



The Drive Toward Healthier Buildings: The Market Drivers and Impact of Building Design and Construction on Occupant Health, Well-Being and Productivity

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SmartMarket Report

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The Drive Toward Healthier Buildings: The Market Drivers and Impact of Building Design and Construction on Occupant Health, Well-Being and Productivity SmartMarket Report

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About McGraw Hill Construction

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Introduction

Health, well-being and productivity are fundamental—not only do they allow us as individuals to live full lives, but they also significantly impact household incomes and organizational bottom lines, with companies spending about 10 times the resources on employees compared with what they spend on building operations and maintenance.

Therefore, we are excited to release this landmark study that investigates the connection of buildings and health from the industry perspective—as well as from the perspectives of homeowners, human resources executives and, most important, medical practitioners.

The public is highly influenced by the advice their physicians offer them about healthier home decisions. **However, currently, the research points to a woeful lack of knowledge by medical practitioners about this connection.** In fact, less than half of them even believe there is a connection.

Some of this can be attributed to the fact that only 15% report receiving any information on the connection between health and buildings. Clearly, more education must be provided, but this will be challenging since 22% of the medical practitioners say that more information would not influence what they recommend to patients. Therefore, it is important to discover the factors that will convince them of the value of offering advice on buildings to their patients. To do this, we need to focus on how they currently gather information

and offer relevant advice about conditions that are currently responsible for causing the greatest amount of impact on patient health and well-being.

Construction professionals are focusing on creating spaces that foster better health, happiness, collaboration and productivity. However, to drive wider use of healthy building practices, they need market conditions to encourage owners of homes and nonresidential buildings, to actively make these investments.

Specifically, they report the following important triggers as spurring higher levels of healthy building activity:

- **Greater public awareness of the health impacts of buildings**
- **Creation of better tools and methodologies to collect data and measure health impacts to help justify investments**
- **Codes and incentives that encourage healthier building practices**

MHC would like to thank the American Institute of Architects for taking a leadership role in identifying the need for research in this area. We would also like to thank our other premier research partners—United Technologies, CB Richard Ellis and the U.S. Green Building Council; our supporting research partners—the American Society of Interior Designers and Delos; and our contributing partners (see Resources on page 101 for more information) for enabling us to bring this ground-breaking research to the market.



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SmartMarket Report

THE DRIVE TOWARD HEALTHIER BUILDINGS: THE MARKET DRIVERS AND IMPACT OF BUILDING DESIGN AND CONSTRUCTION ON OCCUPANT HEALTH, WELL-BEING AND PRODUCTIVITY

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Executive Summary

Health and wellness are critical issues affecting today's society, economy and individuals' quality of life. Professions can play a role in helping mitigate health hazards through healthy design and construction practices in our nation's homes, schools, hospitals, workplaces and other buildings. However, in order to fully educate the public and convince owners to make investments, medical professionals need to fold recommendations about their patients' environments into their care policies, and today, doctors are overlooking the connections and advantages healthy design, construction and operations of our nation's buildings can have on the public's health.

Turning Medical Practitioners Into Advocates

Homeowners today typically look to friends, family, peers and their doctors for advice on healthy home and building decisions. The challenge is that they are not looking to the industry, which is most well-informed of the ways homeowners can improve the physical environments they occupy. Therefore, because physicians have the second highest influence on these decisions, it is critical that they become informed advocates of healthy design, construction, and operation and maintenance decisions.

GENERAL AWARENESS OF THE LINK BETWEEN HEALTH AND BUILDINGS IS LOW

Today, the medical professionals surveyed in this new study—general practitioners (GPs), pediatricians and psychologists/psychiatrists—do not make the connection between health and the built environment. In fact, only one of the three groups, pediatricians, has a majority that sees the connection. GPs are the least aware, with only 32% making the connection.

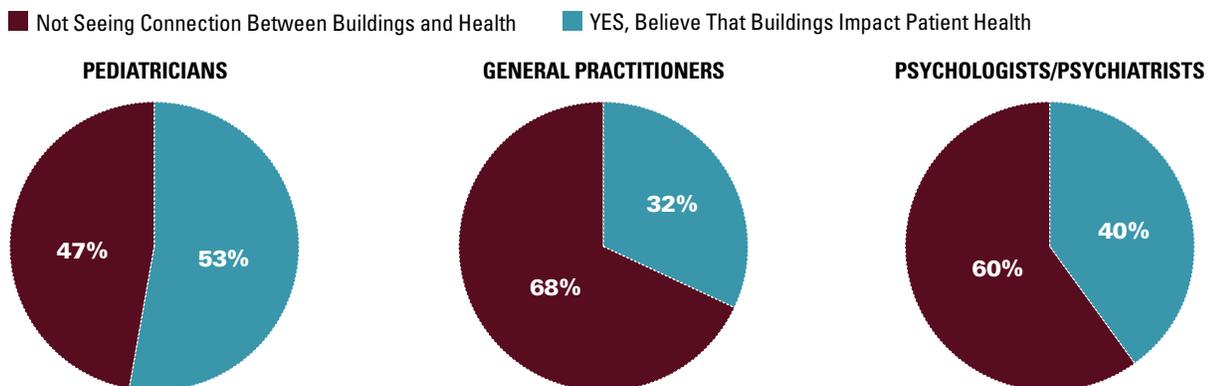
DATA EXPLAINING THE LACK OF AWARENESS

Several data points help explain why these professionals may not be making the connection.

- **Only 15% receive any information on the connection.** Therefore, physicians who make the connection do so with information they seek out on their own.
- **Also, most of the most serious health risks factors for adults and children/adolescents in the U.S. reported by physicians do not align with the types of information that they ask their patients about.** The issues they list of most concern are poor diet, lack of exercise, obesity, poverty, smoking and chronic stress. However, when they talk to their patients, these medical practitioners are not making the connection of how building decisions can help alleviate or help the patient deal with these significant health issues. Instead, the medical practitioners ask questions at a more specific level when they ask about patients' environments, focusing on chemicals and mildew, which are important to health, but do not as significantly impact the overall health issues that physicians believe are plaguing Americans.

Medical Professionals' View on Connection Between Buildings and Patient Health

Source: McGraw Hill Construction, 2014



OVERCOMING CHALLENGES

Though it is clear that medical practitioners need to be more educated on how building design, construction, and operation and maintenance decisions can affect their patients’ health, the solution is not as simple as providing more information. It is important to understand how these practitioners currently get information, as well as their culture and receptivity to additional information.

- **Information Sources: Medical journals are the main source of information for the few physicians who get information on the connection between health and buildings.** Considering these articles are likely to be submitted by their peers, rather than the design and construction community, this is a hurdle the industry will need to address. **Other information sources used—government resources and health-focused nonprofit organizations—offer more opportunity for the industry to form collaborative partnerships** that provide the necessary information in formats most familiar to medical professionals.
- **Receptivity to More Information:**
 - **More than a fifth (22%) say that more information would likely not change what they do today.** To face this challenge, the industry must focus on those physicians who are most receptive to getting more information.
 - **Though only a small portion say more information would have a strong/very strong impact on the advice they deliver (17%) overall, there is a good share (57%) that say it would likely have some impact.** This means there is receptivity in the market. The industry just needs to find a way to reach them—and in a format that is easy to digest. Medical professionals today face information overload, as well as changing information around insurance rules and elements of the Affordable Care Act, so the industry must convey information in as simple and clear a fashion as possible.

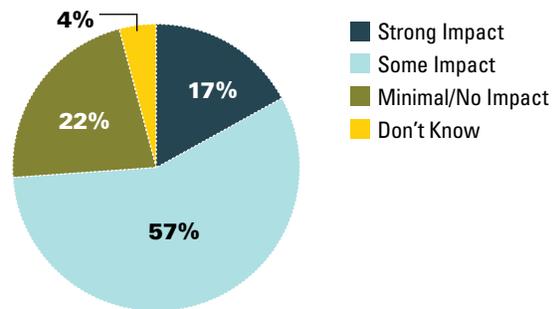
Encouraging the Industry to Continue to Increase Attention on Creating Healthier Environments for Occupants

CURRENT AND FUTURE EXPECTED IMPACT OF HEALTH ON DECISIONS

Many findings in the report show that industry professionals in both the residential and nonresidential sectors are aware of health as an important factor to incorporate into their design and construction activities.

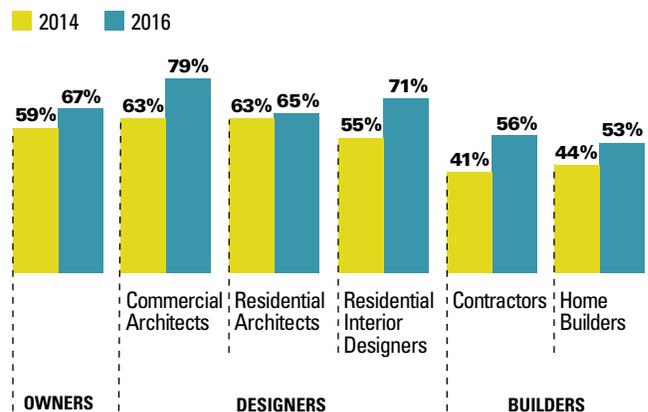
Impact Additional Information on the Connection Between Buildings and Health Would Have on Advice Offered to Patients

Source: McGraw Hill Construction, 2014



Impact of Buildings on Occupant Health Has a High Influence on Firms’ Design and Construction Decisions (By Industry Player Type)

Source: McGraw Hill Construction, 2014



- **As can be seen in the chart above, all the players expect health to have a higher influence on their activities over the next two years.**
- **Firm size and location do not affect these findings, but green level of involvement does. Firms that do more green work are also more likely to report the influence of health on their decisions.**

FACTORS CRITICAL TO DRIVE MORE INVESTMENT IN HEALTHIER BUILDINGS

In order to see this growth come to fruition, it is critical to encourage investment in healthier building practices and products by addressing the key industry drivers.

In many ways, the drivers align for the nonresidential

and residential sectors, with owner demand being the highest for both sectors.

Recommended actions that would trigger increased activities in both sectors:

- **Increase demand by creating greater public awareness of the health impacts of buildings. (This is also critical for the medical professions, as noted on pages 4 and 5.)**
- **Focus on better tools and methodologies to collect data and measure health impacts—and then share that data with the industry, particularly owners.**
- **Encourage codes and incentives to emphasize healthier building practices, both residential and nonresidential.**

USE GREEN BUILDING PRACTITIONERS AND REFRAME GREEN OUTCOMES TO EMPHASIZE HEALTH OUTCOMES

Across the board, firms doing more green work are also more invested in healthy building decisions. Not only do they report it having more influence on their decisions, they also report using more healthy building practices and products, measuring health outcomes more frequently and using a wider variety of information sources to keep themselves educated on the connection.

These greener firms can be champions for the market, particularly if they reframe their green projects from an

occupant-focused perspective. For example, several of the projects profiled in this report for their healthy aspects are also green projects that address energy, water, operations and resource efficiency.

However, the term “high-performance buildings” is often interpreted as relating to energy, water and operating efficiency. Therefore, we need to reframe the terms green and high performance in order to better capture the health and productivity advantages—and to reflect where companies really need performance gains. In fact, companies spend at least 10 times more on their employees than they do on utility or operating costs. We need to encourage and support organizations that are taking an active role in redefining these terms in order to be more reflective of the true costs and outcomes of our building decisions.

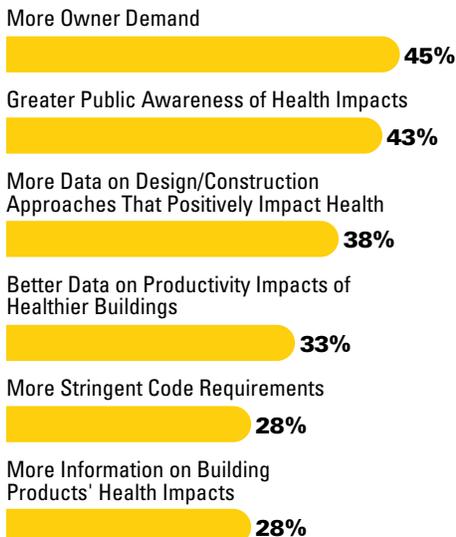
Motivating Owners to Make Healthy Building Investments

There are many reasons for owners to invest in healthy buildings, but the benefits to the occupants of buildings must be clear and trackable. Additionally, the industry should focus on the factors they most value.

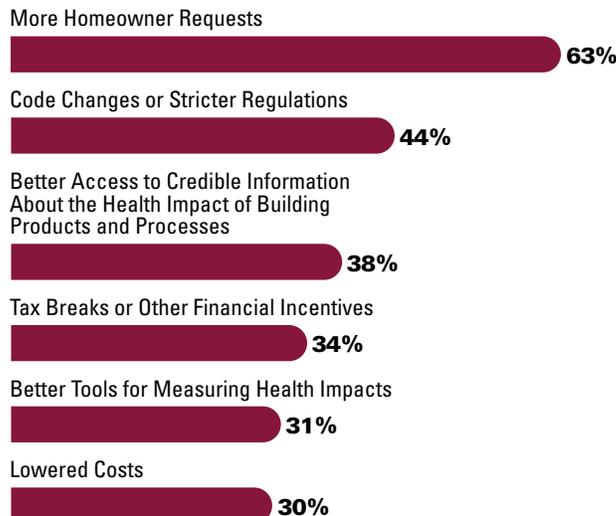
Top Drivers Encouraging Greater Industry Focus on Health Impacts in the Next Two Years (For the Nonresidential and Residential Building Sectors)

Source: McGraw Hill Construction, 2014

NONRESIDENTIAL



RESIDENTIAL



BENEFITS NEED TO BE BETTER UNDERSTOOD AND MORE FREQUENTLY MEASURED

Nonresidential building owners report many benefits of healthy buildings, most notably:

- 47% report healthcare cost reductions, ranging from 1% to 5%. However, most (52%) don't know.
- 66% report improved employee satisfaction and engagement.
- 56% report lower absenteeism at varying ranges, but the remainder doesn't know.
- 21% report higher employee productivity, though an overwhelming 56% don't know.

The high percentage that doesn't know suggests more measurement needs to occur—and that better tools are needed to do so. This is critical for the industry to address since owners' human resource executives report that greater worker productivity, lower absenteeism, reduced company healthcare costs, and improved employee satisfaction and engagement would contribute strongly to ROI and encourage more investment.

The same challenge arises on the residential side, with nearly half of those professionals reporting that they do not get reports from homeowners on the ongoing impact of their homes on their health.

SOCIAL ENGAGEMENT AND COMMUNITY AMENITIES MAKE A DIFFERENCE

In corporate offices, owners are interested in a number of features in the spaces they lease.

In particular, it is notable that spaces for social interaction are important. 66% currently consider this in leasing decisions today, and 75% expect to consider it in the future. The design community recognizes this need, with 70% expecting to engage in this activity by 2016. These are the kinds of design decisions that reflect the changing ways that spaces need to be designed in order to address productivity for a generation that does not work the same way as those that preceded them.

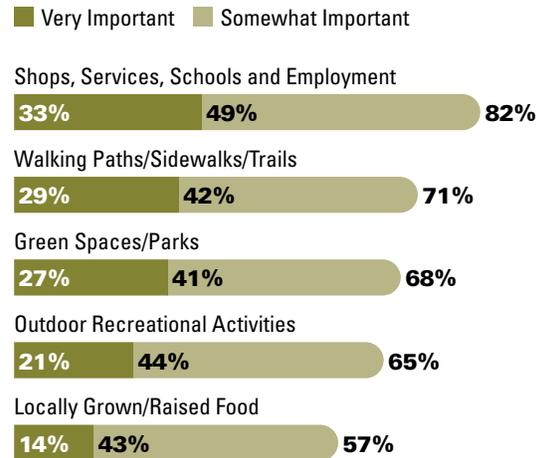
For the homeowner, there are community attributes that impact the decisions on where to live. The chart at right shows what factors are very important to them. It is notable that these were all underreported by home builders and residential architects, revealing a disconnect between what the industry offers and what homeowners value. The industry needs to recognize these needs.

What's Next?

This study is an important first step at connecting the

Importance of Home's Proximity to Community Amenities in Decision of Where to Live (According to Homeowners)

Source: McGraw Hill Construction, 2014



threads between the differing opinions of both the industry engagement and putting these healthier practices into action and the influence agents—homeowners, medical practitioners and human resource executives—who can encourage adoption of these practices. However, it is only the first step.

This project was limited by scope and budget so we focused on buildings as a first step. This study confirmed that building design, construction, operations and maintenance decisions are indeed critical in helping improve the well-being of occupants. It also demonstrated how interconnected buildings are with the communities around them. It is important that the next stage of research examines how urban design and planning can help compliment and increase the benefits of building decisions on human health and well-being.

This study also intentionally focused on medical professionals who actively treat patients because of their direct influence on the public. However, considering how much information they lack, it will clearly be important to incorporate public health, medical policy and the research community into the solution.

We see this report as the first step in an ongoing set of research investigations because there is no more important issue than encouraging the investment in healthier buildings and getting medical professionals to recognize the role the construction industry can play in improving human health and productivity.

Data: Introduction

The construction industry is still in the early stages of grappling with the challenges raised by the impact of buildings on the health and well-being of their occupants. While some limited studies have been done in this area, especially in regard to schools, the complexity and multiple levels involved in this issue have made it difficult to grasp. Certainly, there is the challenge of studying complex systems like health and well-being and determining the precise impacts of specific factors like acoustics, light, exposure to potential toxins and designs that encourage greater movement by building occupants in order to create design and construction strategies that maximize the positive impact that a building can have on its occupants.

However, there is also the challenge of dealing with different stakeholders who directly impact the process and strategies for creating healthier buildings. These include architects and contractors, in both the commercial/institutional and residential sectors, along with building owners and homeowners. In addition, the insights of those not directly involved in making decisions but who can inform building owners are also essential, such as owner human resource (HR) executives, who have the pulse for a company on its healthcare costs and productivity impacts, and healthcare professionals, whom most people engage for advice on how to improve their health and well-being.

The research published in this *SmartMarket Report* was designed to establish the level of awareness of building health impacts and the degree to which they influence decisions made about building across this span of stakeholders.

The data analysis is divided into four major sections:

- **Medical Professionals:** Explores what general practitioners, pediatricians and psychiatrists/psychologists find to be the state of health in the U.S., including the risk factors to health, and the degree to which they recognize the impact of buildings on health and communicate about how to improve those impacts to their patients.
- **Commercial/Institutional Construction Industry and Owner HR Executives:** Reveals the degree to which health factors currently impact design and construction decisions of commercial/institutional building owners, architects and contractors, and the growth expected in that influence. In addition, the top factors that help encourage and discourage the consideration of health factors are provided, and the current and future level use of healthy building practices and materials is explored, as well as the benefits seen by those who have made investments in healthy buildings and the top metrics used to gauge those benefits. The insights of owner HR executives support the construction industry findings by demonstrating the value in the commercial sector of healthy building investments from a group whose expertise has influence over those who make building decisions.
- **Residential Building Professionals:** Examines the influence of health factors on residential architects and contractors, including many of the same topics considered by the commercial/institutional construction professionals, including influence, drivers, use of practices and materials, metrics for measurement and the benefits achieved.
- **Homeowners:** Determines the degree to which homeowners are aware of the health implications of the buildings they occupy and the healthy building products and practices they most frequently employ in their homes.

By capturing the breadth of stakeholder responses, the findings of this study demonstrate the most critical factors to increase overall awareness of building impact on health and the role of each stakeholder in making the built environment healthier. It provides a strong foundation on which to support further research efforts on this challenging, but essential, topic.

Data: Medical Professionals'

Opinions on Buildings' Impact on Health

Introduction

THE DRIVE TOWARD HEALTHIER BUILDINGS DATA

Doctors and other medical professionals provide regular feedback to their patients on how to improve their health—both during wellness visits and during illnesses. These recommendations extend to things that patients can do to create healthier places that they occupy. This is confirmed by the 18% of homeowners who rank doctors as having the most influence on their healthy home decisions, and the additional 26% who rate doctors as a top three influence agent. Given this level of impact, it is critical that the medical community that works directly with patients not only make the connection between health and the built environment, but also that they are informed enough to be able to ask the right questions of patients and either make direct recommendations or direct their patients to valuable resources.

Most doctors are not making this connection today, and when they do, often they are asking for information on only acute illness triggers, such as mold or toxic exposure, rather than about things in and outside the home patients can do to improve overall wellness.

However, it is important to note that many of the health risk factors cited by the medical professionals are areas where the design and construction community can help create solutions. However, architects and contractors need more public awareness in order to convince owners to invest in these healthier building solutions, and doctors are critical in increasing that public awareness. Therefore, it becomes critical to benchmark where medical professionals are positioned today in order to be able to determine best how to encourage them to recognize the importance buildings and spaces have on health and well-being.

Some of the lack of awareness and activity in this area may be due to the very little information medical professionals are currently receiving on the health connection of health and buildings—only 15% report receiving any information in this area. And to further compound the issue, there is a strong portion that claim more information on the connection would have minimal or no influence on their actions. Therefore, we need to better understand the portion of the professionals that are deeply entrenched in their current mindset, and also to focus on the majority that are more ambivalent and think more information might have some influence on their actions in offering advice on mitigating health risks from buildings.

Data and Market Understanding

The data and analysis in this data section of the report provide new intelligence on how medical professionals—general practitioners, pediatricians and psychologists/psychiatrists—view the connection between the health of their patients and the built environment. The medical professionals also provided insights into the factors most affecting health in the U.S. today.

The study focused on practitioners who were doing clinical work, interacting with patients directly. Medical professionals in the public health field were excluded because of their engagement on these issues from a policy and research perspective and because they do not interact with patients directly.

A total of 91 active medical professionals around the U.S. responded to this survey with even distribution across the three types of physicians noted above. For the full methodology, see pages 99–100.

Data: State of Health in the U.S.

Risk Factors Impacting Health of Adults

There are many risk factors that are impacting the health of adults in the U.S., but they differ for medical professionals treating physical ailments (e.g., general practitioners, family doctors) and those treating psychological complaints (e.g., psychologists, psychiatrists). It is important to identify and understand these risks so that the design and construction community can create solutions to help mitigate them.

Biggest Medical Risk Factors

The top four risk factors are far greater than others reported by medical doctors, and many are interrelated. Overall, lack of exercise is cited by the most professionals. However, when looking at the factors they rank as having the greatest impact (those ranked 1st), obesity and poor diet emerge as the top factors.

While it's not statistically significant due to respondent size, it is notable that these four factors are ones that professionals in the South rank them at relatively higher rates than their peers in other parts of the U.S. (they rank the others at relatively lower rates). These results are consistent with the higher obesity rates in this part of the country as well as the high levels of fat and calories in some traditional recipes in the region.

All three of these are ones that the design and construction community, and the larger urban planning community, can have an impact on. And here has been focused attention on creating spaces and communities in order to foster movement and provide access to fresh fruits and vegetables. It is important that medical professionals understand these impacts.

Biggest Psychological Risk Factors

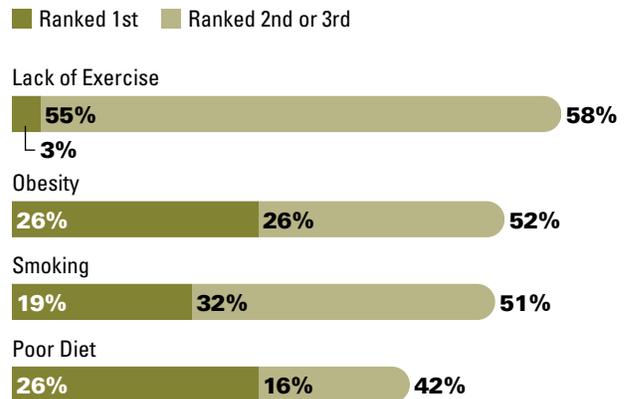
Medical professionals who treat patients for psychological disorders have a different set of priorities they deem as having the greatest health risk, but unlike on the physical front, when it comes to psychological risk factors, one dominates the rest. Overwhelmingly, chronic stress is cited as the biggest health risk, far exceeding the next two factors of alcohol and drug use. No other factor was reported by more than 22%.

There are many ways that buildings can be designed and built to reduce stress. Lighting, in particular, has been shown to have significant impacts on building occupants as have workplace/room configuration, access to fresh air and access to views of nature. It is definitely not just the building itself that impacts stress levels. However, creating homes where people can breathe and sleep

Risk Factors With the Biggest Impact on Adult Health

(According to General Practitioners)

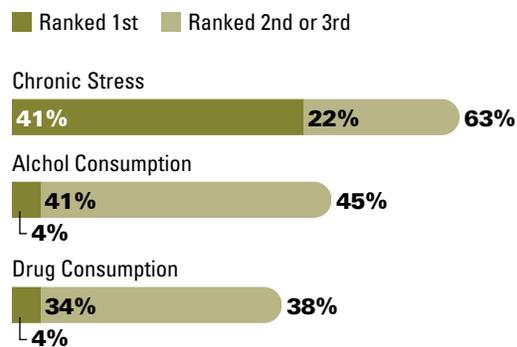
Source: McGraw Hill Construction, 2014



Risk Factors With the Biggest Impact on Adult Health

(According to Psychologists/Psychiatrists)

Source: McGraw Hill Construction, 2014



better; hospitals with access to light and fewer acoustical distractions; and workplaces that foster comfort and wellness can definitely help contribute positively.

Risk Factors Impacting Health of Children

There are many risk factors that are impacting the health of children in the U.S. These risk factors differ a little for medical professionals treating physical ailments and those treating psychological complaints, but unlike for adult patients, there is some agreement. Some of these risks also have different implications on children versus adults. It is important to note these differences so that the design and construction community can prioritize its approaches depending on the occupant of the building.

Biggest Medical Risk Factors

Overall, there is general alignment with the top risk factors cited by pediatricians and general practitioners (GPs), with three important distinctions:

- **Obesity:** Ranks as much more important to pediatricians, with an overwhelming 37% selecting it as the number one health risk factor.
- **Lack of Exercise:** For GPs, this is more important than obesity or diet. This may be somewhat influenced by the fact that the largest number of them list this as a health risk factor for adults. GPs may be looking at treating families more holistically, making this more notable to them.
- **Poverty:** Pediatricians more often report this, though there are certainly correlations with poor diet and obesity given the high price and accessibility of fresh produce and foods to those in poverty. Because of the way healthcare insurance is delivered in the U.S., poorer adult patients may not visit the doctor as much as pediatric patients in the same income situation, making this more noticeable for pediatricians.

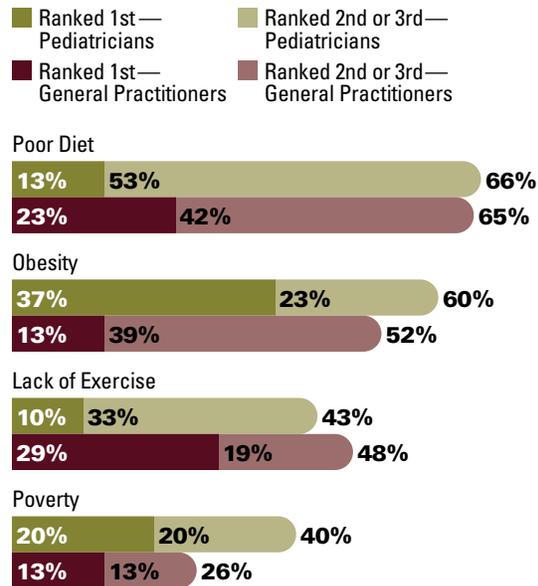
Biggest Psychological Risk Factors

While chronic stress again is cited by mental health practitioners as the number one risk factor impacting patient health, in overall numbers, poverty and lack of exercise exceed it—aligning with what the pediatricians and GPs report. Again, it is likely that psychologists with child and adolescent patients see patients with more diverse economic backgrounds, versus those with adult patients, where those with more affluence are likely to be able to afford treatment.

While industry professionals cannot help alleviate poverty, they can help foster the creation of spaces that alleviate some of the impacts of poverty on health—such as access to food and safety. As the case study on the Kensington High School for the Creative and Performing Arts in Philadelphia (see page 62) demonstrates, the design of

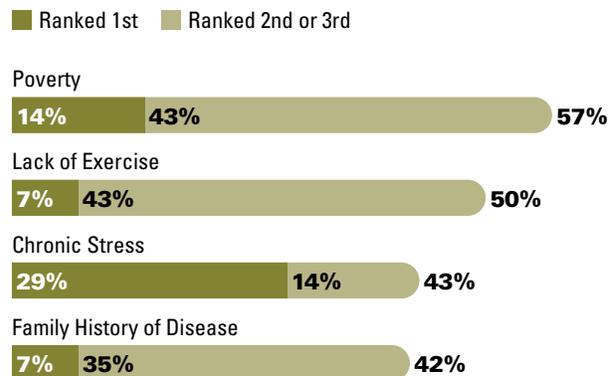
Risk Factors With the Biggest Impact on Child Health (According to Pediatricians and General Practitioners)

Source: McGraw Hill Construction, 2014



Risk Factors With the Biggest Impact on Child Health (According to Psychologists/Psychiatrists)

Source: McGraw Hill Construction, 2014



a school can help foster community engagement, create a safer learning environment and spaces for physical activity, among other advantages. These are important as society looks for solutions to help mitigate the negative impacts of poverty on health and well-being.

Obesity's Increasing Impact on Health

According to the National Center for Health Statistics, obesity in the U.S. has more than doubled in adults and children since the 1970s. It is also routinely reported in public health research as a leading public health problem in the U.S. Therefore, it is not surprising that nearly all medical professionals—92%—report that it has had more or much more impact on health in just the last 10 years.

Obesity is not only a health concern in its own right, as noted by the medical professionals for both adult and pediatric patients (see pages 10 and 11), it also is exacerbated by other risk factors, such as poverty, poor diet and lack of exercise, making it one of the hardest to solve without also addressing other larger issues.

Aside from the medical community recognizing the increasing problem of obesity, public awareness of the problem is also higher, especially as it relates to impact on child health. The medical practitioners report that 71% of their patients are more or much more aware of the negative impact of obesity on adult health compared with 10 years ago, and 64% are more aware of the impact on child/adolescent health. What is more notable is that 36% report the public being much more aware of the problem of child obesity.

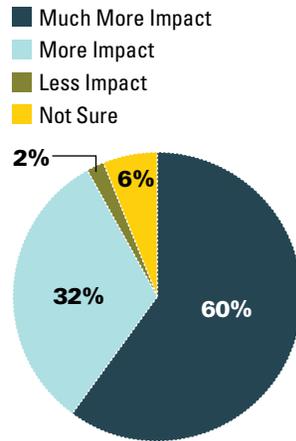
There has been a great deal of public attention on the issue of child obesity, including the movement toward healthier meals for children (particularly in schools), better access to affordable healthier foods, better nutritional labeling on foods and increased movement of children. One notable recent initiative has been the *Let's Move!* campaign launched by First Lady Michelle Obama in 2010 dedicated to addressing childhood obesity and trying to solve the problem within a generation, which includes all the elements listed above.

The design and construction community has also started to address these issues with "Active Design" principles starting to emerge as a way to design buildings, lots and communities to encourage exercise for adults, children and adolescents. See the article on page 13 for more information on this emerging trend.

For medical professionals identifying obesity and mobility as factors leading to health problems in their patients, recognizing and encouraging these design principles could have important positive impacts.

Change in Impact of Obesity on Health Over the Last Ten Years (According to All Medical Professionals)

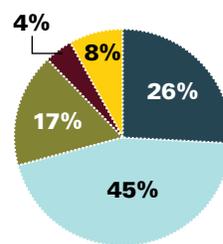
Source: McGraw Hill Construction, 2014



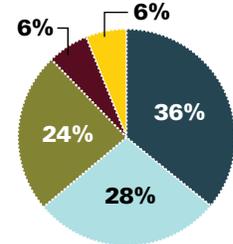
Change in Patient Awareness of the Impact of Obesity on Health (According to All Medical Professionals)

Source: McGraw Hill Construction, 2014

For Adult Patients



For Pediatric Patients



Active Design

Design and construction professionals are aware that the built environment can create opportunities for physical activity. Active design is becoming more prominent as a way to configure urban spaces, buildings and interiors to encourage users' good health.

In a recent Centers for Disease Control and Prevention survey of 450,000 U.S. adults, only 20.6% of participants reported achieving total recommended amounts of exercise. These numbers have experienced a steady decline in spite of the known health consequences. Last year Harvard scientists linked lack of exercise to more deaths from diabetes, heart disease and similar inactivity-related diseases than those caused by smoking.

Design and construction professionals have been long aware that the design of the built environment can create opportunities for physical activity. Smart Growth, which achieved widespread recognition in the 1990s, steers urban planners toward walkable communities. It also champions "complete streets" in which safe intersections, wide sidewalks and integrated bikeways encourage vigorous and recreational exercise.

Active Design

Today, embedding opportunities for activity within the built environment is a stand-alone movement. In active design, urban spaces, buildings and interiors are programmed and configured to encourage users' good health.

The 2010 publication *Active Design Guidelines: Promoting Physical Activity and Health in Design* codified its guiding principles. The joint effort between the New York City Departments of Design and Construction, Health and Mental

Hygiene, Transportation and City Planning advises giving stairs, fitness amenities and spaces of social interaction prominence within architectural designs. The document focuses equally on strategies for creating neighborhoods, streets and outdoor spaces that encourage exercise, play and active transportation. Shaping the urban realm for healthy food access is another concern.

From Advocacy to Policy

While documents like *Active Design Guidelines* translate scientific research into public-health strategies, policy bridges the gap between knowledge and real-world implementation. The U.S. Green Building Council is developing an Active Design Index for LEED projects, for example, and its new LEED Pilot Credit "Design for Active Occupants" already has been used on 30 projects.

Active design is a nascent issue in the sphere of U.S. public policy, though current efforts in this field already have several commonalities like municipal scale. A 2011 American Planning Association survey found that approximately 20 local governments had adopted health elements as part of their general plans. One high-profile rollout since then is the Plan for a Healthy Los Angeles, which was completing its public review as of press time. Among the six major themes of the new plan are expanding and improving open space, and remedying food deserts.

Perhaps the most tangible recent success was the July 2013 signing of New York City's Active Design Executive Order by then-mayor Bloomberg. The legislation requires active design in city-funded development projects. Also in 2013, Bloomberg created the Center for Active Design to steward *Active Design Guidelines* and spread its message via initiatives like the FitCity conference series.

Smaller governments are breaking new ground in active design alongside first-tier cities. The Nashville Area Metropolitan Planning Organization has made active transportation one of three goals of its 2035 Transportation Plan, and the region's corresponding investment plan dedicates 15% of urban roadway funds to active mobility, 10 times the national average. Through a partnership with the Center for Active Design, the Region of Peel in Canada is piloting multiple public-space projects that encourage residents to engage in recreation and access healthier food.

Some policymakers do not yet recognize the relationship between the design of physical space and public health. Yet the fate of longer-running campaigning for complete streets suggests that all of active design's principles are poised for widespread acceptance. According to the Urban Land Institute's year-old guidelines document *Ten Principles for Building Healthy Places*, more than 500 local U.S. governments have adopted a complete-streets policy. ■

Data: Impact of Buildings on Health

THE DRIVE TOWARD HEALTHIER BUILDINGS DATA

Awareness of the Impact of Buildings on Health

Unfortunately, despite the growing influence that health outcomes are having on the design and construction community (see page 24), medical practitioners are not making the connection between health and the spaces their patients occupy. Even for the most informed, pediatricians, only a little over half (53%) recognize the impact of buildings on their patients' health. Clearly, there needs to be an increase in awareness by physicians on the impact of buildings on health in order for them to play an active role in helping to encourage healthier decisions by their patients as well as by those making building design, construction and investment decisions.

Of the portion that aren't making the connection, most don't know (30% of pediatricians, 61% of GPs and 57% of psychiatrists/psychologists), which suggests that there is an opportunity to educate this group to get them to recognize the connection.

Distinguishing Impacts of Buildings on Health From Other Impacts

One factor that may be leading physicians to not make the connection is that many also find it hard to discern the impact of buildings on health from other environmental or lifestyle impacts—28% report that they cannot make that distinction, and another 40% aren't sure.

These are fundamental findings. If the medical community is not even making the connection between health and buildings, they will not be able to offer comprehensive advice to their patients. This will leave the public less informed than they would be if their medical health providers were making the connection.

Medical Professionals' View on Connection Between Buildings and Patient Health

Source: McGraw Hill Construction, 2014

- YES, Believe That Buildings Impact Patient Health
- Not Seeing Connection Between Buildings and Health



Reported Building Health Hazards

As can be seen in the table at right, mold and mildew exposure is the health hazard reported by most health professionals for all building types. There are differences in the other top factors by building type as noted by the green shaded boxes.

It is still notable that, overall, the percentage reporting the hazards are relatively low, with only mold and mildew reported by a majority of the professionals. This reinforces the low level of connection these practitioners are currently making between buildings and health.

It may be because these kinds of hazards are not obviously connected to the top health risks medical practitioners are dealing with (see pages 10 and 11). Thus, it is worth investigating design and construction features that are more closely aligned with helping address obesity, exercise/mobility and stress, among others.

Home Health Hazards

Along with concerns about mold, exposure to toxins and design features that might lead to slips and falls make up the home health hazards reported by the highest number of medical professionals.

VARIATION BY MEDICAL PROFESSION

Though mold is key across all the professions, there are some variations by medical profession:

- **Pediatricians:** For them, the second highest reported home health hazard is crowding (reported by 43%), followed by lead exposure (reported by 31%). There have been changes in the law related to lead exposure, with particular emphasis on its effects on child development, making this understandably more important to this group.
- **General Practitioners (GPs):** The second and third highest reported home health hazards for GPs—design features that lead to slips and falls (46%) and inadequate upkeep of home systems (29%)—are ones that are applicable to patients of all ages. In particular, the risk of falls is extremely serious for older patients and may be top of mind for GPs who see seniors in their practice.
- **Psychologists/Psychiatrists:** Mental health professionals place more emphasis on indoor air quality and access to natural light (both reported by 37%). Natural light has long been acknowledged as a factor that has improved mental health. In fact, light therapy is one treatment option for seasonal affective disorder, which is depression that occurs at the same time every year (most often in the winter and autumn) and may be triggered by decreased levels of natural daylight during these months.

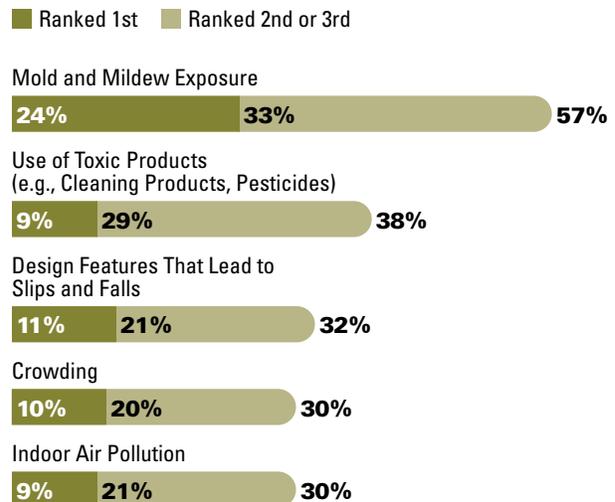
Health Hazards Reported by All Medical Professionals

Source: McGraw Hill Construction, 2014

Benefit	Home	Workplace Schools	Schools
Mold and Mildew Exposure	57%	51%	57%
Use of Toxic Products (e.g., Cleaning Products, Pesticides)	38%	44%	30%
Design Features That Lead to Slips and Falls	32%	29%	28%
Indoor Air Pollution	30%	31%	20%
Crowding	30%	27%	34%
Home/Building	29%	24%	23%
Lead Exposure	20%	18%	27%
Lack of Access to Fresh Air	20%	22%	32%
Lack of Access to Natural Light	19%	26%	25%
Noise Pollution	9%	16%	9%

Top HOME Health Hazards Reported by All Medical Professionals

Source: McGraw Hill Construction, 2014



Workplace Health Hazards

As for the other building types, mold is an issue highly reported by all medical practitioners, but again, there is some variation by medical profession.

VARIATION BY MEDICAL PROFESSION

- **GPs:** Notably, GPs do not rank mold and mildew as their highest health hazard. The top overall reported workplace health hazard is use of toxic products, such as cleaning products or pesticides (reported by 49% overall). The third most reported hazard—indoor air pollution (reported by 42%) is also the one that the most GPs rank first as a health hazard (20% rate this their top factor, followed by mold by 19%). It is possible that GPs' lower rating of design features leading to slips and falls could relate to the fact that fewer seniors are in these buildings and also could be due to the feeling that companies would be sensitive to potential lawsuits and be more attuned to these features being addressed in workplaces versus in people's homes.
- **Psychologists/Psychiatrists:** Other than the top factors shown in the chart, mental health professionals cite access to natural light as a top workplace health hazard (reported by 36%). Again, the well-established link between light and depression is likely a reason for the emphasis on this factor for this group.

School Health Hazards

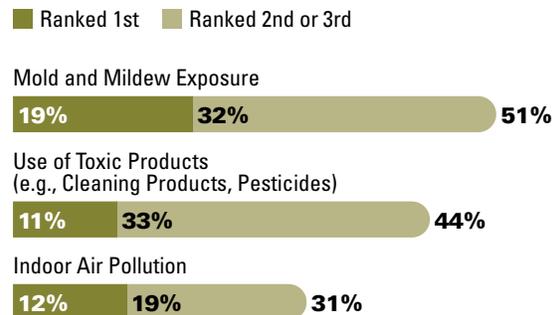
Mold is the most highly reported school health hazard for all medical professionals in schools. Though it didn't make the overall top list shown in the chart, pediatricians and mental health professionals agree on lead exposure—when they ranked it as a top health hazard, they ranked it first (17% for pediatricians and 29% for psychologists/psychiatrists), demonstrating the seriousness that medical professionals give to the potential for lead poisoning.

