



# Evidence-Based Hospital Design Can Reduce Stress and Improve Outcomes for Patients and Caregivers

Developing community-based tools to increase the use of evidence-based design in hospital construction

## SUMMARY

From 2005 to 2008, researchers at the [Center for Health Design](#) and the [Georgia Institute of Technology's College of Architecture](#) worked, individually and in collaboration, to advance the emerging field of evidence-based design. In that approach, health care executives and design professionals use research showing how to reduce stress and improve outcomes for patients and caregivers when designing hospitals.

## Key Results

In reports on four grants, project staff from the Center for Health Design and Georgia Tech cited the following key results. Staff:

- Laid the foundation for an evidence-based design accreditation and certification program, to accredit design professionals who understand how to use an evidence-based design process in building hospitals.
- Developed the [RIPPLE database and Web site](#) to provide information on evidence-based design, and the strategies organizations have used to build hospitals with a safer, healthier physical environment.
- Produced a series of publications on evidence-based design, including:
  - Eight papers targeted to health care executives, design professionals, researchers and students, available as online reports and articles in professional journals.
  - *A Visual Reference for Evidence-Based Design*, a 350-page book with dozens of case studies on evidence-based design supported by in-depth research, including more than 300 full-color annotated photographs and architectural plans.
  - An update of a 2004 literature review on evidence-based design.
  - A report outlining a program of hospital tours, to enable health care executives to learn about evidence-based hospital design and construction.

## Funding

The Robert Wood Johnson Foundation (RWJF) supported this project through four grants totaling \$1,639,414.

## THE PROBLEM

In 2004 the United States was facing one of the largest hospital building booms in its history. Owing to aging 1970s-era hospitals, population shifts, the graying of the baby-boom generation and the advent of new technologies, the nation was on course to spend more than \$16 billion on hospital construction that year, projected in 2009 to rise to more than \$50 billion annually by the end of the decade (Babwin D, *Hospitals & Health Networks*, 76(3): 48–54, 2002).

Also in 2004, the Center for Health Design engaged researchers from Texas A&M University and Georgia Institute of Technology and published an RWJF-funded [literature review](#) of more than 600 studies on the relationship between hospital design and staff and patient outcomes. The researchers found that single-bed rooms, lower noise levels, ergonomic designs, and better ventilation, lighting and layout can reduce medical errors, lower stress levels among staff and patients, and promote faster healing with fewer infections, less pain and less reliance on drugs.

However, health care executives were often uninformed about how a hospital's physical design can affect patients and staff. The emerging field of evidence-based design—the process of basing design decisions on research showing how to make hospitals safer, quieter, less stressful and truly healing environments—also lacked standards for qualifying professionals trained to create such facilities.

## CONTEXT

RWJF is committed to improving the quality of health care for all Americans. RWJF's Quality/Equality approach has several major components, each representing significant investments and multiple partners. The components are:

***Aligning Forces for Quality.*** In 2007 (the year the grant described in this report was issued), *Aligning Forces for Quality* was the core strategy of the Foundation's long-standing commitment to improve the quality of health care that Americans receive. Through this national initiative, RWJF is working to lift the overall quality of health and health care in targeted communities across the country.

**Transparency.** While performance measurement and public reporting in quality have become more common, there needs to be far greater collaboration at the federal and local levels to standardize measurement and reporting activities and create measures that are more meaningful to patients, providers and others.

**Measuring Progress.** The Foundation devotes a substantial portion of its portfolio to research, tracking and evaluation. Some of this work involves:

- Using its existing research investments to assess more purposefully progress in the communities engaged in *Aligning Forces for Quality*.
- Issuing targeted solicitations to the field to garner ideas for new interventions and tools to help spur the pace of quality change and transformation.

**Communications.** RWJF is designing and executing communications activities and support at multiple levels.

- Local communities, for example, might require different types of targeted assistance with messaging, advocacy and engagement.
- At the national level, RWJF will actively share the stories and lessons learned from its regional work.

## THE PROJECT

Under four RWJF grants, researchers at the Center for Health Design and the Georgia Institute of Technology College of Architecture worked, individually and together, to advance the emerging field of evidence-based design. Practitioners of evidence-based design, including hospital executives and design professionals, base decisions regarding hospitals' physical environment on research showing how to reduce stress and improve outcomes for patients and caregivers.

### Developing an Evidence-Based Design Accreditation and Certification Program

Under this grant (ID# 053774), staff from the Center for Health Design defined an evidence-based design process, and used it to develop a program for accrediting design professionals who understand that approach.

