

Consultation Room Design and the Clinical Encounter: The Space and Interaction Randomized Trial

Julka R. Almquist; Caroline Kelly, MID; Joyce Bromberg; Sandra C. Bryant, MS; Teresa J. H. Christianson; and Victor M. Montori, MSc, MD

Abstract

Objective: The design of the consultation room remains largely unaltered despite major changes in clinical practice, such as the electronic medical record and patient-centered care. The value of redesigning the consultation room to accommodate

Author Affiliations: Ms. Almquist is in the Dept. of Planning, Policy, and Design in the School of Ecology at the University of California, Irvine. Ms. Kelly and Ms. Bromberg are in Research, WorkSpace Futures at Steelcase, Inc., in Grand Rapids, MI. Ms. Bryant and Ms. Christianson are in the Division of Biostatistics and Bioinformatics, Dept. of Health Sciences Research, at the Mayo Clinic in Rochester, MN. Dr. Montori is in the Knowledge and Encounter Research Unit of the Dept. of Medicine as well as the Center for Innovation and the Division of Health Care Policy and Research in the Dept. of Health Sciences Research, all at the Mayo Clinic.

Corresponding Author: Victor M. Montori, Mayo Clinic, Plummer 3-35, 200 First Street SW, Rochester, MN 55905 (Montori.victor@mayo.edu).

Trial Registration: ClinicalTrials.gov NCT00806559

Acknowledgments: The authors are grateful to the participating patients; to the participating clinicians, nurses, clinical assistants, and administrative personnel of the Division of General Internal Medicine; and to the staff of the SPARC Design Studio of the Mayo Clinic Center for Innovation who enabled the redesign of the study rooms for this trial and allowed the trial within the workflow of the practice. They also thank Rebecca Mullan, MS, and Laurie Pencille, MSW, who provided critical assistance in the management of this trial, and to Richard Locker, who assisted with study coordination. They are also grateful to Mark Greiner, Senior Vice President, WorkSpace Futures, for his sponsorship of the project, and to Alan Rheault and Mary Juhlin of Nurture by Steelcase for their help in the design and realization of the consultation rooms.

these changes and the effect of a redesign on patient-clinician interaction are unclear.

Methods: The authors randomly allocated 65 patient-physician dyads to consultations in a standard room ($n = 30$) or in an experimental room designed with a semicircular table around which the clinician and the patient sat, with equal access to the computer screen ($n = 35$). Participant responses to post-visit surveys, assessing patient experiences in these rooms, were compared in an intention-to-treat fashion.

Results: The authors found no differences between the rooms in terms of patient satisfaction with the consultation, mutual respect, or communication quality. Compared to the standard room, patients in the experimental room were better able to interact with the computer monitor (24 [75%] vs. 17 [59%], $P = 0.07$) and had a greater ability to look at the screen at any time (22 [73%] vs. 8 [28%], $P < 0.001$); and they reported that clinicians allowed them to review the medical record on the screen (22 [71%] vs. 13 [45%], $P = 0.012$), shared information on the computer screen (24 [80%] vs. 18 [60%], $P = 0.037$), and reviewed information on the Internet with the patient (13 [43%] vs. 7 [26%], $P = 0.010$) more than those in the standard room.

Conclusions: The design of the consultation room affects the clinical encounter. In particular, ready access to a computer screen using the electronic medical record and the Internet may enhance information sharing.

Key Words: Consultation room office design, patient-physician communication, randomized trial, evidence-based design, electronic medical record

Introduction

The exam or consultation room, in which millions of outpatient visits take place yearly, may critically affect the quality of healthcare in general and of the patient-clinician interaction in particular. Although there has been much work examining patient-clinician interaction, little has been done to understand the extent to which it can be affected by the design of the consultation room.

The traditional consultation room involves a desk designed for a physician's individual use, with the clinician sitting in the primary work position on a chair with enhanced mobility. The patient and care partner (e.g., family member) sit to the side on fixed chairs with limited access to the computer screen. Although this traditional design of the consultation room has been used for many years, three trends in healthcare suggest the need to reconsider how it could affect patient-clinician interaction: (1) patient-centered care as a manifestation of high-quality care; (2) the shift from acute care models in the outpatient setting to relationship-based care in the context of chronic care delivery; and (3) the evolution toward information-intensive encounters, in which the electronic medical record and health information on the Internet play key roles in supporting clinical decision making and patient education.

Traditionally, patient-clinician interaction has followed a paternalistic model, with the patient taking a passive role in the consultation (Emanuel & Emanuel, 2000; Szasz & Hollender, 1956). Recently, the patient-centered-care movement has encouraged greater patient involvement and

a more egalitarian encounter with the clinician, promoting two-way communication and greater access to information (Frankel et al., 2005; Kaba & Sooriakuaran, 2007). Although the Institute of Medicine (IOM) considered patient-centered care a key component of high-quality healthcare (IOM, 2001), an apparent disconnect has emerged: a patient-centered encounter occurring in a space designed to support a clinician-centered consultation.