VARIATION BY MEDICAL PROFESSION

- **Pediatricians:** Overall, their top four are listed in the chart. However, also important to them are design features that lead to slips and falls (reported by 30% overall) and lead exposure (reported by 27%). Since they see children for injuries, they are understandably more attuned to this potential hazard as compared with their mental health counterparts.

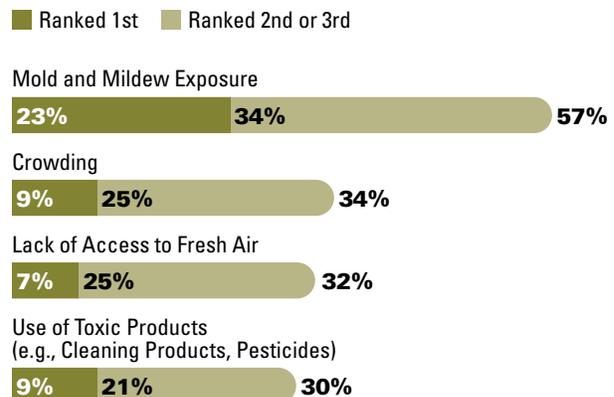
Top WORKPLACE Health Hazards Reported by All Medical Professionals

Source: McGraw Hill Construction, 2014



Top SCHOOL Health Hazards Reported by All Medical Professionals

Source: McGraw Hill Construction, 2014



- **Psychologists/Psychiatrists:** Use of toxic products is much lower for this group (reported by only 14%), but of much more importance to them is lack of access to natural light—reported by 42%, it is their second highest reported school health hazard. There has been a lot of research on improving natural light with researchers linking it to better mental health. With child depression and other disorders of high concern, this natural solution is understandably top of mind for these professionals.

Discussing Building-Related Health Risks

With Patients

Questioning Patients About Their Physical Environments

Interestingly, though the majority of the medical professionals aren't making the connection between buildings and health, the overwhelming majority of them are asking questions of their patients about their physical environments, many more than are acknowledging the connection.

As can be seen on page 18, they are mostly asking questions around toxic exposures and mold, which doctors may attribute more to home cleaning or maintenance practices than those influenced by design/construction.

On the positive side, this does indicate that physicians are open to asking relevant environment-related questions and suggests that if they are armed with the right questions, they could help gather more insights into what conditions the public is exposed to in their homes, workplaces, schools and other buildings.

Giving Advice on Mitigating Building-Related Health Risks

Many medical professionals are offering advice to their patients on how to mitigate building-related health risks.

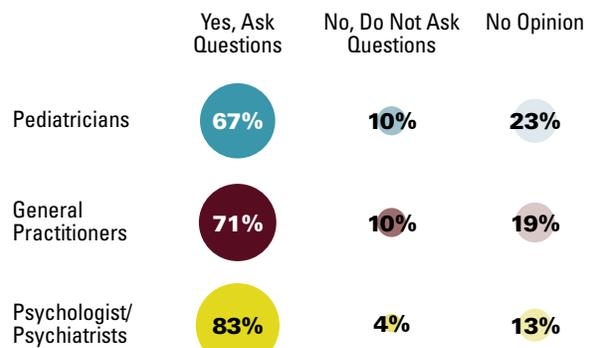
The percentages are generally aligned with the percentages that are seeing the connection between buildings in health, but they are a little higher for each group (for example, 53% of pediatricians make the connection, but 60% of them are offering advice).

Since they have a receptive audience (physicians are a top influence agent for homeowners in their healthy home and product decisions), it is critical medical professionals make the right connections so their advice is of the most value to their patients.

This area does warrant additional research into the kind of advice currently being offered, so that the industry can determine where the focus is currently oriented and help fill in the gaps by supplying medical providers with additional mitigation strategies they could pass onto their patients.

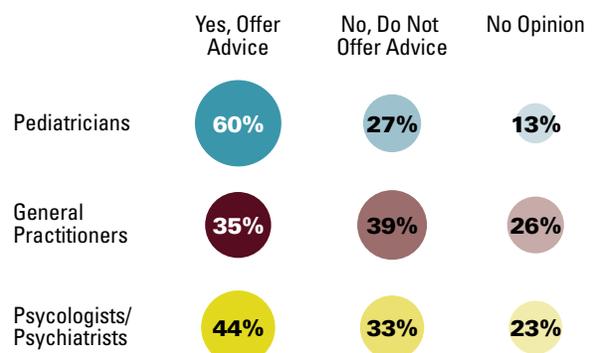
Percentage of Medical Professionals Who Ask Patients About Their Physical Environments

Source: McGraw Hill Construction, 2014



Percentage of Medical Professionals Who Have Given Advice on Mitigating Building-Related Health Risks

Source: McGraw Hill Construction, 2014



Amount of Information Gathered

About Patients' Environments

Though medical practitioners are asking about their patients' different environments, they are mostly collecting only a small amount of information. Of the three building types investigated, they are collecting most about homes, likely because they feel their patients have most control over this—and perhaps because this is the area medical professionals are most comfortable offering advice about.

VARIATION BY MEDICAL PROFESSION

General practitioners follow the averages charted, but there are differences for the other professionals.

- **Pediatricians:** They collect the least amount of information. For schools, 23% collect no information, and another 57% collect only a small amount—both higher than the average. For homes, they also collect the least, with 67% either collecting no or a small amount of information. Interestingly, this is contrary to the fact that this group is making more connections between environments and health.
- **Psychologists/Psychiatrists:** They collect the most information, with half of them collecting a fair amount of information on schools and an even higher 53% collecting a fair amount on homes. Their higher collection rates may also have to do with their practice, where they spend more of their time talking with patients in general.

Information Collected of Value to Medical Professionals

Consistent with the health hazards they report in buildings, the information that medical professionals find of value relate to mold/mildew, access to natural light and air, and exposure to toxins (whether through drinking water or chemicals used).

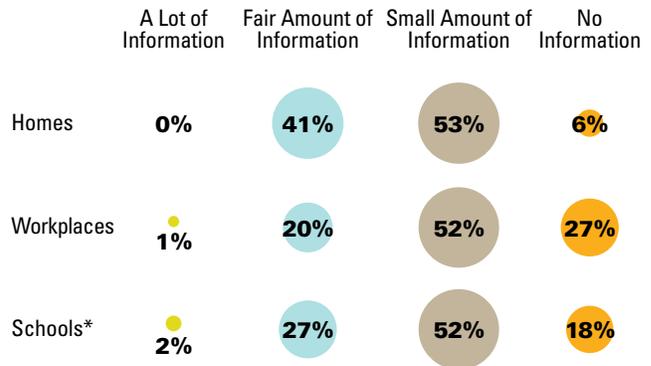
VARIATION BY MEDICAL PROFESSION

While pediatricians and GPs tend to agree, there are a few areas of difference with their mental health counterparts.

- Not surprisingly, the mental health professionals were more focused on access to light and fresh air. These are areas that they reported at higher rates than their peers.
- Additionally, though they did not make the overall list, a significant portion of these professionals also reported that access to privacy (reported by 67%) and access to social gathering places (53%) are also important to help evaluate their patients' health. Considering they are dealing with depression, attention deficit, stress and other disorders, these two factors would be important at helping combat that.

Amount of Information Collected About Different Patient Environments

Source: McGraw Hill Construction, 2014

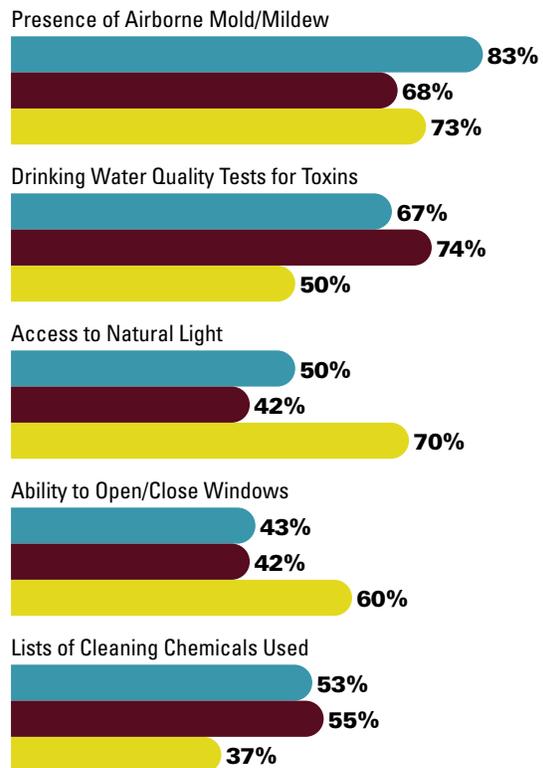


*Schools asked only of those with pediatric patients

Information of Value to Medical Professionals to Determine Health Impact of Buildings

Source: McGraw-Hill Construction, 2014

- Pediatricians
- General Practitioners
- Psychologists/Psychiatrists



Information on Buildings' Impact on Health

One of the key reasons that medical professionals may not be making the connection between buildings and health is because they do not receive any information on the topic. In fact, a mere 15% reporting getting any information. It is interesting that the fewest pediatricians report getting any information (10%) compared with general practitioners (19%) and psychologists/psychiatrists (17%) since relatively more of them acknowledge the connection between buildings and health.

Though the numbers are very low, the resources that these professionals are using does provide some insight into the way medical professionals learn about building impacts on health.

JOURNALS/ARTICLES

The highest number of medical professionals report getting information from journals and articles. This poses a challenge for the industry since most of the articles accepted into journals are typically ones that have to pass a peer review first. It is unlikely that medical journals would easily accept an article from the construction industry. The medical counterparts involved in public health or research may have the best chance at using this mechanism to increase awareness amongst their practitioner counterparts, versus the industry or associations.

GOVERNMENT AGENCIES

Government resources are having some effect, particularly on for pediatricians and general practitioners. This means that the industry should continue to partner with appropriate agencies, such as departments of health and environment.

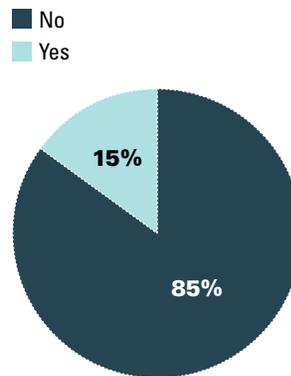
NONPROFIT ORGANIZATIONS

Nonprofits that focus on health, such as the American Lung Association, are also sources. However, other nonprofit organizations (such as environmental, building-focused groups and industry trade associations) are not sources of information. So, while direct outreach is important for the industry, it is also important that professionals look to continue partnerships with the public health community and nonprofits to help share their messages.

It is also notable that no physicians reported their own professional associations, like the AMA, as a resource. This suggests that these groups are not making the connection of buildings on health either.

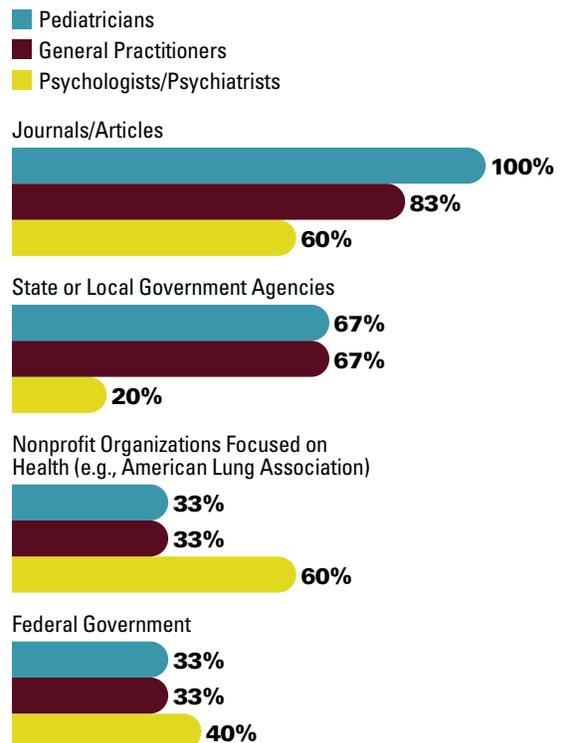
Percentage of Medical Professionals Who Receive Information About the Impacts of Buildings and Community Design on Health

Source: McGraw Hill Construction, 2014



Sources of Information on Building Impacts on Health (By Medical Profession)

Source: McGraw Hill Construction, 2014



Influence of Additional Information on Health Impacts of Buildings

THE DRIVE TOWARD HEALTHIER BUILDINGS DATA

Though it is a challenge that so few medical professionals currently receive information about the impacts buildings can have on health, it is a larger challenge that many medical professionals do not think it would matter if they did.

■ **Unfortunately, the general practitioners (GPs), who currently have the fewest that acknowledge the connection between buildings and health, also have the largest share (35%) that doesn't think that more information will make a difference to their future activities.** However, there is still a majority that either would definitely use that information (17%) or believe it would have some impact (45%), so there is still a big opportunity to have an influence on what GPs share with their patients related to home and other building-related decisions.

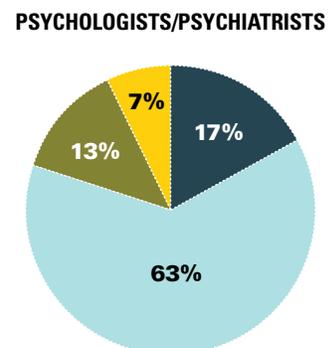
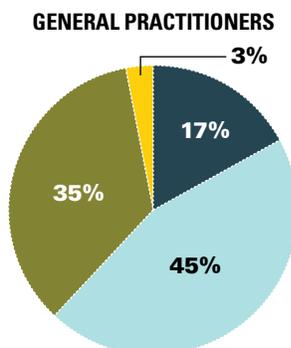
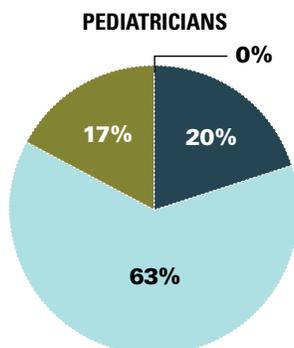
■ **Pediatricians and psychologists/psychiatrists report similar percentages that report more information would have a high impact or some impact on what they share with patients related to buildings.**

Therefore, it is important that the industry continue its efforts to connect with medical practitioners. It is worth deepening knowledge of how they get information, what information would be most practical and how to make their use of the information easy.

Impact Additional Information on the Connection Between Buildings and Health Would Have on Advice Offered to Patients (By Medical Profession)

Source: McGraw Hill Construction, 2014

- Strong Impact
- Some Impact
- Minimal/No Impact
- Not Sure



Research Connects the Built Environment to Human Health

A large and growing body of research demonstrates the impacts of the built environment on health. The construction industry is responding on multiple fronts, but challenges still exist.

In 1984, Roger Ulrich published a study that would launch a discipline. Observing 46 patients recovering from gallstone surgery in a suburban Pennsylvania hospital between 1972 and 1981, Ulrich found that the 23 patients whose beds faced the facility's landscaped grounds recovered a day faster than the others, whose beds looked onto a brick wall.

Design and Healthcare/Productivity Outcomes

Ulrich's study was among the first to empirically connect the built environment to human health, and it inaugurated the practice of quantifying its outcomes. Researchers have since created a significant knowledge base: According to the Center for Health Design, a Concord, California-based advocacy group, by 2008 as many as 1,200 studies similarly concluded that design has physiological effects by way of exacerbating or easing stress.

Most initial research centered on the hospital settings where stress levels could be quantified through healing metrics, such as recovery days or pain management dosages. Additional work extended into other building types and outcomes. Pioneering researchers like U.S. General Services Administration (GSA) environmental psychologist Judith Heerwagen and Carnegie Mellon architecture professor Vivian Loftness have linked daylighting, views, acoustic comfort and other design

considerations to the productivity of office and retail spaces.

Speaking about the Institute for Place and Wellbeing (IPW), its co-founder Esther Sternberg may as well be speaking for the field as a whole, calling it "a new frontier of medicine and environmental health, going beyond removing toxins from the environment to create environments at all scales to support both physical and emotional health."

Trends in Construction

Through approaches like evidence-based and biophilic design, this movement has crept into the world of construction too. Yet such diffusion has taken place more slowly than the breadth of research would suggest. "The real estate community is the tougher nut to crack," says Brendan Owens, vice president of LEED technical development at the U.S. Green Building Council (USGBC). In order to speed clients' adoption of a health-based perspective, he states, "At this point we're working on verifying causation."

Owens reports that USGBC itself has gotten involved in the process of singling out design's relationship with stress triggers, by evaluating user responses regarding indoor lighting, thermal comfort and noise via location-enabled smartphone surveys. "I think the stitching together of all those data into BIM applications holds tremendous promise," he says. Another formative effort, at the Columbia University

GSAPP Cloud Lab, is deploying electroencephalography-based brain-computer interfaces to test stress, attention and other human responses to city situations, to then apply to urban design.

Back at IPW—a partnership of the University of Arizona's Arizona Center for Integrative Medicine, Tucson-based College of Medicine, and the College of Architecture, Planning and Landscape Architecture—an interdisciplinary team is honing Sternberg's existing method of measuring stress and immune biomarkers in sweat. She notes, "The goal will be to determine the effects of specific environmental features on health and well-being in real time and real place."

These efforts also suggest next steps being taken to incorporate human health outcomes into sustainable design, which has proven most sympathetic to the specialty. For example, USGBC and GSA are weighing new design standards for health outcomes.

Meanwhile, another effort involves making the business case to possible clients. Speaking of the LEED-Platinum Bank of America Tower designed by Cook+Fox, architect Bob Fox describes a study that may define the discipline's next 30 years: "While the annual cost of energy savings is about \$3 million, increasing the productivity of 5,000 occupants by just 1 percent, or five minutes, gains \$10 million. So where would a corporate executive put their money?" ■

Data: Construction Industry and HR Executive Insights on Building Impact on Health and Well-Being

Introduction

The impact of building design and construction on the health and well-being of occupants has been increasingly garnering attention in the design and construction industry. However, there has been no comprehensive study of the awareness of and importance granted to these issues in the process of building design and construction, as well as the factors driving their greater consideration.

The research in this section of the *SmartMarket Report* addresses that gap by examining the responses of building owners, architects and contractors about the impact of health factors on decisions about building design and construction. It provides their insights on the benefits of healthy buildings and how they are and should be measured, the use of healthy building products and practices, and the factors driving investment in the creation of healthier building projects. In addition, a separate survey of owner human resource (HR) executives, who are particularly attuned to the benefits of increasing health, well-being, satisfaction and productivity, reveals the value of healthy buildings for these owners.

The Need for Healthy Buildings

The survey of HR executives demonstrates the need for attention to building impacts on health and well-being.

- One quarter (25%) of the HR executives consider absenteeism among the top causes of lost productivity for their companies, and another 53% find it to be one of many factors reducing productivity.
- 24% find that 5% or more of their employees take excessive sick days (more than 10 per year).
- Cold and flu outbreaks are identified by the highest percentage (50%) of HR executives as often contributing to absenteeism and lower productivity.
- A relatively large percentage also notes headaches/migraines (19%) and psychological complaints like depression or anxiety (16%) often contributing to absenteeism and lower productivity.
- Over half find that lack of sufficient exercise (59%) and concerns about weight/obesity (53%) are among the biggest challenges that affect the ability of employees to stay healthy.

Strategies, such as improved ventilation and indoor air quality, reduced exposure to toxins and design strategies that encourage greater physical activity, can have a significantly positive impact on these factors.

Note About the Data

The following section reflects the responses from two separate studies conducted online.

- A construction industry survey that included building owners, architects and contractors, conducted from March 28 to May 5, 2014
- A survey of owner human resource (HR) executives, conducted from March 10–18, 2014

Given the important role building owners must play to help drive healthy design and construction practices in the future, the perspective of the HR executives is valuable to understand the full spectrum of factors influencing owners in their decisions. Although HR executives are typically not decision-makers on building projects, their insights into staff, productivity and health aspects of the workplace make them an important source of information and influence for building decision-makers.

For more information on the methodology of this and the other studies, see page 99.

HR executives also reveal the degree to which their organizations have invested in a healthier workforce:

- Over 80% report that their companies sponsor fitness/wellness programs (86%) and biometric screenings (81%).
- 62% report that their companies offer a healthcare facility onsite or free/discounted gym memberships.
- Other investments made by the companies of over half of the respondents include disease-management programs (57%) and onsite dining facilities offering healthy meal options (52%).

Need for Data

With such widespread recognition of the importance of investing in employee health, buildings may appear to be an obvious candidate for attention to health issues. Certainly, the findings of the study demonstrate a widespread awareness among building owners and owner HR executives of the impact that a building can have on occupant health and well-being. However, the findings also reveal the challenge of finding data that demonstrates the efficacy of specific building products and practices on occupant health.

Construction Industry and HR Executive Insights on Building Impact on Health and Well-Being

Introduction CONTINUED

These data are essential to encouraging wider adoption of healthy building practices. Owners, architects and contractors cannot fully factor health impacts into their decisions if they do not have a clear understanding of the implications of the choices they make to achieve and maximize the desired effect and on the building owner or lessee's bottom line.

Importance of Green Building

One clear trend emerging from the data is the important role that the rise of the green building movement has played in driving consideration of health factors in the design and construction of buildings. Building owners, architects and contractors with a high level of involvement in green building—those with green projects accounting for more than 60% of their overall work or portfolio—are also using more green products and practices and are more influenced by health factors in the decisions they make on projects.

Certainly, one of the important factors that distinguishes the current green building movement from the pioneers in the 1960s and 1970s is broader attention to building occupant experience. In addition, as tools like LEED certification have evolved, greater attention to factors impacting health has emerged. The findings of this study support the influence of green building on raising awareness and consideration of health impacts in the design and construction process.

Contrast With Other Stakeholders

The findings reveal that there is broad awareness of the impact of buildings on occupant health across players and that all players agree that more attention will be given to improving health impacts in the near future. These findings are in marked contrast to one of the other major stakeholders in this area, health professionals, who are generally less cognizant and less interested in building impacts and how they influence their patients.

Geographic Trends for Healthy Design and Construction Practices in the U.S.

While the analysis of the data in this section is conducted by player, interesting differences emerge in the responses of all three industry players—owners, architects and contractors—across the four major census regions that reveal trends about the implementation of healthy building practices.

The influence of green building in driving consideration of health impacts in the design and construction process is much more evident in the Northeast and the West.

- For 64% in the West and 65% in the Northeast, their commitment to green building encourages consideration of health factors on projects, compared with the South (57%) and the Midwest (52%).
- Green codes encourage the consideration of health issues in

the West for 61%, more than in the Northeast (43%), South (36%) or Midwest (36%).

- 36% in the East considered “certified green” one of the top three most effective terms for explaining health impacts of building projects to the general public, compared with between 25% and 28% in the South, Midwest and West.

The link between green and health is likely one reason why several healthy products and practices are used by a much higher percentage of companies in the Northeast and West than in the South or Midwest, both now and expected in the future. Those products and practices include non-toxic building materials, acoustical comfort, CO₂ sensors, wide accessibility to outdoor views and natural

ventilation. Most of these products and practices can help earn points in green building rating systems.

The West is also leading the way on some practices, with higher influence accorded acoustic codes and wider discussion of Health Impact Assessments (HIAs) with clients than in other regions. (See page 43 for discussion of HIAs.) Contractors are also considered more influential in the incorporation of health considerations into design and construction decisions in the West than in other regions, with 41% considering them influential in the West, compared with between 23% and 30% in the other three regions. This may be due to wider adoption of collaborative project delivery methods, like integrated project delivery, in the West.

Data: Impact of Health Factors on Decisions About Design, Construction and Office Leasing

Current and Future Expected Impact of Occupant Health on Design and Construction Decisions

THE DRIVE TOWARD HEALTHIER BUILDINGS DATA

Impact on Design and Construction Decisions of Building Health Impacts

A much higher percentage of building owners, architects and contractors expect the impact of a building on the health of its occupants to have a high impact on their design and construction decisions in the next two years than it does currently. It is likely that the increased influence of this factor in the industry is driven in part by more widespread attention to health concerns like obesity in the U.S., combined with increased attention to health issues in recent versions of green building rating systems like LEED.

Comparison to Other Factors Influencing Design and Construction Decisions

Generally, energy savings and aesthetics have a high impact on the design and construction decisions of a larger percentage of respondents than the impact of buildings on health. This is important because it influences what kinds of investments each player is likely to make when conflicts between these factors arise.

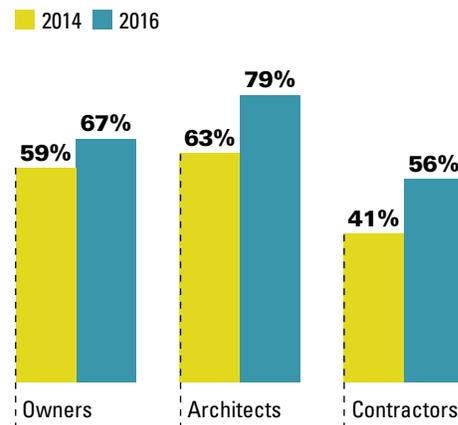
A nuanced picture emerges by player when comparing the impact of health and productivity to the impact of other factors that also influence decisions about buildings.

- **Owners: A higher percentage of owners in 2014 are and in 2016 will be highly impacted in their construction decisions by cost savings and aesthetics than by health or productivity factors.** Given the owners' role in driving priorities on construction projects, this finding suggests that more information needs to be provided to owners about the potential financial implications of healthier buildings. However, the current lack of good data in these areas may make fewer owners willing to prioritize these factors.
- **Architects: In 2014, more architects consider health important than the other players, and by 2016, the second highest percentage of architects expect health to have a high impact on their decisions.** These findings may suggest that architects play a critical role in driving consideration of the impact of buildings on the health of occupants, similar to the role they played in driving the adoption of green building when that movement was emerging.

Factors Influencing Design and Construction Decisions

(Current and Expected Future by Player)

Source: McGraw Hill Construction, 2014



Impact of Buildings on Occupant Health Has a High Influence on Firms' Design/Construction Decisions

(Current and Expected Future By Player)

Source: McGraw Hill Construction, 2014

- Highest Percentage Report High Impact
- Second Highest Percentage Report High Impact
- Third Highest Percentage Report High Impact

	2014			2016		
	Owners	Architects	Contractors	Owners	Architects	Contractors
Energy Saving	79%	77%	68%	87%	88%	77%
Aesthetics	65%	86%	54%	68%	88%	54%
Improving Productivity	56%	64%	57%	65%	74%	68%
Water Savings	60%	56%	40%	77%	73%	56%
Impact of Building on Health	59%	63%	41%	67%	79%	56%
Improving Surrounding Community	53%	62%	38%	59%	72%	53%

Impact of Health Factors on Decisions About Design, Construction and Office Leasing

Current and Future Expected Impact of Occupant Health on Design and Construction Decisions CONTINUED

- **Contractors: Contractors give greater weight to productivity factors than health factors.** Even though health factors are among those ranked as impactful by the three highest percentages of contractors by 2014, they are still selected by a much lower percentage of contractors than energy savings or productivity factors. Linking health factors to productivity gains may help increase contractor prioritization of health issues.

Variation by Level of Green Involvement

A significantly higher percentage of architects and contractors doing more green projects place a high value on health, but there is no significant difference between owners doing more green and those doing fewer green projects.

- **75% of architects doing more than 60% of their projects green report that the impact of a building on health has a high influence on the design/construction decisions, compared with 57% of those doing fewer green projects.**
- **63% of contractors doing more than 60% green projects find health to be highly influential, compared with 35% of those doing fewer green projects.**
- **While 68% of owners doing more than 60% green projects find health influential, the difference between that percentage and the 52% doing fewer green projects is not statistically significant.** A significantly higher percentage of owners doing more than 60% green projects, however, do emphasize energy and water savings, suggesting a greater tendency for owners to perceive green as environmental savings more than efforts to improve healthiness in buildings.

Similar findings occur in their estimation of the importance of health on their decisions in the next two years.

Variation by Firm Size

70% of architects from small firms (those with annual billings in 2013 under \$500,000) find that health influences their design decisions, compared with 61% of those from firms with annual billings of \$5 million or more. However, that difference is no longer evident in two years, nor is there a difference in the response of firms by size from the other players.

Top Sectors for Consideration of Health Issues in the Design and Construction of Projects

While office, healthcare and education are the top sectors overall in which health issues are most frequently and explicitly addressed, the attention to health issues by sector varies by player.

- **Owners: Office is by far the sector with the highest consideration of health (35%) by owners. In fact, the next highest sector, colleges/universities, has less than half the percentage of respondents (17%) than offices.** While this finding is no doubt influenced by the higher percentage of owners doing office work who participated in the survey (see methodology on page 99), even when just looking at owners by the larger categories in which they conduct their work, their consideration of health issues in the office sector far exceeds that in any other sector.

 - 62% of owners doing commercial work consider office among the top three sectors in which they address health issues in construction.
 - 30% of owners doing institutional work consider college/university among the top three sectors in which they address health issues in construction.
 - 29% of owners doing institutional work consider healthcare facilities among the top three sectors in which they address health issues in construction.
- **Architects: While the office sector is selected by the highest percentage (47%) as being among the top three sectors, healthcare (44%) is a close second.** Architects also exceed other players in the office, multifamily and retail sectors in terms of consideration of health. This is consistent with the greater interest in health they generally demonstrate (see page 24).
- **Contractors: Healthcare (55%) is the most important, with a 15 percentage point differential between that and the next most commonly selected, K-12 schools.** However, a much higher percentage of contractors report that they address health issues in the K-12 sector than any other player, suggesting that contractors are particularly aware of health issues in this sector.

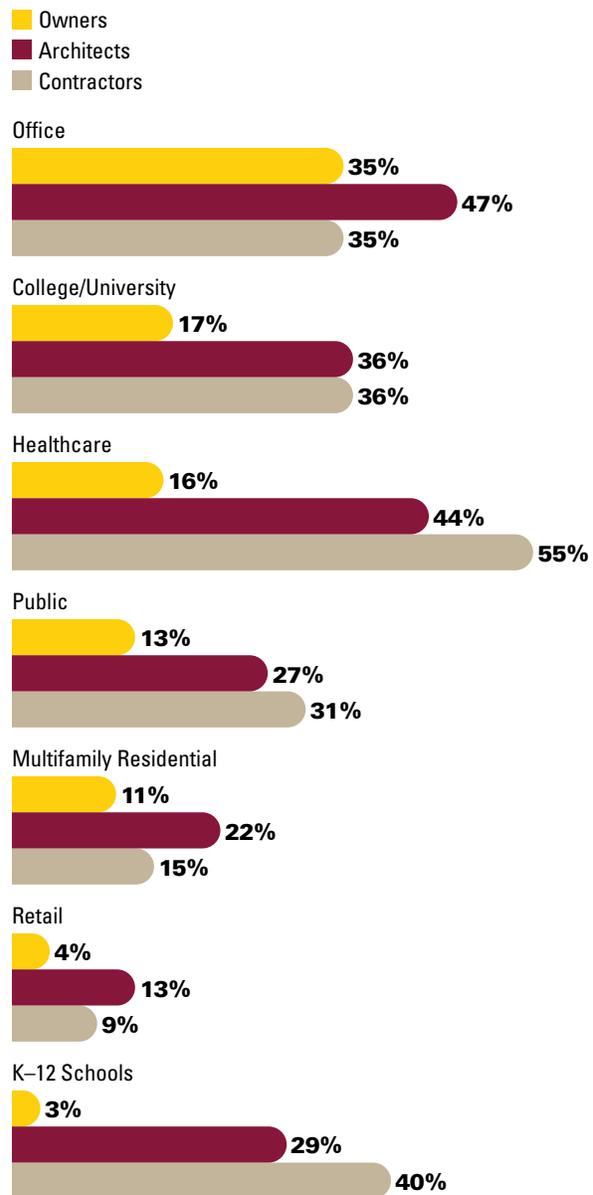
These findings do suggest that owners lag behind other players in consideration of health issues in sectors other than office.

Variation by Firm Size

A significantly higher percentage of architects from large firms (billings of \$5 million or more) rank the institutional sectors (healthcare, education, public buildings) among the top three in which they consider health issues. However, more firms with annual billings under \$5 million

Sectors Selected as Being Among Top Three in Which Health Issues Are Most Frequently Addressed (By Player)

Source: McGraw Hill Construction, 2014



consider health in multifamily projects.

For contractors, the only difference by firm size is that larger firms (project value of \$100 million or more) consider health when doing healthcare facilities and college/university projects more.

Top Factors for Consideration of Health in Decisions About Building Construction, Leasing or Operations

THE DRIVE TOWARD HEALTHIER BUILDINGS DATA

94% of Owner HR executives report that their company takes health factors into account when making decisions on the design, location and operations of their buildings.

This finding may seem to be in sharp contrast to the finding that 59% of building owners directly involved with construction projects report that health factors have a high impact on their construction decisions (see page 24). However, another 30% of the building owners directly involved in construction report a medium level of influence, leading to 89% that are seeing at least some influence in their decisions based on the building's impact on occupant health, a figure much more in line with the findings from the HR executives and demonstrating consistency in owner responses across surveys.

Factors That Lead Organizations to Consider Health Factors

The only two factors selected by more than half of HR executives as being among the top three influencing their companies to consider health factors suggest the importance of employee response to their efforts.

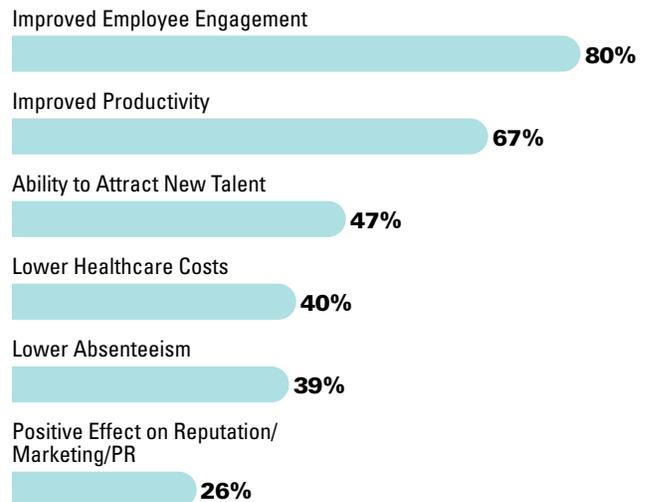
- **Employee Engagement: 80%**
- **Improved Productivity: 67%**

While expectations about improved productivity clearly play a role, it is improvements in employee engagement that drive nearly all the firms of the HR executives that participated. This finding suggests that greater public awareness of the impact of buildings on health, which in turn would lead to more employee demand for healthier buildings, could be a significant factor driving companies to more widely consider healthfulness as a requirement for their buildings.

In addition, more clear evidence demonstrating links between healthy buildings and improved productivity could help make that factor more influential in decisions.

Factors Ranked Among Top Three in Leading Organizations to Consider Health Factors in Decisions on Buildings (According to Owner HR Executives)

Source: McGraw Hill Construction, 2014



Most Important Drivers for Consideration of Health in Design and Construction

THE DRIVE TOWARD HEALTHIER BUILDINGS DATA

No single driver has influenced the industry as a whole to consider the factors impacting health when making design/construction decisions on past projects. Instead, each player is influenced by different factors.

OWNERS

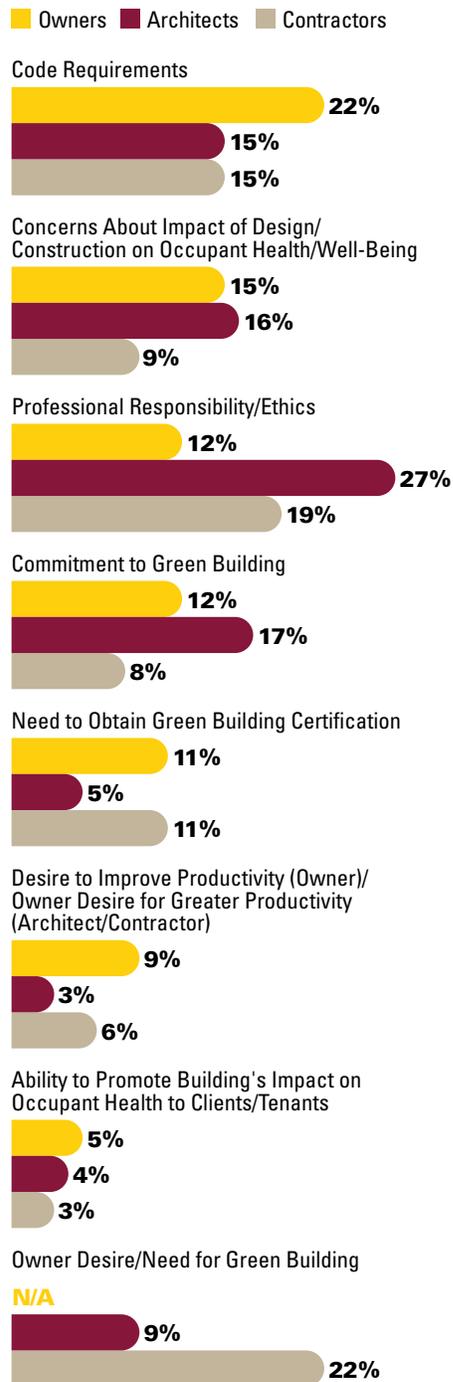
22% of owners consider code requirements the most important driver for green, compared with 15% of contractors and architects. This suggests that owners are only responding to needs rather than actively driving this market, although when asked to consider all important drivers, instead of just the top driver, the percentage of owners that select professional responsibility and ethics (68%) nearly equals the percentage that select codes (69%), suggesting that other factors are also influential, though less of a primary driver than codes. In terms of the codes with the highest level of influence, owners, similar to architects and contractors, find that building codes are the most influential, followed by energy codes, with green codes and acoustical codes a distant third and fourth, respectively.

- **Building Codes: 85% of owners that find codes influential report that these encouraged them to consider health factors.**
- **Energy Codes: 75%**
- **Green Codes: 40%**
- **Acoustical Codes: 17%**

The second most important factor for owners is a concern about the impact of design/construction activities on occupant health/well-being (15%). Owners face the most direct consequences from unhealthy buildings, from lost productivity to reduced employee satisfaction, but the percentage that rate this factor highly is roughly equivalent to the percentage of architects. This may suggest that concerns about liability may be making this factor more important than the desire for improved productivity and engagement, since architects may share liability concerns but would not directly see the benefits owners achieve in their healthy buildings.

Most Important Driver for Consideration of Health Factors in Design and Construction Decisions on Past Projects (By Player)

Source: McGraw Hill Construction, 2014



Impact of Health Factors on Decisions About Design, Construction and Office Leasing

Most Important Drivers for Consideration of Health in Design and Construction

CONTINUED

ARCHITECTS

27% of architects consider professional responsibility and ethics the top driver for their consideration of health factors in past projects, 10 percentage points more than the next highest factor. This factor also ranks higher among small (billings less than \$500,000) architect firms than larger ones. This finding is reminiscent of the early stages of green building adoption in the U.S., when firms were largely doing green because they considered it the right thing to do. As evidence continues to grow about the cost benefits of healthy buildings or as owners begin to demand healthier buildings, this driver may shift to be more market driven.

In addition, a significantly higher percentage of architects than other players find related drivers to be their most important:

- **Commitment to Green Building:** 17% (higher than both contractors and owners, higher among larger architectural firms than smaller ones and higher among firms doing more than 60% green projects than those doing less)
- **Concerns About the Impact of Building Design on the Health and Well-Being of Building Occupants:** 16% (higher than contractors)

CONTRACTORS

22% of contractors consider an owner's desire or need for a green building to be the largest driver for their consideration of health factors in past projects.

This factor is also a bigger driver for medium to large contractors (those with a project value of \$10 million or over), compared with smaller firms. Contractors are more market-driven than architects on this issue, responding more strongly to client demands. However, professional responsibility and ethics is the factor selected as most important by the second highest percentage (19%) of contractors, a strong finding that demonstrates its importance in influencing their decisions.

Since owners are the most critical factor in driving the market, this finding suggests that greater awareness and attention to health factors in building and energy codes could be a successful strategy to increase the healthfulness of buildings.

Certification Methods Encouraging Consideration of Factors Impacting Health

While only 5% of architects and 11% of contractors and owners cite the need to obtain green building certification as the most important driver, over 40% of each of the players did select it as one of many factors that encouraged them to consider factors impacting health on their projects. By far, LEED was the certification system most important in driving health considerations.

- **LEED: Encouraged 97% of architects, 98% of contractors and 90% of owners to consider factors impacting health in their projects**
- **Energy Star: 28% of architects, 29% of contractors and 33% of owners**
- **Living Building Challenge: 15% of architects, 3% of contractors and 3% of owners**
- **Green Globes: 8% of architects, 9% of contractors and 5% of owners**

While the Living Building Challenge has the most comprehensive approach to improving health, it is not as influential in the marketplace as LEED or Energy Star.

Influence of Building Codes in Encouraging Healthier Projects

THE DRIVE TOWARD HEALTHIER BUILDINGS DATA

Despite the fact that owners appear to be the most widely influenced by building codes in their healthy building efforts up to this point, they are also the player least convinced about the effectiveness of current building codes in encouraging healthier projects. **58% of owners report that current building codes or standards encourage healthier projects, compared with 62% of architects and 75% of contractors.**

Since codes have been an important trigger for healthy building activity for owners up until now, more effective codes are likely to be able to improve the health impacts of buildings on a wider basis.

Ways in Which Codes/Standards Encourage Healthier Projects

While there are no statistically significant differences, the top ways in which codes encourage healthier projects differs between owners and other players.

