GLOBAL
GREEN and
HEALTHY
HOSPITALS

A Comprehensive Environmental Health
Agenda for Hospitals and Health
Systems Around the World

Health Care
Without Harm

www.noharm.org
www.greenhospitals.net

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ABOUT THIS AGENDA

The Global Green and Healthy Hospitals Agenda sets out to support existing efforts around the world to promote greater sustainability and environmental health in the health sector, and thereby to strengthen health systems globally.

This document provides a comprehensive framework for hospitals and health systems everywhere in the world to achieve greater sustainability and to contribute to improved public environmental health.

This framework consists of ten interconnected goals. Each contains a series of Action Items that hospitals and health systems can implement. Tools and resources to support implementation are available on www.greenhospitals.net.   Most hospitals will want to start with a focus on two or three goals and chart a course for specific steps to achieve them, with a plan to subsequently move on to the next challenge.

Building a Worldwide Network

The Global Green and Healthy Hospitals Agenda forms the foundation of the Global Green and Healthy Hospitals Network (www.greenhospitals.net).   By endorsing the Agenda and committing to begin by implementing at least two of its goals, while improving their environmental performance and contribution to environmental health year by year, hospitals and health systems automatically join the network (at no cost).

A project of Health Care Without Harm, the Global Green and Healthy Hospitals Network will serve as a virtual community for hospitals and health systems seeking to implement and evolve the Agenda by charting progress in achieving measurable outputs, while sharing best practices and finding solutions to the challenges they share.

Hospitals and health systems that have financial resources at their disposal are encouraged (but not required) to contribute, as part of their membership in the network, to HCWH's Global Green and Healthy Hospitals Fund, which is dedicated to supporting less well-resourced hospital and health systems as they strive to implement this agenda.

To endorse this Agenda and join the Global Green and Healthy Hospitals Network, for a list of existing members and to learn more about the Global Green and Healthy Hospitals Fund please visit www.greenhospitals.net.

Introduction

We are living in a moment in which the twin crises of public health and the environment are merging, the confluence of the two magnifying the destructive power of each. As they run together, the crosscurrents of disease and ecological deterioration build on one another, becoming increasingly turbulent and damaging forces that are tearing at the very fabric of our societies. Climate change, chemical contamination, and unsustainable resource use are all exacerbating ill-health the world over. These environmental health problems are increasing pressure on, and eroding the capacity of, already thinly stretched health care systems.

Meanwhile, the health sector itself is paradoxically contributing to these very environmental health problems, even as it attempts to address their impacts. Through the products and technologies it deploys, the resources it consumes, the waste it generates and the buildings it constructs and operates, the health sector is a significant source of pollution around the world, and therefore an unintentional contributor to trends that undermine public health.

Yet the converse is also true. While there is a confluence of crises, there is also a growing convergence of solutions that foster both public health and environmental sustainability, pointing the way toward a greener, healthier future.

Nurses, doctors, hospitals, health systems and ministries of health are increasingly at the center of the solutions -- playing leadership roles in transforming their own institutions and becoming advocates for policies and practices that promote public environmental health, while often saving scarce financial resources.

These health sector leaders have evolved the Hippocratic Oath of "First Do No Harm" beyond the immediacy of the doctor-patient relationship to incorporate a more global vision of health and sustainability. Whether working to substitute hazardous chemicals with safer alternatives, reduce a hospital's climate footprint, or eliminate a community's exposure to health care waste, these trailblazers recognize that we cannot have healthy people on a sick planet, and are putting hospitals and the health sector at the forefront of a global movement for environmental health.

The Global Green and Healthy Hospitals Agenda is an effort to build on the good work happening around the world, and engender an approach to sustainability and health that can be replicated by thousands of hospitals and health systems in a diversity of countries and health settings.

The twin crises of public health and environment are magnifying each others' destructive power.... Yet there is also a growing convergence of solutions.

A Public Environmental Health Crisis

According to the Millennium Ecosystem Assessment carried out under the auspices of the United Nations, in the last half of the 20th century, humans changed ecosystems more rapidly and extensively than in any comparable period of time in human history. This transformation was carried out largely to meet rapidly growing demands for food, fresh water, timber, fiber and fuel, contributing to substantial net gains in human well being.

