D., & Bechky, B. A. (2007). It's more than a desk: Working smarter through leveraged office design. *California Management Review*, 49(2), 80–101. doi:10.2307/41166384
- Ficarra, B. (2010). Patient care: Why you, the patient, are the most important part of the health care team. Retrieved from [https://www.huffingtonpost.com/barbara-ficarra/patient-care-why-you-the-patient\\_b\\_800009.html](https://www.huffingtonpost.com/barbara-ficarra/patient-care-why-you-the-patient_b_800009.html)
- Freihoefer, K., Kaiser, L., Vonasek, D., & Bayramzadeh, S. (2017). Setting the stage: A comparative analysis of an onstage/offstage and a linear clinic modules. *Health Environments Research & Design Journal*, 11(2), 89–103. doi:10.1177/1937586717729348
- Gharaveis, A., Hamilton, D. K., & Pati, D. (2017). The impact of environmental design on teamwork and communication in healthcare facilities: A systematic literature review. *Health Environments Research & Design Journal*, 11(1), 119–137. doi:10.1177/1937586717730333
- Gharaveis, A., Hamilton, D. K., Pati, D., & Shepley, M. (2018). The impact of visibility on teamwork, collaborative communication, and security in emergency departments: An exploratory study. *Health Environments Research & Design Journal*, 11(4), 37–49. doi:10.1177/1937586717735290
- Gharaveis, A., Pati, D., Hamilton, D. K., Shepley, M., Rodiek, S., & Najarian, M. (2019). The influence of visibility on medical teamwork in emergency departments: A mixed-methods study. *Health Environments Research & Design Journal*. (Publish ahead of print). doi:10.1177/1937586719885376
- Gharaveis, A., Shepley, M., Hamilton, D. K., Pati, D., & Rodiek, S. (2019). The influence of visibility on staff face-to-face communication and efficiency in emergency departments. *Facilities*, 37(5), 352–363. doi:10.1108/F-07-2018-0077
- Goffman, E. (1959). *The presentation of self in everyday life*. New York: Anchor Books.
- Hatch, M. J. (1990). The symbolics of office design: An empirical exploration. In P. Gagliardi (Ed.), *Symbols and artifacts: Views of the corporate landscape* (pp. 129–146). New York: Walter de Gruyter.

## VISIBILITY AND TEAMWORK PERCEPTION

18

- Heerwagen, J. H., Kampschroer, K., Powell, K. M., & Loftness, V. (2004). Collaborative knowledge work environments. *Building Research & Information*, 32(6), 510–528. doi:10.1080/09613210412331313025
- Henry, B. W., Rooney, D., Eller, S., McCarthy, D., Seivert, N., Nannicelli, A., & Vozenilek, J. (2013). What patients observe about teamwork in the emergency department: Development of the PIVOT questionnaire. *Journal of Participatory Medicine*, 5, e4.
- Henry, B. W., Rooney, D., Eller, S., Vozenilek, J., & McCarthy, D. (2014). Testing of the Patients' Insights and Views of Teamwork (PIVOT) survey: A validity study. *Patient education and counseling*, 96(3), 346–351. doi:10.1016/j.pec.2014.06.002
- Hillier, B., Hanson, J., & Peponis, J. (1984). What do we mean by building function? In J. A. Powell, I. Cooper, & S. Lera (Eds.), *Designing for building utilisation* (pp. 61–72). London: Spon Press
- Ibelle, B. (2004, October 25). Law firm thrives with non-traditional office. *Lawyers Weekly USA*. Retrieved from <http://lawyersusaonline.com/blog/2004/10/25/law-firm-thrives-with-nontraditional-office/>
- IBM. (n.d.). SPSS Statistics 22.0.0. Retrieved from [https://www.ibm.com/support/knowledgecenter/en/SSLVMB\\_22.0.0/com.ibm.spss.statistics\\_22.kc.doc/pv\\_welcome.html](https://www.ibm.com/support/knowledgecenter/en/SSLVMB_22.0.0/com.ibm.spss.statistics_22.kc.doc/pv_welcome.html)
- Jackson, G. L., Powers, B. J., Chatterjee, R., Bettger, J. P., Kemper, A. R., Hasselblad, V., . . . , & Williams Jr., J. W. (2013). The Patient-Centered Medical Home: A systematic review. *Annals of Internal Medicine*, 158(3), 169–178. doi:10.7326/0003-4819-158-3-201302050-00579
- Karp, Z., Kamnetz, S., Wietfeldt, N., Sinsky, C., Molfenter, T., & Pandhi, N. (2019). Influence of environmental design on team interactions across three family medicine clinics: Perceptions of communication, efficiency, and privacy. *Health Environments Research & Design Journal*. doi:10.1177/1937586719834729
- Kim, S. E., & Jung, C. S. (2015). The effects of status symbols in the office on employee attitudes in a human service agency. *Human Service Organizations: Management, Leadership & Governance*, 39(4), 306–322. doi:10.1080/23303131.2015.1046008
- King, H. B., Battles, J., Baker, D. P., Alonso, A., Salas, E., Webster, J., . . . , & Salisbury, M. (2008). TeamSTEPPS™: Team Strategies and Tools to Enhance Performance and Patient Safety.
- Kotler, P. (1974). Atmospherics as a marketing tool. *Journal of Retailing*, 49(4), 48–64.