- **Helping to identify healthier product options is selected by the highest percentage of owners (37%),** compared with the second highest percentage of architects (31%) and the lowest percentage of contractors (26%) among the three means provided. This suggests that owners and architects put greater emphasis on product selection as a key factor in the healthfulness of projects than contractors do. However, final product selection often is done by contractors, suggesting that more education on the impact of products may be useful among these players.
- **Offering guidance to produce healthier projects is the most widely selected choice by architects (39%) and contractors (37%).** For owners, this is also important, ranking second at 35%. The high performance across all players suggests that the industry is still struggling with the best approach to building healthier projects.
- **Providing incentives is more effective with contractors, with the second highest percentage (29%) finding this influential,** compared with 24% of architects and owners, putting this at the lowest level for both categories. However, this is still a relatively high percentage overall, comparatively, suggesting that all three of these means carry some influence in the industry.

Variation by Level of Green Involvement

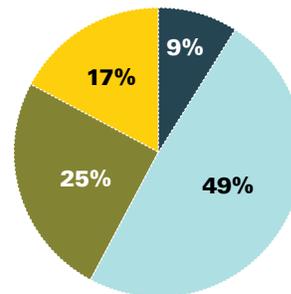
45% of architects doing more than 60% green projects find codes to not be an effective encouragement for

Effectiveness of Building Codes in Encouraging Healthier Projects (By Player)

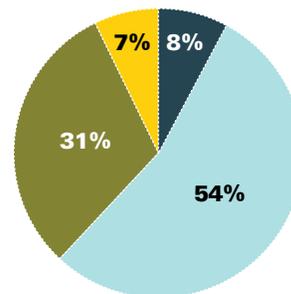
Source: McGraw Hill Construction, 2014

- Very Effective
- Somewhat Effective
- Not Effective
- Not Sure

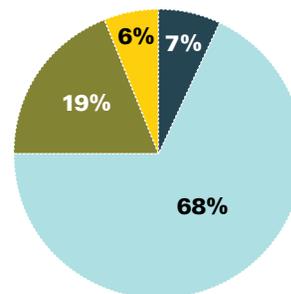
Owners



Architects



Contractors



healthier projects, significantly more than those doing fewer green projects. However, there is no similar differential among contractors or owners.

Influence of Players on the Incorporation of Health Considerations Into Design and Construction Decisions

Generally, the major players on a construction project agree about the influence of different players on the incorporation of health considerations into design and construction decisions, with a few differences noted below between architects and contractors.

93% of architects and contractors find owners to be influential, making them the most influential of all the players. This finding demonstrates the importance of educating owners on the financial and productivity benefits of healthier buildings.

After owners, the chart demonstrates that players fall into tiers of influence.

■ **Players With High Influence: 70% consider building operators/facility managers influential and 68% consider architects influential, making these the most influential players other than the owners.**

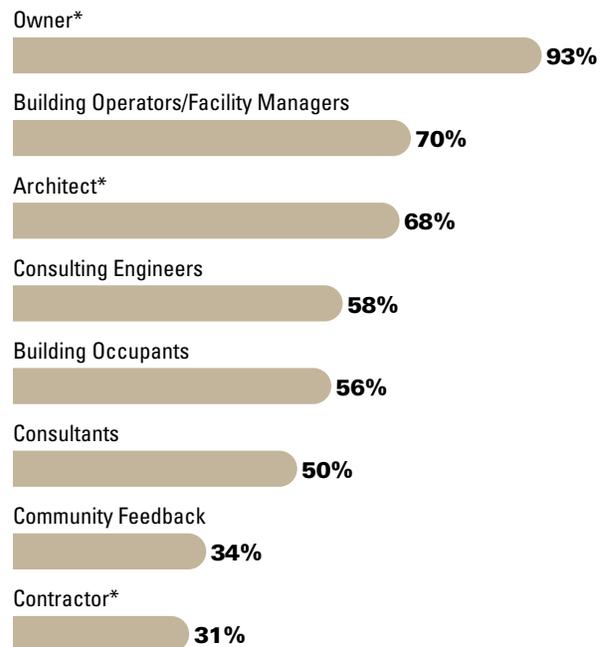
- The influence of building operators/facility managers suggests that for many buildings, healthiness is considered as much of an operational as a construction strategy.
- A higher percentage of architects (70%) consider building operators/facility managers influential than contractors (60%). Architects may be more likely to engage the needs of operators/facility managers during design than contractors are during construction.
- For other trends researched by McGraw Hill Construction, such as the use of green building materials and methods, architects are typically considered quite influential, and this finding continues that trend. Architects are best positioned in the process to include healthy practices and products into the building.

■ **Players With Medium Influence: Around half of the respondents consider consulting engineers (58%), building occupants (56%) and consultants (50%) influential.**

- Consulting engineers' control of ventilation and heating/cooling systems may be a prime driver in this strong performance.
- A significantly higher percentage of architects (60%) find building occupants to be influential than contractors (46%), with owners (55%) straddling the middle. In addition, more architects doing more than 60% green projects find occupants to be influential than those doing fewer green projects. Again, architects may be more likely to engage with building occupants during the design process than contractors are during construction, especially on green building projects.

Influence of Players on the Incorporation of Health Considerations Into Design and Construction Decisions

Source: McGraw Hill Construction, 2014



*Players were not asked about the influence of their own group, so owners were not asked about owners, contractors were not asked about contractors, and architects were not asked about architects.

- For owners, architects and contractors alike, those doing more than 60% green projects find consultants more influential than those doing fewer green projects.
- **Players With Low Influence: The community (34%) and contractors (31%) are the least influential in determining the incorporation of health considerations in projects.** This finding may seem surprising, given the number of specific building products selected by contractors. However, by the time a contractor is involved, the level of interest in building features that enhance health may be already established.

Re-Envisioning the Healthcare Setting

UCSF Medical Center at Mission Bay

SAN FRANCISCO, CALIFORNIA



UCSF Medical Center at Mission Bay makes the built environment an active participant in healing patients.

THE DRIVE TOWARD HEALTHIER BUILDINGS

The UCSF Medical Center at Mission Bay is the first San Francisco-area hospital to be built from the ground up in more than 30 years. Recognizing a shining opportunity to further its mission to advance health in the broadest possible sense, the University of California, San Francisco (UCSF) worked closely with its project team to envision a built environment that would actively contribute to health and healing.

“Their goal was to redefine the delivery of healthcare,” says David Johnson, AIA, partner and managing director at William McDonough + Partners, architects for UCSF Mission Bay in collaboration with Anshen + Allen, now Stantec, “and if we focused on environmental health within the patient environment, that would be the leverage point for them.”

The team then articulated the primary principle of environmental health into a cascading filter through which thousands of design decisions were tested against the project’s core values. Two categories of decision-making carried particular significance for health: materiality and psychosocial quality.

Scrutinizing Materials for Health Impacts

Getting hold of product information to evaluate materials’ health impacts wasn’t always easy. Manufacturers often consider products’ material content a trade secret. And even when they’re willing to answer questions, they’re often unaware of their products’ health implications.

“There had been a lot of work done by manufacturers with their eye on LEED,” says Herb Moussa, AIA, principal at Stantec and project architect on UCSF Mission Bay, “but the industry didn’t have toxicity in mind.”

Raising questions with manufacturers is one of the first steps in changing the market, and the Mission Bay design team considers its work in opening that discussion to be one the project’s major contributions to building health: If manufacturers keep hearing those questions, things will start to change.

To help discriminate among products in the market, the design team brought in McDonough Braungart Design Chemistry (MBDC), a sustainability consulting and product certification firm

with materials expertise. Working with MBDC, the team developed screening criteria for five main categories of toxins—carcinogens, endocrine disruptors, mutagens, teratogens and reproductive toxins. They then screened 130 interior finishes, scored the results against a matrix with patient health at the top and picked the highest scorers.

Their investigation yielded a surprising insight: base products were generally benign; it was the additives that introduced toxins. Additives such as paint color, stain guards, fire retardants, antimicrobials and sealants, which were intended to make the base products perform better, were actually making the products worse from the perspective of health.

That insight led the team to focus on materials that would perform without additives. For example, they specified rubber flooring, which requires no sealant. They scrutinized carpet fiber type, density, strength and means of coloring for inherent stain resistance, and picked carpet tiles rather than rolls for ease of replacement if an area became stained beyond cleanability. And

UCSF Medical Center at Mission Bay

SAN FRANCISCO, CALIFORNIA

THE DRIVE TOWARD HEALTHIER BUILDINGS

they succeeded in having a code requirement for flame-retardants on furniture waived on the grounds that flame-retardants would add nothing to the fully sprinklered building's safety, in fact the reverse.

Supporting the Mind in Healing the Body

As well as minimizing environmental toxins, the Medical Center maximizes environmental support for the healing role of the mind. David Johnson credits the evidentiary framework that underlies the design team's work in this area to Derek Parker, FAIA, co-founder of The Center for Health Design (CHD), and for many years head of Anshen + Allen. Parker helped bring evidence-based design into the mainstream by co-developing CHD's Pebble Project research initiative, and creating the research-based Fable Hospital concept that supports the business case for better healthcare buildings. Because of Parker's work, says Johnson, "it is easy to draw correlations between view, aspect, fresh air, color, light and the recovery of the patient."

At Mission Bay, every patient room enjoys ample daylight and a view into a garden or park. The project includes over four acres of green space, including 1.2 acres of rooftop gardens, many of which are designed specifically for the needs of the patients in adjacent floor areas. A lush, calming garden provides a place of respite for cancer patients, for example, and a patterned and resilient activity surface encourages play in a children's garden. To screen views between patient populations, the landscape design uses ground contours and butterfly- and



Carefully screened materials create a variety of environments.

bird-friendly plantings to give patients on both sides of the screen something beautiful to look at.

Inside the Center, in addition to day-lit rooms and views of nature, the design for the Women's Specialty Hospital uses expansive two-story atriums, intimate meditation spaces, soft color schemes and carefully curated exhibits of art to lift patients' spirits. It also includes versatile spaces to meet the needs of family and caregivers.

In the children's hospital, a diversity of environments and experiences support kids' quality of life and their continuing vital engagement with it. Children are able to make and record music, for example, or participate in television broadcasts to other patients in the hospital, visit with friends and family through telemedia, and even continue school in a fully accredited classroom.

"It is just huge for their morale as they go through their hardship," says Moussa, "not feeling like they're the only ones, that they're losing connection."

UCSF's commitment to creating a built environment that actively supports health, broadly defined, earned it a 2012 Client Achievement

Project Facts and Figures

stats

Owner

University of California, San Francisco

Architect

Stantec Architecture

Associate Architect

William McDonough + Partners

Project & Construction

Management Consultant

Cambridge CM, Inc.

General Contractor

DPR Construction, Inc.

Sustainability Consultant

and Product Certification

Firm

McDonough Braungart Design Chemistry

Type of Project

- 183-bed children's hospital
- 36-bed women's specialty hospital
- 70-bed cancer hospital

Size

878,000 square feet

Budget

\$1.52 billion

Completed

August 22, 2014 (Open to the Public February 2015)

Honor Award from the AIA California Council. That commitment, said Johnson in his letter of support for the award, "has resulted in a project that will offer long-term learning opportunities for the AEC community, the medical community, and all the staff and patients who spend time there for decades to come." ■

Data: Drivers and Challenges

for Future Investment in Healthy Buildings

Top Drivers Encouraging Industry Focus on the Impact of Buildings on Health in the Next Two Years

THE DRIVE TOWARD HEALTHIER BUILDINGS DATA

When asked to rank the top three drivers encouraging the industry to focus more on the impact of buildings on health during design and construction, **owners and architects agree that the top driver is greater public awareness of the health impact of building design.** This is also the second most important driver for contractors and selected by a high percentage of architects doing more than 60% green projects. Greater public awareness is essential to create more demand for healthier buildings and to increase the prioritization of health factors during the design and construction process.

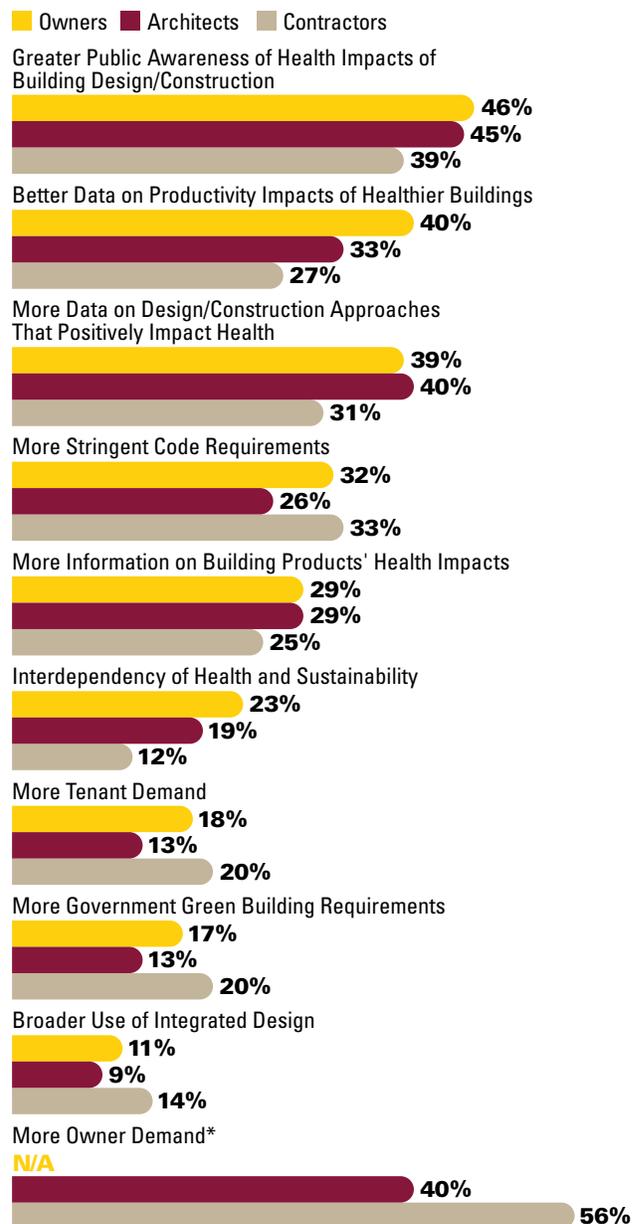
On the other hand, the top driver for contractors is more owner demand, with 56% reporting this as a top three driver. This finding is consistent with other McGraw Hill Construction research on important construction industry trends, such as building information modeling or green building, where contractors see client engagement as a primary driver. It is also the second highest driver for architects, clearly demonstrating the importance of owner engagement to increase the degree to which health factors are a major consideration on a project. However, the more green work an architect does, the less this factor is seen to be an encouragement, suggesting that green architects are more likely to focus on health impacts without owner influence.

The findings also demonstrate that more attention to health in building design will be driven by multiple factors, especially better data and codes.

- **Owners: Better data is an important driver for owners, with 40% selecting data on productivity impacts and 39% selecting data on the health impacts of design and construction approaches as among their top three drivers.** 29% find more information on building product health impacts would be a key driver as well. More data is critical to demonstrate the business benefits of healthier buildings, and specific results currently are relatively scarce because of the challenge of demonstrating the impact of one element on a complex system impacted by multiple factors.
- **Architects: Other than owner demand, architects find that better data will be a key driver for them, particularly data on the impacts on health of design and construction approaches (40%) and on products (29%).**
- **Contractors: In addition to data on design/construction approaches that impact health (31%), contractors see stringent codes (33%) as an important requirement.** Owners also share that belief with 32% selecting codes as one of their top three drivers. This finding is

Top Three Drivers Encouraging Greater Industry Focus on Building Health Impacts in the Next Two Years (By Player)

Source: McGraw Hill Construction, 2014



* Not asked of owners

consistent with the triggers that owners and contractors report encourage their use of healthy methods on their past projects.

Top Factors According to Owner HR Executives Encouraging Investment in Healthy Buildings

THE DRIVE TOWARD HEALTHIER BUILDINGS DATA

Owner HR executives, similar to the building owners directly involved in building projects, place strong emphasis on having more data as one of the top three drivers that they believe would encourage their organization to invest in healthy buildings. More data on employee health benefits is ranked among the top three drivers by 60% of HR executives, the highest percentage, and data on productivity benefits is selected among the top benefits by the third highest percentage (50%). This clearly supports the findings of the construction professionals that improved data will play a critical role in encouraging greater use of healthy building practices and products.

Another factor considered important by HR executives is positive employee feedback on healthy building features, selected by 56% as one of the top three drivers that would encourage healthy building investments. This again reinforces the previous finding that greater public awareness of the health impacts of buildings is critical to create demand for these spaces (see page 34).

The final factor that a high percentage of HR executives ranked as one of their companies' top three drivers is incentives/lower insurance rates from insurance companies for healthy buildings. It is notable that, while this is only the fourth highest percentage of respondents selecting the top three items, 34% of respondents rank this factor first among the drivers, by far the largest percentage for any driver ranked first. This disparity may be due to the lack of consistent practices in this regard by insurance companies. Those who have experienced direct cost savings may be more enthusiastic than those who regard this driver as purely speculative.

Top Three Drivers for Investments in Healthier Buildings (According to Owner HR Executives)

Source: McGraw Hill Construction, 2014



Top Challenges Preventing Health Impacts From Being a Critical Factor in Design and Construction Decisions

Owners, architects and contractors largely agree on the most important challenges that prevent companies from making health impacts a critical factor in their design/construction decisions. Most factors have a spread of 10 percentage points or less between players who rank that challenge among their top three.

- **The highest percentage of architects (59%) and contractors (67%) find that lack of owner willingness to invest in needed improvements is among the top three challenges they face.** For owners, this factor has the third highest percentage of respondents identifying it among their top three challenges, although fewer owners doing more than 60% green projects consider it a top challenge. This again confirms the importance of owners in driving greater consideration of health factors in building design/construction.
- **The highest percentage of owners (57%) rank concerns about the need to consider other factors—such as cost, schedule and energy performance—in their decisions about buildings as one of the top three challenges.** A high percentage of architects (52%) and contractors (59%) also consider this a top three challenge, confirming its recognition across the industry.

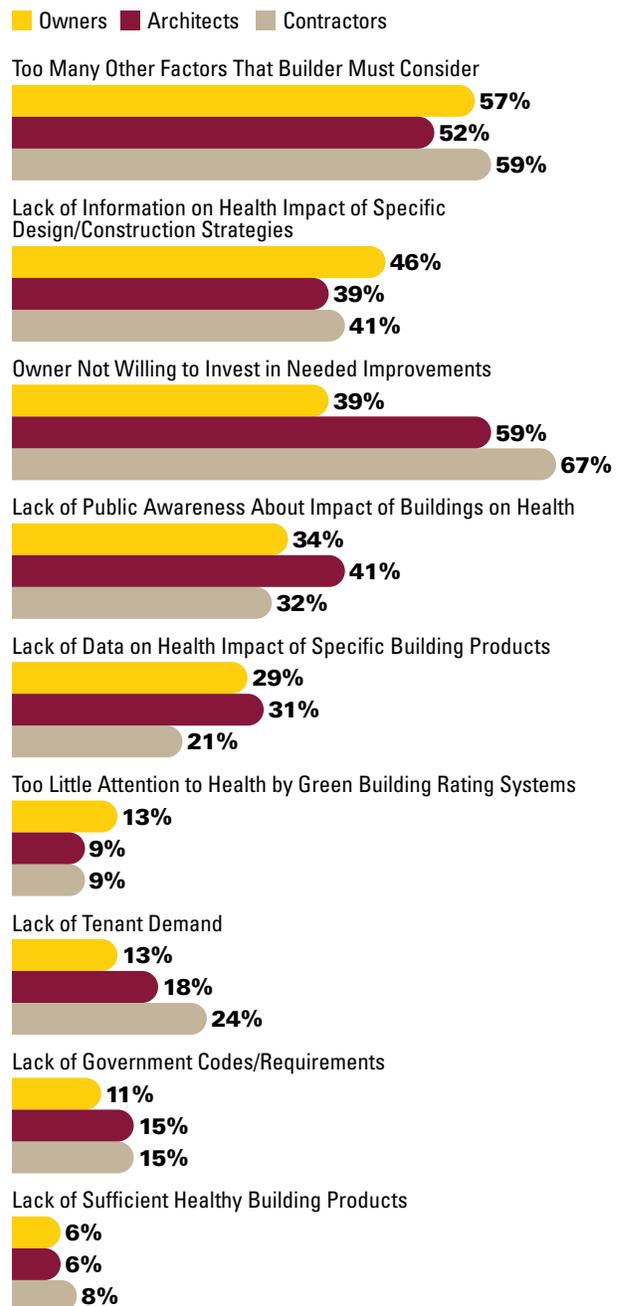
The remaining top challenges involve the lack of good data and lack of public awareness, consistent with findings on drivers (see page 34).

- **Owners are particularly concerned about the lack of information about the impact of specific building design/construction strategies on the health of the occupants.** Without good data, it is harder to make a business case for investments in specific strategies.
- **Architects have the highest level of concern about the lack of public awareness of building impacts on health.**
- **While there is generally less concern about the lack of data on products than there is on practices, 29% of owners and 31% of architects do still find this to be one of the top three challenges.**
- **A higher percentage of architects and contractors doing more than 60% green projects are concerned about the lack of information on specific design/construction strategies and lack of data on products than those doing fewer green projects.**

Investments in research, education and making product information more widely available could increase the use of healthier products and practices. These factors could also encourage owners to be more willing to invest, which would drive the trend toward healthier buildings in the industry.

Top Three Challenges Preventing Companies From Making Health Impacts a Critical Factor in Design/Construction Decisions (By Player)

Source: McGraw Hill Construction, 2014



Top Obstacles According to Owner HR Executives to Investment in Healthy Buildings

Four obstacles have roughly the same percentage of Owner HR executives—from 50% to 59%—who rank them among the top three obstacles to their companies’ investment in green building.

- **Competing Priorities Are Considered More Important:** This finding corresponds to the high degree of concern reflected by the building professionals at owners and demonstrates the awareness of multiple demands made on buildings to be resilient, sustainable, efficient and other use-specific priorities. However, it is worth noting that only 12% rank this as the most important obstacle, suggesting that other obstacles may be even more critical to address.
- **Challenge of Estimating ROI Due to Inability to Isolate Building Impact on Health/Productivity:** This obstacle relates directly to the need for data made clear by both the HR executives and by the building industry professionals. However, the challenge of isolating this factor continues to impede the ability to gather data. With 25%, though, ranking this as the most important obstacle, the industry will need to address this challenge.
- **Concerns About Cost of Creating a Healthy Building:** 28% of HR executives rank this as the most important obstacle their company encounters, the highest percentage for any obstacle, which demonstrates that the perception of cost is a problem. However, the evolution of green building has demonstrated that wider industry knowledge about best practices and greater availability of appropriate products can significantly reduce concerns about the cost of increasing performance, and it is likely that as healthy buildings become more commonplace, this concern will also become less prominent.
- **Lack of Knowledge About Health Impacts of Building Operations/Maintenance:** This finding reinforces the need for education about building impacts on health, which needs to extend to the operational phase of the building as well.

One additional finding worth noting is that very few (21%) consider the influence of leaders who doubt that buildings have an impact on health to be a major obstacle. This finding, along with those that demonstrate the expectation of growing consideration of health in design and construction decisions (see page 24), reveals that the information and education required in the industry is not broadly on the idea that buildings impact

Top Three Obstacles That Make Investment in Healthy Buildings Difficult (According to Owner HR Executives)

Source: McGraw Hill Construction, 2014



health but on specific strategies and products that can be employed to improve buildings in a cost-effective manner.

Variation by Level of Green Involvement

HR executives who work in green buildings or whose companies have green policies have significantly different views of three obstacles.

- **A lower percentage (27%) of respondents whose offices are in a green building believe that lack of knowledge about the health impacts of building operations and maintenance is an issue than the rest (69%).**
- **No HR executives from companies in green buildings believe that their leaders doubt the impact on health.**
- **Over two thirds of HR executives in companies with green policies believe that the split between capital and operating budgets is an obstacle to investment in healthy buildings, compared with 12% whose companies do not have green policies.**

Data: Metrics and Benefits

Most Important Ways to Measure Health Impacts of Buildings (According to Architects and Contractors)

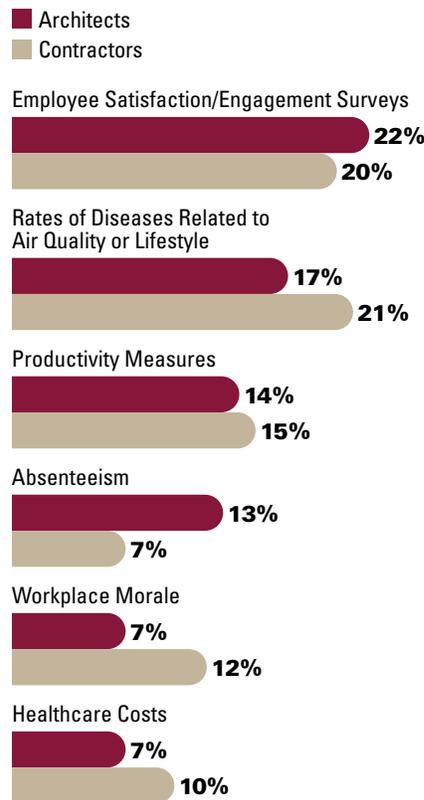
The top two ways to measure the health impacts of buildings, according to architects and contractors, mirror the factors that owner HR executives believe will lead their organizations to take health factors into account in their decisions about buildings. (See page 35.)

- **Employee Satisfaction/Engagement: The highest percentage of architects (22%) and second highest percentage of general contractors (21%) both consider employee satisfaction and engagement the most important way to measure the impact of green buildings.** This is the most commonly employed metric used by owners (see page 39) and corresponds to the high ranking given to improved employee engagement by HR executives, demonstrating that a key benefit of healthy buildings is increased employee satisfaction. This metric is also relatively straightforward and can be directed toward specific building features or improvements, making it easier to perform than some of the other metrics measured.
- **Rates of Diseases Related to Air Quality or Lifestyle: The highest percentage of contractors (21%) and second highest percentage of architects (17%) select measuring rates of diseases related to air quality or lifestyle as the most important measure of building impacts on health.** While not a direct measure of building impact, these factors can be isolated for analysis and mitigated through better building systems. However, only 10% of owners use this metric, possibly suggesting that it may be of limited use when they make their business case for healthy building features.
- **Productivity Measures: The third highest percentage of architects (17%) and contractors (21%) consider productivity the most important way to measure health impacts.** While productivity gains are harder to measure than employee engagement or disease rates, architects and contractors recognize the importance of productivity improvements for owners, and in fact, productivity is the second most frequently used metric reported by owners. In addition, productivity improvement is cited by the second highest percentage of HR executives as a factor that leads their companies to take health factors into account in their decisions about buildings. For most companies, employee-related costs are far higher than costs associated with real estate, and even small productivity gains can have a major financial impact.

Healthcare costs are not considered an important measure by many architects or contractors. The

Most Important Ways to Measure Building Health Impacts (According to Architects and Contractors)

Source: McGraw Hill Construction, 2014



Measures selected by less than 5% of architects or contractors include mood and stress scales, mobile devices measuring stress and relaxation, community engagement with space and occupant physical activities.

challenge of distinguishing costs impacted directly by building features may account for the relatively low percentage that consider this measure important.

Variation by Firm Size

A higher percentage of architects from firms with billings under \$5 million (10%) consider workplace morale to be the most important measure of building health impacts, compared with 3% from smaller firms.

More contractors from companies with more than \$100 million in project value find employee satisfaction/engagement and productivity to be the most important measures of health impact than in companies with a project value of under \$10 million. However, more respondents from the smaller firms find healthcare costs to be the most important measure.

Metrics Used by Owners to Measure the Impact of Specific Construction Decisions on Building Occupant Health

75% of owners report using a metric to measure the health impacts of specific building construction divisions. This high percentage demonstrates that owners are highly cognizant of the health impacts of buildings and are seeking data to demonstrate building performance.

53% of owners report measuring employee satisfaction and engagement, by far the most widely used metric. Employee satisfaction and engagement can be more easily measured using surveys than many other factors, and this is a common metric for larger companies to track for other purposes as well, providing them with experience in using these tools. In addition, as the responses of the HR executives make clear, increased employee engagement is also a prime driver for investment in healthy building and highly valued by owners.

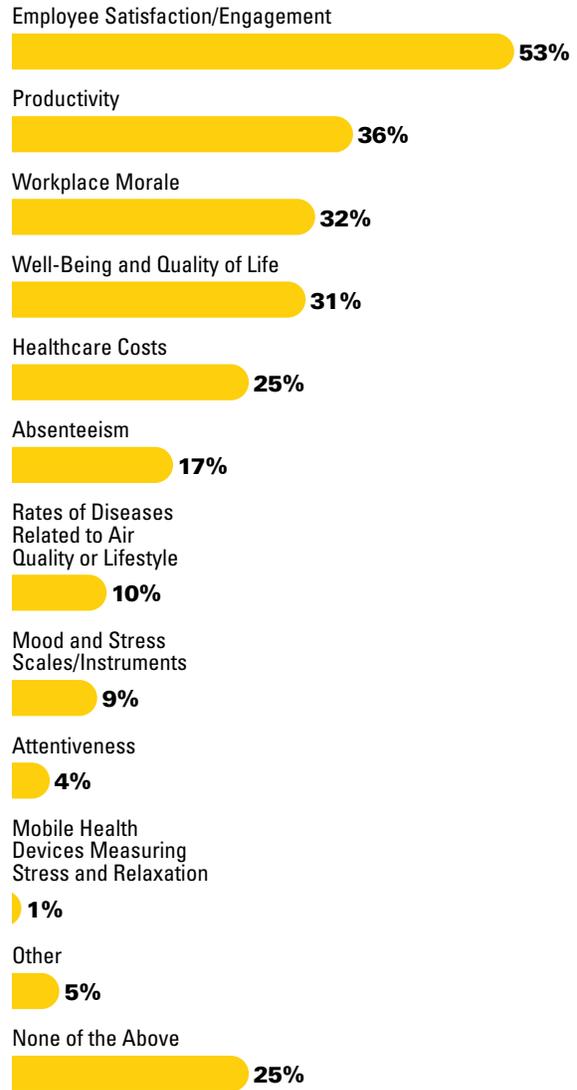
36% also report measuring productivity. Given the challenge of measuring productivity or relating it back to building improvements, this finding is surprising, and it demonstrates the high value owners gain from even small productivity gains and their need to understand the impact of their buildings on this important measure.

The other two measures tracked by more than 30% of building owners again relate to their employees: workplace morale (32%) and well-being and quality of life (31%). Since these are less tangible measures and more challenging to ascertain, the frequency with which they are tracked reveals again that improving employee experience at work is a high priority to many employers.

Healthcare costs are used to measure the impact of specific design and construction decisions on building occupant health by one quarter of the respondents. While it is likely that nearly all companies included in the survey are tracking their healthcare costs, many clearly find it challenging to relate the data they have to specific building improvements. However, since 25% have been able to make those connections, it is possible that more firms may be able to make more direct connections between their healthcare costs and the buildings they occupy.

Metrics Used by Owners to Measure Impact of Specific Construction Decisions on Building Occupant Health

Source: McGraw Hill Construction, 2014



Impact of Buildings on Employee Satisfaction/Engagement

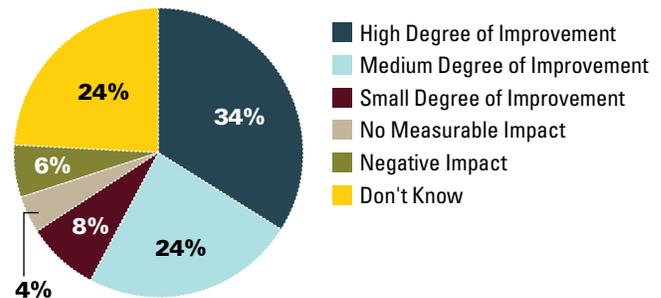
53% of building owners report that they use employee satisfaction/engagement to measure the impact of their buildings on building occupant health and well-being. When asked about the impact they have found, **two thirds (66%) report that they have seen at least some improvement with over half of those (34% of all the owners using this measure) reporting that they see a high degree of improvement.**

Since employee satisfaction is the most highly rated factor that HR executives report as encouraging investment in healthy buildings, this finding is important because it suggests most owners see the results they gain.

Another notable finding is that nearly one quarter (24%) of those that measure employee satisfaction/engagement do not know what impact their buildings have on this measure. This suggests that more information about gathering this data may be helpful for many owners to fully determine the benefits they see from healthy building investments.

Impact of Building on Employee Satisfaction/Engagement (According to Owners Using Employee Satisfaction/Engagement to Measure Building Health Impacts)

Source: McGraw Hill Construction, 2014



Impact of Buildings on Occupant Productivity

36% of owners surveyed report that they use productivity as a measure of the impact of construction decisions on building occupant health. **However, when asked what impact the buildings have on productivity, 56% of the owners that report using that measure say that they do not know.** This finding highlights the challenges faced in the industry to capture productivity gains from healthy buildings.

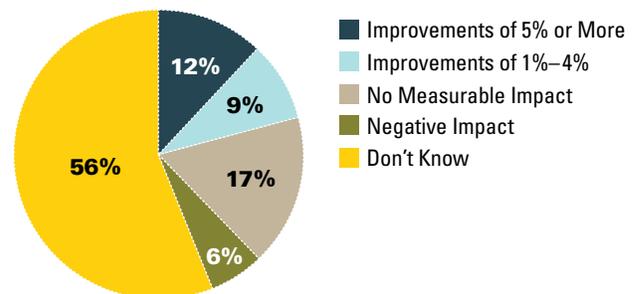
The remainder report the following results.

- **21% (just under half of those that can report on productivity impacts) find that they see improvements, with over half (12%) seeing improvements of 5% or more.**
- **17%, a sizable percentage, report seeing no measurable improvements.**
- **A nearly negligible 6% see a negative impact.**

These findings do suggest that if owners could effectively measure their productivity gains, sizable gains are possible. For most companies, gains of 5% or more would have substantial financial implications. Capturing these results, however, remains an ongoing challenge that the industry must address.

Impact of Buildings on Employee Productivity (According to Owners Using Productivity to Measure Building Health Impacts)

Source: McGraw Hill Construction, 2014



Impact of Buildings on Occupant Well-Being and Quality of Life

31% of owners report that they use occupant well-being and quality of life to measure the impact of construction decisions on building occupants. These owners report very positive results from their healthy building investments.

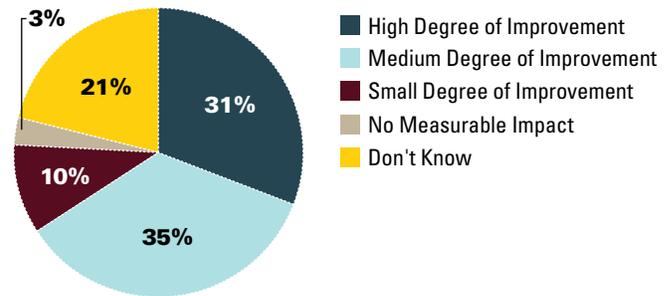
- Of those performing that measurement, 76% report that they are seeing improvements in occupant well-being and quality of life.
- In addition, nearly half of the 76% (31%) see a high degree of improvement and over half (35%) of them see a medium degree of improvement.

While 21% still do not know the impact of their buildings, these findings nonetheless demonstrate that this factor can be measured by owners and that they see strong benefits from their healthy building investments in the impact on building occupants.

This finding is important because for many companies, improved employee well-being and quality of life would contribute directly to employee satisfaction and engagement, benefits highly valued by owners.

Impact of Buildings on Occupant Well-Being and Quality of Life (According to Owners Using Occupant Well-Being/Quality of Life to Measure Building Health Impacts)

Source: McGraw Hill Construction, 2014



Additional Benefits Reported by Owners Conducting Measurement

25% of building owners report using healthcare costs to measure the impact of construction decisions on building occupant health and 17% report using absenteeism. These owners were asked what impact on their building they observed. While the number of owners who qualified to respond is too low for a statistically valid sample, enough did respond to support trending analysis.

- Over half of the owners who report measuring healthcare costs do not know the impact of their buildings on those costs. Healthcare costs, while relatively easy to track, are the result of many factors. Isolating the degree to which buildings contribute to or reduce these costs is challenging for most owners.
- Among those who do track them, over two thirds report an improvement of some sort, with most seeing improvements in the range of 1% to less than 2%.

While these improvements may seem small, for a larger company, they can quickly add up and more than justify the additional expenses associated with making buildings healthier.

- Almost half of the owners measuring absenteeism do not know the impact of their buildings on their absenteeism rate. As with healthcare costs, absenteeism can be impacted by a broad range of factors, and few owners can isolate the impacts of their healthy buildings from other factors.
- About two thirds of those who can determine an impact see some improvement in absenteeism, and the largest percentage (about half) see improvements of 10% or more.
- However, nearly one fifth of those who can determine an impact report no measurable improvements.

As with productivity, these findings support the need for ways for owners to measure these impacts effectively.

Drivers With the Highest Impact on a Firm's Commitment to Measure the Health Impacts of Buildings

Owners, architects and contractors were asked to select the driver with the highest impact on their firm's commitment to measuring the health impacts of buildings among four options. Two options were provided just to owners, two options just to architects and contractors and the remaining two options were asked of all. The results for the architects and contractors have been combined together since there was only a one percentage point difference between their responses for all four options, demonstrating a high level of industry agreement about the importance of these drivers.

OWNERS

The highest percentage of owners find that employee interest in building health impacts (31%) and standardized measurement tools (30%) are the most important drivers for measurement. Owners are motivated by the need to demonstrate healthy building performance to their staff and by the need to make such measurements relatively straightforward. However, they are not motivated by the possibility of engaging architects or contractors in the process (14%), nor by the ability to compare their results against a national database (4%).

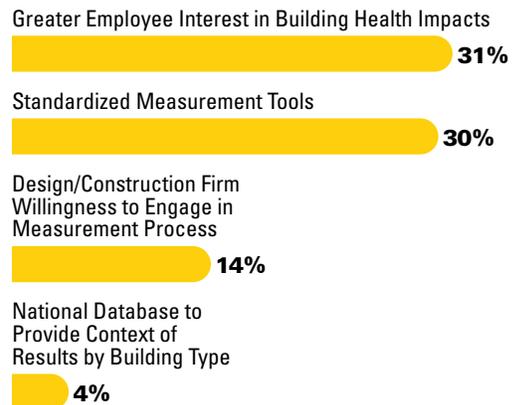
ARCHITECTS AND CONTRACTORS

For architects and contractors, the most important factor encouraging them to commit to measurement of building health impacts is the building owner.

- **The largest percentage consider greater interest on the part of the building owners in health issues (41%) the factor that would have the greatest impact on their commitment to measurement.** Clearly, they would be more willing to invest in measurement if it allowed them to fulfill a need or desire on the part of their clients.
- **Owner willingness to partner in measurement is a top factor for 29%**, which may reflect the challenges these firms face in gathering the appropriate metrics without the cooperation of owners.
- **Architects are the only player for whom their level of green involvement is a factor in the percentage that find the measurement drivers impactful.**
 - A significantly higher percentage of architecture firms that do more than 60% green projects find standardized measurement tools and a national database to have an impact on their commitment to measurement of health impacts in the future than those doing fewer green projects.

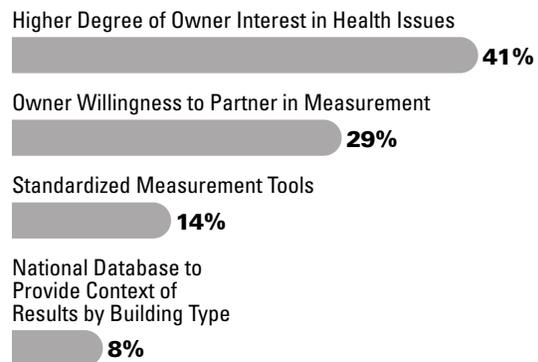
Drivers With the Highest Impact on a Firm's Commitment to Measure the Health Impacts of Buildings (According to Owners)

Source: McGraw Hill Construction, 2014



Drivers With the Highest Impact on a Firm's Commitment to Measure the Health Impacts of Buildings (According to Architects and Contractors)

Source: McGraw Hill Construction, 2014



- A significantly higher percentage of those doing 15% or less of their projects green find that owner interest in health issues is a driver for measurement.

As with owners, the presence of a national database to provide context for the results is important only to a small percentage of respondents.

Use of Health Impact Assessment

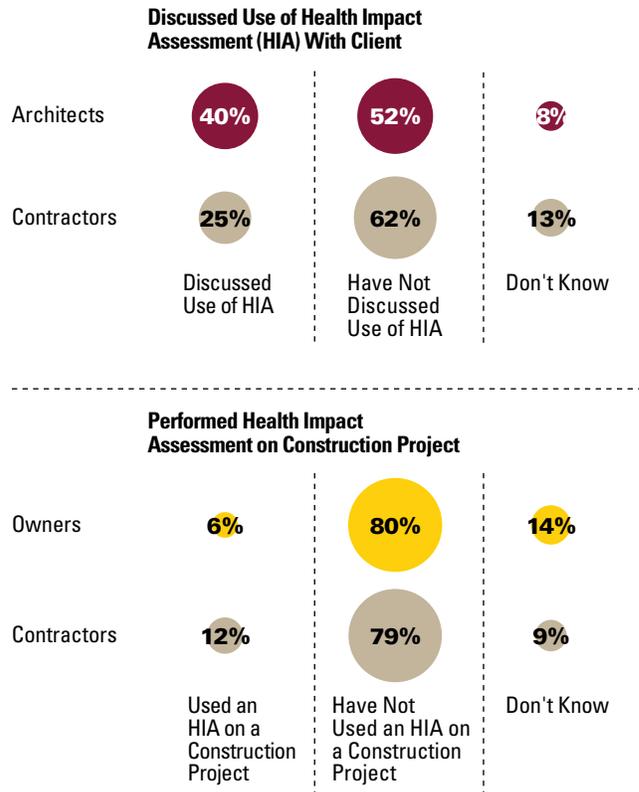
Most design and construction industry professionals are familiar with environmental impact assessments. A Health Impact Assessment (HIA) is a similar process that allows decision-makers to consider the impact of a project on the health of the surrounding community, although it is not currently mandated the way that environmental impact assessments are. While health impacts are included in a limited fashion in environmental impact assessments, they are not covered as extensively as they are in a formal HIA. Industry knowledge about HIA appears to be relatively robust, but actual use of HIAs is relatively low.