Yet these gains have been achieved at growing costs in the form of ecosystem degradation, resulting in a substantial and largely irreversible loss in the diversity of life on Earth, growing harm to human well-being, the exacerbation of poverty for some groups of people and increased risks of nonlinear changes. Indeed, given current trends, the degradation of ecosystem services could grow significantly worse during the first half of this century and is a barrier to achieving the Millennium Development Goals.[1]

Today, roughly a quarter of all human disease and death in the world can be attributed to what the World Health Organization (WHO) broadly defines as environmental factors.

These include unsafe drinking water, poor sanitation and hygiene, indoor and outdoor air pollution, workplace hazards, industrial accidents, automobile accidents, climate change, poor land use practices and poor natural resource management.[2]

For children, the rate of environmentally caused deaths is as high as 36 percent. Environmental health factors play a significantly larger role in developing countries, where water and sanitation, along with indoor and outdoor air pollution, make major contributions to mortality.[3]

The contribution of environmental factors to the burden of disease will be magnified and increased with the growing health-related impacts of climate change. These include shifting patterns of disease, water and food insecurity, vulnerable shelter and human settlements, extreme climate events, heat related illness and population migration. The magnitude of these multiple looming crises led *The Lancet* to declare in 2009 that "Climate change is the biggest global health threat of the 21st century," and will "put the lives and wellbeing of billions of people at increased risk."[4]

# The Role and Responsibility of the Health Sector

The health sector's mandate is to prevent and cure disease. Yet the delivery of health care services -- most notably in hospitals -- often inadvertently contributes to the problem. Hospitals generate significant environmental health impacts both upstream and downstream from service delivery, through the natural resources and products they consume, as well as through the waste they generate.

Until recently, there have been limited metrics to gauge the scale of the issues, but emerging data confirms the significance of the health sector's environmental impacts. For instance, the National Health Service (NHS) in England has calculated its carbon footprint at more than 18 million tons of CO_2 each year -- 25% of total public sector emissions.[5] Brazilian hospitals use huge amounts of energy, accounting for more than 10 % of the country's total commercial energy consumption.[6] In the U.S., the health care sector is the single largest user of chemicals, many of which are known to cause cancer. In China, healthcare construction spending exceeds US$10 billion a year, and is growing by 20% annually, consuming significant amounts of natural resources.[7] There are many more examples.

The environmental health impact of hospitals should come as no surprise given the health sector's huge economic clout.   In 2007, world health expenditures totaled US$ 5.3 trillion, US$ 639 per person per year, or roughly 8 to 10% of global Gross Domestic Product (GDP).[8] Health care's percentage of GDP, as well as overall per capita spending on health care, varies widely between nations, and there are significant health inequalities within countries as well. Yet the environmental health impacts come in all shapes and sizes, ranging from pathogenic medical waste dumped in back of a rural clinic during a vaccination campaign,

NHS in England

25%
of total public sector emissions

18 MILLION tons of CO_2 each year
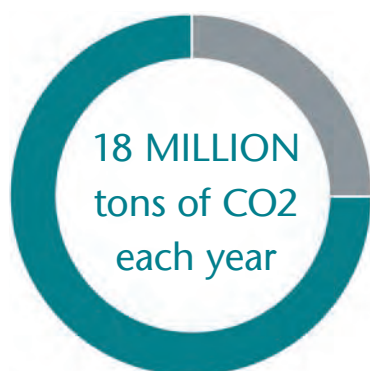
Brazil Healthcare Sector

10%
of total country energy consumption

Health leaders have evolved the Hippocratic Oath of "First Do No Harm" beyond the immediacy of the doctor-patient relationship to incorporate a more global vision of environmental health.

to the air pollution generated by the energy consumption of a high-tech tertiary care facility in a large urban area.

The healthcare sector is also just beginning to understand the impact that environmental problems such as climate change will have on health care services delivery. As average temperatures rise, heat island impacts in dense urban areas will exacerbate chronic respiratory conditions in the elderly and children. More extreme weather events -- hurricanes and typhoons in coastal areas, tornadoes and floods, fires and drought -- will require a more resilient emergency care infrastructure capable of delivering potable water as well as healthcare services. Even in developed countries such as the US, where energy intensive healthcare infrastructure emergency backup is commonplace, the inherent lack of resilience in sealed, grid dependent buildings has proven to impact

continued operation during extreme weather events. The imperative to adapt to this reality is growing by the day.