## VISIBILITY AND TEAMWORK PERCEPTION

19

- Larry, A. M., David, M. L., Suzan, D. O., Susan, M. U., & Frank, J. S. (2003). Culture, the built environment and healthcare organizational performance. *Managing Service Quality*, 13(1), 27–38. doi:10.1108/09604520310456690
- Lim, L., Kim, M., & Zimring, C. M. (2019). Measuring interpersonal visual relationships in healthcare facilities: The Agent Visibility Model and SAVisualPower Tool. *Health Environments Research & Design Journal*, 12(4), 203–216. doi:10.1177/1937586719842357
- Lu, Y., & Zimring, C. (2012). Can intensive care staff see their patients? An improved visibility analysis methodology. *Environment and Behavior*, 44(6), 861–876. doi:10.1177/0013916511405314
- Markhede, H., & Koch, D. (2007, June 12-15). *Positioning analysis: Social structures in configurative modelling*. Paper presented at the 6th International Space Syntax Symposium, Istanbul, Turkey.
- McElroy, J. C., & Morrow, P. C. (2010). Employee reactions to office redesign: A naturally occurring quasi-field experiment in a multi-generational setting. *Human Relations*, 63(5), 609–636. doi:10.1177/0018726709342932
- Mercer, L. M., Tanabe, P., Pang, P. S., Gisondi, M. A., Courtney, D. M., Engel, K. G., . . . , & Makoul, G. (2008). Patient perspectives on communication with the medical team: Pilot study using the Communication Assessment Tool-Team (CAT-T). *Patient Education and Counseling*, 73(2), 220–223. doi:10.1016/j.pec.2008.07.003
- Meterko, M., David, C. M., & Young, G. J. (2004). Teamwork culture and patient satisfaction in hospitals. *Med. Care*, 42(5), 492–498. doi:10.1097/01.mlr.0000124389.58422.b2
- National Committee for Quality Assurance. (n.d.). Patient-Centered Medical Home (PCMH) Recognition. Retrieved from <http://www.ncqa.org/programs/recognition/practices/patient-centered-medical-home-pcmh>
- Parish, J. T., Berry, L. L., & Shun Yin, L. (2008). The effect of the servicescape on service workers. *Journal of Service Reserarch*, 10(3), 220–238. doi:10.1177/1094670507310770
- Patient-Centered Primary Care Collaborative. (n.d.). Defining the Medical Home: A patient-centered philosophy that drives primary care excellence. Retrieved from <https://www.pcpcc.org/about/medical-home>
- Peavey, E., & Cai, H. (2018). A systems framework for understanding the environment's relation to clinical teamwork: A systematic literature review of empirical studies. *Environment and Behavior*. doi:10.1177/0013916518815535