- **40% of architects and 25% of contractors have discussed the use of these assessments with their clients.**
- **In addition, most respondents seem to be familiar with HIAs, since the percentage that don't know if they have discussed use with their clients is low, only 8% for architects and 13% for contractors.**
- **Only 5% of owners and 12% of contractors, however, have actually used a health assessment on their projects.**

Use of HIAs is an emerging practice. The Health Impact Project, a nonprofit initiative promoting the use of HIAs in the U.S., currently has information on over 300 HIAs that have been or are being conducted across the U.S.¹ The process of conducting an HIA is involved and does take time, and the possibility exists of costly recommendations emerging from the process, but for some projects, the potential for avoiding litigation or serious harm may counterbalance these factors.

Recommendation and Use of Health Impact Assessments (By Player)

Source: McGraw Hill Construction, 2014



Health Impact Assessments (HIAs)

The National Academy of Sciences define an HIA as “a systematic process that uses an array of data resources and analytic methods, and considers input from stakeholders to determine the potential effects of a proposed policy, plan, program or project

on the health of a population and the distribution of those effects within the population. Health impact assessment provides recommendations on monitoring and managing those effects.”²

According to a Report in Brief from the National Academy of

Sciences, *Improving Health in the United States: The Role of Health Impact Assessment*, the formal process consists of six components: screening, scoping, assessment, recommendations, reporting, monitoring and evaluation.

1. List of locations available at <http://www.healthimpactproject.org/hia/us>.

2. National Academy of Sciences. *Improving Health in the United States: The Role of Health Impact Assessment Report Brief*. 2011. <http://dels.nas.edu/resources/static-assets/materials-based-on-reports/reports-in-brief/Health-Impact-Assessment-Report-Brief-Final.pdf>.

Top Benefits That Offer the Best Return on Investments in Healthier Work Environments According to Building Owners, Architects and Contractors

Owners, architects and contractors agree that two benefits offer the best return on investment (ROI) on their company's investment in a healthier work environment: **greater worker productivity and improved employee satisfaction**. For owners, these factors are selected among the top three benefits by the same percentage of respondents (59%). However, more architects and contractors find that worker productivity has greater potential ROI for their investments in healthier workspaces than improved employee satisfaction.

Since architects and contractors are ranking the benefits they experience, rather than those of their clients, these findings may be influenced by prolonged recession in the construction industry. Employee retention, a direct beneficiary of employee satisfaction, appears to be a powerful driver in other industries. However, in the design and construction industries, the recession led to chronically high unemployment, and the recovery has not yet resulted in shortages in qualified employees. Therefore, employee retention may not be as important of a factor in this sector yet, although a few years of robust growth could significantly alter this response.

Contractors are the only player with significantly different responses to the other benefits, compared with the rest.

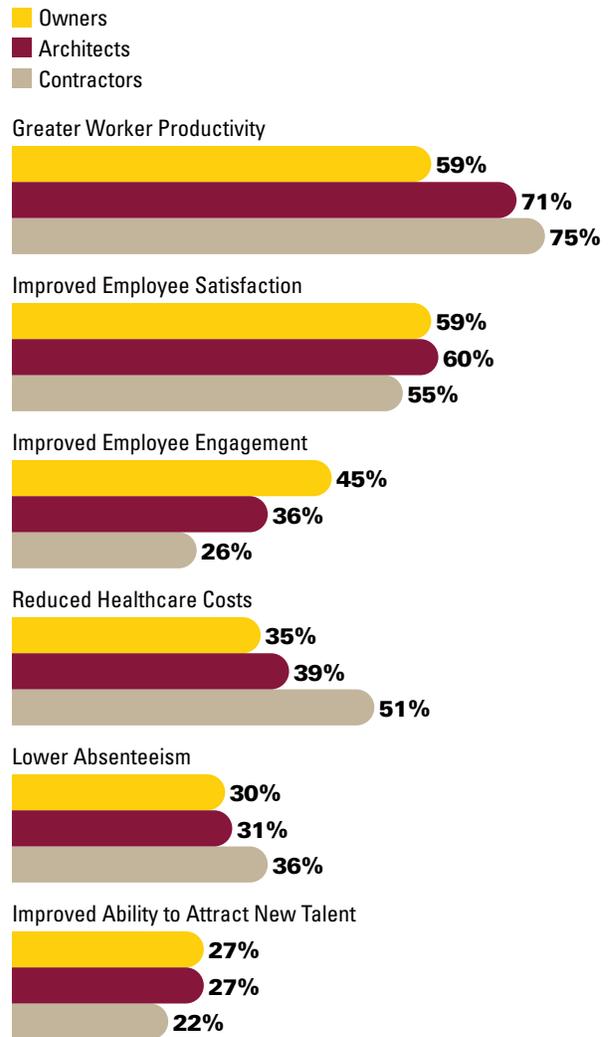
- **A significantly higher percentage of contractors (51%) find the ROI benefits of reduced healthcare costs to be higher than owners (35%) or architects (39%).** Contractors have a particularly people-intensive, low-margin business, so costs like that can be particularly impactful.
- **A significantly lower percentage of contractors find ROI benefits in improved employee engagement (26%) than owners (45%) or architects (36%).**

Variation by Firm Size

For owners, the impact of worker productivity appear to be greater for large firms than for small ones. **79% of owners whose total project value exceeded \$100 million in 2013 select worker productivity as one of the top three benefits that offers the best return on investment, compared with 53% of those with less than \$10 million in projects in 2013.**

Benefits That Offer the Highest Return on Investments in Healthier Work Environments (By Player)

Source: McGraw Hill Construction, 2014



More architects at larger firms find reduced healthcare costs to have a big impact on ROI. **46% of architects with billings of \$5 million or more in 2013 select reduced healthcare costs as one of their top three benefits, compared with 35% of those with lower billings.**

Top Benefits Offering the Best Return on Investment for Healthier Work Environments According to Owner HR Executives

When asked to select the top three benefits with the best return on investment, the benefit selected by the highest percentage of Owner HR executives (91%) is **greater worker productivity**. In fact, it exceeds the next benefit in the percentage that selected it by 38 percentage points. Employees are the greatest costs for most companies and the greatest contributors to their profits. Even a small increase in productivity can have powerful financial implications for companies, so the belief among HR executives that this factor has a high ROI is not surprising.

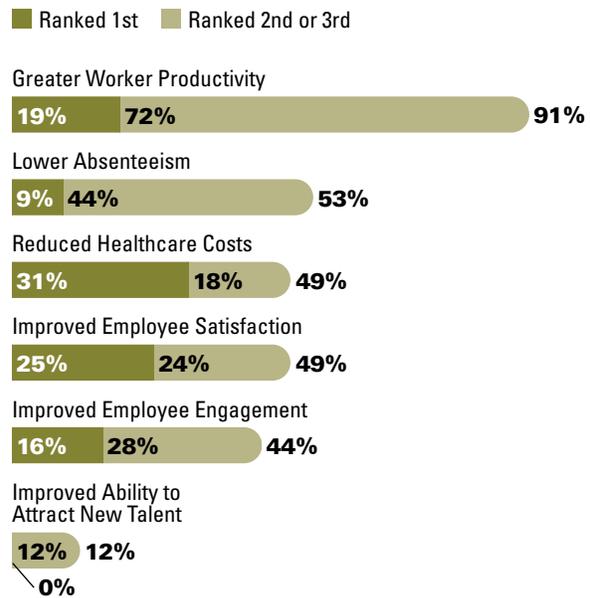
However, when looking solely at what HR executives ranked first as the benefit with the best return on investment, a very different picture emerges. The highest percentage (31%) believe that **reduced healthcare costs for the company has the highest ROI, followed by improved employee satisfaction (25%)**. Improved employee satisfaction is also selected as a top benefit by a higher percentage of executives who work in a green building than those who do not. This finding more closely corresponds to the drivers that HR executives believe are encouraging investment in healthy buildings (see page 35). And in fact, employee satisfaction is also one of the few metrics used by building owners, architects and contractors to track healthy building performance (see page 39). The challenge of tracking productivity improvements related to buildings makes it difficult to determine an exact return on investment for healthy buildings. With these measures, quantifiable data can be more easily determined, although with healthcare costs, the ability to relate those savings directly to building impacts is more difficult.

There are interesting differences between what the HR executives believe are the benefits with the greatest ROI and what the building owners directly involved in construction projects report.

- **While productivity is important to both, a much smaller percentage of building owners (59%) select it among their top three benefits with high ROI.** Since HR executives are charged with tracking employee performance at many firms, it is likely that they are more attuned to the importance of productivity.
- **Absenteeism is less important to the building owners involved in construction, with only 30% reporting it among their top three.** HR executives may be more involved with tracking absentee statistics and more closely aware of the impact on profitability.

Top Benefits With Best Return on Investment in Healthier Work Environment (According to Owner HR Executives)

Source: McGraw Hill Construction, 2014



- **Reduced healthcare costs is also less frequently selected in the top three by building owners involved in construction (35% compared with 49% of HR executives).** Again, this is likely influenced by greater awareness in the HR staff of the full costs of healthcare per employee.
- **Improved employee satisfaction (59%) and improved ability to attract new talent (27%) are more widely selected by building owners involved in construction.** Since both HR executives and building owners involved in construction are directly engaged in attracting and retaining talented employees, it is likely that this factor is given a higher rating by building owners because they are less likely to select the other factors that are of greater importance to HR executives.

These differences demonstrate that owners may respond to the interests and needs of different stakeholders in their organizations, making understanding the priorities and needs of the different stakeholders important.

Willingness to Pay More for Buildings With Demonstrated Positive Impact on Health

When asked whether they would be willing to pay extra to newly construct a building or lease space in one that could be demonstrated to have positive impacts on occupant health, most respondents who could answer the question said that they would pay more. Only 15% of building owners, 3% of HR executives and 10% of architects and contractors rejected outright the idea of paying additional money to be in a healthier building. This finding clearly demonstrates widespread recognition of the value of occupying a healthy working space.

It is notable that a high percentage state that they don't know an answer to this question. For many, they may not be directly involved in decisions about the physical space occupied by their companies. For others, especially the owners directly involved in the construction of buildings for their companies, it is possible that they are skeptical about the ability of a building to demonstrate health impacts and would need to see the specific impacts before being willing to commit to a specific amount extra.

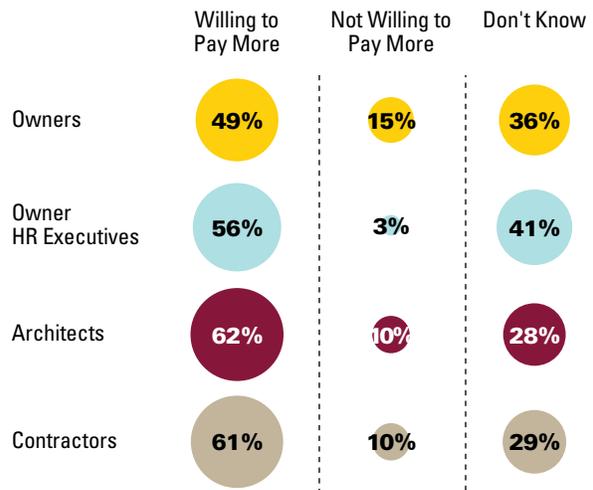
A similar percentage of owners and contractors report being willing to pay more for healthy operations and maintenance (O&M) practices. However, a higher percentage of owner HR executives (91%) believe that their company should be willing to pay extra for healthy O&M practices, an increase of 35 percentage points over those who think their company should pay more to lease/construct a healthier building. This finding is likely due to the relatively low cost of O&M compared with the cost of leasing/building a space. It is particularly telling that almost all of the HR executives who believe that their company should be willing to pay extra for operations and maintenance also say the extra amount would only be a small percentage (below 5%) of their operating costs, and that finding is consistent across all the players.

The amount more that building owners, owner HR executives and contractors would be willing to pay to newly construct a healthy building or lease space in one, however, varies by player, although each group clusters in the 1%–6% range. In general, it is similar to the amount that homeowners are willing to pay extra for green homes reported in the 2014 *Green Multifamily and Single Family Homes SmartMarket Report*, although that amount trends slightly higher, probably due to the expectation of lower utility costs in addition to health benefits.

- **Building Owners:** The median owners are willing to pay extra is 1.8%, the most conservative of all the players.
 - More building owners select the 1%–3% range than the 4%–6% range.

Willingness to Pay More for Buildings With Demonstrated Positive Impact on Health (According to Building Owners, HR Executives, Architects and Contractors)

Source: McGraw Hill Construction, 2014



- This group also has the highest percentage (15%) not willing to pay extra.
- **Owner HR Executives:** The median HR executives believe their company should pay is 5%.
 - More HR executives select the 4%–6% range than the 1%–3% range.
 - This group also has the lowest percentage (3%) that do not believe that their company should pay extra.
- **Architects:** The median architects are willing to pay extra is 2.8%.
 - 9% report being willing to pay 10% or more, equal to the HR executives and significantly higher than the 4% at that level for contractors and owners.
 - More architects also select the 4%–6% range than the 1%–3% range.
- **Contractors:** The median contractors are willing to pay extra is 2.5%.
 - Contractors are evenly split between the 1%–3% range and the 4%–6% range.
 - 10% of contractors report they will pay less than 1% extra, compared with 7% of building owners, 3% of HR executives and 5% of architects.

These findings not only demonstrate the value placed on healthy buildings, but they also make clear the importance of the ability to demonstrate the impact of healthy building features.

Encouraging Wellness at Work

While building-integrated wellness achieves productivity gains in users ranging from medical patients to schoolchildren, this rising trend is most visible in the workplace where employers have embraced it to help stem healthcare costs.

Does the work environment contribute to weight gain? The answer is likely yes. As part of a new survey of 3,000 U.S. employees conducted by CareerBuilder, 39% of respondents report gaining weight on the job. While it is a well-established fact that Americans spend as much as 90% of their time within buildings, CareerBuilder's findings represent mounting concern with sedentary indoor activity's role in obesity and corresponding chronic diseases.

The scrutiny has been accompanied by new calls for buildings in which users can pursue physical activity and general good health.

Foundations of Good Health

In the war against the bulge, owners, leaseholders and managers of office space are making room for battlefields. According to the Society for Human Resource Management's (SHRM's) 2013 annual survey of employee benefits, 25% of employers operate fitness centers. Also in 2013, the National Business Group on Health (NBGH) documented that 44% of large employers maintain onsite health clinics, where staffs include both medical professionals and nutritionists and exercise specialists; companies following a less resource-intensive approach are giving employees access to coaching in these disciplines.

However, the existence of wellness spaces does not necessarily translate

into results. Various studies have found that only approximately one-quarter of employees use their onsite fitness centers. So health and wellness programs help make up some of this shortfall. The Willis Health and Productivity Survey 2014 found that 68% of employers conduct such programs, and last year Fidelity Investments and NBGH calculated that corporations spend an average of \$594 per employee in wellness incentives, up from \$521 in 2012.

Wellness Operations

Much of this investment focuses on services that have little impact on real estate, such as counseling for chronic disease management or online health education. Yet some strategies do have ramifications on building operations. For example, SHRM's survey showed that employers almost unanimously provide exercise classes within their fitness centers, which affect equipment purchases and cleaning schedules.

In another instance, food vendors are featuring healthier and more sustainable food items on their menus, and redrawing cafeteria plans so that the new choices are front and center. The latter phenomenon picked up significantly after the release of concessions guidelines developed by the U.S. General Services Administration with the U.S. Department of Health and Human Services. The government project, which is consistent with the 2010 Dietary

Guidelines for Americans, applies directly to federal civilian cafeterias serving 2 million people.

Future Developments

Many efforts to get office staffs on their feet and eating well take place beyond the individual workstation. Soon, though, exercise and healthy living habits may overtake the entire workday. ABI Research forecasts that by 2018, more than 13 million employees will be wearing activity-tracking devices like fitness bands as part of their wellness programs—although commentators have warned that the trend may be affected by legal tests for privacy invasion and discrimination practices.

Actual physical activity is arriving at the site of work as well, thanks largely to treadmill and standing desks. Between 2004 and 2009 sales of height-adjustable desks multiplied five times, and studies demonstrate treadmill-bound workers' productivity improvements, a fact which no doubt contributes to their burgeoning popularity. Yet the future of office wellness is not entirely predicated on technology. According to preliminary research published in the March issue of the *International Journal of Workplace Health Management*, on-the-job presence of dogs lowered employee stress and upped physical activity. ■

WELL Ahead: Piloting a New Healthy Building Standard

CBRE Headquarters
LOS ANGELES, CALIFORNIA

THE DRIVE TOWARD HEALTHIER BUILDINGS



CBRE's address-free workspace provides employees with a wide range of choices in work setting.

The new headquarters of CBRE, a global leader in corporate real estate services, challenge the conventional workplace paradigm. With no assigned offices or workspaces, the address-free environment pioneers a workplace strategy that aims to maximize employee collaboration and productivity. The strategy focuses on multiple aspects of the work environment, and significant among them is employee health and well-being.

"Our L.A. headquarters is a transformation in many ways," says

Beth Moore, director of workplace strategy at CBRE. "Health is one aspect of a completely new way of working."

An Innovative Setting for Health

CBRE worked closely with Gensler Los Angeles to develop the new workplace strategy, and to locate and design a space that would support the initiative. The new headquarters occupy a glass atrium on the top two floors of a 26-story building in downtown L.A. The difficult-to-lease space had been empty for years, yet its airy volumes and ample daylight

promised something special to a tenant who could figure out how to use it.

Taking advantage of the 40-foot-high atrium, Gensler designed a "sky garden," complete with interactive media, a café and conferencing, as the core of the space. Cantilevered architectural elements, double-height glass conference volumes and an interconnecting stair generate a dynamic set of zones and spatial experiences. A perimeter of plants frames views of downtown L.A. and the Hollywood Hills in the distance.

With individual offices eliminated, 168 individual settings and dozens of shared settings provide employees with choice and variety in how they work, while enabling the new space to accommodate more staff in a smaller area than the firm previously occupied. The money saved on square footage freed CBRE to reinvest in technology, services, and employee health and well-being.

Piloting the WELL Building Standard

Many of the environment-based initiatives under LEED, with which the project certified at the Gold level, carry significant benefits to human health, but CBRE wanted a more explicitly health-based paradigm as well.

"LEED is becoming the new norm," says Moore. "Everyone is creating office buildings that are sustainable for the environment. We wanted to create buildings that are sustainable for the people working in that environment."

To sharpen its health focus, CBRE enrolled as a pilot project in the development of the WELL Building Standard, a performance-based

CBRE Headquarters LOS ANGELES, CALIFORNIA



The design prioritizes daylight, air quality, thermal comfort and activity.

system for measuring, certifying and monitoring features of the built environment that impact human health and well-being. Developed in consultation with medical scientists and building industry practitioners, the standard is currently undergoing an industry review prior to full release later this year.

Certification under the WELL Building Standard requires an on-site post-occupancy performance audit, and re-auditing every three years to maintain certification, a performance-based rather than input-based emphasis, which “the marketplace seems to love,” according to Paul Scialla, founder of the International WELL Building Institute (IWBI), which administers the standard. To streamline the integration of environmental and health priorities, the third-party organization that provides independent oversight of LEED certification, the Green Building Certification Institute, will conduct the auditing for WELL certification.

The WELL Building Standard establishes building performance criteria in seven categories: air, water, nourishment, light, fitness, comfort and mind. Some of the provisions, such as occupant-controllable HVAC, will be familiar to building industry practitioners experienced with LEED; others, such as

electromagnetic shielding, may introduce new considerations.

Health in the Workplace

CBRE’s design team at Gensler found that “there are certain practices we design to anyway,” according to Lindsay Malison, senior associate at Gensler and lead designer on the project. “Designing with the WELL Standard introduced some enhancements that took [those practices] a little bit further.” For example, Gensler specifies low-VOC finishes as a matter of course; the WELL Standard’s list of prohibited materials calls for no-VOC finishes. Similarly, while Gensler would have specified filtered water as standard; WELL calls for more and better dispersed hydration stations than might have otherwise been provided.

In all, CBRE’s headquarters feature more than 50 health- and wellness-focused attributes, including the highlights listed in the table at right.

CBRE’s headquarters opened in the fall of 2013, and the firm is now planning a third-party post-occupancy review to measure its results. Early indicators, says Moore, are positive: “If you ask anyone in the office if they’d go back, the majority, if not everyone, would say no. They’re excited about these changes. They’re happy to go to work.” And maybe a bit healthier too. ■

Project Facts and Figures

Size

48,000 square feet

Architect

Gensler

Contractor

Taslmi Construction Company, Inc.

Completed

2013

Healthy Building Practices Highlights

- Advanced air filtration
- Ultraviolet air disinfection system within the ventilation system to sterilize airborne bacteria, viruses, dust mites and mold spores that may escape filtration
- Use of plants to help clean indoor air, generate oxygen and provide a connection to nature in the city
- Water purification
- Lighting design emphasis on daylighting, controllability and support of circadian rhythms
- Shielding of electrical equipment and wiring
- Ergonomic furniture for users of different physiques
- Stretching and relaxation areas for employees on each floor
- Inducements to activity, such as treadmill desks and an inviting central stair
- Juice station
- Non-porous countertops
- Photocatalytic coating on shared surfaces, such as keyboards.

Data: Use of Healthy Products and Practices

Current and Expected Use

of Healthy Products and Practices in Buildings by Architects and Contractors

THE DRIVE TOWARD HEALTHIER BUILDINGS DATA

More architects and contractors expect to be using all of the healthy products and practices included in the survey by 2016 than are currently doing so today. This result is as telling about the expectations in the industry about the increased need for healthier buildings as it is about the rise in the use of any individual product or practice. It strongly suggests that architects and contractors both recognize that these approaches will need to be more widely adopted in the future, whether due to market demand, mandates, increased focus in green building on health or competitive pressure.

Architects also report a much wider use of most of these products than contractors, both currently and in the future. The only exception is the use of Merv 8+ filters, which a slightly higher percentage of contractors report currently and which only 1% more architects report expecting to use by 2016. However, for six out of eight of the products/practices that both were asked about, the percentage of architects that expect to use them by 2016 is significantly higher than the percentage of contractors, including low-VOC products, non-toxic building materials, acoustic comfort, spaces for social interaction, CO₂ sensors and design/construction strategies encouraging physical activity.

Green building appears to be driving the use of all these products and practices, since a significantly higher percentage of architects and contractors doing more than 60% green projects are using each of the products and practices than those doing less green building.

Architects

The products and practices that architects were asked about can be divided into three categories: design strategies, systems/monitors and products.

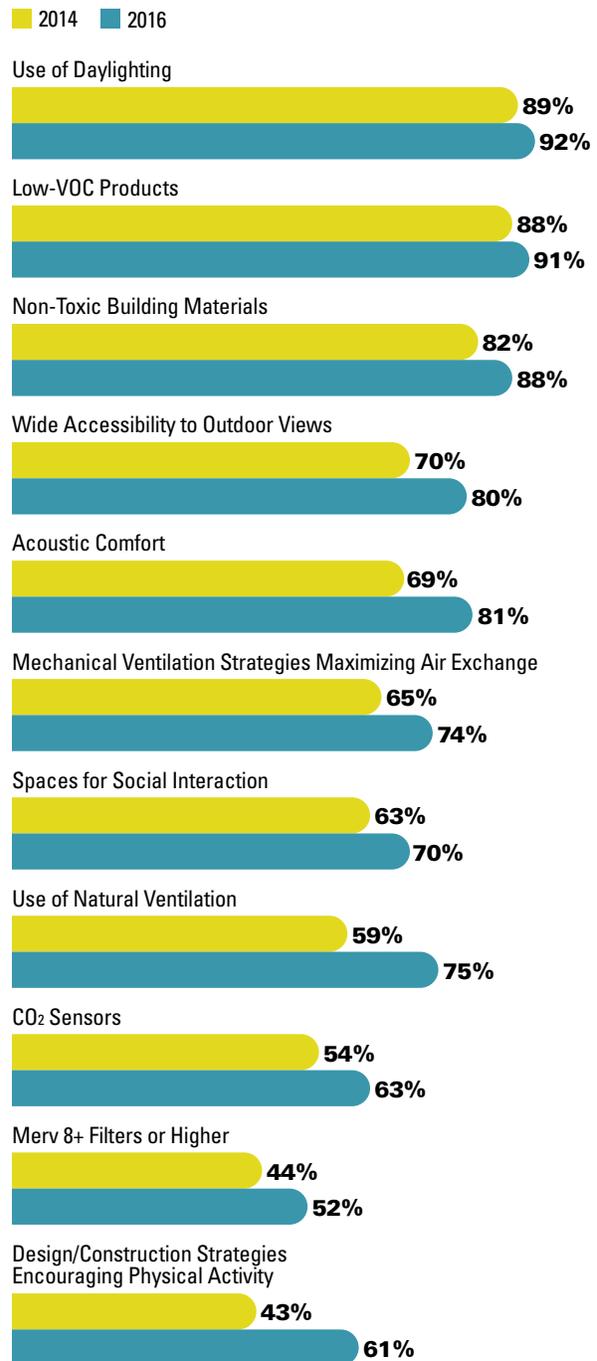
DESIGN STRATEGIES

Design strategies include all approaches where design decisions, rather than the choice of a product or system, lead to the health benefits. They include use of daylighting, accessibility to outdoor views, spaces for social interaction, use of a natural ventilation, and design and construction strategies encouraging physical activity in the building.

Current use of design strategies vary widely, from the most widely used, the use of daylighting, to the least frequently used currently, design/construction activities that encourage physical activity. However, the two practices with the highest level of growth both fall into this category:

Current and Expected Use of Healthy Products/Practices (According to Architects)

Source: McGraw Hill Construction, 2014



Current and Expected Use of Healthy Products and Practices in Buildings by Architects and Contractors

CONTINUED

THE DRIVE TOWARD HEALTHIER BUILDINGS DATA

- An 18 percentage point growth is expected in those using design/construction activities that encourage physical activity, from 43% to 61%.
- A 16 percentage point growth is expected in those using natural ventilation, from 59% to 75%.

As health factors become increasingly important as one way to evaluate building performance, architects are more likely to have these factors as goals from the start of design, and the results suggest a shift in that direction.

SYSTEMS/MONITORS

Three of the healthy practices involve mechanical systems and monitors included in those systems: mechanical ventilation strategies maximizing air exchange, CO₂ sensors and Merv 8+ filters.

- **Mechanical Ventilation Strategies:** Currently used by 65%, with 74% predicting future use. Notably, the use of natural ventilation currently lags behind mechanical strategies at 59%, but by 2016, its use is expected to catch up and even slightly exceed them at 75%.
- **CO₂ Sensors and Merv 8+ Filters:** Both hover at the bottom of strategies used by architects, and despite a respectable growth of 9 and 8 percentage points, respectively, in the percentage intending to use them in 2016, they will still lag behind two years from now. It is likely that mechanical engineers may often be the firms that specify use of these products, so architects may be less likely to consider them as a strategy.

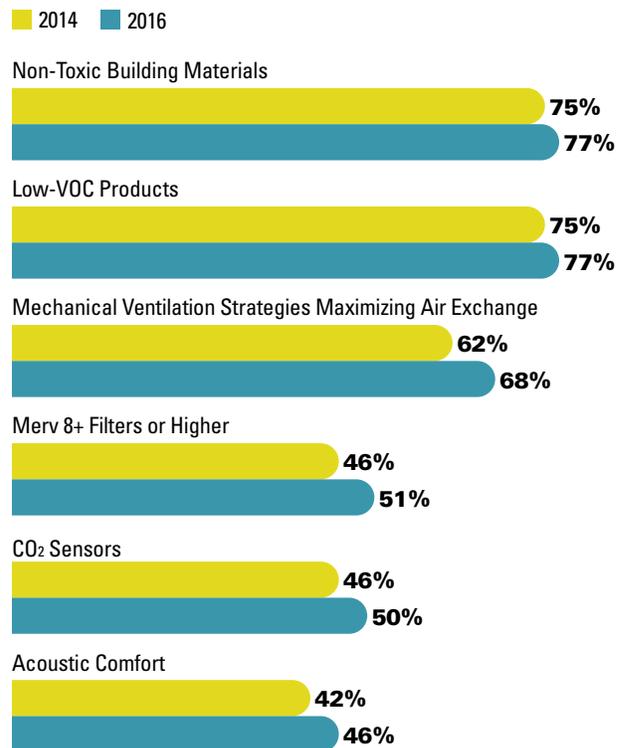
PRODUCTS

Three products with a positive impact on health are included in the survey, and two of them are also among the top products/practices currently employed by architects—low-VOC products (88%) and non-toxic building materials (82%). The third, acoustic comfort, is currently used by a much lower 69%, but it is expecting a dramatic increase to 81%, bringing its future expected use roughly in line with the other two products.

Products are relatively easy compared with other strategies to implement quickly. Also, low-VOC products and non-toxic building materials can earn credits for green projects on systems like LEED, which may be why nearly all (96% and 94%, respectively) of the architects doing more than 60% green projects employ these strategies.

Current and Expected Use of Healthy Products/Practices (According to Contractors)

Source: McGraw Hill Construction, 2014



Contractors

While a clear pattern of growth is evident in the contractors' expected use of healthy products and practices between now and 2016, for the most part, the growth rate is far more modulated than that expected by architects, with percentage point gains largely confined to 2%–6%.

- **Low-VOC products and non-toxic building materials are the most widely used strategies by contractors, like architects, to improve the health impacts of buildings.**
- **The use of mechanical ventilation strategies that maximize air exchange currently ranks higher for contractors than for architects, and the use by contractors (62%) is nearly equal to the use by architects (65%), unlike most of the other products and practices, which contractors lag in using.**

Impact of Products and Practices on the Health of Building Occupants

A higher percentage of architects than contractors tend to find that the products and practices included in the survey have a high impact on the health of building occupants. In general, differences between the percentage of architects and the percentage of contractors that attribute a high impact to these products and practices is quite high: ranging between 11 and 19 percentage points.

The one exception to this general trend is mechanical ventilation strategies that maximize air exchange. The percentage of architects (71%) and contractors (70%) that see this as having a high impact is nearly even, and this practice is the top one noted for contractors, while it is the fifth highest for architects.

This finding suggests that contractors may be more skeptical about most approaches to making buildings healthier than architects, other than improving air quality through high levels of air exchange. **More data are needed for industry agreement to be reached on these products and practices, an essential step to determining the best approaches to making buildings healthier.**

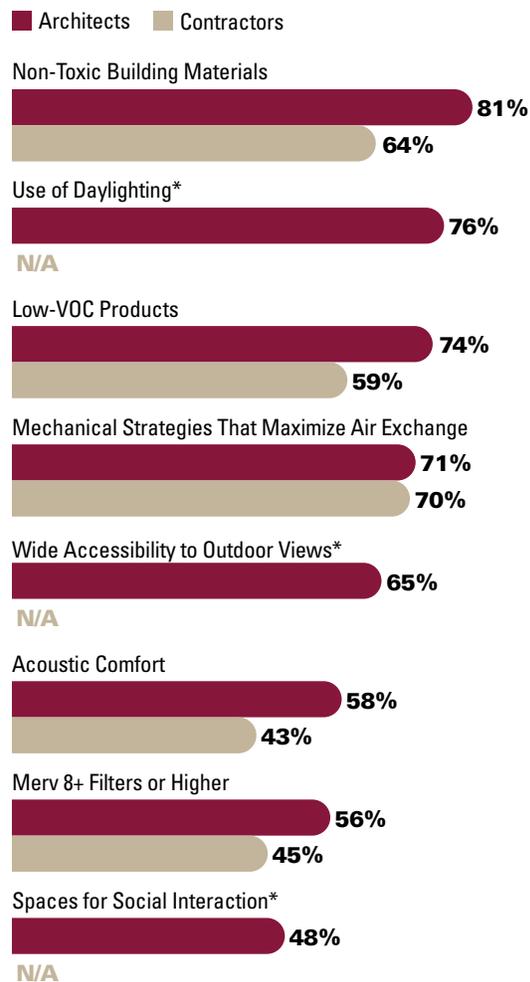
Impact Compared to Use

While the ranking of these products and practices by the highest percentage of architects reporting use (see page 50) and impact (see chart at right) doesn't perfectly align in all cases, for the most part, the products/practices considered highly impactful by the highest percentage of architects also are the ones they use the most.

- **The architects' top three most used products/practices—non-toxic building materials (82%), use of daylighting (89%) and low-VOC products (88%)—are those rated as having a high impact by the highest percentage in the chart on the right.** However, it is notable that the product selected as having a high impact by the largest percentage of architects, non-toxic building materials, comes in third in usage. This suggests that architects may find it easier to find low-VOC products or to incorporate daylighting in their building, than to specify non-toxic building materials.
- **Similarly, the next three most widely-used products/practices rank in the middle in terms of the percentage that credit them with having a high impact.** Thus, mechanical ventilation strategies, accessibility to outdoor views and acoustic comfort are seen by a moderate percentage as impactful and are used by a more moderate percentage of firms. The pattern also continues with the items considered to have a high

Products/Practices With a High Impact on the Health of Building Occupants (According to Architects and Contractors)

Source: McGraw Hill Construction, 2014



*Asked of architects only

impact by the fewest architects also seeing little use, including Merv 8+ filters and spaces for social interaction.

Contractors see the same pattern as architects with one striking exception: despite the value placed by a high percentage of them for improving health, they rank third in use. Depending on the type of contractor, many may not have direct influence over the selection of these systems on projects.

The Emergence of Health Product Declarations

The call by design firms requesting health product declarations (HPDs) from manufacturers indicates pent-up demand for information on building product's compositions. Still in development stage, the HPD is nonetheless becoming more known in the industry—and suggests increased attention on health concerns in design and construction.

On December 11, 2012, Dallas-based HKS Architects issued an open letter requesting manufacturers to provide a Health Product Declaration (HPD)—“a voluntary, open standard for reporting product content and health information so that similar products can be compared in a straightforward manner”—for primary products. Four months later, a third such letter began circulating from CannonDesign, increasing the pressure. Starting January 1, 2015, they stated, only products with publicly available HPDs would be allowed in the firm's materials library and selected for inclusion on projects.

Another 23 architecture firms have issued similar letters since these first efforts, and together they represent hundreds of millions of square feet. The various company policies indicate pent-up demand for information about building products' makeup.

Emergence of HPDs

The HPD was hatched as recently as July 2011 by a joint initiative of the nonprofit group Healthy Building Network (HBN) and BuildingGreen, Inc. A pilot program of 30 manufacturers was announced at Greenbuild 2012, and HPD Open Standard Version 1 launched at Greenbuild a year later. Today the HPD Collaborative oversees the platform.

Understanding building products' impact on human health underpins this fast-paced movement, and HBN

executive director Bill Walsh cites emerging science about endocrine disruption, as well as the 2006 launch of the Living Building Challenge and its accompanying red list of prohibited chemicals, among the reasons for building professionals' growing awareness. The design community has rallied behind HPD specifically, because even though there are as many as 300 product certifications on the market, “very few are health-based,” Walsh says.

Differences Between HPD and EPD

The EPD, or environmental product declaration, is perhaps the best-known example of health impacts' absence from the sustainable building conversation heretofore. This “nutrition label” for products—which requires rigorous life-cycle assessments regulated by the International Organization for Standardization 14044 family of standards and third-party certification—does not include toxicity among its impact categories.

The HPD represents a leap forward in health-based transparency by disclosing all available information in a single format. “You can compare the chemicals in products, you can compare the associated hazards, and you can compare the certifications that each one has, all in a standard way,” Walsh says of architects' attraction to the practice. Manufacturers have been submitting HPDs, in turn, not only as a response

to industry demand, but also because standardization reduces redundant disclosure requests. Walsh reports that manufacturers of complex, multipart products have required more time to complete their filings, while other delays have been caused by supply-chain inquiries and internal legal reviews.

Specifier and Designer Responsibility

By virtue of disclosure, an HPD implies minimal health effects. But in fact, it is the specifier's responsibility to analyze the risks posed by exposure to chemicals. Rand Eckman, director of sustainability of CannonDesign and a signatory of that firm's March 2013 HPD letter, says that applying a “life-cycle attitude” to HPD analysis allows for the declaration's own evolution. “The HPD doesn't name the chemicals used to make a product. Yet, looking beyond an occupant's health, back to extraction and forward to disposal, shows that the things we specify have human impacts.”

In the meantime, architects must first make good on their promise to source only declared materials. “If you're a really good cook, you can go into anybody's refrigerator and come up with a decent meal,” Perkins+Will principal Ken Wilson says of designing with a potentially limited material palette. Eckman expects healthcare entities to be the first clients willing to try the new recipes. ■

Features Currently Considered or Expected

to be Considered in the Next Three Years When Choosing Workspace Locations According to Owner HR Executives

Owner HR executives were asked about a list of building features typically associated with promoting building occupant health and well-being, and they were asked whether these features are currently considered when their organization chooses a new workspace location and, if not, whether they plan to consider that feature in the next three years.

The highest percentage of HR executives (66%) report that places for social interaction is a building feature they consider when choosing a new workspace. This finding corresponds to the high importance given to employee engagement and satisfaction, both by HR executives and by building owners directly involved in building construction (see pages 44 and 45). It demonstrates that companies recognize the importance of this feature for improving employee well-being.

Accessibility of sidewalks is also currently considered by 59% of HR executives in the new workspace decisions, and 16% report that they expect to consider this feature in the next three years, at which point it will be equal with places for social interaction as the feature most widely considered by respondents. With over half of the HR executives reporting that lack of sufficient exercise (59%) and concerns about obesity (53%) are among the biggest challenges affecting their employees ability to remain healthy, it is not surprising that the ability to walk safely is given high, and growing, attention.

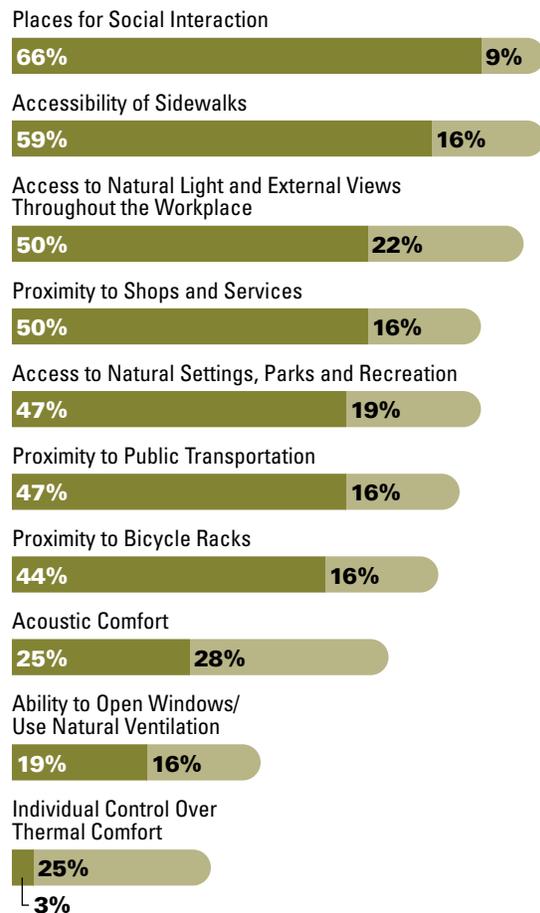
Other factors that encourage more activity selected by a high percentage of HR executives include proximity to shops and services (50%), access to natural settings, parks and recreation (47%), proximity to public transportation (47%) and proximity to bike racks (44%). Thus, activity-related features make up over two thirds of the features currently considered by over 40%. An additional 16% to 19% also expect to consider them in the next three years, emphasizing growing awareness of the importance of activity for maintaining employee health. In addition, a higher percentage of those in a green building consider sidewalk accessibility, access to natural settings and proximity to bike racks in their decisions.

The building feature with the highest level of growth is the consideration of acoustic comfort, where the percentage that have it as a consideration in their decisions about workspaces will more than double, from 25% to 53%. This finding demonstrates growing awareness of the importance of acoustical comfort for employee health and well-being.

Features Considered or Expected to be Considered in the Next Three Years When Choosing Workspace Locations (According to Owner HR Executives)

Source: McGraw Hill Construction, 2014

■ Currently Consider ■ Plan to Consider in Future



While access to natural light and external views is currently considered by 50% and has many more (28%) expecting it to be a consideration, the use of natural ventilation is currently not widely considered and has a relatively conservative level of growth.

Almost none of the executives (3%) currently consider individual control over thermal comfort to be a feature they seek, despite the fact that the three workspace complaints from employees reported by the highest percentage of HR executives are all temperature related. This may be because few buildings offer these features or because of concerns about higher costs and energy use.

Impact of Building Features on Employee Health and Productivity

Most HR executives recognize that the building features included in the survey have at least some impact on employee health and productivity. The only features that more than one quarter of them believe have no impact are proximity to bicycle racks and the ability to open windows/use natural ventilation. Other than those two, the rest are all recognized to have impact on health and productivity by over three quarters of the respondents, with four out of 10 recognized by over 90%.

