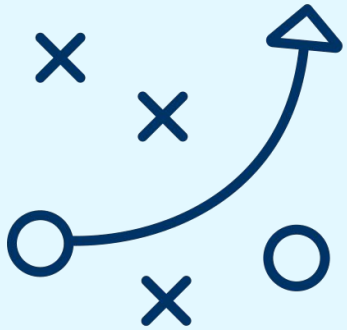
PRESCOUTER

CONSUMER INTEREST IN HEALTHY HOMES

MARKET OVERVIEW & KEY TECHNOLOGIES



How is the healthy home market defined? What is driving its growth? And how can my company contribute?

Through internal research, a client has noted an uptick in the use of the term “healthy home” as it relates to products and services marketed for making residential dwellings and their external environment healthier and safer places to live. With families spending more time than ever within their homes due to safety concerns from the Covid-19 pandemic, consumers are becoming increasingly aware of the connection between health and everyday environmental exposures in their homes.

In this report, we highlight the current state of the market, the main drivers for its growth, and relevant products/technologies that overlap with the manufacturing capabilities, expertise and product development goals of potential clients.

- ✔ **Definition:** According to the National Center for Healthy Housing, a "healthy home" is defined as a household that is dry, clean, pest-free, ventilated, safe, contaminant-free, maintained, thermally controlled, accessible and affordable.
- ✔ **Demand:** Consumer demand for wellness lifestyle real estate and associated communities is on the rise globally: in the U.S., there has been 1.3 million potential buyers each year since 2016. In addition, homes designed to improve people's wellness have 10-25% higher price premiums.
- ✔ **Drivers:** With the COVID-19 pandemic, people have been spending more time in their homes, which is further exacerbated pre-existing unhealthy living conditions. Even before Covid-19, there has been an increase in young homebuyers, particularly new mothers, becoming more aware and concerned about the environment within their home.
- ✔ **Cost of Unhealthy Homes:** ~$100B in taxpayer funding is spent each year to address the impacts of unhealthy home hazards. Interventions in this space can results in huge savings across the medical and housing sectors
- ✔ **Opportunities:** Category-, brand- and customer-spanning opportunities exist for promoting and marketing accessibility, independence, wellness, and sustainability enabled by non-toxic materials, novel construction and design elements, network-connected technologies, and automated disinfection, and improved air and water quality.

WHAT IS A HEALTHY HOME?

According to the National Center for Healthy Housing, a "healthy home" is defined as a household that meets the following criteria:

NOTE:
These are the minimum standards that need to be met for a residence to count as a healthy home. New research indicates, that to support holistic health of individuals, the whole community needs to engage in a wellness lifestyle. This demand is promoting construction of homes and buildings which are proactively designed for this purpose.

There are multiple drivers contributing to the growing trend in consumer and industry investment in the healthy home market.

CONSUMER NEEDS AND AWARENESS

Need

Awareness and concern among consumers aged 25-34 about the "Healthiness" of their homes.

Concern among young mothers about the impact of the home environment on the health of their babies.

Increased time being spent at home.

ENVIRONMENT QUALITY IMPROVEMENT PRODUCTS, SMART HOME TECHNOLOGIES AND WEARABLES

Solution

Affordable technologies for air, water quality, Sanitation (UV-C, sprays), and Pest control.

Smart home technologies - Smart HVAC and vent systems, smart lighting, Time saving chore doing smart devices.

Gamified, social and personalised wearable fitness trackers to incentivize exercise and active lifestyles.

HEALTH-CARE COST OF INJURIES AND CHRONIC DISEASES

Motivation

Affordable technologies for air, water quality, Sanitation (UV-C, sprays), and Pest control.

Annual estimates of emergency visits due to unhealthy housing - Injuries 40M, Asthma 1.7M, COPD 1.5M, Influenza 1.2M, Heat Stroke 4,100.