Yet hospitals and health systems everywhere have the potential not only to adapt to the scourges of climate change, but also, in the process, to promote sustainability, greater health equity and environmental health through investing in healthier buildings, purchasing green, and implementing sustainable operations. Hospitals and health systems can leverage their economic positions and moral standing in a community, to help achieve both the Millennium Development Goals related to health and sustainability, while also helping foster a green economy.[9] Indeed, hospitals and health care workers can be leading promoters of environmental health, by modeling environmentally sustainable, economically sound practices for the broader society and global community.

U.S. Healthcare Sector

LARGEST

consumer of
CARCINOGENIC
CHEMICALS

China

$10 BILLION

PER YEAR expenditure
on health care
construction

Toward Green and Healthy Hospitals

There is no global standard that defines what a 'green and healthy hospital' is or should be. But in essence, it can be defined as follows:

> A green and healthy hospital is one that promotes public health by continuously reducing its environmental impact and ultimately eliminating its contribution to the burden of disease. A green and healthy hospital recognizes the connection between human health and the environment and demonstrates that understanding through its governance, strategy and operations. It connects local needs with environmental action and practices primary prevention by actively engaging in efforts to foster community environmental health, health equity and a green economy.

While there is no one model green and healthy hospital, many hospitals and health systems around the world are taking steps to reduce their environmental footprint, contribute to public health and save money -- all at the same time. For instance:

- The GREEN and CLEAN hospitals program in Thailand, run by the Department of Health Promotion, sets a series of benchmarks for hundreds of health facilities to address their energy use, chemical consumption, food use, waste production and more.[10]

- Indonesia's Ministry of Environment has recently added hospitals to its PROPER program, an environmental performance rating system introduced by the Ministry of Environment in the 1990's to improve industry's environmental performance.

- The National Health Service in England has created a "Route Map" for greening its hospitals.[11]

- The Health Promoting Hospitals Network, originating in Europe with support from the World Health Organization (WHO), is developing a set of sustainability criteria.

- In the US, the NGO Practice Greenhealth has more than 1,000 hospital members that are working to decrease their environmental footprint.

- The WHO is promoting a "Health in the Green Economy" initiative that includes a focus on reducing health care's climate footprint.[12]

- A number of global corporations are competing to build and operate "green hospitals" around the world.

- Initiatives and conferences on greening the health sector are emerging in countries as diverse as Argentina, Brazil, China, India, the Philippines, South Africa and Sweden -- to name but a few.

At the same time, seven leading health systems comprising more than 370 hospitals, are working together with Health Care Without Harm, Practice Greenhealth and the Center for Health Design to launch a Healthier Hospitals Initiative. This effort is aimed to secure commitment from hospitals and health system leaders in the United States to take specific measures to assure greater sustainability and environmental health. These entities have created the Healthier Hospitals Agenda (based on a parallel set of goals to this global agenda) to chart a path to a healthier, more sustainable and more cost effective healthcare system.[13]

The Global Green and Healthy Hospitals Agenda sets out to support existing efforts around the world to promote greater sustainability and environmental health in the health sector and thereby to strengthen health systems globally. It is also designed to parallel and evolve in tandem with the US-focused Healthier Hospitals Agenda, as well as several of the other initiatives mentioned above.

Many hospitals and health systems around the world are reducing their environmental footprint, contributing to public health and saving money.

1 LEADERSHIP

Prioritize Environmental Health as a Strategic Imperative

AGENDA INTENT

Demonstrate leadership support for green and healthy hospitals in order to: create long-term organizational culture change; realize widespread hospital worker and community engagement; and foster public policy that promotes environmental health.

In order to foster green and healthy hospitals, leadership is essential at all levels. This means making environmental health, safety and sustainability key organizational priorities. This can be achieved through education, goal setting, accountability, and incorporating these priorties in all external relations and communications. It amounts to a major change in the culture of the organization, be it an individual hospital, health system or ministry of health.