However, there are only three features believed to have a significant impact by over 30% of the HR executives:

- **Access to Natural Light and External Views Throughout the Workplace:** The highest percentage, 44%, believe that this can have a significant impact on health and productivity, but it only ranks third among the features currently considered when choosing a new workspace.
- **Accessibility of Sidewalks:** 38% think this has a significant impact on health and productivity. Walking is a highly accessible way to exercise and may trump other factors that may be considered less likely to be used.
- **Places for Social Interaction:** There is a critical disparity in the evaluation of the impact of this factor between HR executives and architects and contractors.
 - With 31% of HR executives finding it to have a significant impact on health and productivity, it is the third highest feature, and it tops the factors currently considered for new workspaces.
 - However, it ranks last for architects and contractors in terms of impact on health and well-being, and it is less widely used than most other building features.

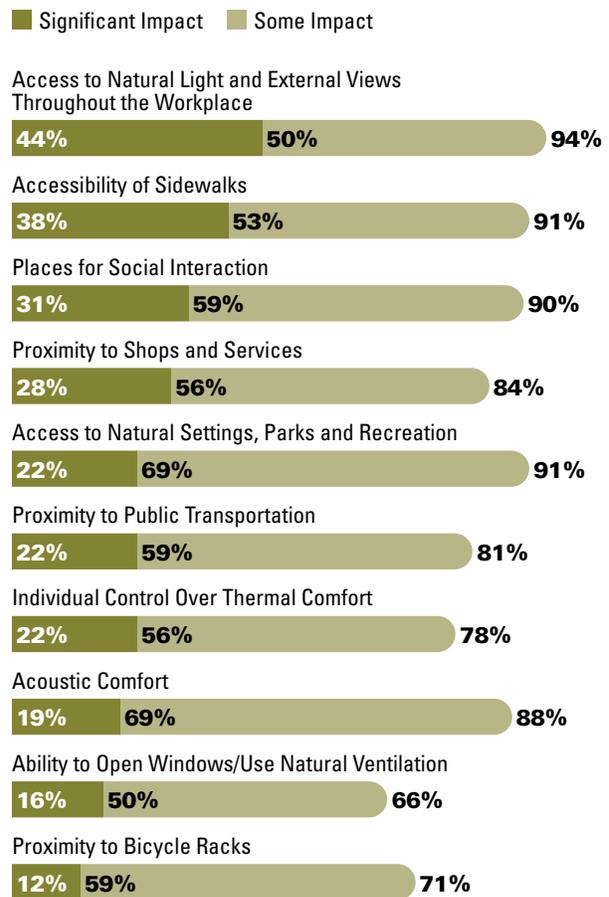
HR executives may have a greater awareness of the impact of mental well being and the influence of social spaces on mental health than is currently typically considered by design and construction professionals.

The remainder of factors, for the most part, correspond with the features they currently consider in new workspaces, for the most part giving greater weight to features that encourage physical activity and less weight to acoustic comfort and the ability to open windows/use natural ventilation.

However, there does appear to be some variation by the size of the firm for which an HR executive works, and their use and evaluation of impact of individual control over thermal comfort.

Impact of Building Features on Employee Health and Productivity (According to HR Executives)

Source: McGraw Hill Construction, 2014



- About two thirds of HR executives from companies with over 400 employees think this feature is not and will not be considered, compared with about one quarter from smaller companies.
- More HR executives from small companies believe this feature should be considered because they believe it can have an impact on productivity, with between one third and one half of the respondents from small companies who think it has a significant impact compared with less than 10% from large companies.

Factors That Influence Product Specification and Purchasing Decisions

More information about the health impacts and makeup of products, as well as a better ability to compare findings between products and compare health and green outcomes, would have a large influence on their rate of specification by architects and a notable influence on the purchase decisions made by contractors.

The high degree of influence of all four factors shown in the chart suggests that the industry generally finds a need for all of these types of information.

- **70% or more architects would be influenced by three out of four of the factors—information on risk impact to human health, comparability between products and identification of product ingredients—and the percentage that find these factors unlikely to influence them is 10% or less.** Even the final factor, comparability between health and green outcomes, is still likely to change specification decisions for 64% of architects, and it is considered influential by a higher percentage (71%) of architects from large firms (billings over \$5 million).
- **Contractors are more influenced by information on risk impact to human health and the comparability between products than they are by the other two factors in their purchasing decisions.** Not only do over half of the contractors report that they are likely to be influenced by these factors, but the percentage that consider it unlikely that they will be influenced is also quite low (13% and 10%, respectively). 67% of contractors from large companies (with a project value of over \$100 million) are influenced by information of the risk impact to human health, a higher percentage than those from smaller firms.

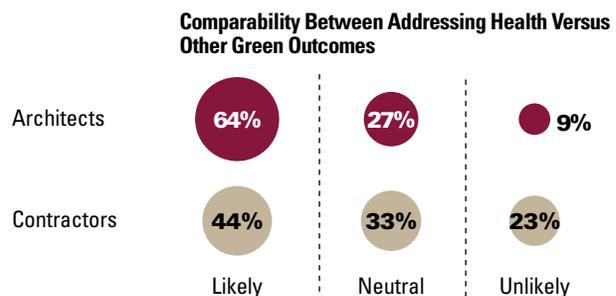
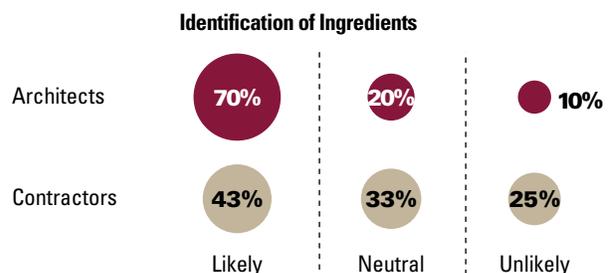
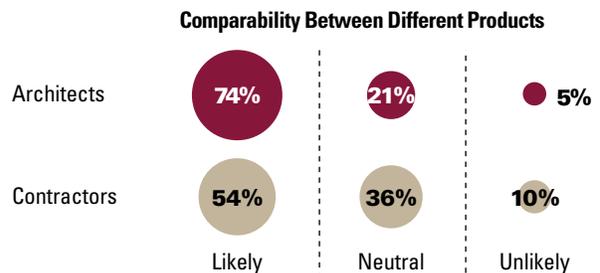
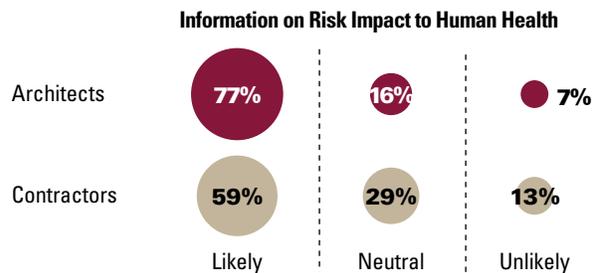
These findings suggest that product manufacturers of healthy building products should push the industry to offer standardized ways to provide more information on the risk impact to human health in their product information that will allow them to be comparable across product categories. It also demonstrates that both architects and contractors still struggle to find enough information on their product selections, a need that the industry must consider if the trend toward healthier buildings is to strengthen.

Variation by Level of Green Involvement

A significantly higher percentage of both architects and contractors who do more than 60% of their projects green report that each of these factors would be likely to influence their decisions, compared with those doing

Factors That Influence Product Specification and Purchasing Decisions (According to Architects and Contractors)

Source: McGraw Hill Construction, 2014



few (15% or less) green projects. This suggests that involvement in green work heightens awareness of the need for more, clearer project information to improve outcomes on projects.

Data: Communication About Health Impact

Most Effective Terminology for

Conveying the Impact of Design and Construction Decisions on Building Occupant Health

THE DRIVE TOWARD HEALTHIER BUILDINGS DATA

Most Effective Terminology for Communicating With Project Team

Building owners, architects and contractors agree that the most effective term to clarify the impact of design/construction decision on the health of building occupants to the project team is “indoor air quality,” with 24% of owners, 29% of architects and 28% of contractors selecting this as their top choice. Improved indoor air quality can have a direct impact on disease transmission and individual productivity.

The next three most popular terms cluster between 15% and 10% overall, although there are some important differences between players in terms of their value.

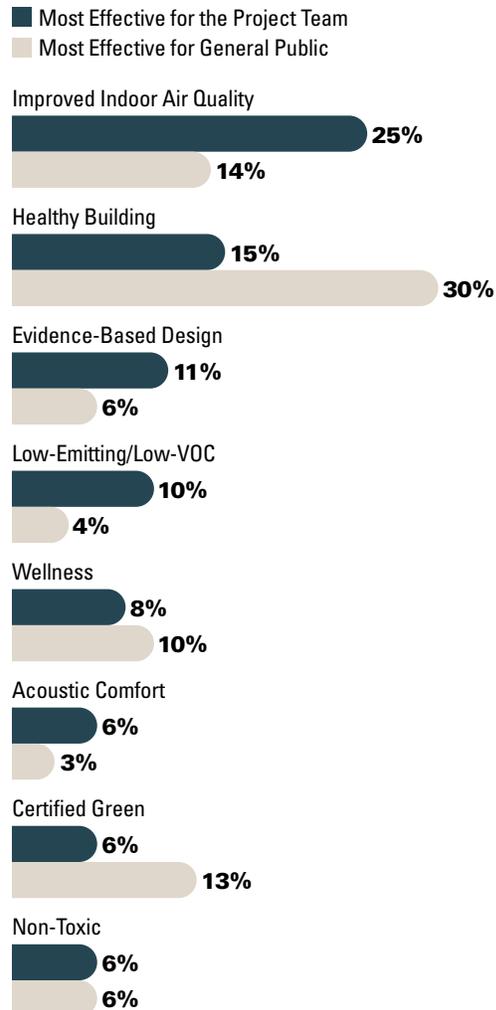
- **Healthy Building: 15% find this term effective for clarifying the impact of design/construction decisions on occupant health.** While a broad term, it can be used in contrast to “sick building,” which is widely used to describe a building with negative health impacts.
- **Low-Emitting/Low-VOC: 10% find this term effective, with consistent levels of agreement across the three player groups.** The widespread use of green building approaches has increased the familiarity of the industry with the use of low-emitting/low-VOC products.
- **Evidence-Based Design: 14% of architects consider this term the most effective means of communicating health impacts to the project team, compared with 4% of owners and 7% of contractors.** Evidence-based design is a specific design approach in the commercial sector that uses academic research and data gathered from owner operations to influence design. However, the low percentage of owners that find this term effective demonstrates that this approach is being driven by the design sector, rather than by owner demand.

Terms that are selected by less than 10% as the most effective for conveying health impacts to the project team are wellness (8%), acoustic comfort (6%), certified green (6%) and non-toxic (6%).

- **Wellness is selected by 13% of owners, suggesting that this broad term speaks to this group more effectively.**
- **With acoustic comfort and certified green, the industry as a whole may not see enough connections drawn between these and health.**
- **The findings on non-toxic are surprising, but this term may finish lower because of its perceived specificity to one element and the challenge of incorporating a non-toxic approach based on information currently available to the industry at large.**

Most Effective Terms for Conveying Impact of Decisions on Building Occupant Health

Source: McGraw Hill Construction, 2014



Most Effective Terminology for Communicating Health Impacts With General Public

There is also strong overall agreement on the most effective terms used to communicate the health impacts of design/construction decisions to the general public. In general, less technical terminology and terms that touch on widely known factors are considered most effective.

Most Effective Terminology for Conveying the Impact of Design and Construction Decisions on Building Occupant Health CONTINUED

THE DRIVE TOWARD HEALTHIER BUILDINGS DATA

- **Healthy Building: 30% report that this term is effective to explain the impact of building decisions on occupant health.** Although the term lacks specificity, it makes the importance of health clear.
- **Improved Indoor Air Quality: Selected by 14% overall.** One does not need to be a design or construction professional to understand that a building with improved indoor air quality is healthier. Typically, air circulation rather than toxins are the factors that leap to mind when contrasting a sick building to a healthy one.

- **Certified Green: Selected by 13% overall, and by 18% of contractors, significantly higher than the 11% of architects and a bit higher than the 15% of owners.** Thus, a higher percentage find being certified green an effective way to convey health to the general public than to the project team. More research is needed to determine if this reflects a higher awareness of green certification in the general public than more specific features like being non-toxic or low-VOC, or if the public generally associates green buildings with healthy buildings.
- **Wellness: Selected by 10% overall.** Again, general terms rather than technical ones appear to be more effective with the general public.

Need for and Sources of Information on Healthy Design and Construction

Most owners, architects and contractors believe that they have the necessary information to design or build projects that positively impact building occupants, but less than half of the architects and contractors believe that they have the information needed to have a positive impact on the building’s surrounding community.

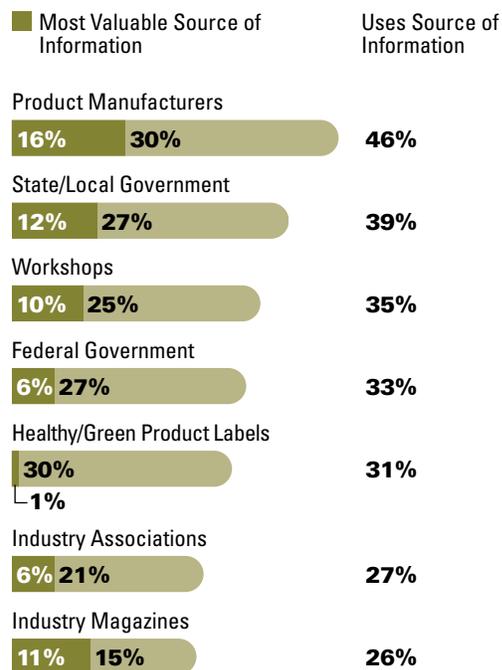
- **Has Information Necessary to Design or Build Projects With a Positive Impact on Building Occupants**
 - Owners: 78%
 - Architects: 70%
 - Contractors: 69%
- **Has Information Necessary to Design or Build Projects With a Positive Impact on Surrounding Community**
 - Owners: 59%
 - Architects: 48%
 - Contractors: 46%

This finding supports the need for data to drive the market and to encourage building owners and the general public to prioritize the need for healthy buildings.

The responses to an open question on the information needed can be categorized into data on benefits, guidelines and product data. Benefits includes responses focused on outcomes and cost savings. Guidelines include design guidelines, green product standards and government regulations. Product data includes transparency/full materials disclosure, information on products that is easy to access and third-party verification.

Sources of Information Used by More Than 25% of Owners

Source: McGraw Hill Construction, 2014



Sources of Information on Healthy Design and Construction Used and Valued

Building product manufacturers are the source of information on healthy design and construction activities that owner, architects and contractors use the most often and find the most valuable. This finding reveals the critical role that product manufacturers play in promoting new healthy design and construction activities.

Workshops are also widely used and moderately valued by the three players. The other sources used and considered most valuable shift by player, and the level of use by player does not always correspond to the value different players place on these sources of information.

OWNERS

Owners are widely using government sources of information for their projects, and the percentage that select state and local governments as the most valuable for providing information on healthy building practices is second only to product manufacturers.

In addition, while 31% of owners report using healthy/green product labels, only 1% find them to be the most valuable source of information. On the other hand, just under one half of the 26% that report obtaining information on healthy practices from industry magazines report that they are the most valuable source of that information.

ARCHITECTS

While all firms report wide use of product manufacturers, a significantly higher percentage of architects (71%) do compared with owners and contractors. This is likely due to the architect’s role in specifying products and their higher engagement with issues of health than other players noted throughout the report, which also leads a significantly higher percentage of them to use several sources of data, including healthy green product labels, industry magazines, websites and trade shows.

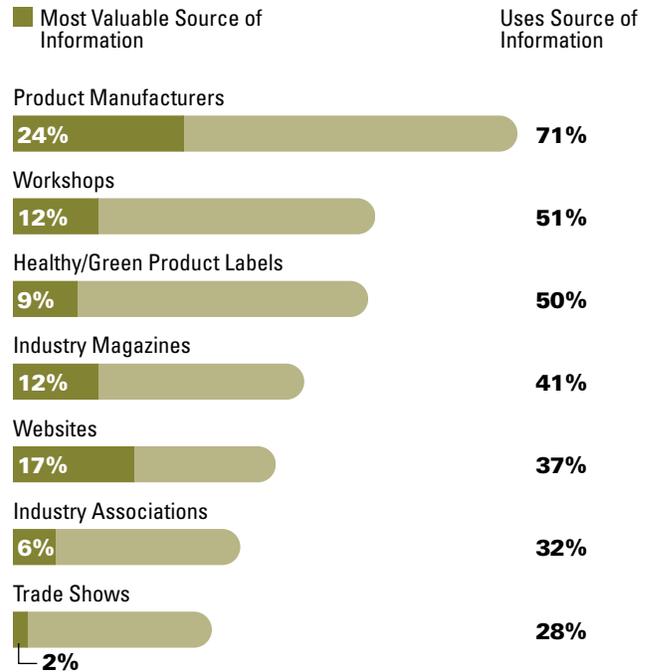
Even though websites have only the fifth highest percentage (37%) that report using them, 17% consider them the most valuable source of information, second only to product manufacturers. This suggests that finding a way for more architects to interact with websites could provide a valuable way to connect with them.

CONTRACTORS

While a relatively low percentage (26%) of contractors use industry magazines, a quite high percentage (15%) consider them the most valuable source of information on healthy building practices.

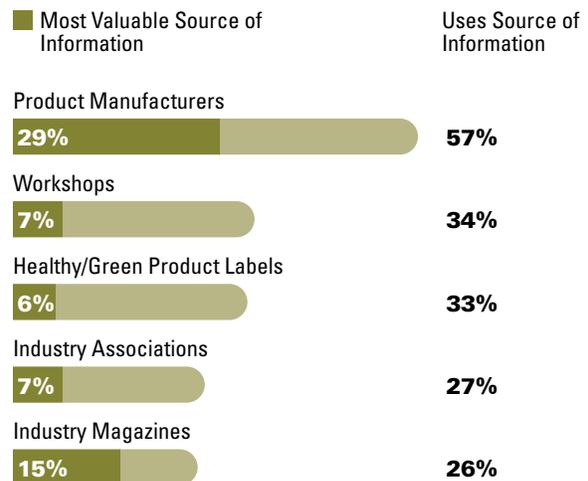
Sources of Information Used by More Than 25% of Architects

Source: McGraw Hill Construction, 2014



Sources of Information used by More than 25% of Contractors

Source: McGraw Hill Construction, 2014



Contractors also have the fewest sources of information used by more than 25% of any of the players included in the survey.

Top Sources of Information for the General Public on Healthy Design and Construction

The findings of this research strongly suggest that more public knowledge of and attention to the impact of building health on design is essential for the industry to prioritize healthy building practices in their decisions about projects. Therefore, the industry’s understanding of how the general public learns about this information is essential.

Owners, architects and contractors agree that the top way in which the general public learns about the health impact of buildings is television. There are a variety of ways in which television can convey this information, including a documentary on this topic, a home improvement show, a news magazine’s exposé on unhealthy building practices, or even a medical drama, which reveals that the source of an ailment is the person’s environment. However, the challenge the industry faces is getting sound, correct data onto this medium.

Consumer magazines are also widely perceived by building industry professionals to be a source of information for the general public, especially by architects. This suggests that the industry needs to focus on ways to raise the profile of this topic. There is wide interest in general media on health topics, and a consumer-oriented approach could attract readers.

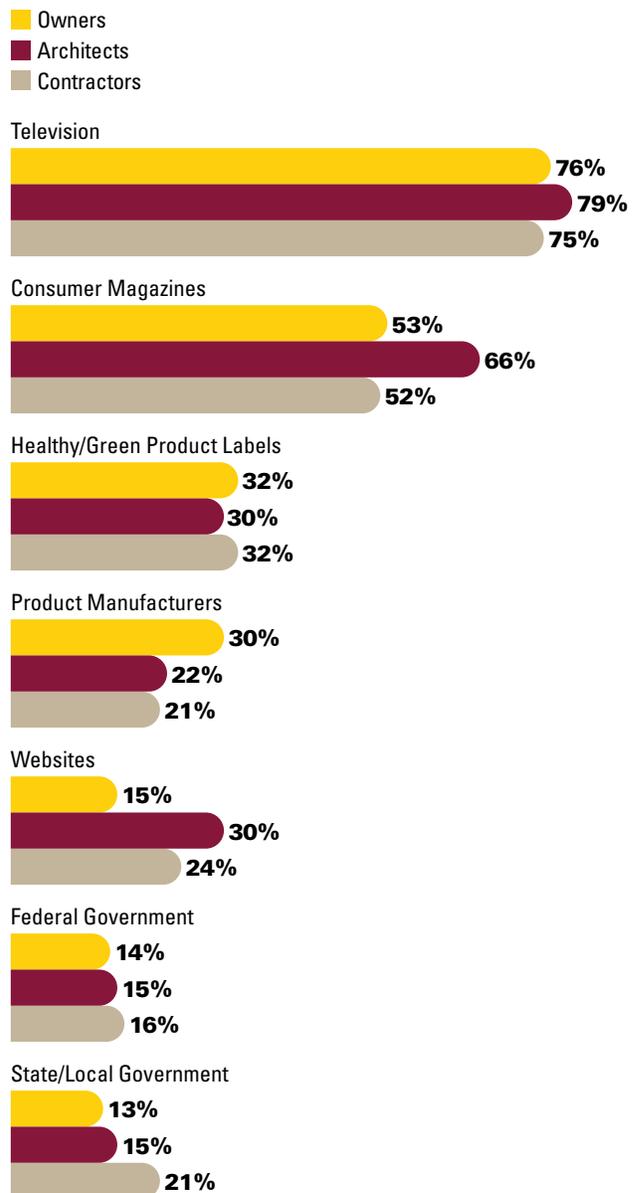
Just under one third find that product labels are used by the general public as well as a means of gaining information on healthy products and practices. However, given the low percentage that consider product labels a valuable source of information for the industry (see pages 58 and 59), it is unlikely that they consider them any more valuable for the general public.

Product manufacturers and websites are also considered a source of information for the general public by a moderate percentage, with more owners considering product manufacturers a source of information and more architects and contractors viewing websites as important. However, the general public is likely only to get information from product manufacturers through advertising, and for consumers to seek out websites, they must have a preexisting interest in and knowledge of the topic.

These findings demonstrate the challenges that the industry faces in encouraging more general public interest in the topic of healthy buildings, and it suggests that to gain broader public awareness and concern about this topic, they may need to think beyond the more traditional modes of industry communication.

Top Sources of Information for the General Public on Healthy Design and Construction (By Player)

Source: McGraw Hill Construction, 2014



Data: Global Construction Professionals

Findings From the Global Construction Industry Survey

THE DRIVE TOWARD HEALTHIER BUILDINGS

McGraw Hill Construction, in partnership with the World Green Building Council, sent the building health impacts survey to its chapter members who then distributed to their individual members. 146 total responses were received from 40 countries, including countries in the Americas, Europe, Africa, the Middle East and Asia.

McGraw Hill Construction's previous research on global construction trends like green building and BIM has made clear that the approach to construction, the drivers and obstacles and many other important factors are all influenced regionally, with no overall global approach. However, looking at the contrast between the U.S. market and the overall global averages is instructive in distinguishing the U.S. market in terms of its approach to buildings and health.

Value Placed on Health

A much higher percentage of building owners in the global survey (77%) report being willing to pay more to work in a healthier building than a traditional one than the owners in the U.S. survey (49%).

It is likely that this finding is influenced by the fact that all of the global survey participants have demonstrated interest in green building by being members of Green Building Councils in their respective countries. This substantiates the U.S. findings that industry professionals who are more involved in green are also more engaged in health. However, even when taking that into account, U.S. companies are clearly more cautious about their willingness to pay more for healthier buildings.

Influence of Government Codes and Requirements

Government codes and requirements have a high influence in the U.S. 22% of U.S. owners report that code requirements are the most important driver for consideration of health impacts in their design decisions, compared with 7% of owners globally. Also, 57% of owners and 30% of contractors globally regard codes as ineffective to promote health, compared with 25% of owners and 19% of contractors in the U.S.

The level of government involvement in health issues appears to strongly influence these findings. Only 11% of owners, and 15% of architects and contractors in the U.S. regard the lack of government codes and regulations as one of the top challenges, compared with 37% of owners and architects, and 48% of contractors globally. This, along with the current political environment, may be why U.S. firms are less likely to consider government green building requirements to be a top driver in the future for encouraging greater industry focus on building health impacts than the global average: 17% of owners, 13% of architects and 20% of contractors in the U.S., compared with 37% of global owners, architects and contractors.

Healthcare

Improving healthcare costs is a much more important driver inside the U.S. than on average globally. With many countries providing government supported or socialized healthcare, it is not surprising that this factor carries more weight in the U.S.

- 25% of U.S. owners use healthcare costs as a metric to measure the impact of building decisions on occupant health, compared with a 7% global average.
- Over one third of U.S. owners, architects and contractors consider reduced healthcare costs one of the benefits that offer the highest return on investment for a healthy building, compared with a little over one quarter for each player globally.

Architects and Contractors

The U.S. findings demonstrate that architects currently have a much higher engagement with building health impacts than contractors in the U.S. However, the global findings suggest that this is a characteristic of the U.S. market rather than generally true, and that globally, contractors have a higher level of engagement in health issues than those in the U.S.

- 54% of global contractors report that the health impact of buildings has a high level of influence on their construction decisions, compared with 41% of U.S. contractors. Interestingly, the opposite is true of architects, where 79% of U.S. architects are highly influenced in their decisions by building health impacts, versus 69% of the architects from the global survey.
- Only 25% of U.S. contractors have discussed Health Impact Assessments with their clients, compared with 52% on average globally.
- A smaller percentage of U.S. contractors also report being influenced in the product purchasing decisions by factors like information on risk impact to human health and identification of product ingredients. ■

From an Unsafe Brownfield to a Thriving Symbol of Community Hope

Kensington High School for the Creative and Performing Arts

PHILADELPHIA, PENNSYLVANIA

THE DRIVE TOWARD HEALTHIER BUILDINGS



Philadelphia's Kensington High School for the Creative and Performing Arts turned a dangerous, brownfield site into a place that not only facilitates learning, but also fosters community health and engagement.

The proposed site for Philadelphia's Kensington High School for the Creative and Performing Arts was a noisy brownfield; a long and narrow former railroad depot with the SEPTA Market-Frankford Elevated Railway "EL" running the length of the property. During peak hours trains go by about two minutes apart. Yet, the worst thing about the site was not physical, it was how the community perceived the property. The site was a brownfield. There was drug dealing, wild dogs, dumping and there had been homicides at the train station at the north end of the site. Not an idyllic setting for a new high school.

The School District of Philadelphia achieved an impressive accomplishment when Kensington High School was designated the first LEED Platinum public high school in the U.S. and as an AIA COTE Top Ten Green Building. What is most striking about this school, however, is that nearly four years after it opened

in 2010, attendance rates have increased, the graduation rate has increased to 69%, and standardized test scores have risen 400%. There is a pathway to the now-popular train station across the school site, and derelict buildings around the site are being purchased and renovated. As Jane Rath, a principal with SMP Architects, described it, "From a throw-away site, contaminated by industrial pollution, neglect and bad vibes, the property has become a symbol of community hope."

Green Design and Right-Sizing Create a Healthy, Positive Learning Environment

To address the stigmas associated with the site and create a welcoming atmosphere, views both in and out of the building were a high priority. Views in would allow families to see their children's accomplishments and make the school a place parents wanted to send their children. Views

out would allow students to see a landscape that includes urban agriculture, green roofs and their own mural art.

However, physically, the site posed several challenges. To maximize daylighting, the design had to work around the shadow cast by the elevated train. To create a bright and airy building, the academic area is U-shaped, allowing daylight to reach into every classroom. In the classrooms, the windows are all operable, enabling natural ventilation.

Noise was the other major challenge for an academic environment. To address this, general-purpose classrooms were placed as far as possible from the trains. Activities that are inherently noisy or could tolerate some added noise, such as the cafeteria and gymnasium, were located closer to the train tracks. In addition, the design of the fenestration and wall sections reduced the noise impact so that the specialty classrooms placed closer to the trains, such as art and dance, are quiet rooms.

Right-sizing the building allowed space to be freed up for urban agriculture and reduced costs enough to pay for additional initiatives. The original design was for a 120,000-square-foot-building, but the final building is 88,450 square feet. The size was reduced partially as a result of the geothermal system, which reduced the mechanical area by 10,000 square feet. The other main factor was reevaluation of space standards resulting in down-sizing the width of the corridors—right-sizing them for the number of students the school was being designed for. The building's resulting central corridor

Kensington High School for the Creative and Performing Arts

PHILADELPHIA, PENNSYLVANIA

spine created a compact, easy to navigate school building.

There were health considerations as well. A significant portion of the student population suffers from asthma. To minimize negative impacts all materials used in the building met the State of California's emissions requirements. To reduce the formation of mold, special procedures were adopted to keep moisture out of building materials during construction. The building envelope was also designed to be extremely tight, both to keep out moisture and conserve energy.

An urban agriculture project was incorporated into the site design to teach urban kids—100% of whom come from families living below the poverty line—about eating better and also showing the food systems as a potential employment opportunity.

Several additional building features were incorporated to help combat the anticipated annual stormwater bill of \$17,000. An integrated approach was used to manage 100% of stormwater on the site. Design features include use of porous paving materials, grass paving blocks, no-mow turf, vegetated roofs on 45% of the roof area, rainwater harvesting from the non-green roofs and a rain garden at the main entrance. This approach eliminated the stormwater bill and increased the amount of "green" the students would be surrounded by.

Not Just a School, a Place for the Community

In designing the school, it was always the intention that it be used for community activities after school hours. The long shape of the building facilitates this. An entrance was

placed at the gym, which is next to the cafeteria, with bathrooms located there as well. The rest of the school building can be closed off while allowing use of the gym and cafeteria for community activities. The arts wing can also function separately from the rest of the school; the Mural Arts Program that takes place after school in the art studio attracts young artists from across Philadelphia.

Shortly after the school opened, the theater and gym were used for such events as rainwater barrel construction, weather-stripping and recycling workshops and sustainability fairs to help encourage community residents to green their homes and businesses. The building continues to be used for community activities on a regular basis.

The school district did not fence the site in, encouraging community use and pride in the school. With 68.7% of the site being green space, a "park" was created in a neighborhood where there was very little green space. In order for the green space to be safe for children's sports, play and growing of food, the land was remediated to residential standards. A pathway to the train station was built crossing the property, making the site safer. More people onsite both during and after school hours, reducing the opportunity for negative activities.

The impact on the surrounding community has been significant. This area of Kensington has made a turnaround. With the high school as the impetus, other projects have followed and derelict buildings surrounding the property have been bought and are being renovated. As Rath put it, "The project teaches about living sustainably to students,

teachers, staff and community. Perhaps the biggest lesson is that even deteriorated urban landscapes can be revitalized to become sources of hope for the future." This sentiment is echoed in a quote from one of the students, "I was born into poverty. I am poor now, but I am no longer without hope." ■

Project Facts and Figures

Owner

The School District of Philadelphia

Architect and Developer

- SMP Architects and SRK Architects Joint Venture

- BSI Construction and AP Construction Joint Venture

Gross Floor Area

88,450 square feet

Total Project Cost

\$25 million

Completed

September 2010

Green Building Rating

Platinum—LEED for Schools, V2 (2011)

Key Design Benefits for Students

Program Space Advantages

- 98% daylight
- 100% with outdoor views
- 92% naturally ventilated

Performance Outcomes

- Truancy Rate Decrease: From 35% to 0%
- Graduation Rate Increase: From 29% to 69%
- Standardized Test Score Improvement: 400%

Data: Residential Industry

Insights on the Impact of Homes on
Occupant Health and Well-Being

Introduction

THE DRIVE TOWARD HEALTHIER BUILDINGS DATA

The residential construction market in the United States is picking up steam after a prolonged downturn with extremely low rates of activity from 2008 to 2012. In 2014, McGraw Hill Construction economists forecast an 18% growth in residential construction starts, by value, with additional double-digit growth in 2015 and 2016. With this increasing level of activity, the time is ripe to ensure that homes of the future are designed and built to maximize advantages for their occupants.

Residential industry professionals are aligned with their commercial and institutional counterparts in the current impact health has on their project work. This suggests that there is a generally consistent thinking in the market on the topic of buildings and their connection to occupant health—whether they are occupants of homes, schools, workplaces or other building types.

Throughout the different studies featured in this *SmartMarket Report*, increased public awareness of the health impacts of building is a key factor in driving more attention to healthy building activities across all sectors—commercial, institutional and residential. However, making homeowners more aware of the impact of healthy homes may be the cornerstone of the efforts to increase public awareness in general. If homeowners recognize how their home decisions can impact their health, comfort and well-being, they will also recognize that similar choices in their schools, hospitals and workplaces can have similar impacts. This will drive the industry as a whole toward prioritizing healthy building practices in their design and construction decisions, but clearly, it will have the most immediate impact on the residential builders and designers who deal directly with this more knowledgeable audience.

One of the biggest challenges facing the residential industry in motivating change is the lack of measurement and follow-up communication occurring between builders, remodelers, architects and interior designers, and their clients. In order to help raise public awareness, the connections need to be strengthened, and nothing is more powerful than examples of the benefits that their activities can lead to. However, currently, those data and examples are lacking—on both the residential and nonresidential side. It is important for the industry to take a leadership role in encouraging ongoing communications and dialogues with their customers—not only to help make homes healthier, but also to improve their relationships with existing clients and position them to gain future work based on these stronger relationships.

Data and Market Understanding

The data and analysis in this data section of the report provide new intelligence to increase understanding of how the residential industry—home builders, remodelers, residential architects, and home interior designers—think about the connection between their projects and the implication on occupant health and well-being.

A total of 322 residential building professionals—including 75 home builders, 40 remodelers, 99 residential architects and 108 interior designers—responded to this online survey. There was strong representation across the four geographic regions of the country (ranging from 21% in the Northeast to 29% in the South). For the full methodology, see page 100.

Data: Impact of Health Factors on Decisions About Home Design and Construction

Current and Future Expected Impact of Homeowner Health on Design and Construction Decisions

THE DRIVE TOWARD HEALTHIER BUILDINGS DATA

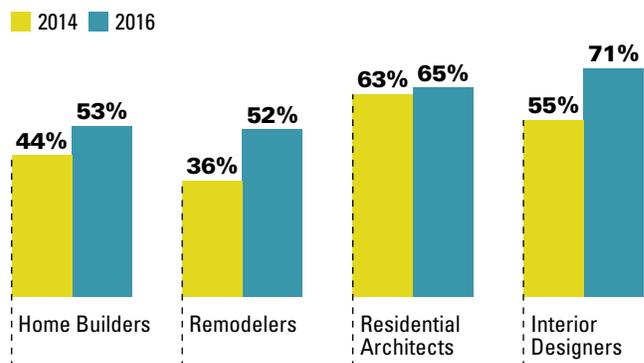
Impact on Design and Construction Decisions of Health Impacts

Although currently the influence of health impacts on the design and construction decisions of the four players involved in home design and construction projects is pretty widely mixed, **by 2016, over half of the builders and remodelers, about two thirds of the residential architects and over 70% of the interior designers expect health impacts to have a high influence on their decisions.** The increasing level of interest across the industry corresponds to the increased influence of building health impacts in the nonresidential building professionals survey (see page 24).

- **63% of residential architects currently report that health impacts have a high level of influence on their design/construction decision,** leading the industry by wide margin. Architects in the nonresidential sector also lead the industry in their concerns with health. One likely factor for this is the larger adoption of green building approaches in the design community.
- **Interior designers expect to see a dramatic increase in the influence of health impacts on their design decisions, from 55% reporting a high influence currently to 71% by 2016, exceeding even residential architects by that point.** This may reflect the intersection of increasing attention to health issues in interior product selections, which combined with a recovering economy and increasing concerns about rising healthcare costs may make homeowners more willing to consider an increased cost to create a healthier home than they would have over the past few years.
- **A notably higher percentage of remodelers also expect to see a high level influence of health impacts on their decisions, increasing from 36% to 52% and bringing them into parity with home builders on this issue.** This finding mirrors the results of the 2014 *Green Multifamily and Single Family SmartMarket Report*, in which remodelers were expecting a significant shift to a higher level of green building as well. Not only is their increased experience with green building likely to positively impact their consideration of health factors in their projects, but the underlying factor of the improving economy and the ability of homeowners to pay more for remodeling projects is likely to be feeding both trends as well.

Impact of Buildings on Occupant Health Has a High Influence on Firm's Design and Construction Decisions (By Residential Player)

Source: McGraw Hill Construction, 2014



VARIATION BY LEVEL OF GREEN INVOLVEMENT

For all four players, a higher percentage of firms doing a higher level of green projects (more than 16% of their projects green) report that their design/construction decisions are highly influenced by the health impacts of homes on their occupants. The following reflects those who state that they give a high degree of consideration to building health impacts:

- **78% of residential architects doing a high level of green projects, compared with 47% of firms doing few/no green projects**
- **83% of green interior designers, compared with 46% of those doing few/no green projects**
- **62% of green builders, compared with 30% of those doing few/no green projects**
- **78% of green remodelers, compared with 45% of those doing few/no green projects**

These dramatic differences clearly indicate a strong connection between green building and consideration of health factors. For most green rating systems, health factors have become increasingly important in recent years, which may be helping to bring consideration of health factors to the forefront for many of these practitioners.

Impact of Health Factors on Decisions About Home Design and Construction

Current and Future Expected Impact of Homeowner Health on Design and Construction Decisions CONTINUED

Comparison to Other Factors Influencing Design and Construction Decisions

Differences between the residential and the nonresidential sectors are evident in the factors that are most influential on design and construction decisions.

- **Aesthetics have a high level of influence on the highest percentage of respondents across the board, regardless of the type of player.**
- **Overall, despite changes in percentages, the factors selected by the first, second and third highest percentage as highly influential in 2016 are consistent with the first, second and third rankings currently.** The only exception is remodelers. The percentage of remodelers who currently consider productivity influential is the third highest for any factor, but by 2016, the percentage that expect to consider health impacts important exceeds productivity and moves from the fourth to third highest.
- **Health impact rank higher compared with other factors for builders and interior designers than they do for residential architects or remodelers.**
- **While the percentage of residential architects that consider health factors influential is quite high compared to other players, these factors also rank fourth, both now and in 2016, when compared with other factors, the consistently lowest ranking for health impacts of any player.**

In all, these findings demonstrate that, despite growing attention to the impact of health in design and construction decisions, healthy building investments are still at risk when they are forced to compete with other building priorities, a factor that the industry must address in order to see wider healthy home investments.

Factors Influencing Design and Construction Decisions (By Residential Player)

Source: McGraw Hill Construction, 2014

- Highest Percentage Report High Impact
- Second Highest Percentage Report High Impact
- Third Highest Percentage Report High Impact

	Builders		Remodelers	
	2014	2016	2014	2016
Aesthetics	65%	68%	75%	70%
Energy Saving	64%	68%	54%	50%
Improving Productivity	48%	59%	40%	48%
Impact of Building on Health	44%	53%	36%	52%
Improving Surrounding Community	42%	54%	33%	47%
Water Savings	40%	48%	38%	45%

	Architects		Interior Designers	
	2014	2016	2014	2016
Aesthetics	95%	92%	89%	90%
Energy Saving	77%	84%	63%	71%
Improving Productivity	38%	46%	47%	58%
Impact of Building on Health	63%	65%	55%	71%
Improving Surrounding Community	64%	68%	37%	54%
Water Savings	44%	63%	55%	68%

Reasons for Considering Homeowner Health in Home Design and Construction

THE DRIVE TOWARD HEALTHIER BUILDINGS DATA

The importance of different reasons for considering impacts on homeowner health in home design and construction vary widely by player.

While homeowner demand is the top reason selected by the highest percentage of all residential players, except architects, its influence is strongest on interior designers (70%) and remodelers (58%). Projects for both of these players are largely driven by direct client need and input, compared with the work of home builders and residential architects building new homes. This finding corresponds with the influence of client demand on the green projects conducted by remodelers in the 2014 *Green Multifamily and Single Family Homes SmartMarket Report*.

However, the influence of client demand on builders and architects should not be discounted, since it is the reason selected by the highest percentage of builders and the second highest percentage of architects. Greater homeowner awareness and demand will be essential in this market, like the green homes market, to drive wider adoption of healthy building practices.

The most important reason selected by the highest percentage of residential architects (48%) is that healthy building practices are the right thing to do. This corresponds to the findings from architects doing nonresidential projects, and it demonstrates that doing the right thing is a critical driver in the consideration of health in building design, regardless of sector.