This disconnect has not been the subject of much experimental research; in fact, most research on space and its effects on healthcare has focused primarily on hospital rooms (Devlin & Arneill, 2003; Landerfeld, Palmer, Kresevic, Fortinsky, & Kowal, 1995; Martin et al., 1998; Ulrich, 1984; Ulrich, 1991). Arguably, outpatient visits—though brief—are numerous, and critical decisions are made during outpatient encounters. The increase in chronic disease and the recent focus on integrating care for these patients in relationship-based outpatient “medical homes” makes the consultation room the central space for healthcare delivery.

Practices are also at varying stages of transition from paper records to electronic medical records and computers present in the consultation room. These computers allow clinicians to collect information about the patient, to display record information important for decision making, and to bill properly for services provided. Importantly, clinicians often use electronic resources and the Internet to access information during visits. In many practices, patient education material re-

sides only in an electronic environment, and the computer represents the interface at the point of care. Research on the effect of the computer on consultations strongly suggests that the design of the consultation room may have adapted poorly to the arrival of the computer and even worse to its evolving functions within the consultation (Frankel et al., 2005; Garrison, Bernard, & Rasmussen, 2002; Greatbatch, Heath, Champion, & Luff, 1995; Pearce, Dwan, Arnold, Phillips, & Trumble, 2009).

To understand the extent to which a consultation room designed to support modern clinical encounters could affect the patient-clinician interaction in comparison to a traditional room, the Space and Interaction Trial (SIT) was conducted. SIT was a pilot randomized controlled trial of real clinical encounters to measure the effect of a design intervention by means of participant self-report questionnaires. In particular, the impact of three specific design features that potentially support the evolved nature of healthcare today were evaluated: (1) the placement of the computer screen; (2) the type and position of the desk; and (3) the arrangement of the seats.

Methods

SIT was a randomized controlled trial that took place during the summer of 2007 at the Mayo Clinic in Rochester, Minnesota. The Institutional Review Board of the Mayo Clinic approved the study protocol. All participants, including clinicians, patients, and their care partners (i.e., significant others who accompany patients into consultations) gave written informed consent.

Setting

The study was conducted in the Division of General Internal Medicine of the Mayo Clinic. Clinicians in this division conduct general examinations of patients referred to the Mayo Clinic. These patients often are elderly, reflecting the Mayo Clinic patient demographic (Brennan, Miner, & Rizza, 1998), and they have multiple medical problems. These examinations often include tests and consultations with specialists, after which patients return to a general medicine physician for a summary visit. In the summary visit, patients and physicians review the results and implications of these tests and consultations and set up a plan of action. Thus, summary visits represent information-intensive clinical encounters in which effective communication is essential.

Participants

There were three types of participants in the SIT: clinicians, patients, and patients' care partners. Clinicians with patients scheduled for a summary visit during the study period were eligible. The physicians were selected based on their proximity to the Mayo Clinic's Innovation Center, the SPARC (which stands for See, Plan, Act, Refine, Communicate) Corridor where the consultation rooms were located, and their willingness to move their practices into the redesigned spaces for 1 week. Patients assigned to a physician during the participation week were approached to participate in the study. If care partners accompanied patients, they were also asked to participate. Clinicians and the study coordinator judged the eligibility of patients and care partners based on

their ability (e.g., adequate vision, literacy, and mental status) to give written informed consent for participation in the study and its procedures, and to answer a post-visit questionnaire.

Interventions

Two consultation rooms were redesigned to configure a standard room and an experimental room. The standard room was modeled as a composite, using design guidelines from the Mayo Clinic, the Veterans Health Administration (1995), and design reference books (Institute of Medicine, 2001; Malkin, 2002; Malkin, 2008) (Figure 1A). Key features of this room recognized the physician as the primary user and included:

(1) distinct designated spaces for patients and clinicians; (2) a desk surface for clinician use; and (3) the setup of the computer monitor and input devices that favor physician use.

The experimental room (Figure 1B) was designed to enhance patient-centered care that uses technology in the consultation. This room featured a half-round table with a computer monitor on an extendable arm mounted on the wall above the table. It differs from the standard room in the following ways: (1) the desk surface is shared space for patients and clinicians; (2) the computer monitor and input devices allow similar access for patients and clinicians; and (3) participants