The following are four key leadership areas:

Form a Hospital Task Force

Fostering the development of a hospital or system-wide interdisciplinary sustainability task force, with management support and backing, helps ensure that environmental health and sustainability goals are implemented facility- or system-wide and applied to all departments. Providing a central dedicated staff member (if possible) can also help implement many of the action items included in this document.

Foster Research

Support for research on environmental health will also more clearly identify the links between environmental sustainability and health outcomes. Research can also provide better guidance on which efforts can accelerate the adoption of new practices and procedures.

Engage the Community

Educating and working with both health professionals and the community in which a hospital or health system is situated on key environmental health issues can support disease prevention and

health promotion. Fostering environmental health literacy among hospital staff and community members is essential to protect public health. These stakeholders can be important allies in identifying environmental health risks for the populations a hospital or health system serves.

Communities can also emulate environmental health promotion practices undertaken by a hospital -- such as reducing exposures to hazardous chemicals or safely managing waste. In some cases, hospitals and health systems can also provide essential health services to a community, such as potable water in situations where there is no other clean water source.

Advocate for Environmental Health Policy

In many countries and institutions, policies promoting environmental health are absent, insufficient, unenforced or underfinanced in their implementation. Many public policies regarding environmental health and sustainability are also outdated and do not take into account new scientific research and case study findings.

Hospitals, health systems and health professionals can all play an important role in promoting appropriate and well implemented public policy at the local, national and international levels. Government agencies, legislative bodies, multi-lateral and bilateral aid agencies, other institutions that finance health care construction, as well as those that accredit hospitals, can all be encouraged to create policies that foster green and healthy hospitals, as well as environmental health in the broader community.

Hospitals' environmental health advocacy should also seek to prioritize primary health care and pursue disease prevention strategies to lower the future need for more resource-intensive therapies. Doing so can reduce the health sector's costs and environmental footprint, as well as the burden of disease to which the sector's activities inadvertently contribute. There are many examples of such steps throughout this document. For instance, a top priority in many large urban areas in developing countries is to improve basic public health infrastructure such as sanitary landfills, water treatment and delivery systems and waste water management. Hospitals can play a leadership role in advocating for these services, which will not only reduce the burden of disease but also benefit the operations of the hospitals themselves.

Action Items

- Develop and commit to a system-wide green and healthy hospital policy.

- Form a task force consisting of representatives of various departments and professions within the organization to help guide and implement efforts.

- Dedicate staff resources at the executive/directorate and facility levels to address environmental health issues organization- or system-wide.

- Invest in research to remove barriers to further innovation.

- Assure that strategic and operating plans and budgets reflect the commitment to a green and healthy hospital.

- Provide opportunities for educating staff and community on environmental factors that

contribute to the burden of disease, as well as the relationship between public environmental health and disease prevention.

- Together with the local community, engage in dialogues, debates and initiatives related to disease prevention and environmental health.

- Collaborate with other stakeholders to map environmental health risks and conduct surveilance of diseases associated or potentially associated with environmental factors.

- Build or participate in local networks of hospitals and/or health services groups committed to advocate for environmental health policies.

- Advocate for disease prevention and environmental health as core components of future health strategies.

- Encourage multilateral and bilateral agencies financing hospital construction or health sector operations to collaborate with public and private sector counterparts, to ensure that such financing promotes the development and operation of environmentally sustainable health facilities that foster community environmental health.

- Educate accreditation bodies about the intersection between environmental sustainability, human health and health care standards. Identify ways that sustainability practices can be incorporated into accreditation standards.

For Tools and Resources to implement this goal please visit www.greenhospitals.net

2 CHEMICALS

Substitute Harmful Chemicals with Safer Alternatives

AGENDA INTENT

Improve the health and safety of patients, staff, communities and the environment by using safer chemicals, materials, products and processes, going beyond the requirements of environmental compliance.

The Global Problem

Toxic chemical exposures begin before birth and continue throughout our lives. Many of these chemicals have been linked to serious illnesses, including asthma, infertility, learning disabilities, Parkinson's disease and cancer.[14] These chemicals are also a major source of indoor air pollution. Some, such as mercury and dioxin, have been identified as global chemicals of concern by the world's governments for their contributions to international environmental health problems.

