

# New synergies between research, practice, and education for health and wellbeing outcomes in the built environment

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## ABSTRACT

Traditionally, health-related design research has been carried out mostly in academic or research settings, while designing real-world built environments has been the domain of professional practice. Conventional roles of architects, however, are undergoing significant change with new research undertakings in professional practice (Hensel and Nilsson 2019). Recent years have seen the emergence of new human-centric research programs and initiatives at architecture firms on a global scale.

Practitioners, educators, and researchers now increasingly use evidence-based designs to create spaces that have healthy outcomes for people. The AIA-ACSA Design and Health Consortium, for example, has created a multi-disciplinary network to translate design and health research into practice for professionals, policy makers, and the public.

This paper examines the transformational impact of health research in architectural practice. Through a systematic review of health and built environment research carried out by design firms, the paper includes the study of different sources of information such as peer-reviewed publications, conference proceedings, white papers, webpages, and smartphone applications developed by these firms. A mapping exercise categorizes these studies by different typologies and research goals. It analyzes the research methods and findings presented in these sources and discusses real-world implications for design, professional practice, and future research.

Finally, this research highlights gaps that still exist in the field of design and health. To bridge these gaps and create new synergies between research, practice, and education a new model for research and design methodologies in health and the built environment called LEAPP is proposed and described in this paper.

**KEYWORDS:** Architects, Health, Built Environment, Design Implications, Professional Practice

## INTRODUCTION

Traditionally, health-related design research has been carried out mostly in academic or research settings, while designing real-world built environments has been the domain of professional practice (Hensel and Nilson 2019). Conventional roles of architects, however, are undergoing significant change with new research undertakings in professional practice. Recent years have seen the emergence of new human-centric research programs and initiatives at architecture firms on a global scale.

Design practitioners often refer to their design processes as being human-centered. In recent years, their approach to design solutions and design-making processes in their publications, websites, whitepapers, and advertisements have been frequently described as being human-centric and evidence-based. Indeed, practitioners now increasingly use evidence-based design recommendations suggested by educators and researchers to study and create spaces that have healthy outcomes for people. The AIA-ACSA Design and Health Consortium, for example, has created a multi-disciplinary network to translate design and health research into practice for professionals, policy makers, and the public (Design & Health Consortium).

Evidence-based design is design-making that is grounded in research and tested in practice (van Aken and Romme 2012). The validity of evidence-based design principles depends on how well they are connected to the body of scientific knowledge and the extent to which the principles have been tested in practice. The notion of ‘testing’ refers to the reviews of the building or spaces from user experience, critics reviews, and performance assessment. Evidence-based design is meant to develop prescriptive knowledge and solutions that serve to improve professional practice (van Aken and Romme 2012).

Human-centered designs for spaces are solutions that emerge from involving the users of that space (Crandal, Michelle 2019). A myriad of design and design-related fields now advocate this approach. These include usability engineering, user-centered design, participatory design, and experience-based design (Johnson, Slavo and Zoetewey 2008). Architectural discourse ideally, is inspired by users’ needs, and showcases skills that can address those needs. Design research methodologies serve as tools and conceptual frameworks to develop real-world solutions.

Human-centric and evidence-based design processes identify specific problems and acknowledge their conditions, locations, target populations, and other variables. For this study, the sources that were collected and analyzed, share a focus on health research in architectural practice and involve methods that address specific space typologies. Every design firm studied comes with its own variation of these methods, processes, and outcomes.

In this study, we connect professional practice in the field of design and health by firms to the identification of any evidence-based and human-centered research methods that they may have used. The goal is to reveal the influence, outcomes, and limitations of design and health related research conducted by design firms. Importantly, it also highlights the gap in the documentation of actual built projects versus the documentation of their research and design processes by firms. Several methodologies and mechanisms of their evidence-based and human-centered processes or practices, therefore, are invisible to educators and researchers in academia, and industry colleagues. The research knowledge that is presumably developed for problem-solving and practice, therefore, becomes limited in its influence in the field of design and health if it is not documented and published.