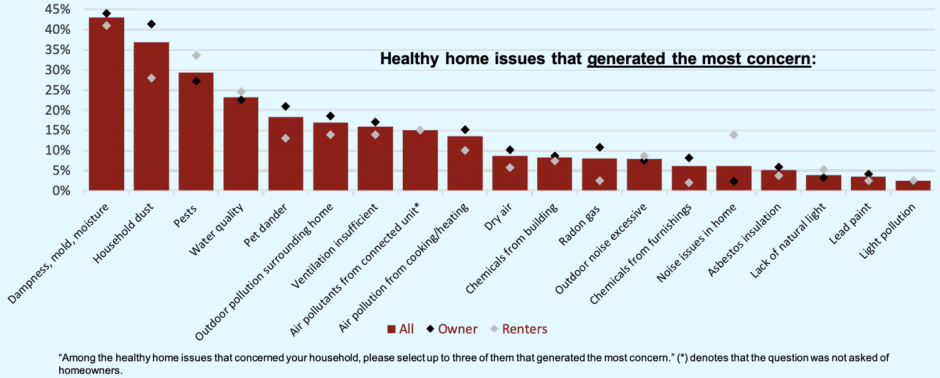
Annual taxpayer funding estimate spent on addressing diseases and injuries - $81B+ on Asthma, $31+ Slip and Fall injuries, $51B on Lead Poisoning, totalling ~$160B (more than the value of the global smart home market of $130B.

Household health awareness is on the rise.

As per a 2018 survey 29% of homeowners and 35% of renters were concerned about the health risks posed by their homes. Indoor air quality was the top concern with 75% of households, expressing dust, pet dander, and cooking related air pollution being brought up as contributing factors. Moisture, mold, dust, pests and water quality were other major concerns.

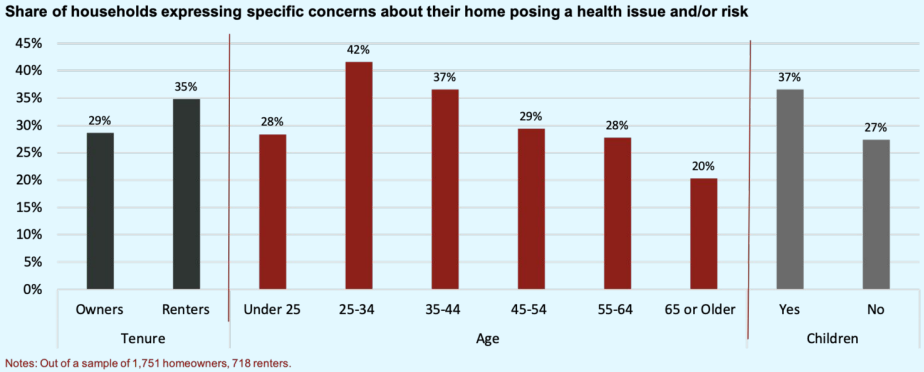
Millennials, teenagers, and educated residents have an increased awareness of the origins of the products they use, and tend to express the most concern over the effects of their homes on their overall health, as described in the under 25 - 44 age groups in households below.

Young mothers are also increasingly aware of the health impacts of the home environment of their babies, due to the prevalence of allergies and child asthma. Increased moisture and toxic products are top factors encouraging families to seek the products that are less harmful.



"Among the healthy home issues that concerned your household, please select up to three of them that generated the most concern." (*) denotes that the question was not asked of homeowners.

Top issues that cause the most concern among young mothers, millennials, teenagers and educated individuals. Source: The Farnsworth Group - 2018 Healthy Home Study.



Notes: Out of a sample of 1,751 homeowners, 718 renters.

Millenials and teenagers express the most concern over health risks of their households. Source: The Farnsworth Group - 2018 Healthy Home Study.

Wellness communities are gaining popularity.

Demand to provide facilities such as sidewalks, public exercise facilities, and design features which provide more opportunities for exercise in future real estate is rising, as it is far more economical to achieve a wellness community, than it is to make wellness centred renovations in existing homes.