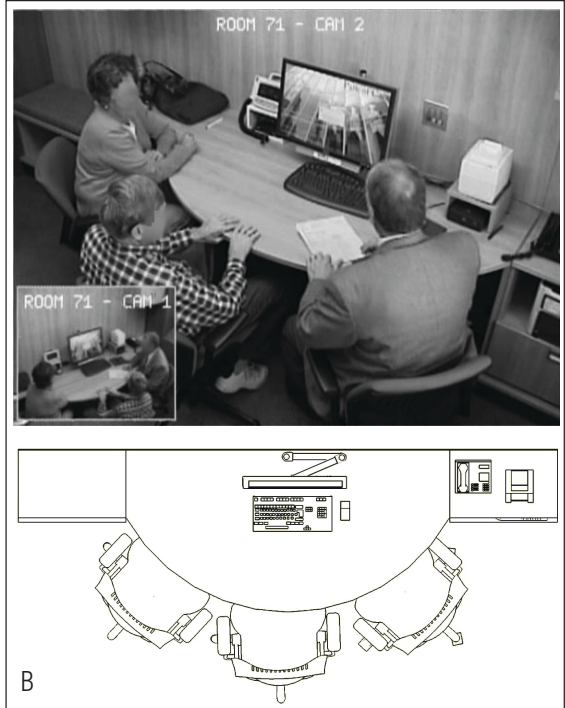


Figure 1. (A) Standard room design. (B) Experimental room design with semicircular table for shared nonhierarchical space, a 24-inch computer monitor on an armature, accessible computer input devices, and flexible seating.

sit on three adjustable chairs of the same design (with glides on patient chairs for safety and casters for clinician mobility) set around the table. The arm-mounted monitor was in full view of everyone sitting at the table and could be adjusted as needed. The computer input devices, i.e., wireless keyboard and mouse, were similarly accessible to patients, care partners, and clinicians. Otherwise, the standard and experimental rooms were identical in terms of finishes and equipment.

Room Allocation

Only one clinician per week participated in the study. This constraint was introduced because (1) this study took place in the context of a real practice setting; (2) there was only one room of each kind; (3) appointment duration could not be predicted; and (4) each patient-clinician dyad had to have a similar opportunity to experience both rooms. To deal with this constraint, the study coordinator randomly allocated the first patient of the day to either room using a coin toss (heads = experimental room, tails = standard room). When this method of allocation created an imbalance in room type used of more than three in a day, the under-represented room type was the first used the following day. Subsequent patients were assigned alternately to the rooms to ensure that patients with back-to-back appointments would not be assigned to the same room, creating delays in the practice.

To ensure practice flow, the study coordinator invited patients into the study and obtained their consent to participate only after they were seated in the room to which they had been allocated. If

they did not agree to participate, the visit would proceed as usual with no data collection. Neither patients nor clinicians were aware of the hypotheses of this trial.

Data Collection

The authors also extracted demographic data from the medical record including age and sex, number of times seen by the same physician during the current episode of care before the study visit, and whether patients had prior episodes of care at the Mayo Clinic.

Participating patients were asked to answer a questionnaire immediately after the visit. After the study team identified the domains of interest by reviewing literature and brainstorming, researchers formulated the questions. This involved adapting the American Board of Internal Medicine Patient Satisfaction Questionnaire (Webster, 1989) using Thom and colleagues' the Trust in Physician scale (Leisen & Hyman, 2001; Thom, Ribisl, Stewart, & Luke, 1999) and drafting additional questions, given the unique research question and context involved. Although the pilot study questions were measured on a 7-point Likert scale, the final questionnaire measured the questions on a 5-point scale. The questionnaire was field tested after patients had completed it. Patients were interviewed by study personnel to compare their stated answers to the meaning they intended to convey (i.e., a cognitive debrief was conducted). When the questions led to answers that failed to convey the meaning participants expressed, these questions were refined and field tested again. The resulting questionnaire culmi-

nated in six domains of interest: (1) satisfaction with the visit and the consultation room; (2) mutual respect; (3) patient trust in the clinician; (4) communication quality; (5) people-room interaction; and (6) interpersonal-room interaction. The domains of satisfaction, mutual respect, trust, and communication were developed based on the aforementioned surveys. The people-room interaction domain captured patients' experience of the way the room and its furnishings were positioned, including the issues of comfort, understanding where to sit and where to place belongings, and access to the computer monitor and input devices. The interpersonal-room interaction domain asked questions regarding the way the patient, physician, and care partner related by using artifacts in the room. Responses to each question were reordered, where necessary, so that high values represented desirable attributes. The score in each domain represents the mean of the individual questions, scaled from 0 to 100, with 100 representing total agreement or satisfaction.

In addition to the validity of these questions, the authors sought to measure their reliability by asking the care partner, when present, to complete the patient questionnaire independently at the same time as the patient. Because some of the questions were based on construct validity, the authors wanted to achieve a higher level of reliability. Given time constraints for validating surveys, they opted to give the survey to the population who would experience the consultation room similarly, i.e., the care partners. This allowed the researchers to compare patients' responses to care partners' responses to strengthen questionnaire

reliability. It also enabled the capture of important data about the care partners' experience in the consultation room. The between-observer reliability of the patient experience captured by the questionnaire was then estimated for each question. To simplify the respondents' task, all questions offered the same 5-point Likert scale with response options ranging from strongly agree to strongly disagree.