## 1.0 METHODOLOGY

### 1.1. APPROACH

The research methodology consists of a systematic content analysis and mapping exercise of peer-reviewed publications, conference proceedings, white papers, websites, and smartphone applications created by professional design firms. These sources of information were scanned for scientific research and evidence-based outcomes in the field of design and health. A conceptual map was then created to identify and categorize the transformational impact of health-related research in architectural practice, and identify its gaps. Solutions are proposed thereafter, to create new and effective synergies between research, practice, and education.

### 1.2. EXAMINING THE ROLE OF HEALTH RESEARCH IN ARCHITECTURE PRACTICE

58 architectural design firms were identified after running a web search for practices or practitioners that focused on design and health research or projects or both, as part of their work portfolio. The selection of these firms was not restricted to any particular geographical area or region; this study, therefore, is international in scope.

An initial review of design firms’ websites led to the following questions: How are design practitioners aware of concerns related to health and the built environment? What is their approach to solving problems in this field? What are their sources of information for decision-making which ultimately leads to design solutions? And importantly, how are these research and design methodologies made available publicly – to peers in the industry, scholars and educators in the field, and other stakeholders? The sources of information that were checked for included but were not limited to, news releases, popular press, academic or peer reviewed or scholarly articles, conferences, white papers, or a combination of any of these venues.

The inquiries led to a systematic content analysis and statistical modeling method known as topic modeling which was used to collect and analyze different elements of the data. This method was followed by the development of the conceptual mapping and frameworks to describe how design research methods are used by the firms in the field of health and the built environment, their impact, and their gaps.

### 1.3. TOPIC MODELING

The topic modeling study of the 58 sources includes keyword identification, frequency analyses, and Pearson correlations. The keyword identification process consists of finding and sorting keywords or key phrases into different themes within the sources analyzed. The results were annotated using a controlled tagging process in the computer program Hypothes.is.<sup>1</sup> The annotations revealed the most frequently used words or keywords that related to each theme. These results were then analyzed to answer the questions which were discussed earlier. Four main, recurring themes were identified and used to group and organize keywords and text as follows:

1. Problem awareness: This theme included an awareness of issues and concerns related to health, wellness, medical or health facilities, or medical or health treatment in the built environment.
2. Design firm's culture or values: This included all the references to the firms' mission, vision, featured projects, abstracts, and design project highlights.
3. Sources of background information: This theme includes references to previous experiences, motivations, client's requirements, trends, common sense design guidelines, research, news or economic benefits.
4. Design and research results: This included the documentation of all built projects, publications or references to publications, posted data, references to conference presentations, white papers, news, applications, etc.

The text connected to each theme in Hipoyhes.is was further analyzed to understand its context or how it was referred to in the source. The frequency analysis involved exporting the meta-data from Hipoyhes.is and sorting out the information by the focus area as described by the firms, the potential research areas based on their expertise, and the use of the products that they offer. Once this was completed, a Pearson correlation was applied to the datasets to find any significant associations between data sets and measure their strength.