As a first step, project staff appointed a 20-member task force composed of architects, interior designers, health care executives and researchers. (For a complete list of task force members, see [Appendix 1.](#))

The task force held weekly conference calls for the first year, and then five meetings between June 2006 and October 2007. At the meetings, task force members:

- Defined and documented the knowledge that design professionals would need to become certified.
- Created questions designed to test individuals' knowledge of evidence-based design, assisted by psychometrics subcontractor [Applied Measurement Professionals](#).

Staff at the Center for Health Design initially subcontracted with [Embanet](#), an educational services provider, to create study guides and online courses for the certification program. As the project evolved, center staff received funding from [Nurture](#), a manufacturer of furniture for health care environments, to develop those components. The contract with Embanet was dissolved and the center staff managed the development and production of the study materials in-house.

### **Creating Tools to Facilitate Evidence-Based Hospital Design**

As they developed the certification program, staff at the Center for Health Design received a second RWJF grant (Grant ID# 055450) to create tools and resources to help hospital executives, design professionals, researchers and students better understand and use evidence-based design. The center planned to develop the following tools:

- Accessible yet well-documented papers on evidence-based design.
- A guidebook to serve as the "gold standard" on evidence-based design.
- A speakers' bureau of people who could knowledgeably discuss evidence-based design with specific audiences.
- A Web site, Healthcare Design Web, documenting best practices and case studies in evidence-based design, including design plans, photos, text and data from the center's architectural and design partners.

The center never launched the site—created with subcontractor Georgia Institute of Technology—because those firms were reluctant to share proprietary information. However, in 2008 project staff began working with the [Global Health and Safety Initiative](#) to create a similar Web site that allows users to search for information on evidence-based design. The Global Health and Safety Initiative is a collaboration of major health care systems and nonprofit groups seeking to transform the way hospitals are designed and run.

For more information, see [Results](#).

### **Planning Site Visits to Promote Evidence-Based Design**

Under this grant (Grant ID# 055899), researchers at Georgia Institute of Technology's School of Architecture developed a plan for a national group of site visits and seminars to bring hospital decision-makers and other staff, as well as facility design professionals, to exemplary hospitals that used evidence-based design and embodied positive organizational culture.

Tours of other facilities can be a vital element in the hospital design process, as they are one of the few times when health care executives can focus on best practices. However,

such tours often fall far short of their potential because sites are poorly chosen, tour leaders lack key information and the tours do not include follow-up, according to the Georgia Tech researchers.

To develop a better program, they conducted interviews and focus groups with 80 hospital administrators, chief nursing officers and vice presidents of health care facilities (see [Appendix 2](#) for details). The researchers sought to answer several questions:

- Are there a need and a demand for evidence-based and collaborative learning-based hospital tours?
- If so, how could such a program best help participants, and also influence hospital executives who cannot participate in the tours directly?
- What are practical models for sustaining such a program?

The interviews and focus groups revealed a need and a demand for tours that:

- Identified sites that exemplify best practices.
- Documented the business design, health care models and outcomes of host sites, and provided access to experienced project teams and knowledgeable peers.
- Provided evidence from research on hospital design.
- Offered materials and learning experiences on evidence-based design for executives who could not participate directly.

The Georgia Tech researchers used these findings to develop a model for improved tours (see [Results](#)).

## **Creating Community-Based Tools to Increase the Use of Evidence-Based Design**

As the Georgia Tech researchers were developing the hospital tour program, they also received RWJF funding to produce tools and white papers on evidence-based design targeting senior hospital officials, including CEOs, chief financial officers and chief nursing officers. Key activities included:

- Recruiting champions of evidence-based design to participate in work groups that would document best practices and develop a research agenda. The groups, which met via teleconferencing and in person, were:
  - Research Applications for Designers
  - Developing an Evidence-Based Design Research Agenda
  - Emergency Environments

To help the work groups develop a research agenda, project staff convened a workshop called Evidence-Based Design 2.0 in Falls Church, Va., in March 2008.

- Working with researchers at the Department of Architecture at Texas A&M University to update the 2004 RWJF-funded literature review on evidence-based design.
- Creating white papers targeted to health care decision-makers on the role of evidence-based design in lowering costs and improving safety, efficiency and satisfaction among hospital patients and employees.

The Georgia Tech team subcontracted underlying research on the papers to a team at Texas A&M as well as leading experts in the field, and subcontracted with the Center for Health Design to publish the papers, create a special Web site landing page to post them, produce on-demand webinars, and promote the papers and webinars.

- Creating a Web site to support a learning community focused on evidence-based design.

## Communications

The Center for Health Design gave presentations on the certification program for design professionals at national and regional industry conferences, such as Healthcare Design .07 and .08, and the 2008 annual meeting of the American College of Healthcare Executives. The center also published an article on the program in *Healthcare Design* magazine.