A substantial percentage of all cancers are attributable to environmental and occupational exposures.[15] Pregnant women, fetuses, infants, children and workers are especially vulnerable. Already, twelve million cancers are diagnosed each year worldwide, and each year over seven million people die of cancer. The majority of all cancers occur in low- and middle-income countries, and this proportion is increasing. The World Health Organization has calculated that nearly one-tenth of all preventable deaths in 2004 were caused by toxic substances.[17]

Overall, the global chemicals industry is projected to grow steadily to 2030, with a continuation of increased chemical use and production in developing countries. Parallel to this trend, the health impacts of chemicals will almost assuredly continue to grow.

Hospital Solutions

Chemicals are ubiquitous in the hospital environment. In the U.S., for instance, the health care sector is the single largest user of chemicals, spending more than double the amount spent by the second largest consuming industry sector. The health sectors in many other countries also consume significant amounts of chemicals. As the UN Strategic Approach to International Chemicals Management (SAICM) points out:

The health care sector is a major consumer of chemicals including those well documented to cause serious impacts on health and the environment. Thus, a sector whose mission it is to protect human health is contributing to the burden of disease. Chemicals in products used in health care affect human health throughout the life cycle of these products -- that is, during production, use and disposal. Vulnerable populations include patients, healthcare workers who experience exposure on a daily basis, factory workers who manufacture the products, workers in waste disposal facilities, and people who live near manufacturing plants or waste disposal sites.[18]

Recent research in some countries has shown that health-sector employees may be more at risk from the chemicals used in their own workplaces than the general public. For example, health sector workers have been reported to have the highest rate of adult asthma among all major occupational groups and to be at a greater risk of developing chronic respiratory illnesses.[19]

Many chemicals used by the health sector are employed for specific purposes unique to health care, for instance, chemotherapy to treat cancer, or disinfectants for sterilization. Yet a growing number of hospitals are substituting some of the most hazardous substances with safer alternatives, without sacrificing quality of patient care. By addressing chemical exposure in health settings, the health sector can not only protect patient and worker health, but also actively demonstrate the safe management of chemicals thereby leading by example.[20]

Action Items

- Develop institution-wide chemicals and materials policy and protocols to protect patient, worker, and community health and the environment, while helping drive society-wide demand for alternatives.

- Implement a facility-specific chemicals action plan with benchmarks and timelines.

- Participate in the WHO-HCWH Global Mercury-Free Health Care Initiative by substituting all mercury thermometers and blood pressure devices with safe, accurate, affordable alternatives.

- Address the use of chemicals of concern, including, for example, glutaraldehyde, halogenated fire retardants, PVC, DEHP and BPA, and seek safer alternatives and substitutes.

- Adopt policies that require disclosure of chemical ingredients in products and materials and seek to ensure that all ingredients have undergone at least basic toxicity testing.

- When products or materials are identified that contain Substances of Very High Concern -- substances that have been identified as carcinogenic, mutagenic or toxic for reproduction, or that are persistent and bioaccumulative or warrant similar concern -- hospitals should make it a high priority to replace them with safer alternatives.[21]

For Tools and Resources to implement this goal please visit www.greenhospitals.net

3 WASTE

Reduce, Treat and Safely Dispose of Healthcare Waste

AGENDA INTENT

Protect public health by reducing the volume and toxicity of waste produced by the health sector, while implementing the most environmentally sound waste management and disposal options.

The Global Problem

The World Health Organization has published Core Principles describing safe and sustainable healthcare waste management as a public health imperative and calling on all associated with it to support and finance it adequately.[22] The world's governments, through the World Health Assembly, have called for greater action on medical waste.[23] A United Nations Human Rights Commission Special Rapporteur has called for "the development of a comprehensive international legal framework aimed at protecting human health and the environment from the adverse effects of improper management and disposal of hazardous medical waste."[24]

Unfortunately, health care waste management is still poorly funded and implemented. The combined toxic and infectious properties of medical waste represent an underestimated environmental and public health threat. A recent literature review came to the conclusion that over half the world's population is at risk from the health impacts of healthcare waste.[25]

Unlike many other hazardous wastes, there is currently no international convention that directly covers medical waste management, so categorization varies from country to country. However, waste is usually categorized according to the risk it carries. The majority of medical waste -- around 75% to 85% -- is similar to normal municipal waste, and has low risk unless it is burned.