## VISIBILITY AND TEAMWORK PERCEPTION

20

- Petterson, S. M., Liaw, W. R., Phillips, R. L., Rabin, D. L., Meyers, D. S., & Bazemore, A. W. (2012). Projecting US primary care physician workforce needs: 2010–2025. *Annals of Family Medicine*, 10(6), 503–509. doi:10.1370/afm.1431
- Rashid, M., Kampschroer, K., & Zimring, C. (2006). Spatial layout and face-to-face interaction in offices—A study of the mechanisms of spatial effects on face-to-face interaction. *Environment and Planning B: Planning and Design*, 33(6), 825–844. doi:10.1068/b31123
- Rathert, C., Brandt, J., & Williams, E. S. (2012). Putting the "patient" in patient safety: A qualitative study of consumer experiences. *Health Expectations*, 15(3), 327–336. doi:10.1111/j.1369-7625.2011.00685.x
- Schottenfeld, L., Petersen, D., Peikes, D., Ricciardi, R., Burak, H., McNellis, R., & Genevro, J. (2016). *Creating patient-centered team-based primary care. Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services. AHRQ Publication No. 16-0002-EF*
- Sheppard, F., Williams, M., & Klein, V. R. (2013). TeamSTEPPS and patient safety in healthcare. *Journal of Healthcare Risk Management*, 32(3), 5–10. doi:10.1002/jhrm.21099
- Shoemaker, S. J., Parchman, M. L., Fuda, K. K., Schaefer, J., Levin, J., Hunt, M., & Ricciardi, R. (2016). A review of instruments to measure interprofessional team-based primary care. *Journal of Interprofessional Care*, 30(4), 423–432. doi:10.3109/13561820.2016.1154023
- Stroebel, R. J., Obeidat, B., Lim, L., Mitchell, J. D., Jasperson, D. B., & Zimring, C. (2019). The impact of clinic design on teamwork development in primary care. *Health Care Management Review*. doi:10.1097/hmr.0000000000000259
- Thurm, D. (2005). Master of the house: Why a company should take control of its building projects. *Harvard Business Review*, 83, 120–129.
- U.S. Department of Veterans Affairs. (2016). *PACT Space Module design guide*. Retrieved from <https://www.cfm.va.gov/til/dGuide/dgPACT.pdf>.
- Vilnai-Yavetz, I., Rafaeli, A., & Yaacov, C. S. (2005). Instrumentality, aesthetics, and symbolism of office design. *Environment and Behavior*, 37(4), 533–551. doi:10.1177/0013916504270695

## VISIBILITY AND TEAMWORK PERCEPTION

1

**Abstract**

**Objective:** This study empirically investigates the relationships between visibility attributes and both patients' and staff members' teamwork experiences.

**Background:** Teamwork among healthcare professionals is critical for the safety and quality of patient care. While a patient-centered, team-based care approach is promoted in primary care clinics, little is known about how clinic layouts can support the teamwork experiences of staff and patients in team-based primary clinics.

**Methods:** This paper measured teamwork perceptions of staff members and patients at four primary care clinics providing team-based care. Visual access to staff workstations from both staff and patient perspectives were analyzed using VisualPower tool. The relationships between teamwork perception and visibility attributes were analyzed for each entity: staff members and patients.

**Results:** The results showed that the visual relationships among staff members and those between staff members and patients have significant associations with overall perceptions of teamwork. While clinics providing more visual connections between staff workstations reported higher teamwork perception of staff members, patient perceptions of staff teamwork were inversely related to the number of visual connections between patients and staff workstations.

**Conclusions:** The findings of the study provide implications for designing team-based primary care clinics to enhance the teamwork experience of both staff members and patients, which is also applicable to teamwork perceptions in other settings where both inhabitants and visitors are main user groups of the spaces. This study illustrates representational function of space: organizations can emphasize their values via layout design by regulating what they show to inhabitants or visitors.

## VISIBILITY AND TEAMWORK PERCEPTION

1

**Executive Summary of Key Concepts**

Recognizing the importance of teamwork, many primary care clinics are moving toward team-based care. Healthcare organizations are adopting various team-based clinic design characteristics, including clinic layouts that visually open up the staff work areas to patients and that entirely separate patients from staff work areas. Focusing on the representational role of physical spaces in conveying values to the visitors and inhabitants, this study investigated whether the visual exposure levels of team work areas would predict teamwork perceptions of patients and staff members by looking at four clinics that varied the visual exposure levels of these team spaces. The results showed that there are significant associations with visual exposure level of team work areas and teamwork perceptions by both staff and patients. Clinics providing more visual connections between staff workstations reported higher teamwork perception of staff members; however, surprisingly, more visual connections between patients and staff workstations were associated with lower teamwork perceptions from the patients' perspective. The findings of this study illustrate the representational role of clinic space, especially team work areas, in relation to teamwork perceptions of the visitors and inhabitants.

## VISIBILITY AND TEAMWORK PERCEPTION

1

**Implications for Practice**

- Designers and facility managers can provide more and less visually exposed work areas for improved teamwork experiences of staff and patients.
- Facility managers, designers, and researchers can use the specified visibility metrics to describe and evaluate a clinic layout for likely teamwork perceptions.
- Organizations can emphasize their organizational values via careful design of what to visually present to inhabitants and visitors.

Table 1.