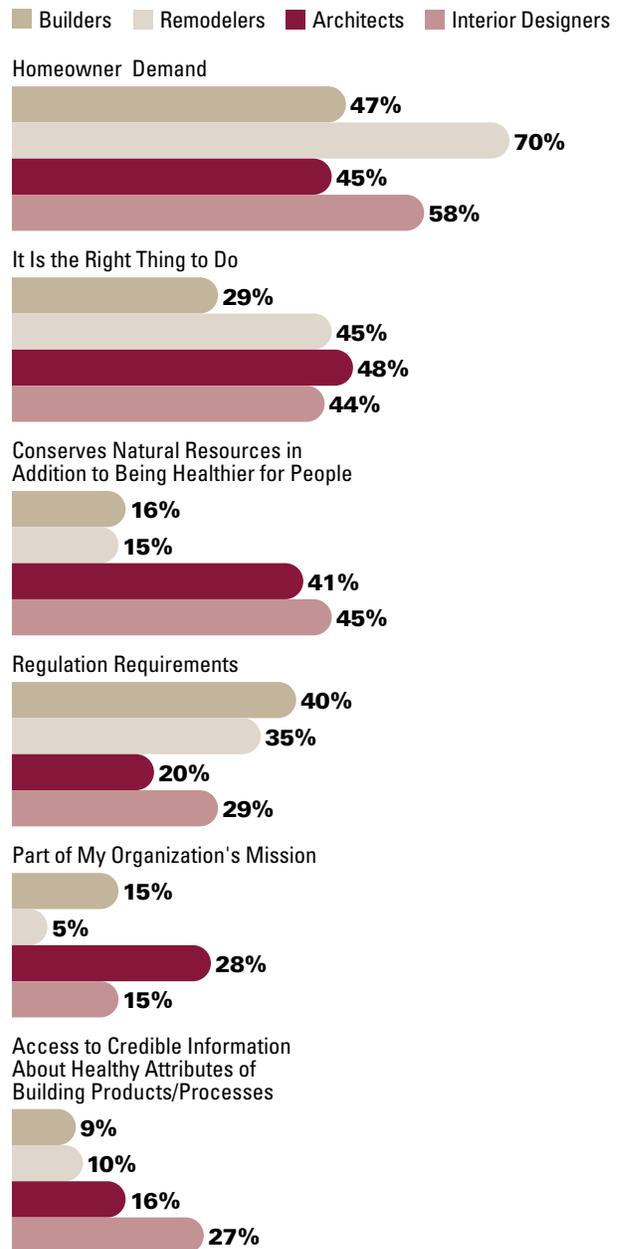
It is also notable that consideration of health because it is the right thing to do is also an important reason for a high percentage of interior designers (45%) and remodelers (44%). Currently, more financial- or market-driven reasons are hard to gauge and measure in this emerging practice. Therefore, even though homeowners are widely aware of the general impact of buildings on health, more information driving the use of specific healthy building practices based on their impacts can help drive market pressure and make the financial/market reasons for healthier homes more evident to all players.

Other factors of higher importance to specific players include:

- **Although the low response from other players kept this factor from being featured in the chart of top reasons, builders are very motivated in their consideration of health impacts by PR and reputation.** This may suggest that some builders are starting to recognize an emphasis on healthy homes as a way to distinguish themselves from competitors.
- **Architects report being more mission driven than other players, corresponding with their emphasis on doing the right thing.**

Most Important Reasons for Health in Residential Projects to Date (By Residential Player)

Source: McGraw Hill Construction, 2014



- **Interior designers are more influenced by access to credible product information.**

Triggers for Encouraging Greater Focus on Designing and Building Healthy Homes in the Future

THE DRIVE TOWARD HEALTHIER BUILDINGS DATA

The top trigger that would encourage all four major players—builders, remodelers, residential architects and interior designers—to give more consideration to occupant health when designing/building homes in the future is more requests from homeowners. The industry’s unanimity on this point strongly underscores the importance of greater outreach to and education of the general public on specific healthy home features.

Codes and regulations are also an important trigger for all four players, selected by 41% to 48% as one of the top three triggers. This corresponds to a strong response to code requirements in the nonresidential survey as well, especially among building owners (see page 28).

Other top triggers include:

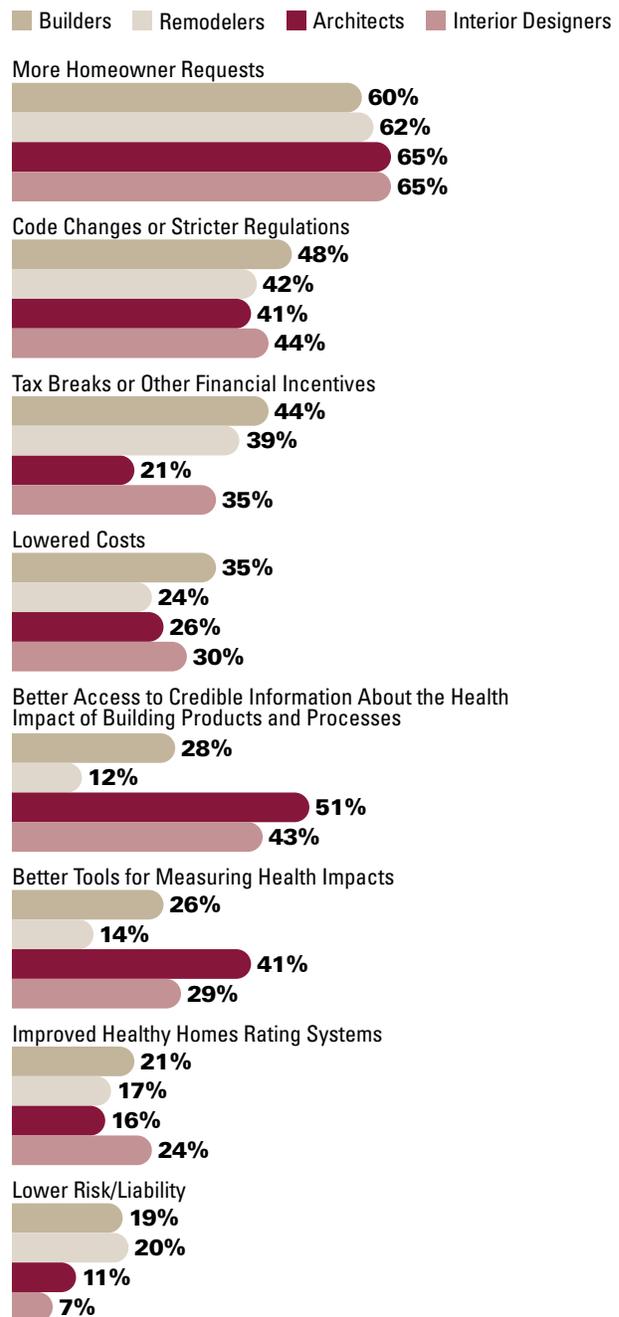
- **Better Access to Credible Information About Health Impacts of Building Products and Processes:** This factor is more influential for residential architects (51%) than codes, and also has a high influence on interior designers (43%). This suggests that the strategy for addressing health issues using building products and practices is most likely determined relatively early in the design process. It also is further indication of the need for more data to help drive health issues evident in the nonresidential study as well.
- **Tax Breaks and Other Financial Incentives:** These have a strong influence on all players except residential architects. Builders, remodelers and even interior designers are more likely to either benefit directly from these incentives or be able to demonstrate savings to their clients than residential architects can.
- **Better Tools for Measuring Health Impacts** is considered one of the top three drivers by a much higher percentage of residential architects than any other player. This finding further supports the critical role that more data and information plays for residential architects to give greater consideration to health impacts in their home designs.

Variation by Level of Green Involvement

34% of builders and 44% of remodelers with higher levels of green involvement (more than 16% green projects) find that improved healthy home rating systems would be an important trigger to increasing their consideration of health impacts, compared with 10% or less of builders and remodelers doing little/no green projects.

Top Three Triggers for Greater Future Consideration of Occupant Health in Home Design and Construction (By Residential Player)

Source: McGraw Hill Construction, 2014



Challenges Preventing Health Considerations From Being a Critical Factor in Home Design and Construction Decisions

THE DRIVE TOWARD HEALTHIER BUILDINGS DATA

Cost concerns are the challenge listed by the greatest percentage of residential players.

Homeowner demand is also listed as a top challenge for all the players. This challenge is also a top trigger to increased attention on health in home design/construction decisions (see page 68). This suggests that the industry must find ways to engage the homeowner. Fortunately, homeowners are aware of the link between their homes and health (see page 84), so industry players need to tap into that knowledge in order to encourage homeowners to prioritize health impacts when making decisions. Similarly, if the industry can demonstrate the value of investing in healthier decisions to homeowners, it may end up overriding cost as a major concern.

Other top challenges include the following:

- **Challenge of Isolating the Home’s Impact on Health and Other Benefits:** Builders and architects are more concerned about this than the other players, likely because they often work with owners on cost/benefit analysis in their decision-making, and therefore, they are more challenged with making linkages of design and construction decisions with benefits.
- **Lack of Credible Information About Health Attributes of Products/Processes:** All players give this a similar weight, though more design firms report it as a challenge.
- **Lack of Public Awareness About Health Impact of Homes:** This rates as the second highest challenge for both architects (49%) and interior designers (50%). It is surprising it is not higher for other players considering how high homeowner demand ranks, since there is clearly a link between the two. There is an additional advantage to tackling this challenge—it provides support to the medical, public health and environmental communities who can help create larger awareness of these issues.

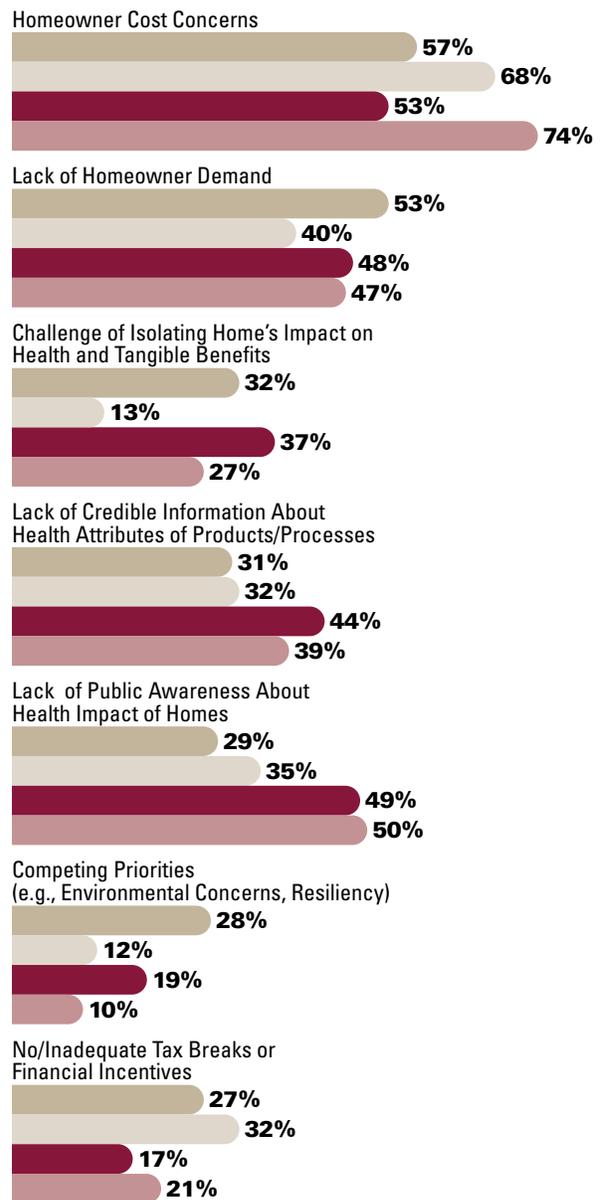
Variation by Level of Green Involvement

- **For builders,** lack of credible information about health attributes of products is selected as a top challenge more frequently for those with higher levels of green involvement (more than 16% green projects)—reported by 44% as an obstacle, compared with 21% of firms with little/no green involvement.
- **For remodelers,** 16% of those with little/no green involvement find that isolating the home’s impact on health and other benefits is an obstacle, while none

Top Three Challenges to Greater Consideration of Occupant Health in Home Design and Construction (By Residential Player)

Source: McGraw Hill Construction, 2014

■ Builders ■ Remodelers ■ Architects ■ Interior Designers



those with greener involvement find this a challenge. This suggests that the greener firms already make links between homes and health and other benefits and therefore find other factors of higher concern.

Data: Metrics and Benefits of Healthy Homes

Measuring Impact of Homes on Occupant Health

Most residential industry players are not doing any measurement on the impact of their decisions on health. However, higher levels of measurement are correlated with higher levels of green work for all players other than interior designers (where there are no statistically significant differences). This not only reinforces the higher awareness of health impacts in green projects, it also is a positive indicator since McGraw Hill Construction is projecting growth in green projects in the residential construction sector (see the *Green Multifamily and Single Family Home SmartMarket Report*, 2014).

- Designers:** This lack of measurement is particularly true on the design side. Architects and interior designers are in alignment as to the amount of measurement they are doing. This is not overly surprising for residential architects, who often hand over design plans to the builder or remodeler to execute. The residential interior designer may also function in this way. However, generally, they are more likely to be engaging closely with the homeowner or developer and be able to influence the factors the homeowner is tracking. This will be particularly important for the industry to help trigger additional health-focused activity and overcome challenges to doing so (see pages 68 and 69).
- For the builders and remodelers, there is also agreement, though more builders—19%—are doing a lot of measurement.** This is consistent with how closely builders work with homeowners and developers. However, the majority (57%) are not doing any measurement, which is a big gap. For remodelers, they have the unique advantage of doing specific upgrades, and working closely with homeowners, so it would be good to see them increasing their level of measurement and encouraging their customers to do more as well—not only to encourage more awareness but also to help future business. If the remodeler can demonstrate the advantages and paybacks to their activities, it may prompt homeowners to engage in more upgrades.

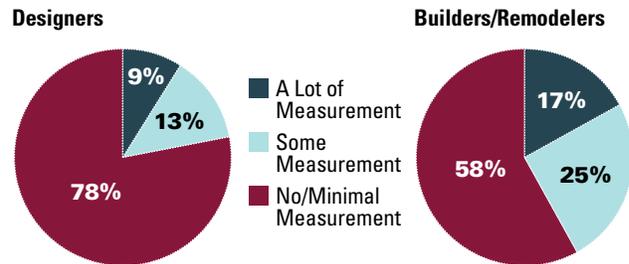
Methods Used to Gather Data

The methods being used to gather data vary by residential industry player.

- Builders more widely use air quality tests, occupant surveys and noise level tests.** Considering their role in building projects, it is not surprising that builders are focused on larger whole-home methods to gather data. It is a little surprising they are also not testing systems at similar levels, but that measure is consistently higher for

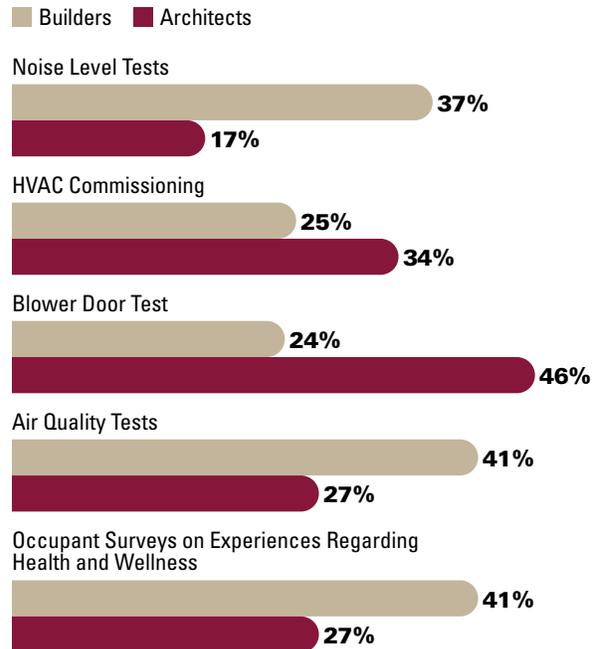
Amount of Measurement on the Impact of Homes on Occupant Health (According to Residential Players)

Source: McGraw Hill Construction, 2014



Top Five Methods of Gathering Data About Homes Designed/Built (According to Home Builders and Residential Architects)

Source: McGraw Hill Construction, 2014



greener builders (41% versus 14%).

- Architects more often report use of blower door tests (their No. 1 listed test) and HVAC commissioning.** Commissioning helps ensure their design is operating at the standard they set. Nearly all activities are more highly reported for those doing more green work.
- Overall, very few remodelers and interior designers report using any of the methods tested in the survey.**

Positive Health Benefits of Home Design and Construction Activities

Overall, 66% of the residential industry players say they do get some reports from the homeowner on their homes about the benefits they are experiencing. While this doesn't supplant the need for more specific data collection by homeowners in partnership with the industry, it does provide indications of how homeowners are connecting their homes with health.

There are differences by industry player type in the kind of benefits being reported to them.

Builders and Remodelers

- **For the top reported benefits, there are some alignments among the builders and remodelers, with homeowners reporting fewer instances of respiratory problems and illnesses overall, as well as better sleep.** In factor, for all players, remodelers report better sleep more than others. That may be because they are coming in and doing HVAC or system upgrades that help improve air quality.
- **A notable percentage of builders (17%) also say that homeowners report they are taking fewer sick days from work and/or school.** This would be an important indicator for owners of offices and other workplace buildings as well as school officials and owners, so it is an important area for the residential industry to talk to their customers about.

Residential Design Professionals

There are more variations between the design professionals. However, overall fewer of them report about these benefits compared with their builder counterparts.

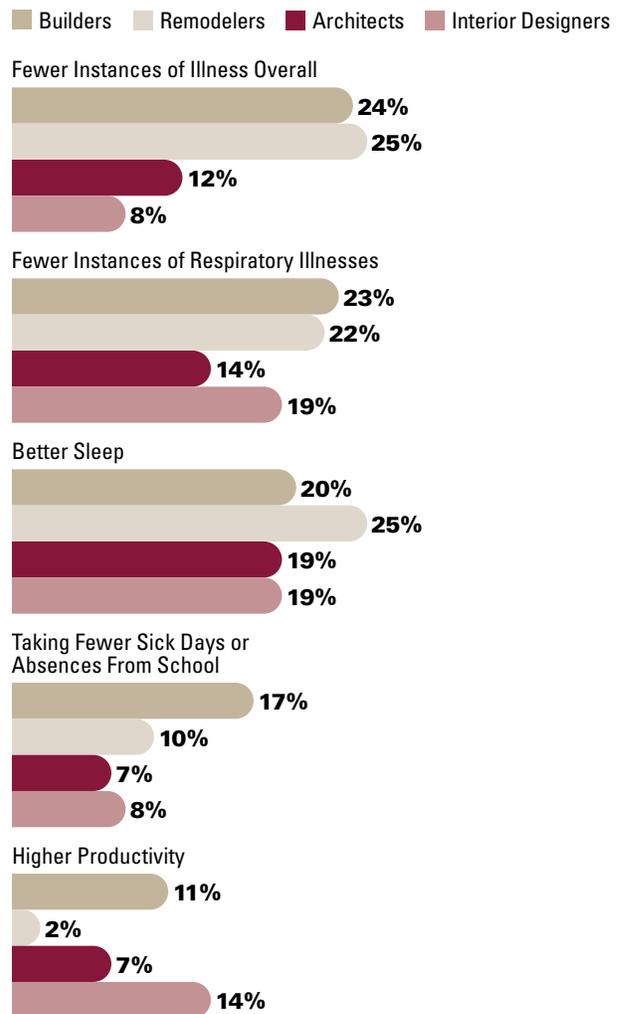
- **Architects receive most information that their projects have led to better sleep for homeowners.** However, at only 19%, this is still relatively low.
- **Aside from better sleep, which 19% report that homeowners are experiencing, interior designers report homeowners also experience fewer instances of respiratory illness and higher productivity in their homes.**

Variation by Level of Green Involvement

Overall, those firms doing green work (more than 15% of projects green) report much higher percentages of those experiencing fewer instances of illness overall (reported by 41% of greener builders, 56% of greener remodelers and 19% of greener architects).

Top Five Health Benefits Reported by Homeowners (According to Residential Industry Players Who Have Received Reports from Homeowners)

Source: McGraw Hill Construction, 2014



- **More greener builders also report fewer instances of respiratory illnesses for their clients (38% versus 12% for non-green).**
- **More greener remodelers also report better sleep for their clients (56% versus 16% for non-green).**

The Green Way to Better Health

Via Verde Housing Complex

SOUTH BRONX, NEW YORK

THE DRIVE TOWARD HEALTHIER BUILDINGS

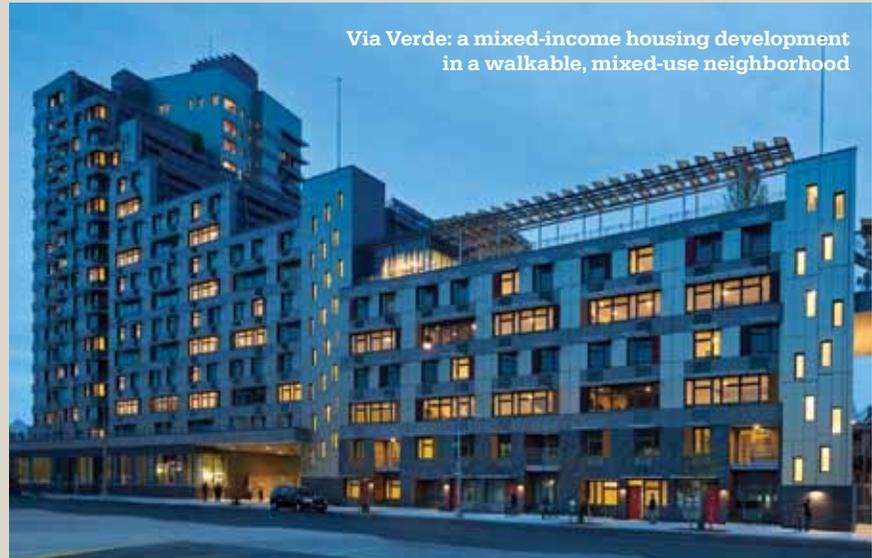
In New York's South Bronx neighborhood, a neighborhood with some of the country's highest rates of poverty and chronic disease, a multi-award-winning mixed-income housing development stands in the vanguard of design for health. Winner of New York City's first juried competition for affordable housing, Via Verde prioritized health from the start.

"There was a real awareness among the [competition] organizers and the design team of some of the problems people are experiencing in areas like the South Bronx, and what you can do through design to address these problems," says William Stein, FAIA, principal at Dattner Architects, project designers in collaboration with Grimshaw Architects. "Design is not the sole answer, but certainly the built environment can have a significant impact."

Rising Activity Levels

Few, if any, health interventions bring so wide a range of benefits as physical activity, and a major determinant of daily activity levels is location. Within a five-minute radius of Via Verde, residents can walk to shops and services for their daily needs, including a community health clinic and pharmacy on Via Verde's own ground floor, as well as bus lines and a subway station connecting to destinations and employment outside the neighborhood. Secure and convenient bike storage supports residents choosing active transportation.

The architecture of the building itself provides an armature for more active and healthier living. Via Verde's primary design move takes advantage of the site's southern



Via Verde: a mixed-income housing development in a walkable, mixed-use neighborhood

exposure, stepping the massing of the building down from a 20-story tower at the north to a mid-rise building, which in turn steps down from 13 to six stories; four- and two-story townhouses make the next steps, and finally an amphitheater steps down to a central courtyard at ground level.

The resulting roof terraces bring double meaning to the term "activity levels." Greened and programmed with a variety of universally accessible gardens, including vegetable plots, Christmas trees, an apple orchard and an exercise patio, the roof terraces not only retain rainwater, but also improve building energy performance and mitigate urban heat island effect. They also provide residents with an amenity that offers multiple health benefits.

The uppermost accessible roof, for example, serves as an outdoor extension for Via Verde's seventh-floor fitness room. To get to the fitness room, stairs linking the stepped roofs to the central courtyard allow residents to walk.

Within the building, prominently located stairs use daylight, colorful finishes and signage to prompt residents to "burn calories, not electricity."

Nourishment, Connection and Nature

Lack of access to fresh and affordable food is a significant part of the equation that adds up to obesity, particularly among lower-income populations; and the price and availability of inferior packaged products can undermine healthier food instincts and cultural traditions. Via Verde's roof-top community gardens offer residents an opportunity to grow their own fresh and affordable vegetables, and to reclaim an enjoyable connection to nourishing food.

An active residents' garden club operates the food gardens with mentorship from Grow NYC, a community gardening nonprofit retained by the project's management to run programs about nutrition and growing. There are no

Photograph: Phippos Rose Dattner Grimshaw and David Sundberg/ESTO

CONTINUED

Via Verde Housing Complex SOUTH BRONX, NEW YORK

individual plots in the food gardens. “These are truly common gardens,” says Stein, “in which residents work together and share the produce.”

Social ties are an essential aspect of health. They are a source of support and empowerment, and the basis of community. The diversity of Via Verde’s outdoor common areas provides a range of opportunities for residents to see each other often enough to connect: whether working in the community gardens, meeting at the children’s play area or participating in special events such as movie night in the courtyard amphitheater. As a neutral, shared space where neighbors can connect regularly and comfortably, Via Verde’s roof gardens exemplify one of the ways a built environment can support the development of social ties.

The roof gardens also provide residents with a connection to nature. The relentless stimulation of urban life can overwhelm individuals’ ability to pay attention, connect or just maintain courtesy. Views of nature—from a wide wilderness to a potted plant—allows the viewer

to recover from mental fatigue. Even Via Verde’s upper, inaccessible green roofs serve in this way, using the building’s fifth facade to green residents’ foreground view.

Health at Home

Almost all apartments in the development have two facades, allowing for cross-ventilation and daylighting. As well as providing a low-energy solution to occupant comfort, the ability to adjust airflow and comfort by opening and closing windows provides building users with a tangible sense of control over an important aspect of their sensory experience. Apartments with daylight from more than one side also provide a fuller and more dynamic experience of light over the course of the day.

Prefabricated rain-screen panels and solar shading devices provide a high-performing building envelope that promotes occupant comfort and indoor air quality. The building further safeguards indoor air quality with low- and no-VOC materials and finishes. Smoking is not permitted in

any of the common areas.

Of the many ways Via Verde supports its residents’ health, the simplest is also one of the most profound. Of the building’s 222 residential units, 71 have been sold to middle-income households earning between 70% and 100% of the area median income (AMI), and 151 have been rented to households earning between 40% and 60% of AMI.

Links between housing and chronic illnesses such as asthma, allergies, depression and cardiovascular disease are well established, and the health impacts of substandard housing disproportionately affect people with lower incomes. By making high-quality housing in a walkable neighborhood affordable to residents with lower incomes, Via Verde transcends the environmental determinants of health, and begins to tackle its social determinants too. ■



Community gardens offer residents an opportunity to work together growing fresh and affordable vegetables.

Photograph: Phipps Rose Dattner Grimshaw and David Sundberg/ESTO

Project Facts and Figures

stats

Developer

Jonathan Rose Companies / Phipps Houses

Architects

Dattner Architects
Grimshaw Architects

Landscape Architect

Lee Weintraub Landscape
Architecture

Type of Project

Multiresidential Housing

Size

300,000 square feet

Units

222

Completed

2012

Data: Community Design Practices

Important Community Design Practices

The residential industry is split with regard to how much they take community design principles into account when selecting or designing sites for homes, with about a third of both residential architects (31%) and home builders (35%) reporting this factor as having no influence on their decisions. There is a larger portion of architects very involved in this issue compared with builders.

Greener firms (those doing more than 15% of their projects green) are across the board more influenced by community design principles.

- Residential Architects: 59% of greener firms rate it as having high/very high influence versus 33% of those with little/no green activity.
- Home Builders: 44% of greener firms rate as high/very high in influence versus 19% for non-green ones.

Community Factors Considered by Home Builders and Architects

Overall, more residential architects are considering aspects of community when they make design decisions, compared with home builders. This is not surprising given the role of the architect versus the builder, who is more likely to be concerned with the structure versus the availability of larger community amenities.

However, it is important to note that these factors are important to homeowners when they are deciding where to live (see page 89), and there is some misalignment in the perception of what the homeowner prioritizes.

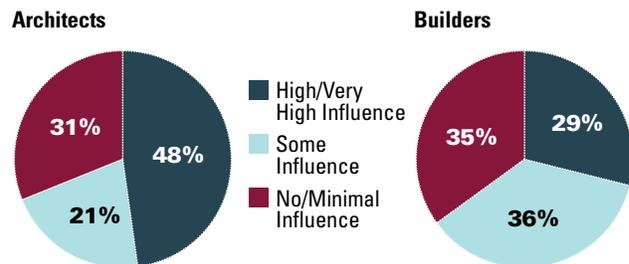
For example, 14% of homeowners say proximity to locally grown food has an impact on where they decide to live, but only 4% of the industry think this is a factor worth considering. Conversely, only 9% of homeowners make decisions based on being near public transportation, but 15% of builders and 21% of architects think it is worth consideration.

It is important for the industry to align its activities with the needs and wants of the homeowner.

Degree to Which Community Design Principles Influence Decisions on Selection/Design of Home Sites

(According to Home Builders and Architects)

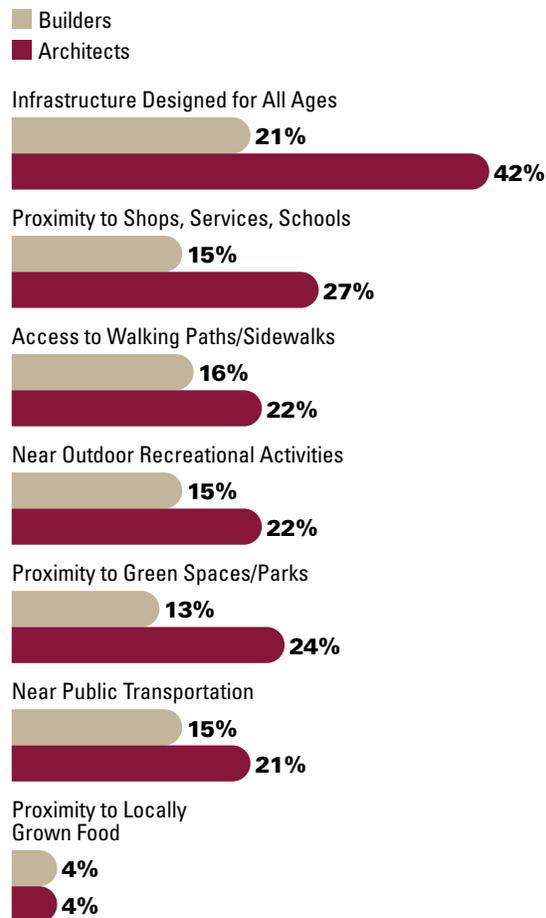
Source: McGraw Hill Construction, 2014



Community Factors Given High Consideration When Designing/Building Homes

(According to Home Builders and Architects)

Source: McGraw Hill Construction, 2014



Benefits and Drivers Encouraging Adoption of Community Design Principles

Benefits Encouraging Adoption of Community Design

There is agreement among the players as to the key benefits that if linked to improved community design would help encourage its adoption. The two key benefits that would prompt the residential construction industry to consider these factors in their work are better quality of life and making a neighborhood more desirable to the market.

In order for these benefits to be realized, it is important for the residential industry to work with homeowners to measure their impacts and to track housing prices in different markets to determine if there is a connection between community design and these outcomes.

Drivers Encouraging Adoption of Community Design Principles

Unlike the influential benefits of community design, the industry players somewhat disagree on the factors that would have the greatest impact on driving adoption of community design principles.

BUILDERS

They believe tax breaks and other financial incentives would be the biggest driver to adoption of more community design principles—reported by 56%.

That is closely followed by 55% reporting greater homeowner awareness. This latter benefit is also the key driver to healthy home building as well, so the industry could combine education and information about healthy homes with community design to help drive both.

REMODELERS

They for the most part agree with builders, with a slightly reversed order—52% report greater homeowner awareness would drive adoption and 48% believe tax breaks/financial incentives would.

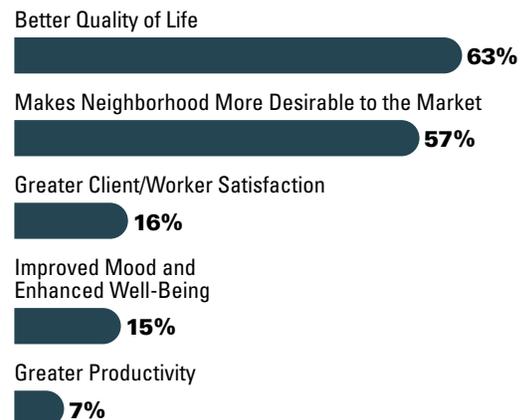
Remodelers are the group with the largest percentage (40%) that report that better industry training would be a driver.

RESIDENTIAL ARCHITECTS

While the most (66%) rate greater homeowner awareness as a key driver, **60% believe that code and zoning law changes would prompt change if they promoted healthy community design.** This is significantly higher than what was reported by the other players.

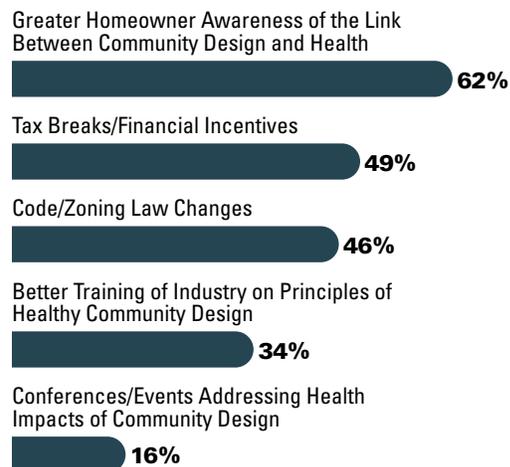
Benefits That Would Help Encourage Adoption of Community Design in the Home Building Industry (According to All Residential Players)

Source: McGraw Hill Construction, 2014



Drivers Encouraging Adoption of Community Design Principles in the Residential Sector (According to All Residential Players)

Source: McGraw Hill Construction, 2014



INTERIOR DESIGNERS

Though their work is not community focused, they have consensus with the average rank ordering of the drivers as shown in the chart, underscoring how important greater homeowner awareness and engagement is in driving new ways of doing things.

A New Kind of Health Plan: Neighborhood Design for Better Public Health

As awareness of the link between neighborhood design and public health grows, design and planning practitioners are developing methods for using them specifically to improve public health.

Links between neighborhood design and public health are so diverse and comprehensive that children's life expectancy can be predicted by their zip codes.

A neighborhood with a mix of uses, for example, encourages walking. Parks promote physical activity. Access to healthy food affects rates of obesity and disease. Neighborhoods with safe streets show higher levels of community participation and outdoor activity. Transportation to employment centers affects poverty and stability. And safe, sound and affordable housing corresponds with better health.

The Mariposa Healthy Living Initiative

At the outset of its planning process for the redevelopment of Mariposa, a 17-acre neighborhood of public housing in south Denver, the Denver Housing Authority (DHA) assigned health as a proxy for residents' quality of life. The DHA commissioned its master-planning team, led by Mithun, to craft and implement a health-based development metric.

The resulting Mariposa Healthy Living Toolkit, which won a 2012 EPA National Achievement Award, provides a replicable model for documenting the existing health of a community, and evaluating the potential effect of proposed development. It organizes community health determinants into six sectors: housing,

transportation, stewardship, social cohesion, services and amenities, and economy. For each sector, the Toolkit provides a comprehensive set of resources for establishing and achieving health-based priorities.

The data generated in the Mariposa health assessment underlies Mithun's master plan for the neighborhood's revitalization. Three construction phases, comprising a vibrant mix of uses, housing types and amenities, are now complete. An early update of key health indicators against a baseline study showed average income, crime rates, access to open space and walking distance to healthy food outlets already beginning to show positive change.

"We don't expect to see a huge change in overall health statistics in such a short time," says Lynne Picard, a director at DHA, "but there are so many individual stories that are amazing. It makes it easier to know we're moving in the right direction."

Seattle's Healthy Living Assessment

The city of Seattle has a history of neighborhood-scale planning. Its Healthy Living Assessment (HLA) tool, which won a 2013 National Planning Achievement Award, builds on that history to provide another example of a structured, multi-pronged approach to health-integrated planning.

To take health into account right from the start of a planning project, the HLA provides three

data-gathering tools and a template for synthesizing the data collected. The first tool consists of a set of detailed questions to assess the status of key health indicators, such as food access, mobility/physical activity and community stability. The second tool is a neighborhood questionnaire designed to generate information not available elsewhere: how people perceive neighborhood safety, for example, and how they get to the grocery store. The third tool is a set of questions for community discussion.

"When you talk about health, you talk about people," says Nora Liu, manager of community development at Seattle's Planning and Development Department. "The HLA allows us to put people first."

Seattle's neighborhood planning team has successfully piloted the HLA in two neighborhood plan updates. The reports that emerged from the pilot projects provide nuanced, humane portraits of neighborhood character and its impact on residents' lives. In addition to planning staples such as walkability, strong commercial cores and access to transit, they highlight previously unrecognized priorities, such as access to healthy food and playgrounds for kids.

Neighborhood residents have taken on the implementation of the resulting neighborhood plans "in a way that I have never seen," says Liu. It seems engagement and empowerment are two more aspects of health that a health-based planning process can generate. ■

Data: Healthy Home

Products and Practices

Products Used When Designing and Building Healthy Homes

THE DRIVE TOWARD HEALTHIER BUILDINGS DATA

Consistently, architects report higher levels of use of nearly all the healthy building products included in the survey than any other player, often at statistically significant levels. This reflects a greater general awareness of architects compared with other players of products chosen specifically for their beneficial health impacts.

Two healthy building products are used by over 70% of the industry professionals surveyed, demonstrating widespread adoption across the industry.

- **Hard Flooring:** This product tops the list for all players. A likely factor driving use is the aesthetic appeal, as much or possibly more than, the health benefits of hard flooring.
- **Low-/No-VOC Products:** Used by the second highest percentage of all players except builders. However, even among builders, over half report using these. The popularity of green rating systems is no doubt contributing to the wide use of these products, and a much higher percentage of remodelers and architects that do a high level of green projects (16% or more) report using these.

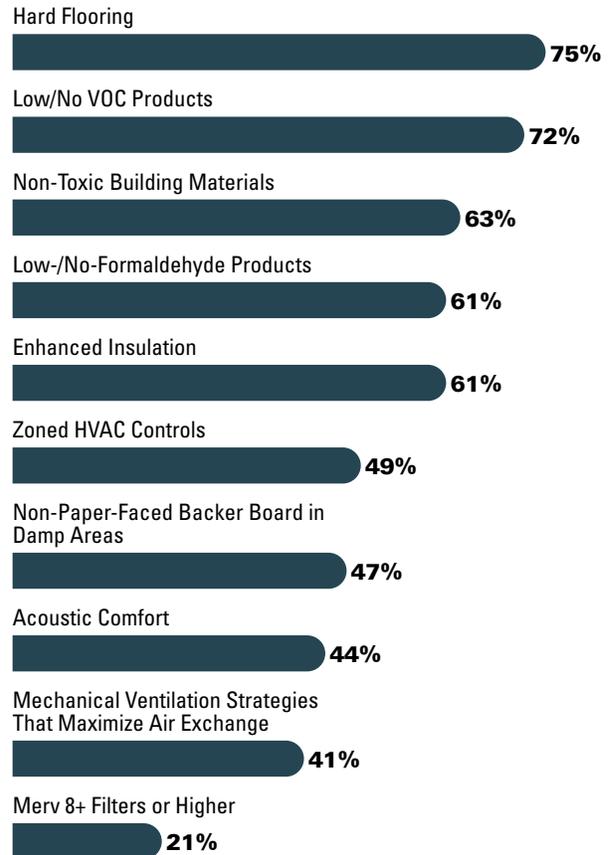
Other products used by over 50% of respondents include:

- **Non-Toxic Building Materials and Low-/No-Formaldehyde Products:** VOCs and formaldehyde are the top chemicals industry professionals identify as important to avoid by a high percentage, and other toxins with a high degree of concern in the industry include heavy metals, perfluorocarbons and toxic flame retardants. It is likely that wide adoption of green building has raised awareness of the impact of these chemicals, since a higher percentage of all players doing a high level of green projects report using non-toxic or low-/no-formaldehyde products (or both), compared with those doing few green projects.
- **Enhanced Insulation:** Insulation is relatively inexpensive and helps save energy, which no doubt contributes to its wide use. A higher percentage of design firms doing a high level of green projects also report using enhanced insulation than those doing few green projects.

Over half of the design firms (architects and interior designers) report using products to achieve acoustic comfort, but only 25% of builders and 22% of remodelers report the same. This finding suggests that design firms are more aware of the importance of acoustics generally, a finding that aligns with their wider awareness of other healthy factors.

Healthy Products and Practices Used When Designing/Building Homes

Source: McGraw Hill Construction, 2014



Practices Used When Designing and Building Healthy Homes

THE DRIVE TOWARD HEALTHIER BUILDINGS DATA

As with healthy products, a much higher percentage of architects uses most of the healthy practices for homes, especially the most common ones. The only exceptions to this general trend are the site-related practices. The high level of use of practices reported by architects further supports the conclusion that they have a more conscious use of practices to enhance health than is common among other players.

The top three most widely used practices for architects and builders alike are enhanced moisture control, improved roof, wall and/or foundation drainage and design for sunlight/daylighting. Other than the use of daylighting, these are also the top practices for remodelers, and changing the amount of daylighting in an existing building can be a daunting prospect. The level of use reported by architects of these practices is, in fact, high enough to be considered standard practice, and certainly these are all features that would make a home better built and more attractive to homebuyers.

The practice used by the third highest percentage of remodelers (52%) is protecting onsite building materials from moisture or weather damage. The work of remodelers is typically closely followed on a day-to-day basis by their clients, who may influence their higher level of use of this practice, but it also would have significant implications to avoid mold or other contaminants.