Statistical Analysis

Sample size calculations were based on the distribution of responses to the question, "During the visit you just had, to what extent did you feel the room felt like an appropriate place to visit with your doctor?" As the pilot survey was, this question was scored from a pilot study of 10 participants on a 7-point Likert scale, with anchors at 1 = Very appropriate; 4 = Neither appropriate nor inappropriate; and 7 = Very inappropriate. In this pilot study, 30% responded with a score of 1 (very appropriate); 20% responded to each score of 2, 3, and 4, respectively; and 10% responded with a score of 5. Not one participant responded with a score of 6 or 7 (very inappropriate). Using this distribution of responses and seeking 80% power for a Wilcoxon rank sum test with a 0.05 two-sided significance level, the authors estimated a sample size of 33 participants for each room configuration.

For each question and domain, the researchers noted the median and interquartile range, and then tested hypotheses of no difference across the two room conditions. Depending on the nature of the data, medians were compared using

the Wilcoxon rank sum tests, proportions were compared using the Fisher exact tests, and the Cochran-Armitage exact tests were used to evaluate the data for trends. To assess the interobserver reliability of the questions, the authors estimated the agreement of scores per question between the patient and the care partner under two standards: perfect and near-perfect agreement (defined as agreement within 1 point in the scales used), along with 95% score confidence intervals. When more than one care partner in the room had completed a questionnaire, the authors averaged the

responses of the care partners with equal weight before comparing them to the patient responses.

Results

From August through October of 2007, 6 physicians and 65 patients participated in the study. Sixty-three patients completed the post-visit survey and are included in the analyses (Figure 2). Patients had a median age of 69 and 48% were women. Of these, 44 (70%) had not had prior episodes of care with the same clinician, and 14 (22%) had not received care at the Mayo

Table 1. Baseline Characteristics

Characteristics	Standard Room (N = 30)	Experimental Room (N = 33)	Total (N = 63)	P-value
Age, median (interquartile range)	68 (58, 74)	73 (67, 75)	69 (61, 75)	0.20 ¹
Women, n (%)	14 (47%)	16 (48%)	30 (48%)	1.0 ²
Care partner in the room, n (%)	14 (47%)	15 (45%)	29 (46%)	1.0 ²
New to Mayo Clinic, n (%)	5 (17%)	9 (27%)	14 (22%)	0.37 ²
New to this clinician, n (%)	8 (27%)	11 (33%)	19 (30%)	0.60 ²

¹ Wilcoxon Rank Sum ² Fisher Exact

Table 2. Results by Domain

	Standard Room (N = 30)	Experimental Room (N = 33)	P-value†
Predefined domains, median (interquartile range)*			
Patient satisfaction with the visit	99.3 (97.2, 100)	100 (98.6, 100)	0.127
Mutual respect	100 (100, 100)	100 (100, 100)	0.305
Trust in Physician scale	100 (100, 100)	100 (100, 100)	0.984
Communication quality	100 (92.9, 100)	100 (92.9, 100)	0.362
People-room interactions (comfort, clear where to sit and place belongings, access to the computer monitor and input devices)	81.8 (72.7, 88.6)	86.4 (77.3, 90.9)	0.140
Interpersonal-room interactions (clinician-computer-patient interactions)	87.5 (68.8, 100)	93.8 (81.3, 100)	0.145

* Higher scores are better † Wilcoxon Rank Sum test

Clinic before the current episode of care. Table 1 describes the baseline characteristics of patients by trial arm. Table 2 describes the results of the study across the six questionnaire domains.