*Summary descriptions of the four study settings.*

	Clinic A	Clinic B	Clinic C	Clinic D
Organization	X	X	Y	Y
Geographic location	GA	GA	WI	MN
Year built/renovated	2011	2012	2016	2016
Number of exam rooms	6	28	13	30
Size of enrolled patient population	4,000	11,400	4,000	15,000
Number of teams	1	2	1	2
Total number of non-admin staff members	14	34	27	60
Total number of workstations across team areas	14	33	21	53

Table 2.

*Results of visual relationship analyses. The four clinics show distinct levels of staff-staff and staff-patient visual relationships.*

Variables	Clinic A	Clinic B	Clinic C	Clinic D
<b>1. Staff members seeing other staff workstations</b>				
Number of workstations	14	33	21	53
Average number of visible other workstations	4.4	7.0	5.7	27.5
Total number of visible workstations	13	32	20	52
Ratio	34.1%	22.0%	28.6%	53.0%
<b>2. Patients seeing staff workstations</b>				
Number of patient path points	95	426	198	353
Average number of visible staff workstations	4.83	2.54	7.56	0.36
Total number of visible staff workstations	14	33	21	53
Ratio	34.5%	7.7%	36.0%	0.7%

Table 3.

*Descriptive statistics of teamwork perception surveys. The four clinics show relatively high perception of staff and patient teamwork. Staff teamwork perception varies a little, and patient teamwork perception is similar among the four clinics.*

	Staff Teamwork Perception (4 items; $\alpha = .843$ )			Patient Teamwork Perception (14 items; $\alpha = .908$ )		
	N	Mean	SD	N	Mean	SD
Clinic A	14	4.39	0.50	58	4.37	0.47
Clinic B	15	4.07	0.71	63	4.49	0.60
Clinic C	19	4.50	0.42	24	4.38	0.51
Clinic D	35	4.81	0.31	60	4.63	0.40
Total	83	4.54	0.53	205	4.48	0.51

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

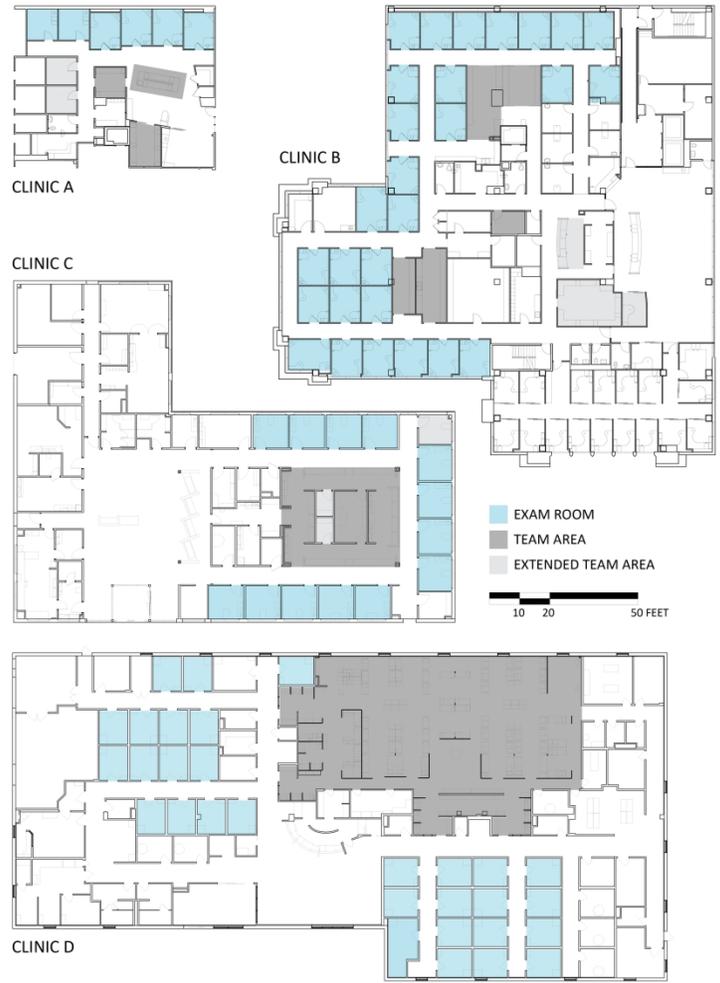


Figure 1. The layouts of the four clinics. Grey areas represent team spaces, and blue areas indicate exam rooms.

215x279mm (300 x 300 DPI)



29 Figure 2. View of staff work areas. The selected views illustrate how staff team spaces are visible to patients  
30 from the point of the patient paths. Team spaces in Clinic A are wide open and most are visible to patients  
31 who enter the clinic, while team spaces in Clinic D are almost not visible to patients. Team spaces in Clinic B  
32 and Clinic C are partially visible from the corridors, perpendicular to the patient path and over the partition,  
33 respectively.