## 2.0. RESULTS

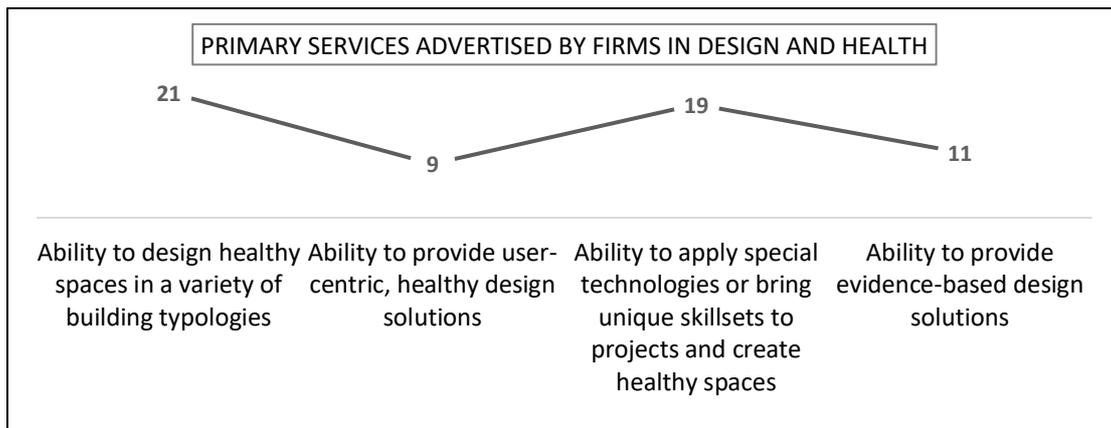
The search for architecture firms with any linkages to health-related work resulted in 58 different national (based in the United States) and international firms. The results of the content analysis and topic modeling showed findings related to the primary and secondary areas of focus of their work, and how this was highlighted in websites, publications or other means to attract the viewers' attention.

### 2.1. PRIMARY THEMES IN DESIGN AND HEALTH PRACTICE

21 firms were found to have building typology as primary focus, i.e. they claim to have expertise in designing healthy environments for a variety of different building types. Nine firms mention customized user and demand-based services in any building type. 19 firms emphasize the use of special technology or a special skillset to solve unique design challenges to create healthy solutions for spaces. 11 firms describe their design focus as evidence-based. 17 firms have more than one area of focus: two link the building type with user needs or user-experience, three link a special technology or skillset to meeting user needs, eight link special technologies or skillsets with evidence-based design outcomes, two link designing different healthy building types to the use of special technologies or skillsets, and two link the users, skillsets, and evidence-based designs together. Figure 1 shows the number of architecture firms sorted by how they advertised their strengths or areas of primary focus in design and health.

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<sup>1</sup> <https://web.hypothes.is>



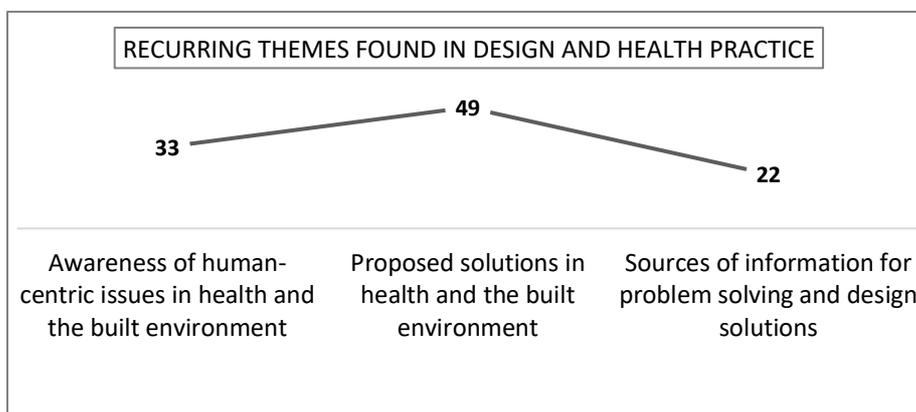
**Figure 1:** Number of firms sorted by their advertised primary areas of focus or strengths in the field of design and health. Source: Author.

The definitions of evidence-based practice and human-centric approaches by design firms were found to vary, but were mostly pragmatic and related to real-world projects. In one instance, evidence-based is described as ‘a way to validate the design methods and architecture practice that incorporates de learning from experimental/empirical experimentation during their own client-architecture relationship, sometimes based in field-related documents of various sources’. Another firm described a human-centric approach as ‘a consumer/client driven process that attend the specific needs prioritizing health, wellness, harmony, and the environment’.