The center distributed a book and white papers on evidence-based design at national and regional conferences, and sent press releases and email messages on those publications to health care executives and design professionals.

The center dedicated a section of its [Web site](#)—Healthcare Leadership: Evidence-Based Design Resources for Healthcare Executives—to the white papers, multimedia webinars (online seminars) and other resources on evidence-based design. Project staff also created two new Web sites (see [Results](#)).

## Other Funding

Additional funding included \$120,000 from Kaiser Permanente to the Center for Health Design to develop the RIPPLE Web site, which allows users to search for information on evidence-based design (see [Results](#)). Georgia Tech received significant in-kind support for the Evidence-Based Design 2.0 Workshop.

For a complete list of other funders, see [Appendix 3](#).

## RESULTS

### Grant ID#s 053774 and 055450

In reports to RWJF, staff from the Center for Health Design cited the following results from its two grants. Project staff:

- **Laid the foundation for an evidence-based design accreditation and certification program.** Results included:
  - Producing *Evidence-Based Design Accreditation and Certification Program*, a 100-page report outlining the elements of such a program, and the knowledge professionals would need to become accredited in evidence-based hospital design.
  - Creating a certification exam with 100 questions, winnowed from 200 potential questions with the help of psychometrics subcontractor [Applied Measurement Professionals](#).
  - Producing three study guides and a handbook for certification candidates.

The process of developing these components was much more complex than staff had anticipated, so the center did not launch the exam until April 2009. For details on the program as implemented, see [Afterward](#). For more information on the publications, see the [Bibliography](#).

- **Published four issue papers on evidence-based design by center staff and board members.** The papers included:
  - *Sound Control for Improved Outcomes in Healthcare Settings*, available [online](#).
  - *The Role of the Physical and Social Environment in Promoting Health, Safety, and Effectiveness in the Healthcare Workplace*, available [online](#).
  - *The Impact of the Environment on Infections in Healthcare Facilities*, available [online](#).
  - *The Impact of Light on Outcomes in Healthcare Settings*, available [online](#).

The Center for Health Design posted the papers on its Web site, and users have downloaded more than 10,000 copies. Expanded versions of three of the papers also appeared in *Health Environments Research and Design Journal*. See the [Bibliography](#) for details.

- **Produced *A Visual Reference for Evidence-Based Design*, a 350-page book by center board member Jain Malkin.** The book includes:
  - Dozens of case studies on evidence-based design supported by in-depth research, including more than 300 full-color annotated photographs and architectural plans.
  - Best practices for patient-centered hospital design and construction.

- A step-by-step guide to creating a research agenda for evidence-based design.

Center staff printed 3,000 copies of the book, sold more than 800, and distributed more than 100 free copies at health care conferences, along with 540 printed and bound compilations of the four papers. See the [Bibliography](#) for details.

- **Made some 20 presentations on evidence-based design at national and regional conferences, and posted the presentations on the center Web site, as part of the effort to launch a speakers' bureau.**

Project staff decided to provide speakers as opportunities arose rather than create a full-scale bureau, as the center lacked the funds to create and market the bureau and hire full-time staff to administer it.

- **Developed the [RIPPLE database and Web site](#), which allows users to search for information on evidence-based design, and learn about strategies organizations have used to design their hospitals.** The site includes three major functions:

- The Learn track, which provides information on the strategies organizations have used to design their hospitals, as well as design recommendations from the center's partners.
- The Compare track, still under development, which will allow users to compare the design decisions of various hospitals and their outcomes.
- The Act track, which allows users to discuss information gleaned from the database and share experiences in applying evidence-based design.

Center staff launched a beta site in July 2008, and 321 individuals had registered by March 2009.

### **Grant ID#s 055899 and 058197**

In reports to RWJF, researchers at the Georgia Institute of Technology's College of Architecture cited the following results from those two grants. Project staff:

- **Produced *Hospitals for the 21st Century: Planning Site Visits to Promote Evidence-Based Design*, a report that proposes a model for enhanced hospital design tours.** The model includes:

- Developing carefully selected regional tour sites, and ensuring that a "faculty" facilitator conducts them.
- Providing information on evidence-based design on an affiliated Web site.
- Creating an online knowledge community.
- Building an aggressive campaign to publicize the tours.

See the [Bibliography](#) for details on the report.

The Emergency Environments work group formed as part of the project began a pilot study of patients' impressions of waiting rooms in the Emergency Medicine Department of the University of Kansas.