34 173x120mm (300 x 300 DPI)

35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



Figure 3. Staff members seeing other staff members' workstations. Staff members in all four clinics are visually connected to each other by varying degrees. Clinic B shows the lowest level of connection (22% on average), and Clinic D shows the highest visual connections between staff workstations (53% on average).

175x232mm (300 x 300 DPI)



Figure 4. Patients seeing staff members' workstations. Patients in Clinic A and Clinic C can see more of staff workstations compared to those in Clinic B and Clinic D. Patients in Clinic D can rarely see staff workstations in the team area.

175x232mm (300 x 300 DPI)

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



Figure 5. Staff-staff visual relationship and staff teamwork perception. Clinics with higher visual connections between staff members have higher staff teamwork perceptions.

190x127mm (300 x 300 DPI)

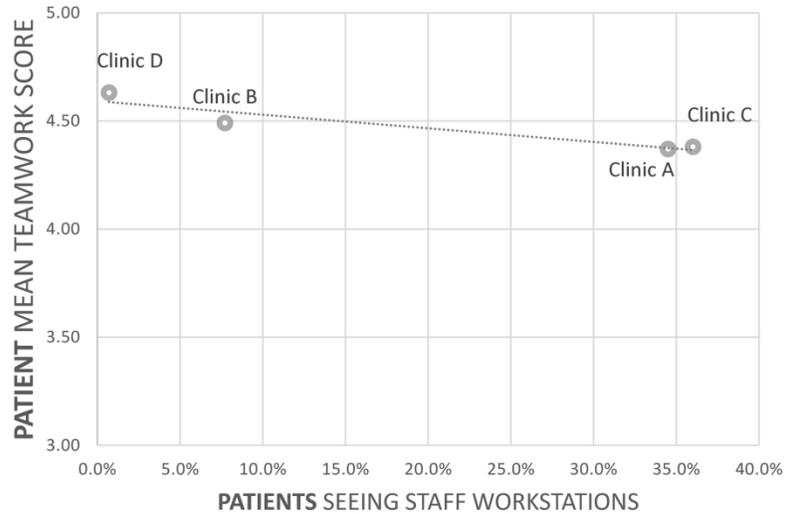


Figure 6. Patient-staff visual interface and patient teamwork perception. Clinics with higher visual connections between staff members and patients have lower patient teamwork perceptions.

190x127mm (300 x 300 DPI)

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

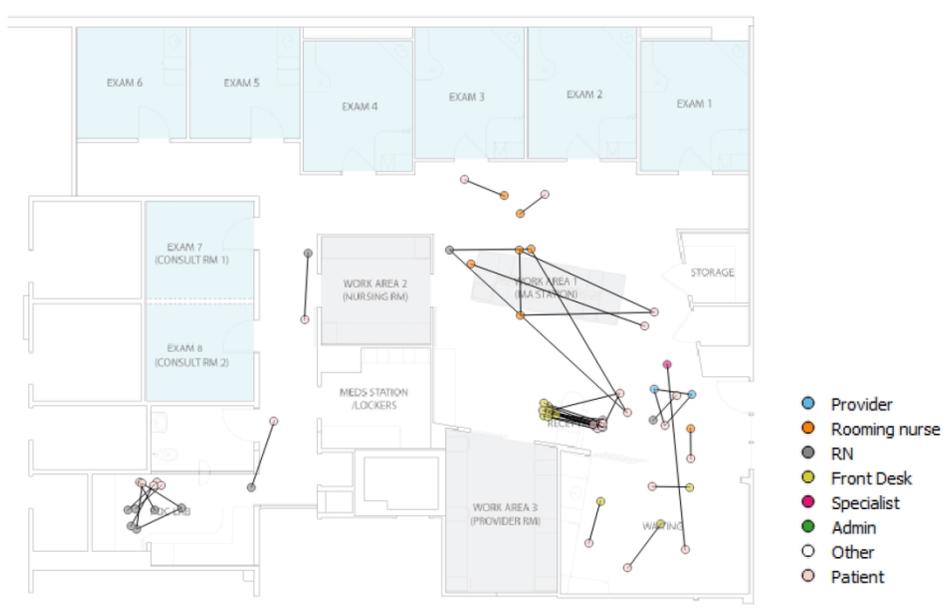


Figure 7. Locations of all observed communication between patients and staff members in Clinic A. Interactions between staff members and patients were observed in visually exposed team areas.

190x127mm (300 x 300 DPI)