## 2.2. RECURRING THEMES IN DESIGN AND HEALTH PRACTICE

The data extracted by the controlled tagging tool showed three main tendencies by firms in the field of design and health: 1) their main area of focus of the architecture practice within the field of design and health, 2) an awareness of existing problems or concerns related to human factors and the associated areas of their existing or potential research expertise, and 3) the proposed solutions, outcomes or products of their work. An analysis of 60 different references or descriptions as to what the firms defined as the main focus of their architecture practice showed that most firms preferred writing about their general expertise and specialties, while fewer showed an awareness of issues and concerns in health and the built environment or mentioned the sources of their research or even inspiration, and very few published the outcomes of their research.

The most frequent theme was the one for proposed solutions which showed 49 keywords or text references, followed by the 33 references to the awareness of a problem to be solved. Lastly, there are 22 references to a source or multiple sources of information or evidence that led to a design solution. Quite often, however, design solutions and built projects were described without discussing problems, issues, client or user needs first. The results of these recurring theme frequencies are shown in figure 2.



**Figure 2:** Frequencies of recurring themes found in design and health practice. Source: Author.

The results of the Pearson correlation are shown in Table 1. They revealed an insignificant association between *problem awareness* and *proposed solutions* (-0.25) which indicates that firms in design and health are unlikely to link *proposed solutions* with *problems, issues, or concerns*. This may also indicate that they did not follow any specific research methodology while working towards design outcomes or if they did, then they did not document or describe in any way. Similarly, the correlation between *proposed solutions* and *sources of information* was weak or insignificant (0.0029). There was also found to be no association between *problem awareness* and *sources of information*. Further, only ten firms mentioned three of these themes in their descriptions, 24 use two themes, and 26 only mentioned one themes.

Themes	Results of Pearson correlation	
Problem awareness & Proposed solutions	-0.26	insignificant
Proposed solutions & Sources of information	0.00	insignificant
Problem awareness & Sources of information	-0.01	insignificant

Table 1: Results of the Pearson correlation test between different themes in design and theme. Source: Author.

### 2.3. SPECIFIC RESEARCH AREAS IN DESIGN AND HEALTH

The 58 architecture firms studied mentioned or referred to having an expertise in 73 different research areas in total. These 73 existing or potential research areas were derived by reviewing all the keywords or text from the content analysis and topic modeling exercises described earlier. The following primary fields of research expertise and knowledge areas were found in the analysis of firms of design and health: *health* with 35 references, *environment* with 13, *building technology or materials* with 17, *special talent or services offered or skillsets* with 16, particular *research methods or approach* with 50, and *economic benefits* with three references. These results are also shown in figure 3.

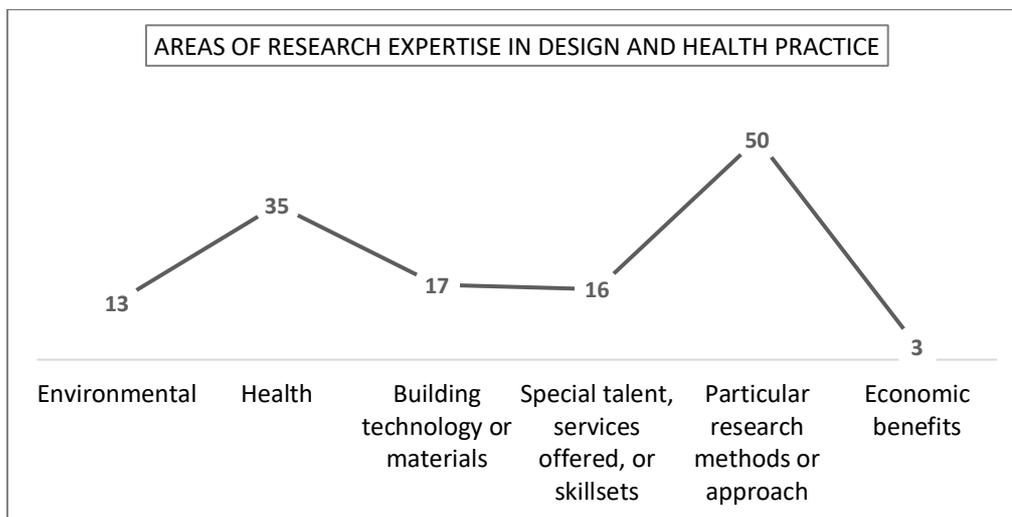


Figure 3: Frequencies of different areas of research expertise in design and health practice. Source: Author.