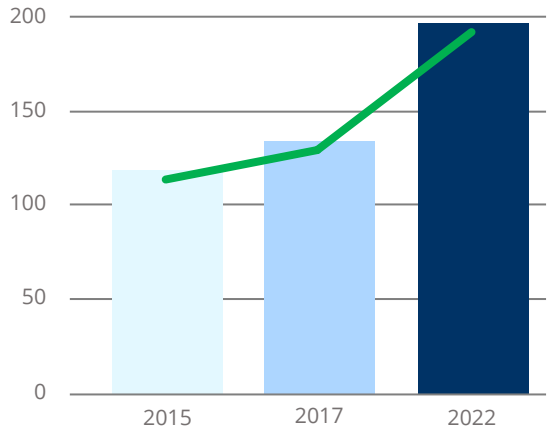
In the current COVID world, individuals have to be proactive in protecting the health of their of not just their own, but their fellow man as well. Hence, wellness has to become an active goal of a community. Hence, individuals are coming together with wellness as a common goal, and there is growing transition of individuals to wellness community centric lifestyles or WE-centric communal living in buildings and homes which are not only sustainable and healthy, but also have a net zero carbon footprint, reducing our impact on the environment.

The **$134B** wellness real estate market

~1.5% of the total annual global construction market

~50% the size of the global green building industry

MARKET SIZE (US $ BILLIONS)



The market size of wellness real estate grew at an annual growth rate of **6.4%** between 2015 and 2017 and **is projected to grow at a rate of 8% between 2017 and 2022**. Source: Global Wellness Institute.

Future design and construction of homes and neighbourhoods need to be centred around human health and wellness as the default approach, and not as an added luxury.

With such grave consequences of unhealthy homes (seen on the right), significant investment in human health through healthy homes as preventive measures can no longer be delayed.

The COVID-19 pandemic has exacerbated the problems of unhealthy home conditions with an estimated 150 million people forced to shelter at home.

THE COSTS OF UNHEALTHY HOMES

Healthcare spending in the US is **the highest in the world**

Chronic diseases add up to **$3.5T** in annual healthcare expenditure. Ironically, many of these diseases stem from unhealthy lifestyles, which are often encouraged in unhealthy homes which come at a cost of **$8T** in annual spending.

30 million families
currently live in unhealthy homes

resulting each year to

14.2 million missed school days by students due to asthma

14.4 million missed work days by adults

What does this mean for companies?

Diverse opportunities exist for promoting and marketing accessibility, independence, wellness, and sustainability.

Category-, brand- and customer-spanning opportunities exist for promoting and marketing accessibility, independence, wellness, and sustainability enabled by non-toxic materials, novel construction and design elements, network-connected technologies, and automated disinfection, and improved air and water quality.

Presented here are a number of examples of commercially available technologies which promote one aspect of the healthy home structure..

There are a multitude of air purification technologies each addressing an aspect of air quality in homes.

Indoor air quality can be measured by **at-home air quality test kits**. These usually measure 5 key components in indoor air - VOCs, PM2.5 levels (particulates and allergens), humidity, CO_2, and temperature. The smart kits can sync with other smart devices in the home.

Awair Air Quality Monitor

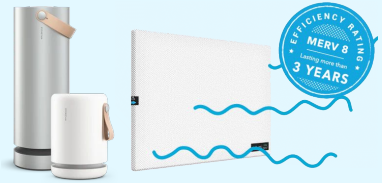
Residents should check for signs of mold such as a musty smell, black spots on walls, damp areas which can be confirmed with the humidity readings. Peeling lead based paints and outgassing paints should be replaced with titanium dioxide and strontium based paints.

Carbon monoxide detectors should be placed near bedrooms and on all floors of a house.

Google Nest Protect - CO detector & smoke alarm

Long term exposure to Radon a radioactive gas can cause lung cancer, this can be measured using short term and long term measuring kits.