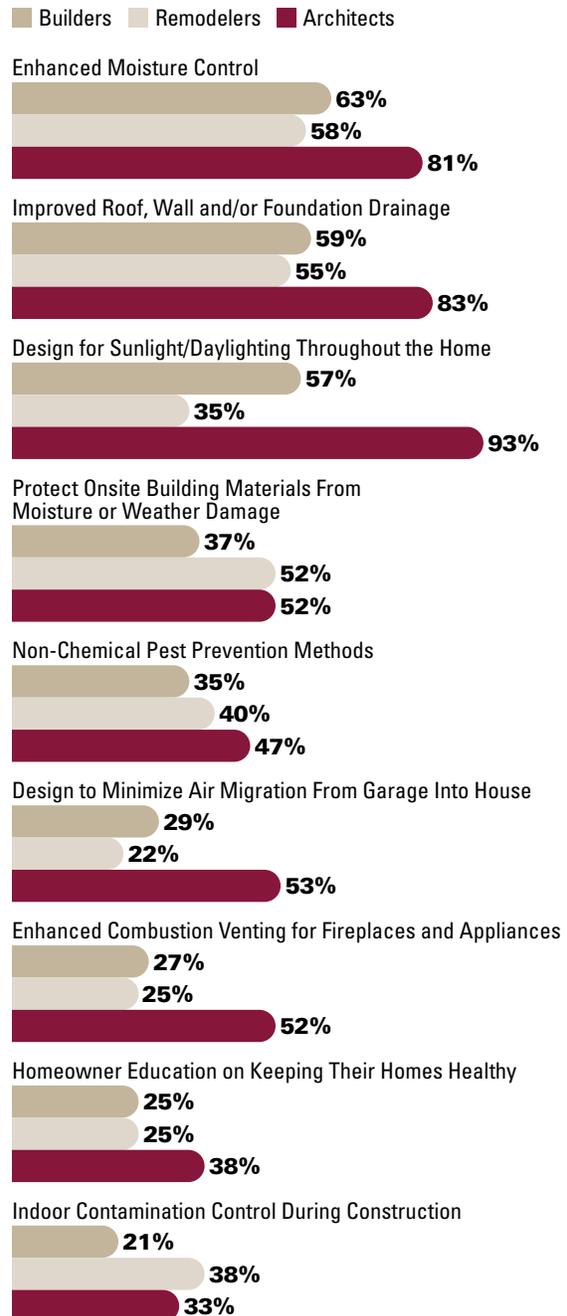
Other key findings include:

- **Non-chemical pest prevention is the only other healthy practice used by more than one third of the builders (42%).** This practice may provide appeal to new homebuyers who are concerned about toxic chemicals and prefer non-chemical methods like sealing and caulking.
- **38% of remodelers report using indoor contamination control during construction, the only other practice used by over one third in this group.** It is actually surprising that more homeowners do not request this practice, which suggests that they may not be aware of the necessity to do so.
- **A higher percentage of builders and architects with a high level of green involvement report doing more of these practices than those doing less green work.**
 - More green builders use daylighting, improved drainage and enhanced combustion venting.
 - More green architects use enhanced moisture control, enhanced combustion venting, protection of onsite materials, indoor contamination control and non-chemical pest prevention methods.

Healthy Design and Construction Practices Used for Homes

(According to Residential Industry Players)

Source: McGraw Hill Construction, 2014



Factors Encouraging Increased Use of Healthy Home Products and Practices

Better professional training is the top factor encouraging an increased use of healthy home products and practices for most players in the industry, with only builders more motivated by financial incentives like tax breaks.

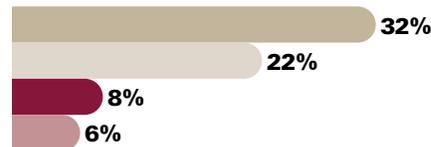
- Builders: Top factor is tax breaks or other incentives (32%).** Builders benefit from tax breaks and other incentives in two ways. They either lower their direct costs for building or allow them to make the feature associated with the tax breaks more appealing to homeowners due to cost savings. The other major factor influencing builders is the need for better training, although a lower percentage of builders select this factor as more influential than the percentage of other players.
- Remodelers: Better professional training is their top factor (25%), followed closely by tax breaks or other incentives.** This finding, combined with the top factors reported by builders, reveals that construction companies recognize a gap in the knowledge and skills surrounding healthy building practices in the construction industry. However, the high performance of tax breaks/financial incentives also demonstrates that builders are much more motivated by these factors than those in the design professions.
- Architects: Better professional training is their top factor as well (31%), nearly twice as many as any other factor.** In addition, a slightly higher percentage of architects seek more data on the impact of environmental variables and more healthy project case studies than other players. Given the high level of use of products and practices reported by architects, this finding is surprising. It does, however, support their high level of awareness and engagement with health and suggest that they see these practices as not entirely sufficient to achieve their healthy building aspirations.
- Interior Designers: 38% of interior designers seek better professional training, the highest percentage of any player, and the second highest percentage (17%) believe well-informed homeowners are influential.** While interior designers are also seeking better training on healthy practices, their attention to homeowner recognition of this issue is consistent with the findings throughout the report.

Top Factor For Adoption of Healthy Products and Practices for Home Design and Construction (By Residential Player)

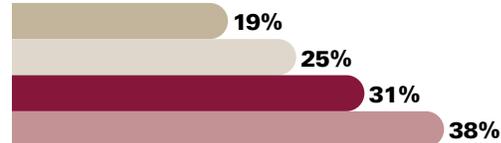
Source: McGraw Hill Construction, 2014

■ Builders ■ Remodelers ■ Architects ■ Interior Designers

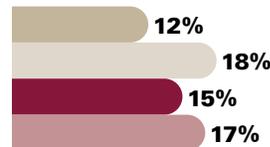
Tax Breaks or Other Financial Incentives



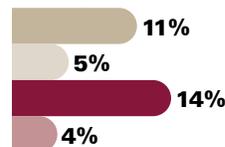
Better Professional Training on Healthy Design and Building Practices



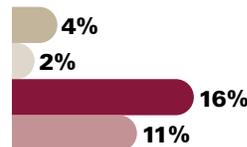
Well-Informed Homeowners About the Link Between Homes and Health



Database of Healthy Homes Case Studies



Accurate Measures of Occupant Health and Well-Being Related to Environmental Variables



Use of Building Product Labels and Standards

Other than Energy Star, which has a high level of public recognition and awareness (see page 93), the rest of the labels vary in use by the residential player type. Overall, builders and interior designers use these labels more frequently, which is consistent with their role, since many of the labels apply to floor coverings (specifically, carpet) or wall coverings, such as paints, which are things both builders and interior designers most often work with.

Variation by Player

BUILDERS

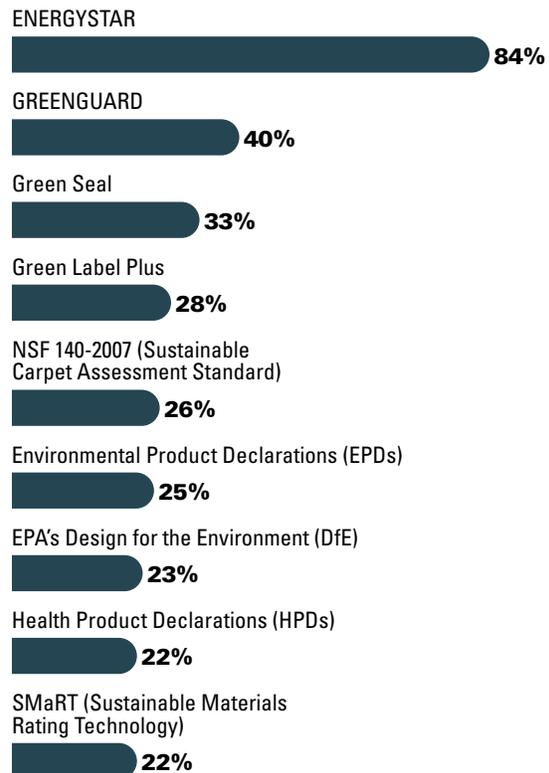
- Second behind Energy Star for builders in overall use is **Green Seal**, which may be more popular because it applies to a range of products (though it is most known for labelling paint).
- Third and fourth, respectively, are **EPA’s Design for the Environment (DfE)** program and **SMaRT**, a sustainable products standard and label for building products, textiles and flooring. Both are more widely used by builders than other players. DfE is used by 39% of builders versus 20% of builders, 15% of architects and 22% of interior designers. SMaRT is used by 36% of builders, compared with 20% of remodelers, 16% of architects and 19% of interior designers. Builders may be more aware of SMaRT because having certain products certified under it can potentially help one earn credits in the LEED green building ratings system.
- It is also notable that builders use labels that didn’t make the top list more frequently than other players. More than 25% of them report using **EcoOptions (the Home Depot’s green product label)**, **GreenScreen for Safer Chemicals**, **SCS FloorScore**, **SCS Sustainable Choice** (which certifies products to the NSF 140 standard) and **ECOLOGO** from UL Environment.

INTERIOR DESIGNERS

- They use **GREENGUARD**, most heavily compared to the other residential industry players, with 65% reporting its use, including the 34% that report using it often.
- **NSF 140** and **Green Seal** are also the next highest used at 42% and 36%, respectively.
- Interior designers and builders are the only groups reporting the use of **HPDs** by more than 25%. This emerging label (see sidebar article on page 53) is being highly talked about in the nonresidential building space, and will be interesting to track to see if it gathers more or less momentum in the residential sector.

Top Green and Healthy Building Product Labels, Standards and Assessment Tools Used at Least Sometimes by Residential Professionals

Source: McGraw Hill Construction, 2014



- Of the lesser used labels, the only one used by more than 25% is **Master Painters Institute (MPI) Green Performance Standard**.

RESIDENTIAL ARCHITECTS

The only labels they use at more than 25%, other than Energy Star, is **GREENGUARD** (used by 37%), **Green Seal** (26%) and **Green Label Plus** from the Carpet and Rug Institute (25%).

REMODELERS

Overall, remodelers use product labels and standards less than the other players, with their usage percent of labels other than Energy Star ranging from 8% to 23% (Green Seal).

Data: Influencing Agents and Information Sources on Healthy Homes

Factors That Influence the Decision to Design or Build Healthy Homes

THE DRIVE TOWARD HEALTHIER BUILDINGS DATA

There are many organizations and factors that encourage the residential industry to focus on health in their work. However, across all the players, direct requests from homeowners have the most influence. It is even more influential for architects and interior designers.

It is noteworthy that for firms doing more green work, government regulations, whether at the state/local or federal levels, have less influence. This suggests that for these firms, they don't need regulation to make the decision to do healthier projects—other market factors and potential benefits are more influential.

Variation by Player

BUILDERS

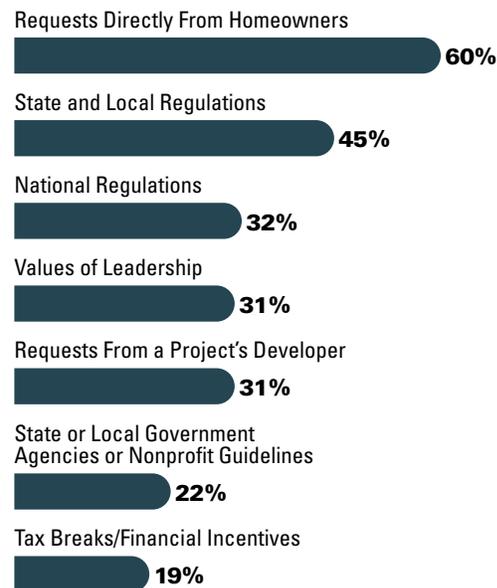
- Overall, builders report the highest level of influence from all the actors, with all factors—those listed in the chart and the lesser influence agents of market research, voluntary ratings systems or guidelines and competitive pressure—reported as having at least some influence by at least 56%.
- State and local regulations are more influential to builders than homeowner requests are—48% rate this as having a lot of influence, compared with 40% for requests for homeowners. Builders also report this at much higher rates than their counterparts in the industry.
- National regulations are also important to builders, though at comparable levels to the other players.

REMODELERS

Remodelers' order of influence generally follows the overall averages shown on the chart. The only exception is guidelines from state or local government agencies or nonprofits, where 30% of remodelers rate this as having a lot of influence. This is below requests from homeowners (52%), state and local regulations (45%) and national regulations (32%).

Factors/Organizations With High Influence on the Residential Industry's Decision to Build or Design Healthy Homes

Source: McGraw Hill Construction, 2014



ARCHITECTS

- For architects, values of their leadership are much more influential than for the other groups. 51% rate it as having high importance, compared with only 24% of builders, 8% of remodelers and 26% of interior designers. This suggests this group is less sensitive to direct homeowner wants than the other groups.
- A significant number are also influenced by the developer community, with 40% rating as having a lot of influence. This is higher than the other groups as well.
- National regulations have much less influence compared with the other groups.

INTERIOR DESIGNERS

There are no notable differences for interior designers from the averages listed in the chart, though for the lesser influencers, more interior designers report that market research findings that show homeowners want healthy homes would influence them—23% report this would have a lot of influence, compared with an average of 10% for the other groups.

Information Sources on Health Impact of Homes

Across all the players, there is agreement that information directly from product manufacturers is the source they use more than any other to learn about healthy homes. This is a positive result for manufacturers who often have information on how their products are performing. It is unclear if this is the source most-used because it is most valuable or if there is a dearth of information in other outlets for the industry. At any rate, it is important for manufacturers to play a leadership role in educating the industry and homeowners on the impact of their products.

The only downside to relying on information from manufacturers is that they take a single view of the connection of health and homes, whereas research and articles could take a more holistic approach to reporting on the connection between health and homes.

Across many of the categories, a higher number of greener firms report using the various information sources. This likely is a result of them knowing where to go for information as well as their overall general higher attention to health in their projects (see page 65).

Variation by Player

BUILDERS

- For builders, their second most-used source overall is peers (used by 66% at least sometimes) followed by articles in the trade press (63%).
- For the source often used, the second highest behind information from product manufacturers, is information from government agencies, at 20%. This is significantly higher than usage by the other players.

REMODELERS

- Peers are also ranked second highest overall as a source for home remodelers, used by 58% at least sometimes. Peers also rank as the group that is used most frequently, with 20% reporting they use them often for information.
- The third highest is information from professional and trade associations, used by 54% at least sometimes.

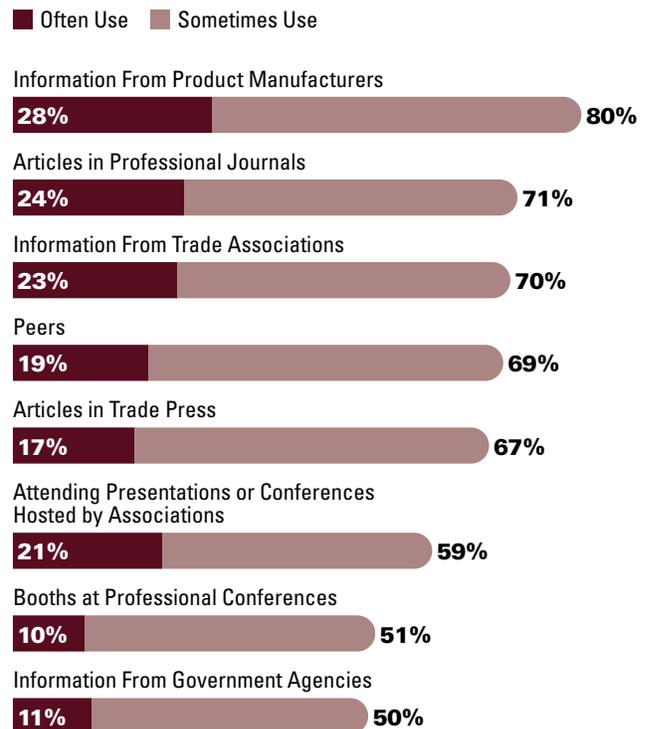
RESIDENTIAL ARCHITECTS

Overall, architects use the top sources more than the other residential players. Their top three are the same as shown in the total averages on the chart, but at higher percentages.

- 83% use product manufacturer information at least sometimes; 26% use it often.

Top Information Sources Used by the Residential Industry to Learn About Health Impacts of Homes (Those Used by at Least Half of the Residential Players)

Source: McGraw Hill Construction, 2014



- 81% use articles in professional journals, and 34% use them frequently. This is significantly higher than for the other players, who have much lower numbers using articles often.

- An impressive 29% also report often using sessions they attend at conferences for information.

Considering many architects hold credentialing that requires continuing education credits, this may be a more common practice for them as compared to other players.

INTERIOR DESIGNERS

Interior designers also use the sources at higher rates as compared with builders and remodelers, though at a somewhat different order.

- Second highest is information from trade associations, used by 75% at least sometimes, including 30% using it often.
- Third, articles in professional journals are used by 75% at least sometimes and 22% often.

Data: Homeowner

Insights on Building Impact on Health and Well-Being

Introduction

After several years of decline and uncertainty, the markets for both new housing and remodeling have picked up steam. According to the 2014 McGraw Hill Construction Dodge Construction Market Forecast, single family and multifamily housing will account for 45% of the dollar value of all construction projects started in the U.S., with single family houses making up the lion's share of residential projects. And data released by the U.S. Census Bureau say that Americans spent \$130 billion on remodeling projects in 2013—a rise of 3.1% since 2012 and the largest dollar figure spent on remodeling since 2007, when the housing market began to slump.

With this activity on the rise, it presents an opportunity for builders, designers and homeowners to create spaces that are healthier for themselves and their families. Research shows that furnishings, finishes and fixtures—as well as design, construction and maintenance practices both indoors and out—affect indoor air quality and other measures of a home's health, which have been linked to health problems ranging from poor sleep quality and lower productivity to higher rates of allergies, asthma and seasonal illnesses. For several years, makers of cleaning products have developed alternatives to address the demand for healthier alternatives, and building product manufacturers responded by offering low-impact product lines for everything from flooring to drywall to paint. More recently, home builders have begun to assess how and whether to incorporate health considerations into their buildings and in communications with potential customers.

This section of the report presents findings from McGraw Hill Construction's new survey homeowners with the goal of gaining a better understanding of the market for healthy homes as well as healthy home products and practices—and the factors, drivers and benefits reported by homeowners who have made these decisions.

- By and large, most homeowners are making healthy home decisions, undertaking at least five activities that contribute to improve their home's health. In addition, a majority of homeowners believe that homes impact health, and most are willing to pay at least a little bit more for healthy homes and products. But the market for healthy homes and healthy home products is not uniform. Beliefs about homes and health, and the products and practices used to achieve a healthy home, vary by age, region and other demographic and lifestyle factors. Companies seeking inroads into the healthy home building or product market should understand these differences so that they may identify and reach potential customers effectively.
- Word of mouth from trusted family members and friends is the top factor considered when choosing healthy products and practices for the home, followed closely by their physicians, making it critical these professionals understand the impact of these decisions on health (see page 14 for where physician opinion is today on these issues).
- Finally, there is a significant portion of homeowners who don't believe there's a link between homes and health, suggesting that there's an opportunity for the industry to engage homeowners on this topic and perhaps help drive the market for solutions.

Data and Market Understanding

The data and analysis in this data section of the report provide new intelligence to increase understanding of how homeowners think about the connection between the buildings they occupy (at home, school, work, etc.) and their health and productivity.

Homeowners not only make decisions about the products and practices used in their homes, they are also influence decisions made in their communities, in their schools and in their workplaces. And they also encourage the industry at large to make investments (see page 68).

A total of 209 homeowners around the U.S. responded to this survey with distributions geographically as well as by age, marital status, education level, income level and presence of children. For the full methodology, see pages 99–100.

Data: Awareness of Health and Impact of Buildings

Home Factors Impacting Health Conditions

Nearly two thirds of homeowners (63%) believe that products and practices used in homes can have an impact on health. The most commonly cited health condition is allergies (50%), followed by asthma/respiratory illnesses (32%) and headaches/migraines (30%).

These factors are consistent with three of the top four home health hazards homeowners report: use of toxic products (reported by 40%), mold and mildew (34%), and indoor air pollution (22%). Slips and falls were identified as the top home health hazard (at 52%), and while there are design and construction strategies that can mitigate this risk, most of the home factors affecting health are oriented around infections and general wellness.

Demographic Variations

A handful of demographic and lifestyle factors play a role in the reported home factors affecting health:

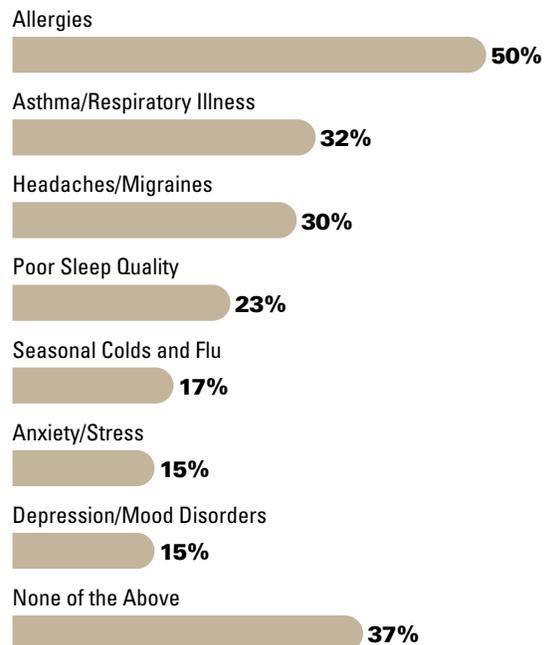
- Education Level:** Homeowners with postgraduate degrees are less likely to believe that homes don't have an impact on health (28% versus 37% overall). They're also more likely to believe that homes have an impact on allergies (60% versus 50%), asthma/respiratory illness (43% versus 32%) and anxiety/stress (18% versus 15%). This suggests that people with more formal education have a better understanding of the link between homes and health.
- Age:** Homeowners aged 50–59 are more likely to link items used at home with poor sleep quality (35% versus 23% overall). It is possible that they've noticed this impact through experience, as sleep quality is a challenge for many people at this age. In contrast, homeowners aged 20–39 are more likely to link items used at home to anxiety and stress (22% versus 15% overall). It is possible that younger people are more fluent on this topic because broad discussions about emotional well-being and stress began to surface more recently.
- Having Children Under 18 at Home:** These parents are more likely to believe there is a link between homes and allergies (55%), asthma/respiratory illness (42%) and anxiety/stress (25%). Respiratory problems can become apparent at a young age, which could explain why parents are attuned to this connection.

Some types of homeowners were more likely to say that homes do not impact health:

- Those who don't participate in community organizations (53% versus 37% overall).**
- Those unwilling to pay more for a healthy home or**

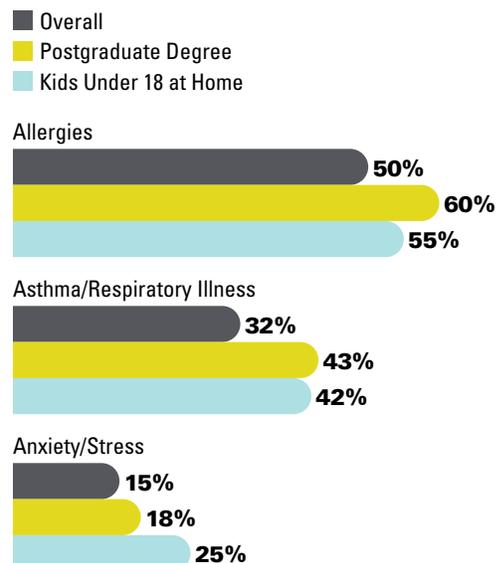
Health Conditions Affected by Home Factors (According to Homeowners)

Source: McGraw Hill Construction, 2014



Health Conditions Affected by Home Factors (Variations by Key Demographics)

Source: McGraw Hill Construction, 2014



home products, or who don't know if they would pay more for either.

Health Information Tracked by Homeowners

Today, more than three quarters of homeowners (76%) don't track home or health information at all. Though they weren't asked why, possible causes could include:

- They lack the time to collect data.
- They don't realize that these data could yield valuable information about their homes and/or health.
- A lack of standard or simple data collection methods and tools makes recording difficult.

The data collected most frequently were types of illnesses (12% of homeowners), length of illnesses (11%) and sick days/missed work (10%). Fewer than 10% of homeowners collect home data such as air quality tests or air infiltration measurements. Though the differences in these responses are small, the numbers suggest that it is harder for people to track home data versus health data.

A few types of homeowners are less likely to record home and health information:

- Older homeowners (85% of those age 60–69 and 80% of those over 70)
- People without children under 18 at home (81%)
- People who don't participate in community organizations (94%)

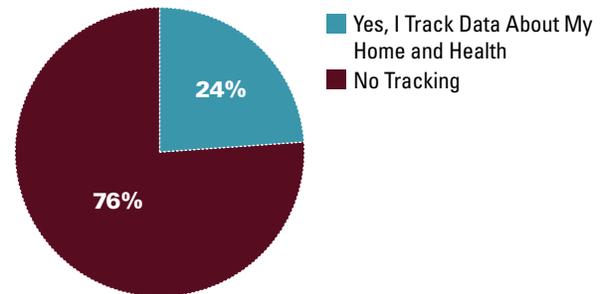
Other Key Trends From Data

- Those who have children under 18 at home: Not surprisingly, this group is more likely to do air quality tests (18% versus 9% overall) and collect information on lengths of illnesses (22% versus 11%).
- People willing to spend 4% to 6% more on healthy home products and services are more likely to record illness types (22%) and illness lengths (25%).
- Those with postgraduate degrees are less likely to record illness types than those with less education (6% versus 17% for those with a bachelor's degree and 15% for those who didn't go to college). A similar trend exists for recording length of illnesses. One possible explanation is that being sick and taking sick days from work affect highly educated (and perhaps wealthier) people less, though there were no statistically significant differences in these responses among homeowners of different incomes.

It is possible that improved tools and methods for tracking home data and personal health might entice homeowners to use them—especially parents of young children and people who already take measures to make their homes healthy.

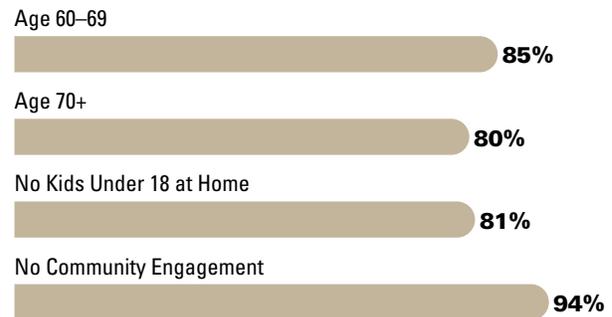
Percentage of Homeowners Who Track Data About Home and Health

Source: McGraw Hill Construction, 2014



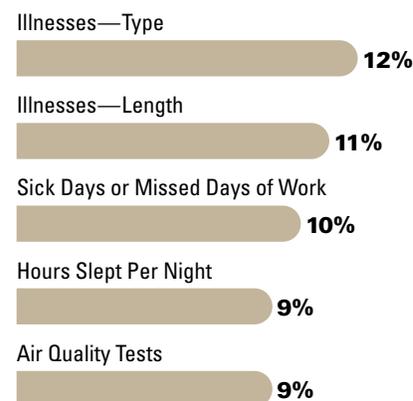
Homeowner Groups Unlikely to Track Data (Percentage That Does Not Track Data)

Source: McGraw Hill Construction, 2014



Home and Health Data Tracked Most Frequently (According to Homeowners)

Source: McGraw Hill Construction, 2014



Impact of Other Buildings on Health

Homeowners are also aware of the connection between other buildings and their health, with 90% reporting school buildings impact health and 95% reporting hospital buildings impact health.

Specific Health Impacts Affected by Schools Buildings and Operations

Similar to the factors impacting health in the home, the top health factors reported for schools are allergies and respiratory illnesses. There has been a heavy focus in recent years to educate about the link between buildings and asthma, particularly for schools in low-income communities (where student asthma rates are significantly higher than the general population). Clearly, this attention has had an impact on public awareness.

Other factors reported at lesser levels include test scores (45%), positive social interaction (44%), absenteeism (38%), violence/aggressive behavior (35%) and child obesity (27%).

Across most of the impact metrics, homeowners in the Northeast more often report impacts of the buildings. Specifically, higher percentages report the following impacts: productivity/performance (67%), test scores (59% versus an average of 41% in the other regions) and absenteeism (52% versus an average of 34% in the other regions). Also higher in the Northeast, and also in the Midwest, are impacts of schools on learning efficiency and on violence/aggressive behavior.

Specific Health Impacts Affected by Hospital Buildings and Operations

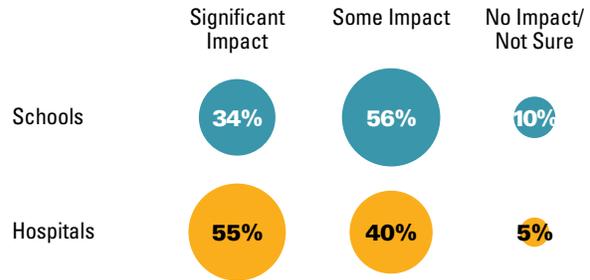
High numbers of homeowners make the connection between hospital buildings and health outcomes, with infection rates and sleep quality being the ones with the biggest impacts. Respondents 70 and over report the impact of buildings on infection rates at significantly higher levels compared with others—73% of them rate hospitals as having a very significant impact versus 53% overall. Given this population’s vulnerability to infection, it makes sense they are more attuned to this impact.

Other factors reported at lesser levels are medical errors (50%), length of hospital stay (50%), pain medication use (36%) and pain level (35%).

Regional location made a difference here as well, with those in the Northeast again more likely to make the connection in some areas, notably: Sleep quality (at 80%), stress levels (74%), staff turnover (74%) and recovery rates (73% versus 54% on average in the other regions).

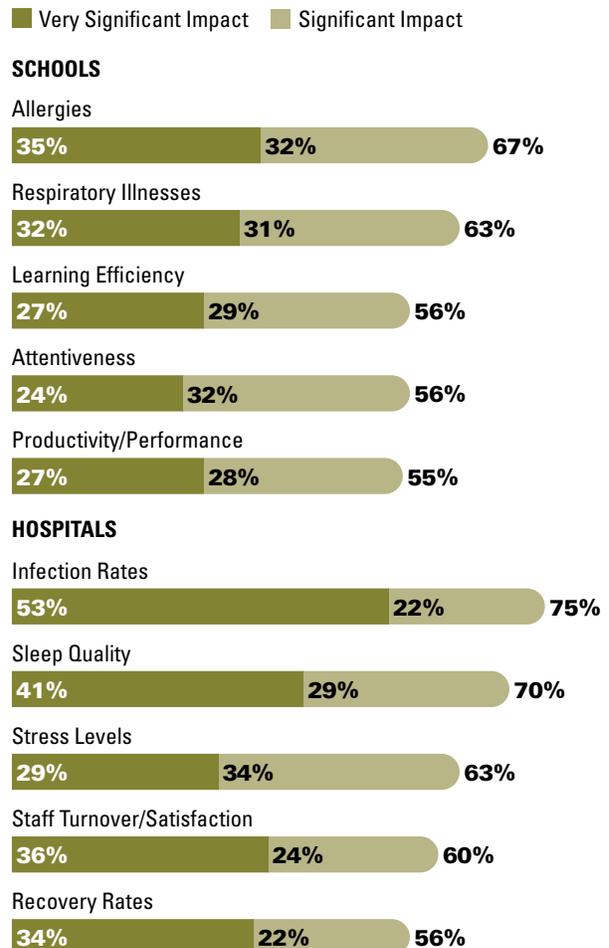
Impact of Buildings on Health (According to Homeowners)

Source: McGraw Hill Construction, 2014



Top Five Impacts of School and Hospital Buildings Affecting Student Health/Productivity and Patient Health (According to Homeowners)

Source: McGraw Hill Construction, 2014



Data: Benefits From Healthy Homes

For this study, homeowners who report engaging in five or more of the practices mentioned in the study are deemed to have a healthy home, and 95% of homeowners earned this label.

When these homeowners were asked what benefits they notice since making their homes healthy, they name the improvements at right, with better sleep leading the way.

For several responses, three groups of homeowners report higher levels of benefits than overall:

- **Those under age 40** rate all factors except fewer instances of respiratory illnesses higher, with their top three:
 - Happier/Better Mood: 62%
 - Better Sleep: 56%
 - Higher Productivity: 38%
- **Those who have children under 18 at home** rate all factors, except more positive social interaction, higher than other groups, with their top three:
 - Better Sleep: 60%
 - Happier/Better Mood: 56%
 - More Comfortable When Home: 47%
- **Those who live in the West** rank every factor higher than the overall average, with their top three:
 - Happier/Better Mood: 49%
 - More Comfortable When Home: 43%
 - Fewer Instances of Illnesses Overall: 43%

It is possible that younger homeowners are more well-versed in mental health issues, as the impact of our surroundings and other variables on mental health is a relatively recent area of study.

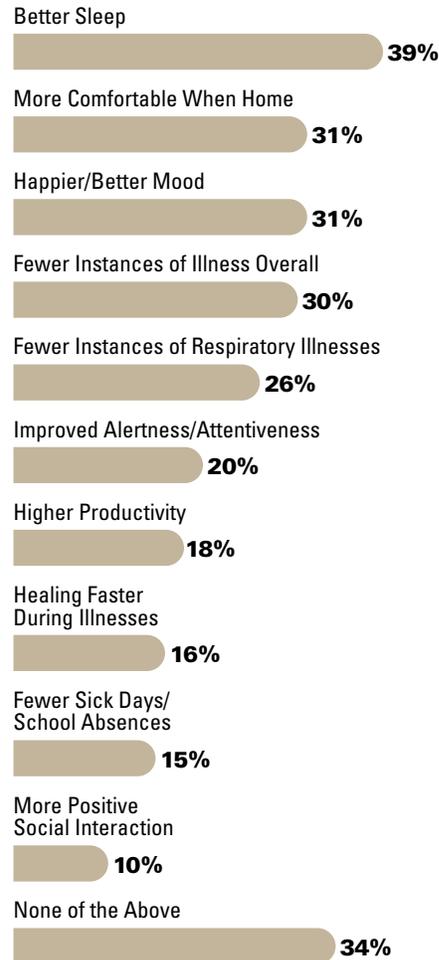
More than a third of homeowners (34%) notice no benefits to having a healthy home, with some demographic and lifestyle trends apparent:

- **75% of these are 50 or older**
- **74% make less than \$100,000**
- **91% have no children under 18 at home**

For older homeowners, these data are consistent with the fact that they tend to collect less data about their homes and health than younger ones, so it is possible that older people are unable to notice a link between their home's health and their own. Older homeowners may also believe that a healthy home is a lifestyle choice that's better for the planet but doesn't affect human health. In any event, these results may be worthy of further study, and the industry has an opportunity to educate these groups about the link between their homes and health.

Reported Benefits of a Healthy Home (According to Homeowners)

Source: McGraw Hill Construction, 2014



Tax and Financial Incentives

Financial incentives such as rebates, discounts and tax breaks play an important role in getting homeowners to invest in healthy home upgrades. In fact, 40% of homeowners have made a healthy home choice based on tax or financial incentives.

Those from the West use financial incentives slightly more (46% versus 40% overall), while people age 50–59 and people who don't participate in community organizations use them less (33% and 29%, respectively, versus 40%). Otherwise, there is little variation across demographic and lifestyle factors, suggesting that incentives are working broadly across many types of homeowners.

Sources of Incentives

The sources of the incentives are shown in the chart at right, but there are some significant differences by homeowner location.

- People in the **South** use EPA incentives at a higher rate (38% versus 32% overall) as well as other incentives (33% versus 23%), suggesting that state and local agencies in this region either do not offer incentives or that homeowners are not aware of them.
- Those in the **West** use local environmental agencies at a higher rate (28% versus 12% overall) as well as other incentives (33% versus 23%), suggesting that there are more of both types of programs in this region.

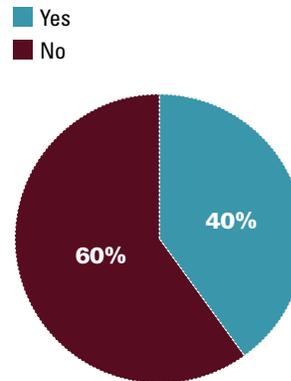
Upgrades Done With Help of Incentives

The top upgrades done with the help of incentives are shown at right, with differences due primarily to homeowner age and location:

- **HVAC upgrades** are more popular for those from the Northeast and South (both 38% versus 25% overall). The same is true for those earning less than \$50,000 per year (41%) and those who engage in fewer than 10 healthy home activities (46%), suggesting that even those who cannot or have not invested much in a healthy home will undertake a significant upgrade if an incentive exists.
- **Windows** are more popular for those from the Midwest (34% versus 24% overall) as well as people age 40–49 (33%) and people with children under 18 at home (32%). They were less popular among people from the West (11%) and those 70 and older (7%).
- **Appliances** are more popular for those from the Midwest and West (21% and 22% versus 17% overall).
- **Doors** are more popular in the Northeast (19% versus 11% overall).

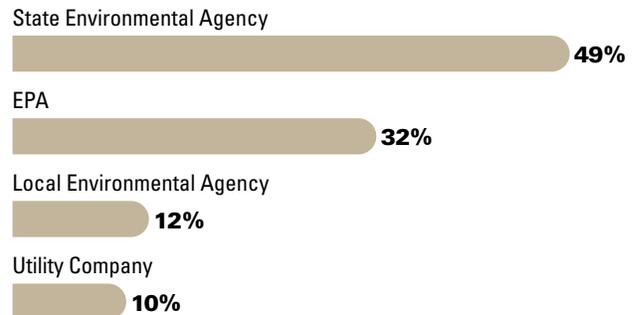
Homeowners Who Used a Tax Incentive to Make a Healthy Home Upgrade

Source: McGraw Hill Construction, 2014



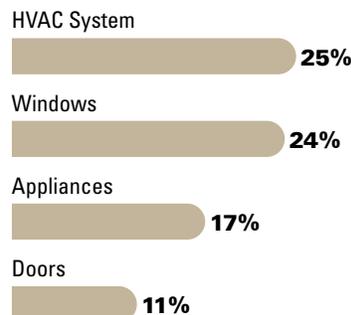
Organization Providing Incentive (According to Homeowners)

Source: McGraw Hill Construction, 2014



Most Popular Upgrades Made Because of Tax/Financial Incentive Received (According to Homeowners)

Source: McGraw Hill Construction, 2014



Importance of Community Design on Where to Live

Proximity to shops, services, schools and employment opportunities is the top community design factor for all homeowners (82% say it is very important or somewhat important), followed by proximity to walking paths (71%) and green spaces (68%).

Somewhat surprisingly, **proximity to public transportation is ranked relatively low overall**. Roughly a third of homeowners (35%) say it is very important or somewhat important, lagging behind proximity to outdoor recreation (65%) and to locally grown or locally raised food (57%). Still, more people ages 40–49 and 50–59 say it is very important to be near public transit (13% and 19%, versus 9% overall), perhaps because they are more likely to be working (and thus commuting to work) and/or bringing their kids to and from school.

Demographic Variations

Other than the age-based differences noted above, there are only scattered significant differences among homeowners who rank factors as more important at a higher rate than overall. In general, and not surprisingly, those who partake in more healthy home activities, and those willing to pay more for a healthy home and healthy home products, rate community factors as more important than others do. In addition, homeowners who earn more than \$100,000 per year value outdoor and health factors at a higher rate:

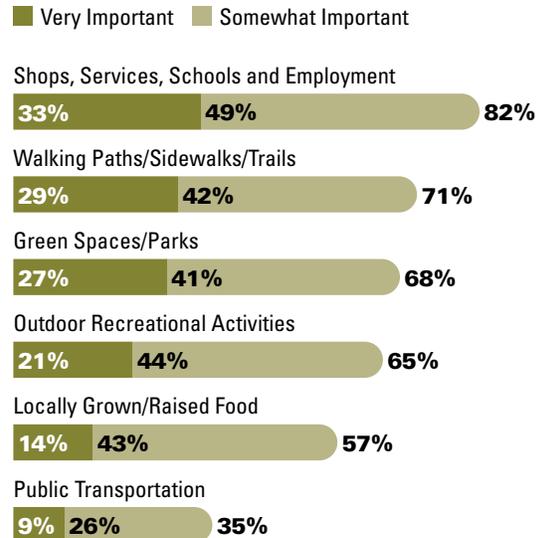
- **77% say green spaces and parks are very or somewhat important versus 68% overall.**
- **43% say being near local food is very important versus 14% overall.**
- **35% say walking paths are very important versus 29% overall.**

In contrast, a few groups consistently deem community design factors “not important” at a higher rate than overall, in proportions that vary from small to significant:

- **Homeowners who don’t participate in community organizations (for all factors)**
- **Those who don’t have a bachelor’s degree (for five of eight factors)**
- **Those 70 and older (for being near public transit, parks/green spaces and bike racks)**

Importance of Home’s Proximity to Amenities (According to Homeowners)

Source: McGraw Hill Construction, 2014



More High-Income Homeowners Want Outdoor Amenities (Percentage Rating Benefit as Very/Somewhat Important)

Source: McGraw Hill Construction, 2014



Willingness to Pay for Healthy Home and Products

Most homeowners are willing to pay at least a small premium for a healthy home (60%) and healthy home products (70%). In both cases, homeowners 60 and older are willing to pay more than younger ones.

Willingness to Pay for a Healthy Home

The primary factor that affects a homeowner's willingness to pay more for a home is age. Percentages broken down by age are shown in the charts.

- **By Age:** People aged 50–59 are not willing to pay more for healthy homes, or don't know if they would pay more, at a higher rate than all other ages. These years tend to be prime years for sending kids to college and saving for retirement, which could explain this trend.
- **By Geographic Region:** A higher proportion of people from the Northeast are not willing to pay more for a healthy home (26% versus 19% overall) or don't know if they would pay more (28% versus 22%). This might be due to relatively high real estate prices in the region.
- **Those Active in Community Organizations:** Among homeowners willing to pay more for a healthy home, those who don't participate in community organizations are generally willing to pay only up to 3% more, while people who are more engaged with their communities are more often willing to pay 4%–6% more.