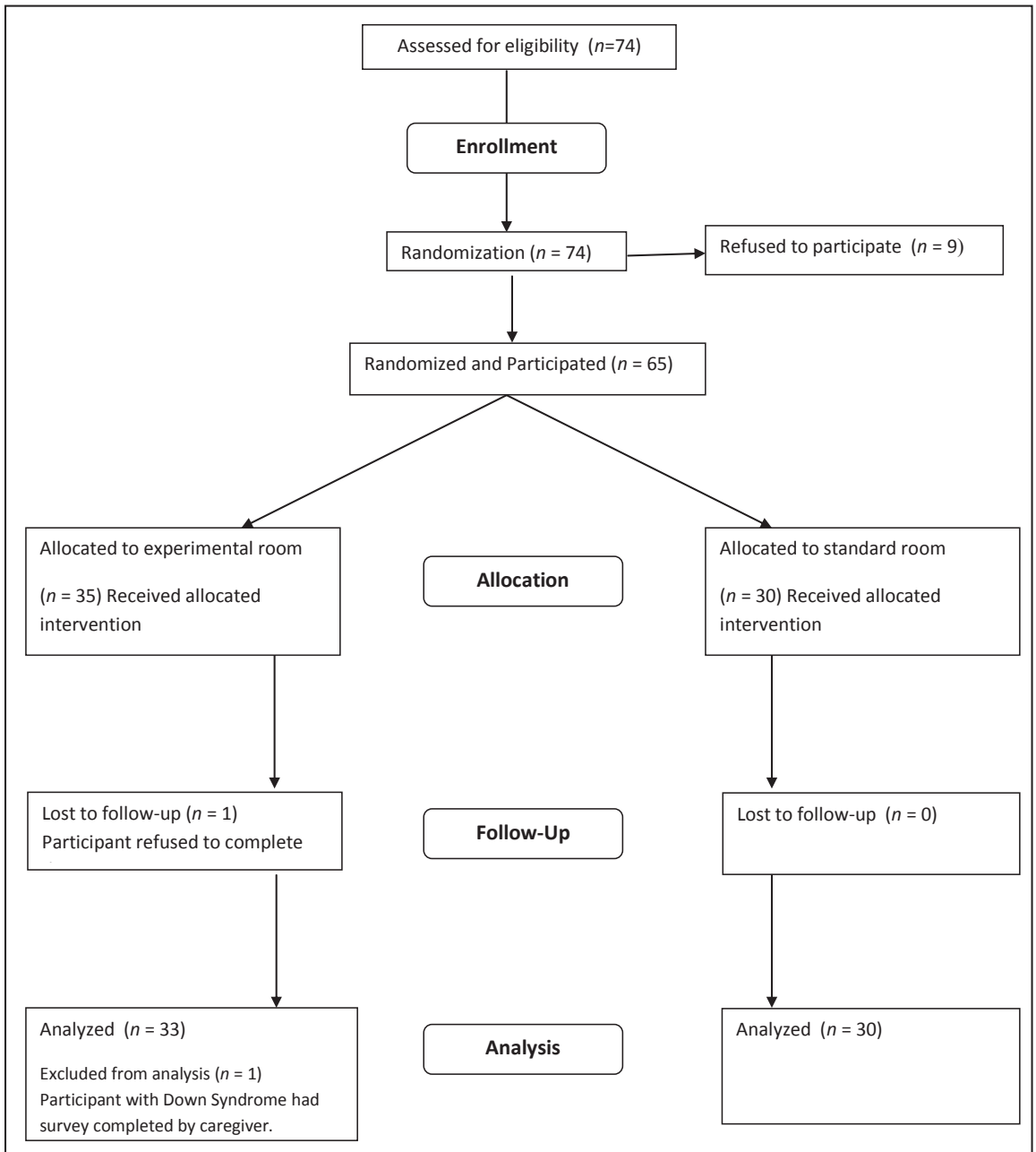


Figure 2. Flow of participants in the trial.

Questionnaire Reliability

Twenty-nine patients (46%) had care partners who participated in the study. The simple perfect agreement between patient and the care partner scores ranged from 35% to 92% across questions (median 74%); and the simple approximate agreement (within a point in the scales used) ranged from 67% to 100% (median 96%). The questions with the least agreement (< 50% simple perfect agreement) inquired about (1) comfort with the room design, seating arrangements, and distance to the provider; (2) the ability to interact with the computer and the information; and (3) comfort expressing different opinions. For the questions with less agreement, there was a trend toward better agreement in the experimental room than in the standard room (e.g., agreement about the ability to interact with the computer was twice as high in the experimental than in the standard room, but the result was not statistically significant, probably because of the small number of care partners).

Satisfaction With the Visit and Room

Overall patient satisfaction with the visit was very high, with no significant difference between trial arms. In the experimental room, the researchers found a trend toward improved patient satisfaction with decision making: 29 (97%) indicated that they had experienced excellent involvement in the decision-making process vs. 25 (83%) in the standard room ($P = 0.17$). In part, this may be the result of patients experiencing excellent use of visual aids to explain treatment options: 24 (86%) in the experimental room vs. 16 (59%) in the standard room ($P = 0.016$).

Mutual Respect, Trust, and Communication Quality

No effect of the room design on patient perceptions of mutual respect was evident; nor were the extent to which patients trusted their clinicians, and the extent to which patients were able to understand their clinicians and were comfortable asking questions and expressing opinions affected by room design. For all these domains, patients in both groups expressed near-perfect endorsement.

People-Room Interactions

This domain captured patients' experience of the way the room and its furnishings were positioned. Compared to 13 (39%) patients in the experimental room, only 6 (20%) patients in the standard room expressed any difficulty about knowing where to sit in the room ($P = 0.035$). Patients in both arms expressed similar comfort with the room and the space available to place belongings. Most striking was the difference in satisfaction—favoring the experimental room—that patients expressed about the location of the computer monitor (24 [75%] vs. 17 [59%], $P = 0.07$) and about their ability to look at the screen at any time (22 [73%] vs. 8 [28%], $P < 0.001$).

Interpersonal-Room Interactions

The space redesign did not affect the extent to which patients were satisfied with their personal space ($P = 0.88$); the distance between them and the clinician ($P = 0.73$); and the opportunity to make eye contact with the clinician ($P = 1.0$). However, the space had a major impact on the way the clinician related to the patient when us-

ing the computer. More patients in the experimental room than in the standard room reported that clinicians allowed them to review the medical record on the screen (22 [71%] vs. 13 [45%], $P = 0.012$); shared information on the computer screen (24 [80%] vs. 18 [60%], $P = 0.037$); and reviewed information on the Internet with them (13 [43%] vs. 7 [26%], $P = 0.010$). There was no difference, however, in the extent to which patients reported having conversations about the information on the monitor (22 [73%] vs. 21 [70%], $P = 0.26$).