It is also a good idea to use air purifiers in each room. They emplcarbonoy multiple technologies such as HEPA, activated, ionic filters, UV-C, plasma fields, electrostatic fabric, and PECO (Photo Electrochemical Oxidation). UV-C, plasma fields, and PECO based technologies can destroy microbes and viruses, hence they may prove to be a good choice for households with crowding and or sick residents. For HVAC systems in residences, there are even machine washable reusable filters available as well.



Left: Molecule - Air & Air Mini+ air purifiers; **Right:** AirThreds Electrostatic Fabric - filter for HVAC vents

Smart thermostats not only control the heating and cooling of air in the HVAC system, they also track residents' daily movements and heating trends over time, to create a tailored heating and cooling schedule.

Smart thermostats even utilise geofencing capabilities by tracking the user's smartphones and start heating or cooling the house as they approach the house, or turn down the HVAC when the residents are away. They also adjust the temperature of the room based on the occupancy of the room, as detected by the integrated sensors.

Unbalanced temperatures in homes can be caused due to an old or faulty thermostat. If rooms end up being too cold or hot, then they can cause various illnesses such as cold like symptoms etc. if the temperature is too cold. Senior citizens and babies, who don't sweat as much and can't cool down easily, can suffer from heat-stroke due to overheating or inadequate cooling of the house.

The Nest Learning Thermostat and Ecobee where the first devices that launched the smart thermostat market.

Nest Learning Thermostat

Molecule - Air & Air Mini+

Even though the cost of a smart thermostat may be significantly higher compared to a traditional model, it saves costs by optimising heating and cooling, and thus minimizing wasted energy. In addition, voice control facilities and IoT connectedness make them an even more attractive option for elderly residents as well.

Water purification systems are designed to be integrated in the kitchen environment, where residents obtain and consume clean drinking water.

There are multiple stage water filters which include sediment removal, carbon filters, UV disinfection, reverse osmosis, and filtering harmful ions.

These systems are usually fitted under the sink. Then there are counter top filters which can produce alkaline water, which infuses necessary minerals in the water while filtering out the chemicals. If on a budget then households can consider faucet mounted water filters that filter out common contaminants and almost all of lead, chlorine, and benzene. An alternative is using water filtration pitchers, which are reported to filter out even pharmaceuticals and hormones which are being found in US water supplies. There are even water filtration dispensers which can fit inside refrigerators.

RCC7 5-Stage Reverse Osmosis Under-Sink Filter

Advanced Alkaline Mineral Countertop Filter – MR-1050

PUR Classic 11-Cup Pitcher with LED

Brita Faucet Mount Filter

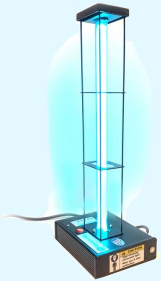
Ultramax Dispenser with Longlast Filter

Sanitation is key to a healthy home.

As hand washing is the primary way to disinfect our hands once we return home after being outside, it is worthwhile to install **touchless faucets in sinks** in bathrooms and kitchens, to prevent accidental transmission of pathogens among family members by touching and handling a faucet. Alternatively, mechanical, **foot pedal operated hands free sinks** have been a mainstay of restaurants for many years. A **UV room sterilizer**, is a potent method to sterilize both the surface and air of microbes, viruses, mold, and breaking down VOCs as well. For carpeted floors, it is worth investing in a **smart home connected Roomba type cleaning robot**. They come equipped with HEPA filters which help in reducing particulate matter and allergens both from the surface and in the air. Apart from the list of disinfectants recommended by the EPA, one may also consider the antiviral, microcapsule spray by Germagic, called **MAP-1**, which can disinfect for 90 days.