Since *particular research methods or approach* were found to be most frequently mentioned, another Pearson correlation was run to compare it with *health*. The relationship was found to insignificant as well, as shown in Table 2 below. Two firms claimed to have four research areas of expertise in design and health, while eight firms mentioned three research areas each. 40 firms mentioned two research areas each, and 23 claimed to have one research area of expertise. In all 58 cases, these existing or potential areas of research were found within the overall description of the architecture practice and not on another specific webpage, portfolio, or another document or part of the website.

Themes	Results of Pearson correlation	
Health & Particular research methods or approach	-0.26	insignificant

Table 2: Results of Pearson correlation between health and particular research methods or approach by firms in design and health. Source: Author.

## 2.4 DOCUMENTING OR ADVERTISING THE WORK

The results of the frequency analysis shown in figure 4 reveal that 81 firms use their *project portfolios* to showcase their expertise, followed by 27 references to the use of *newsletters, reports, or white papers*, 23 to *magazines*, 20 to *news releases*, and 19 to *scholarly journal articles*. *Conferences or blogs* were found to be significantly less used in the field by firms as a way to advertise, present, or document their work.

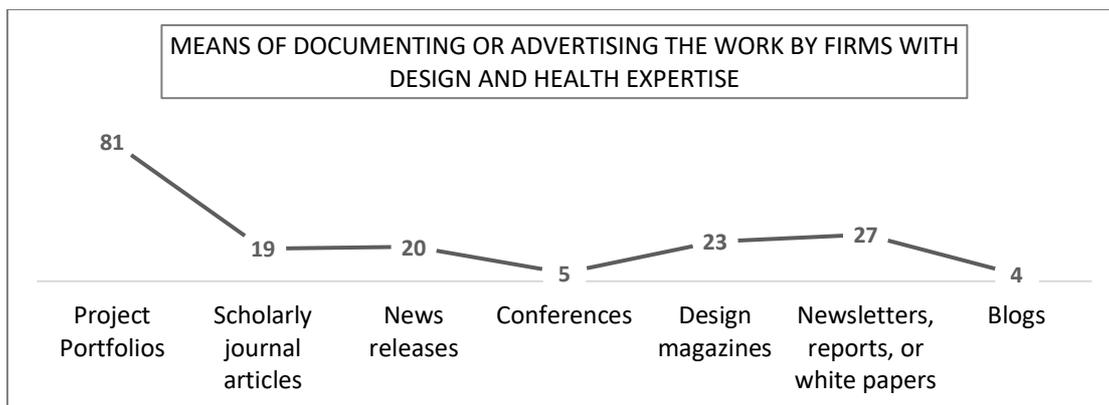


Figure 4: Means to document or advertise projects in design and health by architecture firms. Source: Author.

## 3.0. DISCUSSION: SYNERGIES BETWEEN RESEARCH, PRACTICE, AND EDUCATION

The findings of this study reveal different approaches adopted by design firms that operate at a global or national level in research methodologies and design solutions for projects related to health and wellbeing in the built environment. A larger study which includes surveys and interview of principals, managers, and employees would be required to make more significant conclusions about how the work done by these firms creates linkages with peers in the industry, and has an impact on research, education, and policy in the field. The results of this preliminary study, however, indicate that design firms were focused mostly on providing solutions for different building typologies that were advertised as healthy solutions for users, clients, and stakeholders. There was often an emphasis on providing user-oriented and evidence-based design solutions, but descriptions or mentions of how these concepts were actually implemented in real-world projects were either inadequate or completely missing.