Subgroup and Sensitivity Analyses

There was not enough power to assess for an interaction between room effects and age (< 70 or ≥ 70) or gender; in general, all results were similar to the overall results or trended in the same direction across age and gender subgroups. Appendix A includes the complete questionnaire used, and Appendix B includes the detailed distribution of results per questionnaire item.

Although this trial did not randomize by physician, the researchers performed a sensitivity analysis adjusting for possible clustering for individual physicians. The authors are not aware of an available software solution that would compute the required generalized estimating equations with a nominal logistic model and a binomial link. Thus, to account for clustering, they analyzed outcomes using generalized estimating equations with both normal (identity link) and gamma distributions (both inverse and log links). No changes in significance were identified with any of these models.

Discussion

Main Findings

Data indicate that redesigning the consultation room to accommodate the nature of modern outpatient care (i.e., increased patient involvement in information-intensive encounters) has a positive impact on the way patients experience the consultation, even in environments in which satisfaction with the standard consultation room is very high.

The experimental room was particularly successful at improving access to the computer display for patients and their care partners. Patients reported that physicians made greater use of electronic information (e.g., medical record data, radiological images, health information on the Internet) to explain treatments and make decisions. Notably, patients in both rooms endorsed to a similar extent the notion that they participated in conversations about information on the computer screen; however, patients in the experimental room were also able to see this information directly on the screen. This experience appears to have been reliably captured in the questionnaire, judging by the extent of interobserver agreement between patients and care partners. The ability to interact with the computer was an area of disagreement, mostly because care partners indicated greater levels of dissatisfaction than patients with lack of access to the computer screen in the standard room (because they were seated farther away from the screen than the patients).

Limitations and Strengths of This Study

This study has some important limitations worth bearing in mind. It was a small trial enrolling

a few general medicine physicians and a heterogeneous group of patients in one practice location, exposing them to the experimental room once (rather than over time), and measuring the impact of the experience with an ad hoc questionnaire. Some of the results may reflect novelty and could be fleeting. A potential threat to the reliability of the results is the average age of the participants. The median age of study participants was 69 years; this is in line with Mayo demographics, in which 67% of the patients are 50 years old and older (Brennan et al., 1998). On a larger scale, healthcare utilization in the United States by those more than 65 years old accounts for 46.4 visits to outpatient departments per 100 people, a higher rate than any other age group (except for infants under age 1), resulting in 16.5 million visits to outpatient clinics annually (Hing, Hall, & Xu, 2008). Patients more than age 65 make an additional 228.9 million visits to physician offices each year in the United States (Hing et al., 2008). Thus, the study sample reflects the overall trends in healthcare. However, the room was not designed for a specific group of patients and the results may not accurately reflect the way in which those from a younger generation might interact with it.

Another limitation of the study was that patients could not easily access the usual cues in the consultation room to determine where to sit, and physicians may have used the screen to a greater extent because of its new location in front of the patient. The method employed (patient and care partner survey) may have failed to capture subtle

benefits and downsides that may be perceived only through direct observation of the visit. To overcome this limitation and to understand in greater depth how the interaction differed across the rooms, a qualitative study of video recordings that took place in parallel with this trial is being conducted. The room may represent a good fit for the practice in which it was tested, so these results may not apply to other practice settings (e.g., low-complexity primary care practices) and other types of encounters (e.g., acute care encounters, surgical or pediatric consultations). That this study is the first of its kind and that the developers of the experimental room funded it (see acknowledgment at the end of the article) may offer alternative—yet unlikely—explanations for the positive findings.

These potential limitations must be considered in light of the strengths of the study. The researchers enrolled consecutive patients, all having agreed to participate. Also, the patient-clinician dyads were randomly assigned to each of the two rooms, while ensuring that patients and clinicians remained unaware of the purpose of the room redesign. Almost all patients completed study questionnaires. Also, care partners were used to assess the reliability of the experience captured in patient questionnaires. To this extent, while preliminary, the results appear to describe the different experiences patients had during encounters in each of the rooms validly and reliably. To the authors' knowledge, this is the first randomized trial that assesses the impact of two different consultation room designs.

The SIT in the Context of Available Evidence

Most studies of the impact of clinical space design on healthcare have focused on hospital rooms, measuring their effect on recovery from illness, the use of pain medication, and other measures of care (Devlin & Arneill, 2003; Ulrich, 1984; Ulrich, 1991). Few studies have focused on the clinical consultation or exam room in the outpatient setting (Frankel et al., 2005; Pearce, Trumble, Arnold, Dwan, & Phillips, 2008). There have been a number of studies examining the effect of the introduction of the computer into the exam room that did not consider the physical location of the computer monitor or the overall spatial arrangement of the consultation room (Als, 1997; Greatbatch, Luff, Heath, & Campion, 1993; Greatbatch et al., 1995; Makoul, Curry, & Tang, 2001; Ridsdale & Hudd, 1994).