- **Published an updated version of the 2004 literature review on evidence-based design in the *Spring 2008 issue of Health Environments Research and Design Journal*** (subscriber password required). The update includes information on more than 1,200 additional studies.
- **Produced four white papers on evidence-based design targeted to health care decision-makers, posted on the Center for Health Design Web site:**
  - *The Business Case for Building Better Pediatric Facilities*, available [online](#).
  - *Maximizing the Impact of Nursing Care Quality: A Closer Look at the Hospital Work Environment and the Nurse's Impact on Patient-Care Quality*, available [online](#).
  - *Culture Change and Facility Design: A Model for Joint Optimization*, available [online](#).
  - *Implementing Healthcare Excellence: The Vital Role of the CEO in Evidence-Based Design*, available [online](#).

One of the papers appeared as a chapter in two books, and three of the papers were published in *Health Environments Research and Design Journal*. See the [Bibliography](#) for details.

- **Created the [Healthcare Design Community Portal](#), which allows members of the evidence-based design community to share knowledge and collaborate.**

Recruiting professionals to participate in the site proved more difficult than staff anticipated. For more on these challenges, see [Lessons Learned](#).

## LESSONS LEARNED

1. **Nonprofits should establish a clear planning and reporting process when working with universities.** The Center for Health Design faced challenges in collaborating with Georgia Tech researchers on the HealthCare Design Web site. Universities often lack the latest software for creating sophisticated Web-based tools, according to Project Director Sara Marberry, executive director of the center.

Nonprofits also often work at the pace of for-profit businesses, while academic teams may view joint projects as research with no firm deadline, she says. She recommends creating a timetable for deliverables and consequences for not meeting deadlines. (Project Director/Marberry)

2. **Engage prominent organizations when building online communities.** Convincing key individuals in diverse fields to help create the Healthcare Design Community

Portal proved difficult. Busy professionals are often reluctant to devote time and energy to creating a community that, at least in the early stages, has little to offer them, according to Georgia Tech Project Director Craig Zimring.

Enlisting organizations as well as individuals to help launch such a portal may prove more effective. (Project Director/Zimring)

## **AFTERWARD**

With \$350,000 in funding from Nurture, the Center for Health Design continued to develop the Evidence-Based Design Accreditation and Certification program.

After securing testing facilities in the United States and Europe, the center held the first exam on April 1, 2009. As of November 2009, 162 people were accredited in five countries, and some 1,900 people had signed up to receive weekly e-mails. Further plans for the accreditation program included:

- Forming an advisory council.
- Developing more educational modules.
- Expanding the program to include long-term care and senior living facilities as well as hospitals, and to certify buildings as well as design professionals.
- Collaborating with the Joint Commission, the chief organization accrediting U.S. hospitals.
- Ensuring the program's financial sustainability by charging testing fees and selling study materials.

With a \$149,000 grant from the U.S. Green Buildings Council, the Center for Health Design added both content and tools to the RIPPLE Web site. Researchers from the Georgia Institute of Technology sought funding to continue building the Healthcare Design Community Portal.

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## APPENDIX 1

### Members of the Task Force on Evidence-Based Design Accreditation and Certification

*(Current as of the time of the grant; provided by the grantee organization; not verified by RWJF.)*

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## APPENDIX 2

### Interviews and Focus Groups on Enhanced Hospital Tours

To gain insight into the need for better hospital design tours, Georgia Tech researchers and market research subcontractor [Shugoll Research](#) conducted interviews and focus groups with 80 health care and design professionals. These efforts included:

- Five focus groups:
  - Two with hospital administrators, one conducted by the Georgia Tech research team in April 2006 in Milwaukee, and the other conducted by Shugoll Research in October 2006 by telephone.
  - Two with chief nursing officers/nursing administrators, one conducted by the Georgia Tech research team in April 2006 in Milwaukee, and the other by Shugoll Research in October 2006 by telephone.
  - One with vice presidents of facilities, conducted by Shugoll Research in October 2006 by telephone.
- Interviews with hospital executives, mid-level nursing managers and architects.

## APPENDIX 3

### Additional Funding

*(Current as of the time of the grant; provided by the grantee organization; not verified by RWJF.)*

The Center for Health Design received additional funding to develop the RIPPLE Web site from the following organizations:

- Kaiser Community Foundation: \$24,700
- Kaiser Permanente: \$155,000
- Global Health and Safety Initiative: \$35,000

The School of Architecture at Georgia Institute of Technology received additional funding and in-kind services for the Evidence-Based Design 2.0 Workshop from the following organizations:

- Military Health Systems
- Steelcase
- Martin, Blanck & Associates
- Carter-Burgess
- Gresham Smith and Partners
- Ellerbe Becket

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