Touchless faucet available on Amazon

Foot pedal operated hands free sinks



Deluxe GermAwayUV 95 Watt UV-C Surface Sterilizer with Cage

Irobot Roomba

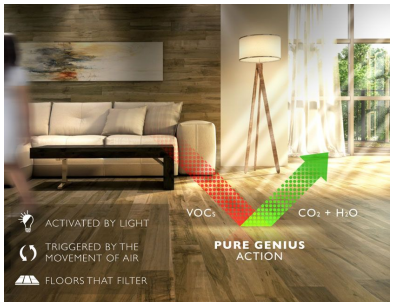
Antibacterial surfaces are the future.

HYDROTECT

Houses which have hard floors, including bathrooms, may consider replacing them with tiles by TOTO, which are coated with Hydrotect, their proprietary titanium dioxide coating which can destroy microbes with its photocatalytic activity.

Glasteel
A Division of Stabilit America

In high traffic areas, microbial, mold, and mildew, resistant resin based wall panels and ceiling tiles by Glasliner can be installed. These surfaces are easy to clean and maintain.



One can also install antibacterial and antifungal treated floors and carpets in their homes. These include silver and zinc pyrithione based antibacterial, and thiazbendazole and isothiazoline based antifungal treatments, by Ultra-Fresh.

FIANDRE® ARCHITECTURAL SURFACES

Fiandre provides tiles with a similar photocatalytic, anti-pollution and antibacterial solution as well.

Some tile suppliers provide pre-coated tiles, or offer to put this coating on their tiles as well. This solution is also available in the form of TiO_2 coated hardwood floors, called Pure Genius, by Lauzon.

Pest control is getting smarter.

Most pests can be controlled through properly sealing homes by repairing cracks and holes. Pests tend to hide and procreate within HVAC systems and gaps in the insulation within the house walls.

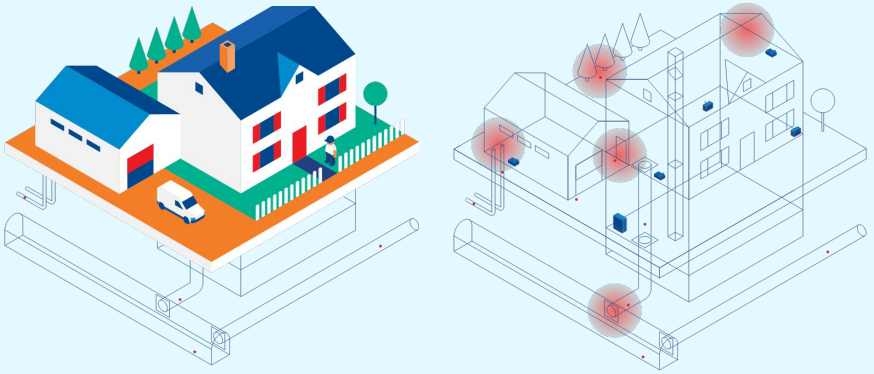
For flying insects, installing appropriate filters for the HVAC systems can do the job. For swarming insects such as ants, termites, and cockroaches, there are many insecticides which can be used indoors. Similarly, for mammalian pests there are traps and pesticides to trap and kill them as well. But, caution must be exercised when using these products indoors, as they can be accidentally ingested by little children and pets.

Essential oil based DIY or store bought concoctions are much safer alternatives.

Orange Guard

For a smart home, pest control has also been updated to include devices such as the, Smart Connect Mini, Smart Eye Mini, and Smart Snap, which work together via a wireless network and communicate with the pest control agency.

Using these devices, the most used routes of rats and mice can be accurately mapped and traps set accordingly. When the rodents are caught the agency is notified immediately via the wireless network. This whole process ensures that the residents themselves never have to witness the rodents themselves, and the whole process of eliminating them becomes very efficient as well.



Anticimex SMART, pest control

Accessibility for the elderly and the differently abled is a significant aspect of smart homes.