There is, however, some important evidence that relates to the results of this study. For example, Greatbatch and colleagues, using video recordings of encounters in the United Kingdom, found that a computer in the office created disruptions in patient-physician interactions (Greatbatch et al., 1995; Greatbatch et al., 1993). They noted that the presence and location of computer equipment (screen, mouse, printer) competed with the patient for the physician's attention and hindered communication. They concluded that, to minimize this disruptive effect, the equipment and the office would need to be redesigned to be more mobile and offer flexible input options. Makoul and associates made similar observations, emphasizing that physicians must have direct access to the computer screen while maintaining adequate

eye contact with patients, who must be able to view the screen (Makoul et al., 2001). Further, Als (1997) and Ridsdale & Hudd (1994) have noted the conflict between patients' desire to see the screen and their belief that they are not allowed to, in part communicated by the position of the screen in the room (i.e., closer to and facing the clinician and away from the patient). A qualitative study by Frankel and associates (2005) provided the most compelling, detailed evidence linking design aspects of the consultation room in general and the computer in particular and their impact on the clinical interaction. Although a key finding of their study is that some clinicians were able to maintain adequate communication while using a computer in the office, they achieved this despite the physical placement of the computer in relation to the clinician and the patient. They considered the physical placement of the computer in the office "the most easily modifiable factor" (Frankel et al., 2005, p. 681), noting that this placement is usually driven by technical convenience (location of the wiring in the room) rather than evidence of its impact on the interaction. The findings of the SIT empirically support the inference that "physical placement of the computer in the exam room is critically important to communication during routine visits" (Frankel et al., 2005, p. 681).

Implications for Future Research and Practice

The literature seems to pay limited attention to overall space design, with almost none of the studies cited (with some exceptions, e.g., Frankel et al., 2005) presenting drawings or photographs to convey spatial arrangements. It is difficult to

make inferences about how the computer affected interaction and communication without having a better idea of where the computer was placed in the space and what the seating arrangements around it were.

Despite the relative frequency with which patients bring care partners to consultations (Main, Holcomb, Dickinson, & Crabtree, 2001; Wolff & Roter, 2008), the authors could not find studies that focused on the role that space design can play in enabling care partners to participate in these visits. Evidence of the important role of care partners in the visits does exist. In a previous study on family involvement in healthcare, the majority of patients (55%) reported that they prefer to have a friend or family member accompany them in the examination room (Wolff & Roter, 2008). Another study found that those who were accompanied by family or friends were more satisfied with their physician's technical and communication skills (Botelho, Lue, & Fiscella, 1996). In the same study, patients with care partners were more actively engaged in communication and conversation and rated physicians' interpersonal skills more highly than those who were unaccompanied (Botelho et al., 1996). The SIT has expanded that evidence by pointing out that these partners hold perceptions similar to those of patients, except when challenged to participate from a disadvantageous physical position (farther away from the clinician and the computer screen).

Technology and information needs in the consultation are changing quickly, challenging the skills of clinicians and patients to adapt their

workflows, and the design of the technology to adapt to the requirements of the modern clinical encounter. This encounter involves not only the active participation of clinicians, patients, and care partners, but also reviewing and sharing more information (e.g., clinical and laboratory data, radiological static and dynamic images), and completing more tasks (e.g., documentation and billing, medication reconciliation, shared decision making). Future work should seek to evaluate how new computer technologies (e.g., handheld devices) and software redesign (e.g., electronic medical record screens better suited to sharing with patients during consultation) as well as new workflows (e.g., using additional personnel to complete tasks during consultations) could further affect the design of the consultation room. The extent to which these findings can affect the design of e-consultations also is unclear, except to emphasize the need to address the communication needs of clinicians, patients, and care partners.

The authors think it is a worthwhile goal to improve the consultation experience. Additional funding and experiments in consultation room redesign offer a new frontier in ongoing efforts to enhance the value of healthcare. Such experiments could help more rigorously to identify design features that would lead to evidence-based environments best suited to promote communication, build partnership, and support effective clinical decision making. The authors believe that considering the experience as a whole can better integrate research and innovation efforts that heretofore have remained in silos, such as those

focused on the organization of health services, electronic medical records, computer interfaces, decision support tools, and healthcare furniture.

Conclusion

In summary, in a randomized trial the study determined that the design of a consultation room affects the clinical encounter. In particular, ready access to the computer screen enhanced patients' experience of information sharing using electronic medical records and the Internet.