Willingness to Pay for Healthy Home Products

As with healthy homes, age is the primary factor that affects a homeowner's willingness to pay more for products. Two trends from above hold true here:

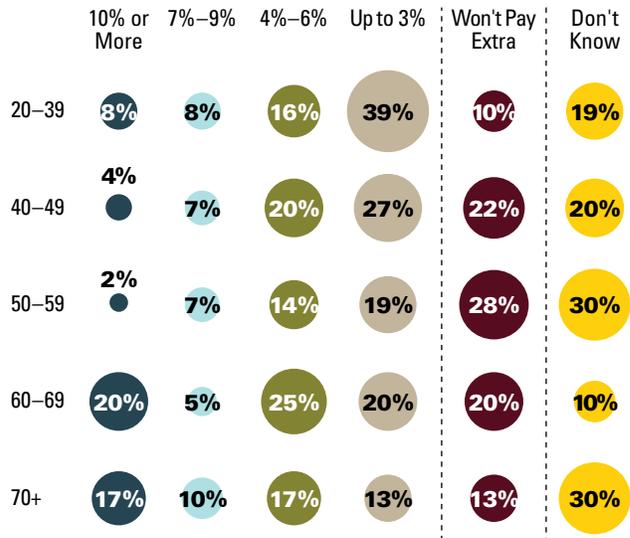
- **By Age:** People aged 50–59 are less willing to pay more for healthy products—in all likelihood for the same reasons they would not pay as much for a healthy home. It seems that once people reach age 60, they are more willing to make investments in their physical environment for health reasons.
- **Those Active in Community Organizations:** The same result appears for willingness to pay for healthy home products as for healthy homes—those who do not participate in community organizations are generally willing to pay only up to 3% more.

Other trends include:

- **Homeowners without a bachelor's degree are more likely to be unwilling to pay more for healthy home products (21% versus 13% overall).**
- **Those making less than \$50,000 per year are more willing to pay 10% or more than any other income**

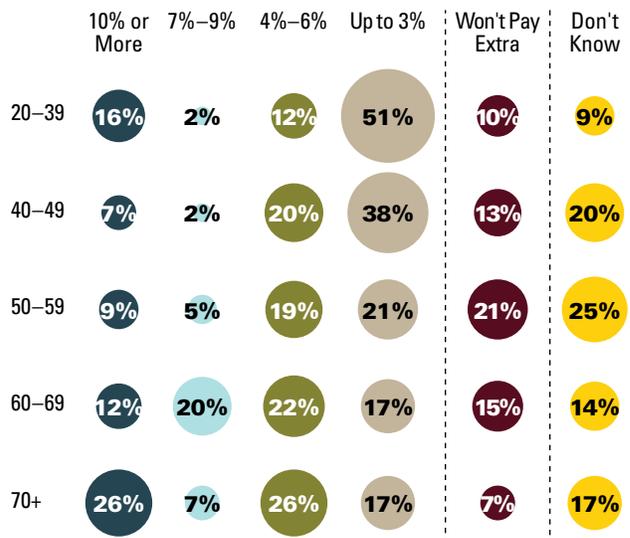
Amount Extra Homeowners Will Pay for a HEALTHY HOME (By Age of Homeowner)

Source: McGraw Hill Construction, 2014



Amount Extra Homeowners Will Pay for Healthy PRODUCTS & PRACTICES (By Age of Homeowner)

Source: McGraw Hill Construction, 2014



- **group (23% versus 13% overall).**
- **Those from the Northeast and the South are more uncertain about their willingness to pay more (24% and 23% versus 17% overall).**

Data: Product and Practices

Used at Home

Relative Importance of Health Versus Other Factors When Making Purchasing Decisions About Home Products

Roughly half of homeowners give the potential health impacts of home products the same consideration as comfort, performance, cost, durability/longevity and aesthetics. In contrast, across these same categories, one in five homeowners don't consider health impacts at all when making choices about home products.

Demographic Variations

A few demographic, regional and lifestyle trends emerged. Though the differences are not always statistically significant, across all categories, the proportion of people who don't consider health impacts is *higher* among these homeowners:

- Those age 70 and older
- Those from the South
- Those who didn't complete college

This same proportion is *lower* among homeowners from the West, and to a lesser degree, from the Northeast. This is not surprising as the culture of Western states, particularly California, emphasizes health, well-being, and "natural" and outdoor living. In the Northeast, a culture of civic and community engagement, and a population that tends to be highly educated, may account for this trend.

COMFORT

Compared with overall responses, comfort is more important than health impacts to people age 60–69 (25% give it more consideration), but less important to people making under \$50,000 per year (27% give it less consideration).

PERFORMANCE

Performance is also more important than health impacts to homeowners age 60–69 (22%). It was less important to homeowners who have children under 18 at home, and to those who have someone requiring medical care at home (in both cases, 24% give it less consideration).

COST

More homeowners age 40–49 say that cost gets less consideration than health impacts as they make purchasing choices (29% versus 20% overall), and more homeowners age 20–39 give cost and health impacts equal weight (55% versus 47%).

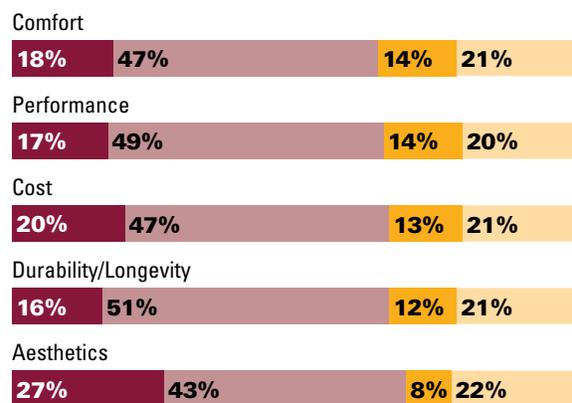
DURABILITY/LONGEVITY

Durability/longevity are more important to homeowners age 60–69 (18% versus 12% overall) but less important to those age 20–39 (only 4% give it greater consideration).

Importance of Health Impacts Versus Other Factors When Making Purchasing Decisions (According to Homeowners)

Source: McGraw Hill Construction, 2014

- Health MORE Important
- Equal Importance
- Health LESS Important
- No Consideration of Health



AESTHETICS

Overall, aesthetics was the least important quality that homeowners consider when choosing home products, though 14% of those with a postgraduate degree, versus 8% overall, give aesthetics more consideration than health effects.

These data suggest that manufacturers should target potential customers appropriately when connecting with them about healthy-home products.

Factors That Influence the Choice of Healthy Products and Practices

When choosing products and practices for the home, **word of mouth from family, friends and colleagues has the greatest influence on homeowners.** Input from family members was ranked first by a wide margin over the next factor most frequently ranked first and was named in the top three by 56% of homeowners. Input from neighbors, friends and colleagues was also ranked in the top three by 58% of homeowners.

Physicians or family doctor also have significant influence. They were cited by 18% of homeowners as most important, behind only family, friends and colleagues. Clearly, doctors have an important role to play, so it's critical their awareness increase from the relative low levels they currently report (see page 14).

Across all demographic and lifestyle factors, **building professionals have little influence over homeowner choices for products and practices.** Only 16% of homeowners rank contractors in their top three; only 3% did so for architects. The reasons for this trend are unclear. It could be that few homeowners work with contractors or architects and thus aren't swayed by them. In any case, this result might be worthy of further exploration to help building professionals learn how to be effective communicators about these topics.

Other Influences

Age played a major role in how homeowners rank the rest of the influences, and other demographic and lifestyle factors play a role as well.

INPUT FROM FAMILY MEMBERS

Input from family members is *more likely* to be ranked in the top three by homeowners using fewer than 10 healthy home activities (76% versus 58% overall). It is *less likely* to be ranked in the top three by homeowners age 70 and older (67% didn't rank it versus 42% overall).

PHYSICIANS

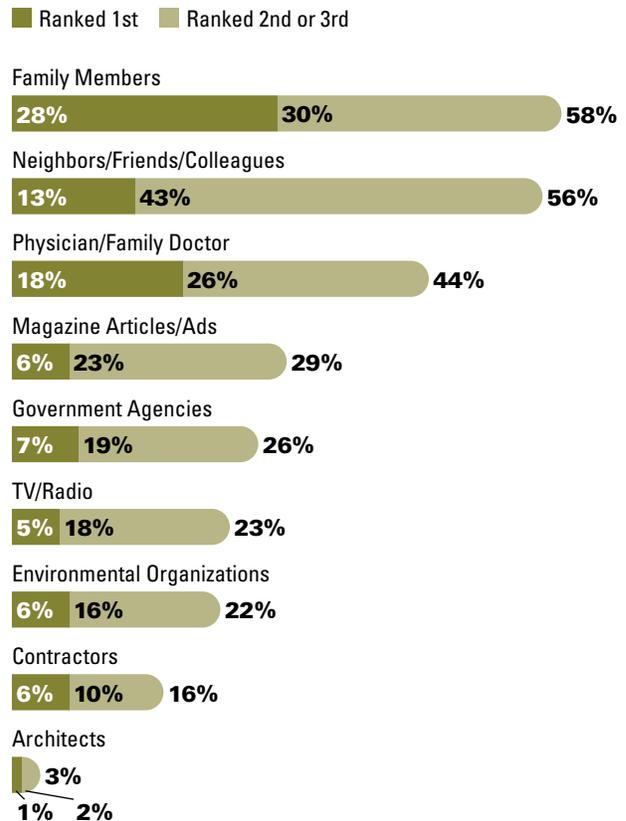
Physicians and family doctors are ranked first more often by people from the South and Midwest (23% and 22%, respectively, versus 18% overall) and homeowners 70 and older (40%). They were also ranked in the top three more frequently by people with children under 18 at home (64% versus 44% overall).

MAGAZINE ARTICLES AND ADS

Magazine articles and ads are more likely to be ranked first by those with a post-graduate degree (11% versus 6% overall) and in the top three by those willing to pay 4%–6% more for a health home (42% versus 29% overall).

Ranked Factors That Influence Choices of Healthy Products and Practices (According to Homeowners)

Source: McGraw Hill Construction, 2014



GOVERNMENT AGENCIES

Government agencies are ranked in the top three more often by people from the Northeast (46% versus 26% overall) and less often by people from the Midwest (16%) and people with children under 18 at home (11%).

TV AND RADIO ADS

TV and radio ads were ranked in the top three more often by people age 60–69 (42% versus 23% overall).

ENVIRONMENTAL ORGANIZATIONS

Environmental organizations are more likely to be ranked in the top three by people age 20–59 (in the mid-30s for percentages on all, versus 22% overall) and less likely among those age 60–69 (92% didn't rank it) and those without a bachelor's degree (95% didn't rank it).

Use of “Green” and “Healthy” Product Labels and Standards

Across all demographics and lifestyle factors, most homeowners are not familiar with national product labels and standards for healthy homes. The range varies from more than six in 10 to nearly nine in 10 reporting they have no familiarity with a particular standard. Not surprisingly, homeowners who have implemented 21 or more healthy home strategies—17% of those surveyed—are more familiar with labels and standards than those who have done fewer, even if they rarely use them.

The notable exception to this trend is EPA’s Energy Star program. More than 90% of all homeowners know what it is, and nearly 80% use it often or sometimes when making purchasing decisions.

Other organizations might benefit from Energy Star’s communication strategies to increase awareness. At the same time, it’s important to note the following:

- **Most of these organizations are smaller than the EPA, and likely have less funding and support for outreach activities.**
- **Most assessment labels and standards are newer than Energy Star, which was created in 1992. This is almost certainly an important factor in why people don’t know about them. Case in point: Nearly three in four homeowners (73%) aren’t familiar with EPA’s WaterSense standard, which was created in 2006.**

Demographic Variations

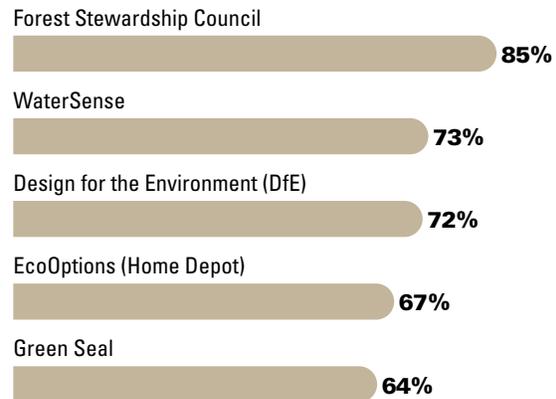
Age and regional differences were noted for some labels and standards:

- **Homeowners age 20–39** are more likely to be unfamiliar with Green Seal (73%) and the Forest Stewardship Council (94%).

- **Those age 70 and older** are more likely to be unfamiliar with WaterSense (87% versus 73% overall).
- **Those in the Northeast** are more likely to be unfamiliar with Home Depot’s EcoOptions (78%), as well as the EPA’s Design for the Environment (DfE), WaterSense and EcoLogo (percentage ranges from mid-80s to low 90s).
- **Those age 50–59** use Energy Star more frequently than other age groups (94%).
- Other groups who use Energy Star more frequently are those living in the West; those who have implemented 16 or more healthy home activities; and those willing to pay more for healthy home products (from 88% to 89%).

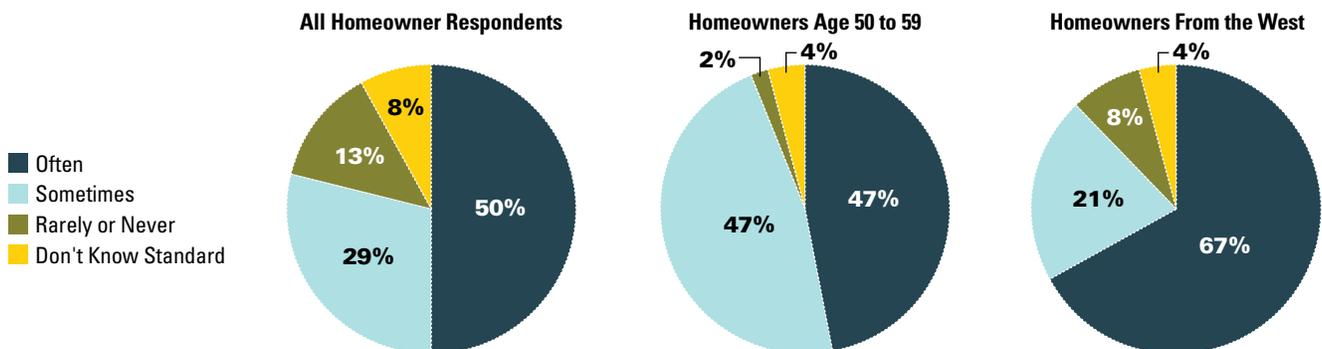
Awareness of Standards Other Than Energy Star Is Low

Source: McGraw Hill Construction, 2014



Frequency Homeowners Use Energy Star When Making Decisions

Source: McGraw Hill Construction, 2014



Healthy Products and Practices Used at Home

Most homeowners (88%) have used at least one of the seven surveyed healthy products or practices in the last three years, and more than half (54%) have used at least three.

Non-toxic cleaning products are the most popular product used by homeowners (64%). This result is logical as cleaning products are relatively low-cost and have been on the market for a long time. Also, cleaning products may be somewhat easier to link to a home’s indoor air quality and health because they’re used often, used on surfaces that are touched frequently and are often scented—all of which could make people more aware of their potential health impacts.

Variation by Age of Homeowner

By and large, older homeowners are more likely to use healthy products than younger ones, with the differences in usage rates ranging from slight to significant. This trend was especially apparent for the following products:

- **Hard Flooring:** Used by 80% of homeowners 70 and older and 75% of those age 60–69, versus 64% overall
- **High-Quality Air Filters on HVAC Systems:** Used by 60% of those 70 and older, versus 43% overall
- **Zoned HVAC Controls:** Used by 60% of those 70 and older, versus 34% overall
- **Furnishings Without Chemical Flame Retardants:** Used most commonly by homeowners age 50–59 (21% versus 11% overall). This might be because this topic is a relatively recent area of concern, and because furnishings without chemical flame retardants can be more expensive, meaning that middle-age homeowners have the resources to invest in them.

Variation by Those More Engaged in Healthy Home Practices

Not surprisingly, homeowners who report doing more than 16 healthy home activities use all products at a higher rate than overall. And, although the trend was not consistent for all products, those willing to pay 4% or more for a healthy home, as well as those willing to pay 4% or more for healthy home products, generally use these products at a higher rate than overall. This trend was most apparent for non-toxic cleaners and non-toxic pesticides.

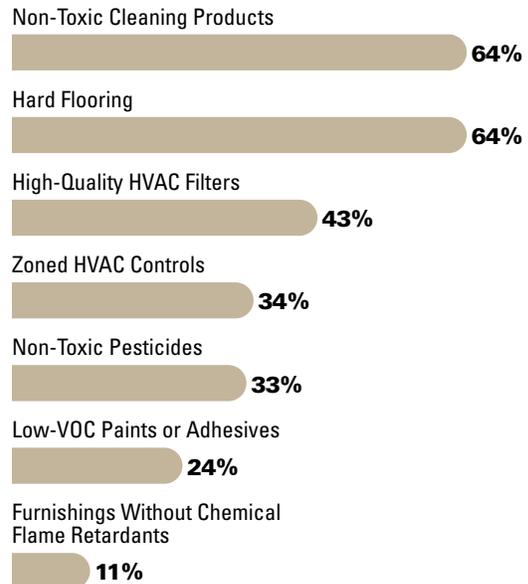
Regional Variations

Some regional differences were apparent in the data.

- **Those living in the South** are more likely to use

Type of Healthy Products Used at Home (According to Homeowners)

Source: McGraw Hill Construction, 2014



high-quality filters on HVAC systems (56% versus 43%), perhaps because these homeowners use their air-conditioning systems frequently from spring through fall, when levels of pollen and airborne particulate matter could be high.

- **Those living in the Northeast** are more likely to use zoned HVAC controls (50% versus 34% overall), perhaps because indoor comfort, in winter especially, is likely very important to these homeowners.

Variations for Those With Children Under 18 at Home

Interestingly, there were no significant differences in use of healthy products between homeowners with children under 18 at home and those without. In some cases, their usage was slightly, though not significantly, lower (e.g., only 27% of them use non-toxic pesticides versus 33% overall).

These results contradict a common perception that parents of young children are more motivated to use healthy products at home. This result might suggest their concern about healthy products are more focused on consumer products versus home products. In general, it is worthy of further study.

Overall, a lower proportion of homeowners have used at least one healthy design and construction practice versus healthy products described in the previous section. Nearly three quarters of homeowners (74%) have used at least one of the eight surveyed practices, versus 88% for healthy products.

As with products, age was a determining factor in these responses. Older homeowners, particularly those 70 and older, are more likely than younger ones to have used these practices, perhaps because they have owned their homes for longer. Uses that showed significant differences include:

- **Non-Chemical Pest Prevention Methods:** Used by 78% of those age 60-69 versus 54% overall
- **Improved Drainage Techniques:** Used by 58% of those age 60-69 and 63% of those age 70 and older, versus 44% overall
- **Enhanced Moisture Control:** Used by 43% of those age 70 and older versus 25% overall
- **Enhanced Venting for Fireplaces and Appliances:** Used by 40% of those age 70 and older versus 25% overall
- **Design for Passive Solar Heating and/or Passive Cooling:** Used by 20% of those age 70 and older versus 11% overall

Compared with products, a greater proportion of homeowners report being unfamiliar with healthy design and construction practices, especially younger and less educated homeowners:

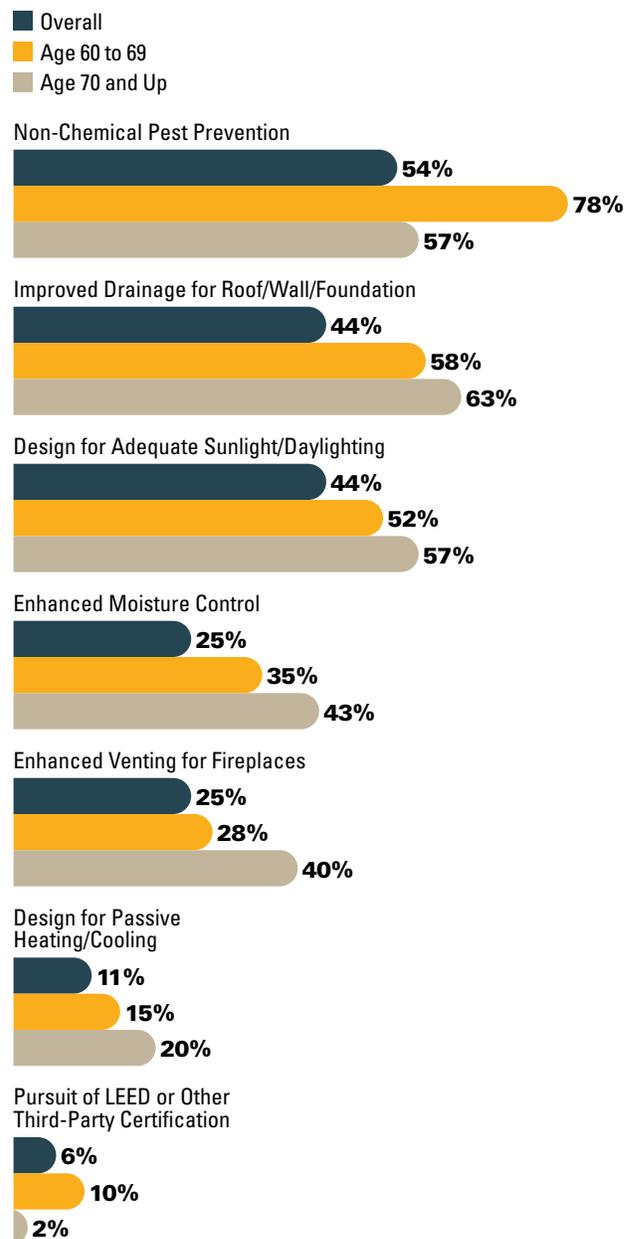
- **Homeowners younger than 40** are more unfamiliar with these practices compared with overall respondents, for all practices except third-party certification. **Those age 40 to 59** were also less familiar with the practices surveyed, though not as consistently or significantly. It seems that people learn about these practices over time.
- **Those without a bachelor's degree** are more unfamiliar with four of the eight practices surveyed, compared with overall respondents.

More details on these trends, emphasizing significant differences, are provided on the chart.

These trends suggest that the industry has an opportunity to educate homeowners, particularly younger and less formally educated ones, about the benefits of healthy design and construction practices and their potential impact on health.

Healthy Design and Construction Practices Used at Home (Overall and According to Age of Homeowner)

Source: McGraw Hill Construction, 2014



Indoor Air Practices Used at Home

More than eight in 10 homeowners (81%) have used at least five of eight common healthy indoor practices, and 38% have used at least seven of them. Very few people (2%) haven't used any.

Not surprisingly, those who reported the highest usage of all eight practices were those who have implemented more than 11 healthy home activities overall. Conversely, for six of the eight practices listed, usage was lower among homeowners who are not involved in community organizations. A possible explanation for this is that these people don't hear about the benefits of such practices by word of mouth.

- **Most Common Practices:** The top two healthy indoor practices are common maintenance tasks—namely, cleaning dryer vents and screens, and vacuuming and sweeping floors without chemical cleaners (both at 91%).
- **Less Commonly Used Practices:** Less obvious practices, such as making sure sump pumps and floor drains are working (to avoid moisture buildup and thus mold and mildew growth), were less popular overall. This particular practice is also less common in the West compared with other regions, perhaps because houses there are more frequently built without basements (e.g., Southern California).

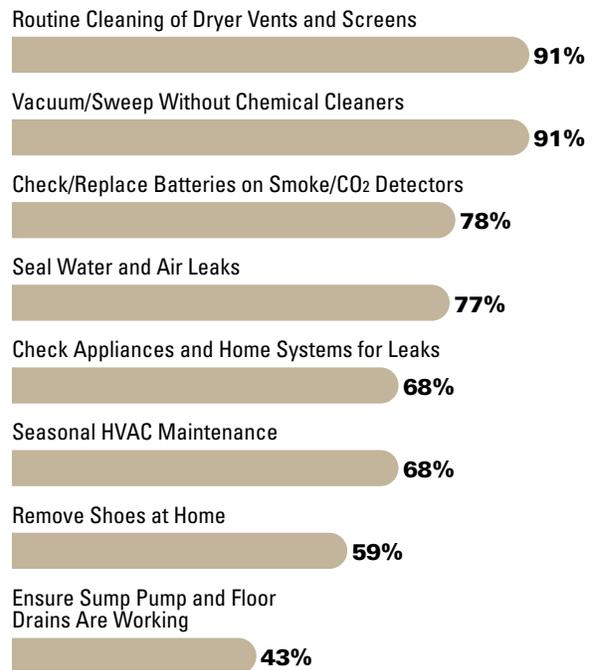
Demographic Variations

Age, region and income, along with a few other factors, all played a role in how homeowners responded as follows:

- Homeowners **check and place batteries in their smoke detectors** more in the West (87%) and less in the South (70%). Those willing to spend 4% to 6% more for a healthy home or healthy products also use this practice at a higher rate (87% and 88%). Nearly half of those who report using the practice (49%) earn more than \$75,000 per year.
- Homeowners age 60–69 **caulk and seal against water and air leaks** more than other ages (88%), perhaps because they've owned their houses for a long time.
- Homeowners who are 70 and older, and those who live in the South, **perform regular seasonal maintenance of HVAC equipment** more often (77% and 93%), and about half of people who use this practice earn more than \$75,000 per year (49%).
- Homeowners from the Midwest **remove their shoes when they enter their homes** more often than in other regions (76%), and about half of the people who engage in this practice are age 49 and under (51%).

Indoor Air Practices Used by Homeowners

Source: McGraw Hill Construction, 2014



- The majority of homeowners who **check the operation of their basement's sump pump and floor drains** are from the Northeast and the Midwest (71%). People making from \$75,000 to \$100,000 per year also use this practice more often (56%), as do people age 60–69 (52%).

Healthy Outdoor Practices Used at Home

Overall, homeowners don't use as many healthy practices outdoors as they do indoors. Nearly all homeowners (94%) use at least one of the seven outdoor practices listed in the survey, and 63% use more than four of them. (This stands in contrast to 81% of homeowners who used five or more indoor practices.)

- **Top Practices:** As with indoor practices, the top practices that homeowners use are routine maintenance tasks: making sure water drains away from the home (75%), cleaning gutters (68%) and regular checks and seals against water leaks (65%).
- **Lowest Reported Practice:** Maintenance of septic tanks is the lowest reported activity (26%) probably because not all homes have septic tanks. It is especially low among homeowners age 20–39 (12%), but higher among those who live in the South (38%) and those who don't participate in community organizations (38%), perhaps because these people live in sparsely populated areas that lack access to public water utilities.

Demographic Variations

Several demographic and lifestyle factors play a role in the practices homeowners use. Not surprisingly, those who have implemented more than 16 or more healthy home activities overall report using these seven practices at a higher rate than overall.

Usage also ranges from slightly to significantly higher versus overall for the following groups:

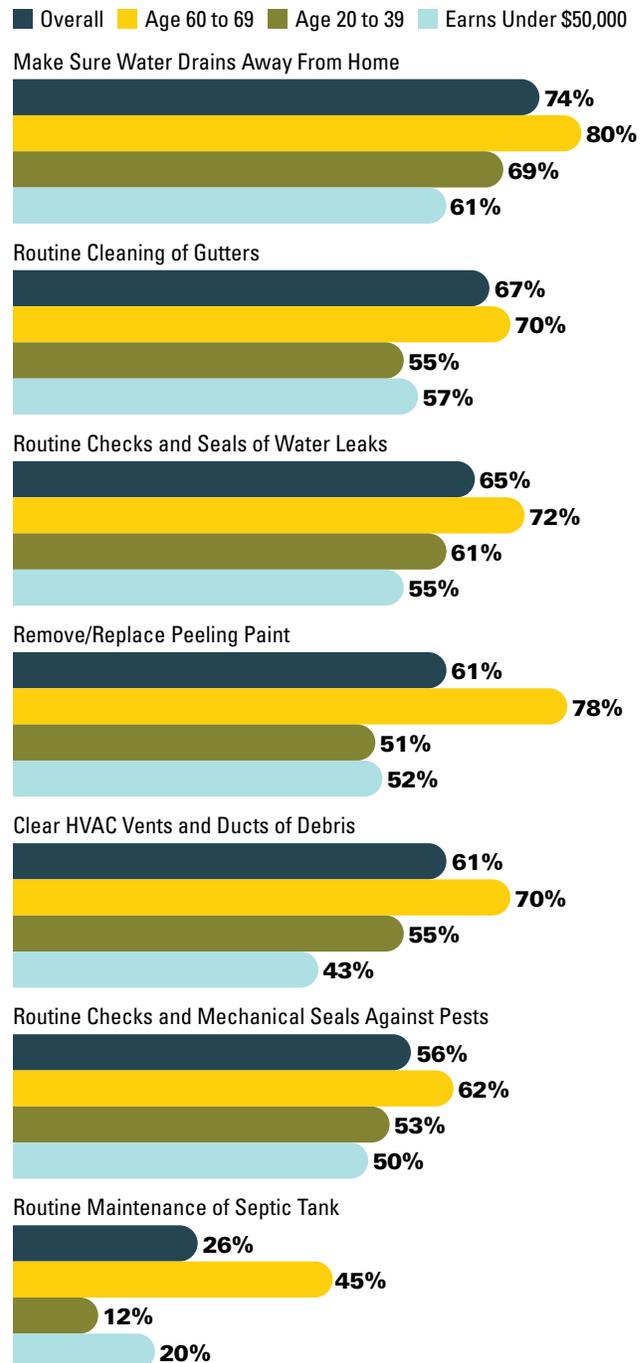
- **Those willing to pay 4% to 6% more for healthy home products (all practices)**
- **Those earning \$75,000 to \$100,000 (six of seven practices)**
- **Those with children under 18 at home (five of seven practices), perhaps because they're highly motivated to keep a home healthy and safe**
- **Those age 60 to 69 (five of seven practices), perhaps because they've owned their houses for a long time and have learned how to maintain them**
- **Those who spend more than \$5,000 annually on healthcare (three of seven practices)**

In contrast, usage ranged from slightly to significantly lower among these groups:

- **Homeowners who earn less than \$50,000 per year (for all practices), perhaps because they lack the time and resources to do the work**
- **Those age 20-39 (for all practices)**
- **Those who don't participate in community organizations (five of seven practices)**

Healthy Outdoor Practices Used by Homeowners

Source: McGraw Hill Construction, 2014



Brands Homeowners Associate with “Healthy Homes”

Across all product categories, a wide range of brands are identified as “healthy,” indicating that no single company dominates this marketplace in any category. More specifics on each category are noted below.

PAINT

“Healthy” paints are made with few or no VOCs, and several manufacturers make them today.

- **Behr, sold exclusively through Home Depot, was named most often as the top healthy paint (26%). This could be due to the fact that Home Depot is a large national retail chain where many homeowners likely shop.**
- **Sherwin Williams and Benjamin Moore were second and third (23% and 11%).**

Age, education level, regional differences and engagement in healthy home choices have an impact on some of the selections for this category:

- **Valspar is named the top brand more often by homeowners age 20–39 (28%) and by those who have a postgraduate degree (20%).**

Those from the Northeast and those who are willing to pay 7% or more for healthy home products name Benjamin Moore the top brand more often (27% and 24%).

FLOORING

Homeowners usually name flooring materials instead of brands in this category. Of the materials, wood is cited more than three times as often as tile, the next highest material named (29% versus 8%). Of those who named wood flooring as the healthiest type, more than half (55%) were under the age of 50.

Armstrong and Pergo, both long-standing flooring companies, were the two brands cited most often.

Armstrong was named more often by people over the age of 70 (33% versus 12% overall).

Those willing to pay 7% or more for a healthy home more often named another brand of flooring instead of these two (47% versus 24% overall), suggesting that this group is more knowledgeable about flooring choices than other homeowners.

APPLIANCES

“Healthy” appliances conserve water and energy and might offer comfort features such as creating less noise. **For appliances, GE was named most often by all homeowners (30%),** with the next two brands—Kenmore and Whirlpool—garnering less than half of GE’s recognition (14% and 13%, respectively).

Homeowners who named GE as the top healthy brand were more likely to make \$75,000 or more per year, while those who have kids under 18 at home more often named Whirlpool as the top brand (30%). No other significant demographic or lifestyle differences were noted in the responses.

FURNISHINGS

La-Z-Boy was named as the top healthy brand by 16% of homeowners, followed by several other brands with single-digit percentages. One furnishing material, leather, was also named by 6% of homeowners.

It is important to note that the sample size for this category was small; fewer than half of all survey homeowners answered this question, and no significant differences in demographics or lifestyle were noted among responses.

CLEANING PRODUCTS

No single brand was recognized as the top healthy brand by more than 9% of homeowners, and more than a third of homeowners (34%) named brands other than the top 12 vote-getters, suggesting that no cleaning product is dominant in the “healthy” marketplace.

Homeowners making less than \$50,000 are more likely to name Clorox as the top healthy brand (16% versus 9% overall), suggesting that price-sensitive consumers might better recognize a well-known and relatively inexpensive brand. And, though the differences aren’t significant, homeowners younger than 50 recognize Seventh Generation as a top brand more often (12% of those 20–39 and 13% of those 40–49, versus 7% overall).

Methodology:

Building Impact on Health Study Research

Five online U.S. based surveys were conducted by McGraw Hill Construction (MHC) to investigate the attitude of industry players and stakeholders in both the nonresidential and residential sectors of the U.S. construction market toward the impact of buildings and building design on occupant health. The online survey for the U.S. nonresidential construction industry was also conducted globally as a separate study.

U.S. Health Professional Survey

Medical professionals influence homeowners and our larger society about factors influencing health, which is why their insights were sought in the research. 91 U.S. medical professionals responded to an online survey between March 4 and 7, 2014.

- 30 pediatricians
- 31 general practitioners/family practice
- 30 psychologists/psychiatrists

The sample was recruited from a panel of health professionals. The sample benchmarks at a 95% confidence interval with a margin of error of 10.3%.

To participate in the survey, respondents had to be a physician, psychologist or psychiatrist by professional training/background, be in a current position that included direct patient care and currently practices in the U.S. Additionally, the primary area of practice for physicians had to be family/general practitioner, internal medicine or pediatrics.

U.S. Nonresidential Construction Industry Survey

Insights directly from the

construction industry are essential to understand the decisions being made on healthier buildings and the factors influencing them. 733 U.S. construction professionals responded to this online survey between March 28 and May 5, 2014.

- 456 architects
- 183 contractors
- 94 building owners

Survey sample was drawn from the MHC Architect and Contractor Panels (100 and 109 responses, respectively), the Dodge construction database (33 responses) and the memberships of associations that partnered in the research (491 responses). Partnering associations included: American Institute of Architects (AIA), American Society of Interior Designers (ASID) and the U.S. Green Building Council (USGBC).

The sample benchmarks at a 95% confidence interval with a margin of error of 3.5%.

To participate in the survey, respondents had to work for a company located in the U.S. In addition, they had to have worked on buildings (architects and contractors) or had building projects in their portfolio in the last three years (owner) in the commercial, institutional, industrial, multifamily, single family or transportation sector. Firms doing over 50% nonbuilding projects were excluded. Respondents from owners also had to be knowledgeable about company construction projects and involved in design, construction or operations/facilities management at their company.

The project sectors included in owners' portfolios in the last three years are as follows by percentage of respondents:

■ Commercial

- Office: 53%
- Retail: 18%
- Commercial Warehouses: 13%

■ Institutional

- College/University: 26%
- Healthcare: 23%
- Public: 21%
- K-12 Schools: 10%

■ Residential

- Multifamily Residential: 18%
- Single Family Residential: 10%

■ Other

- Hotels/Motels: 2%
- Manufacturing: 6%
- Nonbuilding: 10%

Responses are analyzed by player based on level of green involvement and firm size.

LEVEL OF GREEN INVOLVEMENT

Construction professionals were divided into three categories: low green involvement (15% or fewer green projects), medium green involvement (16% to 60% green projects) and high green involvement (more than 60% green projects).

■ Architects

- 30% low green involvement
- 37% medium green involvement
- 31% high green involvement
- 2% don't know

■ Contractors

- 39% low green involvement
- 38% medium green involvement
- 21% high green involvement
- 2% don't know

■ Owners

- 32% low green involvement
- 20% medium green involvement
- 47% high green involvement
- 1% don't know

FIRM SIZE

Measurement of firm size varied by type of firm.

■ Architects: 2013 Firm Billings

- Less than \$500,000: 28%
- \$500,000 to less than \$5 million: 30%
- \$5 million or more: 42%
- **Contractors: 2013 Project Value**
 - Less than \$10 million: 30%
 - \$10 million to less than \$100 million: 36%
 - \$100 million or more: 34%
- **Owners: 2013 Project Value**
 - Less than \$10 million: 28%
 - \$10 million to less than \$100 million: 32%
 - \$100 million or more: 35%
 - Don't know/Prefer not to say: 5%

Global Nonresidential Construction Industry Survey

144 non-U.S. construction professionals responded to this online survey between April 9 and May 13, 2014.

- 68 architects
- 46 contractors
- 30 building owners

Survey sample was drawn from partnering association memberships, including AIA, ASID, USGBC and World Green Building Council.

The sample benchmarks at a 95% confidence interval with a margin of error of 8.2%.

With the exception of the location of their company, all screening criteria were the same as the U.S. survey.

U.S. Human Resources (HR) Executive Survey

The insights of human resource executives about the costs of health and productivity losses make them influential to those who make decisions about buildings. 32 owner HR executives responded to this online survey between March 10 and 18, 2014.

The sample was recruited from

a panel of HR professionals. The sample benchmarks at a 95% confidence interval with a margin of error of 17.5%.

To participate in the survey, respondents had to work for a company headquartered in the U.S., and they had to have a primary role as an HR professional or have 50% or more of the work in their current position associated with human resources.

U.S. Homebuilder, Remodeler and Designer Survey

With a large share of U.S. construction in the residential sector, these professional insights are essential. 322 U.S. building professionals responded to this online survey between March 27 and April 2, 2014.

- 75 builders (70 with the single classification as a builder and five that also indicated other roles but have been classified as primarily builders)
- 40 remodelers (38 with the single classification as a remodeler and two that also indicated other roles but have been classified as primarily remodelers)
- 99 architects (94 with the single classification as an architect and five that also indicated other roles but have been classified as primarily architects)
- 108 interior designers (all with the single classification of interior designer)

The sample was drawn from panel recruiting and building association outreach. Participating associations were AIA and ASID.

The sample benchmarks at a 95% confidence interval with a margin of error of 5.5%.

To participate in the survey,

respondents had to primarily build, remodel, renovate or design single family and multifamily housing. They also had to work primarily in the U.S. and be involved in specification or selection of materials, finishes, fixtures, construction methods or other design/construction decisions.

LEVEL OF GREEN INVOLVEMENT

Because the level of green building in the residential sector is less advanced than in the nonresidential sector, firms were divided into two categories: rather than three: low green involvement (15% or fewer green projects) and high green involvement (16% or more green projects).

■ Builders

- 57% low green involvement
- 43% high green involvement

■ Remodelers

- 78% low green involvement
- 22% high green involvement

■ Architects

- 45% low green involvement
- 55% high green involvement

■ Interior Designers

- 77% low green involvement
- 23% high green involvement

U.S. Homeowner Survey

209 homeowners responded to this online survey between March 17 and 27, 2014. Their perspectives drive the residential market's adoption of products and practices.

The sample was recruited from a panel of homeowners, and it benchmarks at a 95% confidence interval with a margin of error of 6.8%.

To participate in the survey, respondents had to own or rent a single family home or own a condominium, townhouse, duplex or co-op in the U.S. ■

Resources

Organizations and website that can help you get smarter about buildings and the impact on occupant health, well-being and productivity.



McGraw Hill Construction
 Main Website: construction.com
 Dodge: construction.com/dodge
 Research & Analytics:
construction.com/dodge/dodge-market-research.asp
 Architectural Record: archrecord.com
 Engineering News-Record: enr.com
 Sweets: sweets.com
 SmartMarket Reports:
construction.com/market_research

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American Institute of Architects
www.aia.org



CBRE
www.cbre.com



United Technologies Corp.
www.utc.com



U.S. Green Building Council
www.usgbc.org

Premier Partners

American Institute of Architects: www.aia.org

CBRE: www.cbre.com

- CBRE Corporate Responsibility
- CBRE Real Green Research Challenge

United Technologies: www.utc.com

- www.NaturalLeader.com

U.S. Green Building Council: www.usgbc.org

- GBIG Insight on Human Health
- Public Health and the Green Building Industry: Partnership Opportunities for Childhood Obesity Prevention

Supporting Research Partners

American Society of Interior Designers:

www.asid.org/healthbuildingdesign

Delos: www.delosliving.com

Contributing Partners

Armstrong Ceilings:

www.armstrong.com/commceilingsna/

Armstrong Commercial Flooring:

www.armstrong.com/commflooringna/

Dewberry: www.dewberry.com

Integral Group: www.integralgroup.com

Sloan Valve Company: www.sloanvalve.com

Urban Land Institute: www.uli.org/health

U.S. Green Building Council—Northern California Chapter: www.usgbc-ncc.org

Webcor Builders: www.webcor.com

World Green Building Council: www.worldgbc.org

Government and Other Resources:

Center for Disease Control:

www.cdc.gov/healthylives/hia.htm

U.S. Environmental Protection Agency: www.epa.gov

World Health Organization: www.who.int/hia/en/

American Lung Association: www.lung.org

BuildingGreen, Inc.: www.buildinggreen.com

Green Seal: www.greenseal.org

GREENGUARD: www.greenguard.org

The Health Impact Project:

www.healthimpactproject.org/hia/us

Healthy Building Network: www.healthybuilding.net

Robert Wood Johnson Foundation: www.rwjf.org

UL Environment: www.ul.com/environment

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