A few firms were found to document or share their approach, strategy, or research methodologies to solve particular problems and meet user needs. These approaches, however, were mostly limited to one or two types that were used across a range of building and interior design projects. Further, it appears that the reason for these processes not being mentioned or documented most of the time, is not a lack of skillsets or the use of special or state-of-the-art technologies or equipment. The teams' talents, tools, and experience in fact, appear to be very well advertised up-front, presumably, to attract clients and generate more work. This may indicate, therefore, that firms do not believe specific research methodologies to be a valuable means of attracting more clients. Evidence in the field of health and the built environment, however, reveals quite the opposite; design solutions need to be well-grounded in research findings in the field to satisfy user-needs and create healthy environments. By not documenting or sharing research and design methodologies in the field, therefore, design firms miss important opportunities to grow the field of design and health by nurturing more research and increasing the field's knowledge base. This phenomenon may also have a long-term impact on meeting user needs as well as future research, education and practice goals. Additionally, a lack of awareness of existing and latest research could also lead organizations to reinventing the wheel instead of driving innovation in the field.

A new conceptual framework, therefore, for creating more synergies between research, practice, and education is urgently required. A five-step model known as **LEAPP** is proposed as part of this framework, consisting of the following steps:

1. A **L**iterature review on the specific topic and drawing from existing research on spaces of a similar type and function as the new ones to be designed. Creating a customized research methodology based on the knowledge gained in this process.
2. Conducting **E**valuations at the pre-design/pre-occupancy consisting of focus group meetings, surveys, interviews, measurements, virtual reality studies, or a combination of these methods, to understand client requirements, user needs, or evaluating existing spaces to improve or redesign.
3. **A**pplying research findings from the previous step and developing a design solution in response.
4. Conducting a **P**ost-occupancy evaluation and comparing it to pre-design findings, making improvements to the space based on these findings if possible, and learning from the design outcomes.
5. **P**ublishing the design research methodologies and findings in different formats including but not limited to peer-reviewed journals, news releases, popular press, white papers, and conference presentations and proceedings. Additionally, these publications could be used to increase the firm's profile and, in its marketing, and branding strategies.

By following the steps in LEAPP, design and practitioners may be successful in increasing the dissemination of knowledge, make a bigger impact on the field of design and health, and create more synergies with research, education, and practice.

## CONCLUSION

Firms committed to designing healthy environments as one of their primary focus areas or building types may have areas of special expertise that align with human-centric and evidence-based approach to design. However, they miss opportunities to disseminate knowledge by not documenting their work in scholarly journal articles, white-papers, conference presentations, or proceedings. Clients, potential users, and other stakeholders are a valuable source of information in research and design processes. Users should be seen as informants, consultants, and participants of buildings and spaces from the very beginning of the design process.

To create a better impact, design firms must also increase the scope and role of their deliverables. Due limitations in cost, time, and required expertise, however, firms cannot be expected to conduct original research studies for every design project. There may also be some cultural or pragmatic challenges in their application. To counter these limitations, a five-step process known as LEAPP is proposed, to break down and simplify the research process, help in its broader understanding, and to market it better as part of the project. LEAPP, as discussed in detail earlier, suggests that the design of building projects may be based on existing research findings on design and health, pre-design evaluations, as well as post-occupancy evaluations after their design and construction. Importantly, these processes and methodologies followed by the design team must be documented and shared among the larger and more diverse community to create better and impactful synergies with education and research.

## LIMITATIONS OF THE STUDY

This study is limited in scope and scale. To make significant conclusions, a larger study which includes an extensive survey and interviews of design practice leaders, employees at different levels, clients, and other stakeholders, is highly recommended. Five out of the 58 architecture firm websites were protected against tagging tools and their data, and were not included in the frequency analysis. Some reports and newsletters mentioned by firms on their websites were also unavailable for a qualitative review. White papers did not appear to be used to by the firms at all, and therefore, were not included in the analysis as well. A larger survey, however, may find white papers which reveal more research and design methodologies and potential synergies between research, education, and practice.

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