References

- Als, A. (1997). The desk-top computer as a magic box: Patterns of behaviour connected with the desk-top computer; GPs and patients' perceptions. *Family Practice*, 14(1), 17–23.
- Botelho, R. J., Lue, B. H., & Fiscella, K. (1996). Family involvement in routine health care: A survey of patients' behaviors and preferences. *Journal of Family Practice*, 42(6), 572–576.
- Brennan, M. D., Miner, K. M., & Rizza, R. A. (1998). The Mayo Clinic. *The Journal of Clinical Endocrinology & Metabolism*, 83(10), 3427–3434.
- Devlin, A., & Arneill, B. A. (2003). Health care environments and patient outcomes. *Environment and Behavior*, 35(5), 665–694.
- Emanuel, E., & Emanuel, L. L. (2000). Four models of the physician-patient relationship. In E. A. Boetzkes (Ed.), *Readings in health care ethics* (pp. 39–49). New York: Broadview Press.
- Frankel, R., Altschuler, A., George, S., Kinsman, S., Jimison, H., Robertson, N. R., et al. (2005). Effects of exam-room computing on clinician-patient communication: A longitudinal qualitative study. *Journal of General Internal Medicine*, 20(8), 677–682.
- Garrison, G., Bernard, M. E., & Rasmussen, N. H. (2002). 21st-century health care: The effect of computer use by physicians on patient satisfaction at a family medicine clinic. *Family Medicine*, 34(5), 362–368.
- Greatbatch, D., Heath, C., Campion, P., & Luff, P. (1995). How do desk-top computers affect the doctor-patient interaction? *Family Practice*, 12(1), 32–36.
- Greatbatch, D., Luff, P., Heath, C., & Campion, P. (1993). Interpersonal communication and human-computer interaction: An examination of the use of computers in medical consultations. *Interacting With Computers*, 5(2), 193–216.
- Hing, E., Hall, M. J., & Xu, J. (2008). National hospital ambulatory medical care survey: 2006 outpatient department summary. *National Health Statistics Report*, 4, 1–31.
- Institute of Medicine. (2001). *Crossing the quality chasm: A new health system for the 21st century in America*. Washington, DC: National Academies Press.
- Kaba, R., & Sooriakuran, P. (2007). The evolution of the doctor-patient relationship. *International Journal of Surgery*, 5(1), 57–65.
- Landerfeld, C., Palmer, R. M., Kresevic, D. M., Fortinsky, R. H., & Kowal, J. (1995). A randomized trial of care in a hospital medical unit especially designed to improve the functional outcomes of acutely ill older patients. *New England Journal of Medicine*, 332(20), 1338–1344.
- Leisen, B., & Hyman, M. R. (2001). An improved scale for assessing patient's trust in their physician. *Health Marketing Quarterly*, 19(1), 23–42.
- Main, D. S., Holcomb, S., Dickinson, P., & Crabtree, B. F. (2001). The effect of families on the process of outpatient visits in family practice. *Journal of Family Practice*, 50(10), 888.
- Makoul, G., Curry, R., & Tang, P. (2001). The use of electronic medical records: Communication patterns in outpatient encounters. *Journal of the American Medical Informatics Association*, 8(6), 610–615.
- Malkin, J. (2002). *Medical and dental space planning: A comprehensive guide to design, equipment, and clinical procedures* (3rd ed.). New York: John Wiley & Sons.
- Malkin, J. (2008). *A visual reference for evidence-based design*. Concord, CA: The Center for Health Design.
- Martin, D., Diehr, P., Conrad, D. A., Davis, J. H., Leickly, R., & Perrin, E. B. (1998). Randomized trial of a patient-centered hospital unit. *Patient Education and Counseling*, 34(2), 125–133.
- Pearce, C., Dwan, K., Arnold, M., Phillips, C., & Trumble, S. (2009). Doctor, patient and computer—A framework, for the new consultation. *International Journal of Medical Informatics*, 78(1), 32–38.
- Pearce, C., Trumble, S., Arnold, M., Dwan, K., & Phillips, C. (2008). Computers in the new consultation: Within the first five minutes. *Family Practice*, 25(3), 202–208.
- Ridsdale, L., & Hudd, S. (1994). Computers in the consultation: The patient's view. *British Journal of General Practice*, 44(385), 367–369.
- Szasz, T., & Hollender, M. H. (1956). A contribution to the philosophy of medicine. *Archives of Internal Medicine*, XCVII(5), 585–592.
- Thom, D., Ribisl, K., Stewart, A., & Luke, D. A. (1999). Further validation and reliability testing of the Trust in Physician Scale. The Stanford Trust Study Physicians. *Medical Care*, 37(5), 510–517.
- Ulrich, R. (1984). View through a window may influence recovery from surgery. *Science*, 224(4647), 420–421.
- Ulrich, R. (1991). Effects of interior design on wellness: Theory and recent scientific research. *Journal of Healthcare Interior Design*, 3, 97–109.
- Veterans Health Administration. (1995). *Ambulatory Care (Hospital Based) VA Design Guide*. Washington, DC: Department of Veterans Affairs.
- Webster, G. (1989). *Final report on the patient satisfaction questionnaire project*. Philadelphia, PA: American Board of Internal Medicine Committee on Evaluation of Clinical Competence.
- Wolff, J. L., & Roter, D. L. (2008). Hidden in plain sight: Medical visit companions as a resource for vulnerable older adults. *Archives of Internal Medicine*, 168(13), 1409–1415.