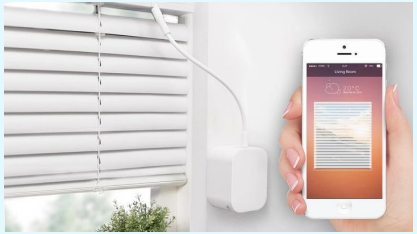
A smart home requires a smart hub to control all the connected smart devices in the house. Samsung, Amazon, and Google are currently dominating this segment.

There are also apps such as Apple's HomeKit which provide disabled people access to a multitude of devices and services through voice control using a smartphone, restoring some independence and enabling more freedom. These include smart locks, which enable disabled people to safely let carers, therapists, and other residents in the house; smart doorbells, which have motion sensor cameras which show the residents inside who is at the door; smart lighting; smart curtains, shades, and blinds, and smart garage openers.

Now, residents wanting to go out for some fresh air in their car can load their scooters, power-chairs, and wheelchairs inside their cars with a push of a button, using **Mobility Innovation's Smart Lifter** range.

Blind individuals can also experience improved mobility using the **Sunu Band**, which is a smart watch enabled with sonar technology to help them navigate their surroundings with echolocation.

Amazon Echo and Alexa devices



Soma Tilt - Smart blinds

Smart Lifter - Mobility Innovation

Sunu Band - Echolocating smart watch

Fitness trackers & the smart home gym to replace gyms.

Many studies describe how a lack of physical activity can be detrimental to health and contributes to many chronic diseases.

Presently and potentially into the future as well, the prevailing sheltering, isolation, and working from home conditions will unfortunately promote a reduction of physical activity, due to a drastic reduction of the spaces available for free mobility. Gamification of exercise apps and devices to encourage both children and youth are already available.

Products such as **Mirror** are designed for more serious fitness enthusiasts. It is an LCD screen that can broadcast instructor videos and even has facilities to provide one-on-one training.

Mirror - Home gym

There are also smart spin bike and treadmill options with on demand classes offered via a touchscreen display, offered by Peloton.

Peloton Bike

Tonal - Home gym

A smart weight room with real time weight adjustment and training by the smart resistance training machine from Tonal is also another excellent option.

For those who like something more intense, they can try out the guided and interactive boxing workout classes using FightCamp's smart boxing gloves, which can count the number of punches and their the intensity as well, helping users progress in their training.

Fight Camp - Smart boxing gloves

Authors

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Daniel is an alumnus of the PreScouter's advanced degree researchers network and has worked with PreScouter for more than three years and on over 50 projects, spanning across areas such as innovation strategy and roadmapping, product and process improvement and development, sustainability, and technology trends throughout the CPG industry. Daniel earned his Ph.D. in Chemical Engineering from the NC State University, where his research focused on developing stimuli-responsive polymer networks for microrobotics applications. After his graduate studies, he completed postdoctoral work at INSA Toulouse, France where his work focused on the intersection of nanoparticle assembly, nanofabrication and microfluidics to develop novel sensors. Before joining PreScouter, Daniel gained industrial experience in pharma manufacturing, polymer processing and science manuscript editing, and he is based in Raleigh, North Carolina.

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Naveen is a medical technology professional with a deep interest in new and emerging technologies and their impact on businesses. He is passionate about understanding his clients' needs and guiding them towards technology solutions which are a perfect fit. He is also a science communicator and has consulted for pharmaceutical research clients, medical technology companies, and for PreScouter. Being of an entrepreneurial mindset he worked as a co-founder of two medical device start-ups in the areas of sports injury rehabilitation and mental health. He is experienced in managing intellectual property, drafting investigators brochures and ethics applications for clinical trials, and navigating regulatory guidelines to maintain compliance levels of medical devices. During his PhD, he developed expertise in the synthesis and use of electrically conductive nanomaterial inks to manufacture wearable biosensors, which resulted in a patented invention, garnering interest from Johnson & Johnson Innovation and 3M. He holds a PhD in Chemical Engineering from Monash University, Australia.

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