The next largest category is infectious waste (approximately 5 to 25%) of total waste. Infectious waste can be subdivided into general infectious, sharps (1% of total waste), highly infectious, anatomical (1%) and pathological wastes.

Chemical and radioactive wastes -- pharmaceuticals, laboratory chemicals, cleaning agents, heavy metals such as mercury from broken thermometers, and pesticides with a variety of health and environmental effects -- comprise about 3% of total medical waste.

up to **85%** of medical waste is similar to regular waste

as low as **5%** is infectious waste

Properly managed, healthcare waste should not cause adverse impacts on human health or the environment.

Hospital wastewaters are often excluded from the list of medical wastes, but are also worth considering. The effluent from healthcare facilities contain more drug-resistant pathogens, a greater variety of chemicals and more hazardous materials than domestic sewage.[26]

Burning of medical waste generates a number of hazardous gases and compounds, including hydrochloric acid, dioxins and furans, and the toxic metals lead, cadmium, and mercury. The disposal of solid waste produces greenhouse gas emissions, including methane, a greenhouse gas twenty-one times more potent than carbon dioxide.

Hospital Solutions

Properly managed, healthcare waste should not cause any adverse impacts on human health or the environment. Medical waste management is complex and success is in large part dependent on changing the habits of hospital staff.

In this regard, waste reduction and proper segregation is essential. By properly sorting and reducing waste, hospitals not only avoid disposal costs and environmental hazards, they are often able to recycle a large proportion of their non-medical waste, reducing the amount of raw materials, energy and processing needed to replace the products they use. On the other hand, when hazardous medical and non-medical waste are mixed together, hospitals end up paying additional charges to dispose of increased volumes of medical waste, which can amount to many times the cost of disposing of non-medical waste.

Health facilities can cut waste and greenhouse gas emissions through composting, recycling (including anesthetic gases), better purchasing (minimizing packaging, using reusable rather than disposable products, and buying recycled products), and minimizing waste transport (local treatment and disposal).[27]

3% of infectious waste are: pathological, highly infectious & sharps

only **3%** of medical waste is hazardous waste

To protect basic human rights, various UN entities recommend switching to alternatives to incineration.

The small portion of medical waste that is potentially infectious includes a high proportion of plastics and can be recycled or landfilled after disinfection, rather than incinerated, since burning plastic produces high quantities of greenhouse gases, in addition to toxic pollutants such as dioxins and furans.[28] [29] Switching to alternatives to incineration, and providing financing for such a transition, has been recommended by UN officials as essential to protecting the right to health and other basic human rights.[30] The Stockholm Convention on Persistent Organic Pollutants[31] and the World Health Organization also recommend using alternatives to incineration to reduce global pollution with dioxins and furans.[32]

A variety of non-burn technologies are available that can safely disinfect, neutralize or contain the wastes for landfill disposal. Information on alternative treatment technologies and waste management is freely available.[33] Autoclaving is probably the most widely used non-incineration disinfection method. Autoclaves are economical, manufactured in a wide range of options that will suit most situations, and are well understood by healthcare systems, which routinely use them for sterilizing surgical and other medical products.

Action Items

- Implement environmentally preferable purchasing procedures and avoid toxic materials such as mercury, PVC and unnecessary disposable products.

- Set up a waste management committee and allocate a dedicated budget for waste management.

- Implement a comprehensive waste reduction program, including avoiding, where feasible, injectable medicines where oral treatments are as effective.

- Segregate waste at source and initiate recycling for non-hazardous wastes.

- Implement a comprehensive waste management training program, including injection safety and safe handling of sharps and other waste categories.

- Ensure waste handlers are trained, vaccinated and have personal protective equipment.

- Introduce non-burn treatment technology in order to ensure that the waste that cannot be avoided is treated and disposed of in an economical, safe and environmentally sustainable manner.

- Advocate for public authorities to build and operate secure landfills to manage non-recyclable waste post-treatment.

- Support and participate in the development and implementation of "zero waste" policies that significantly reduce the amount of waste generated at the hospital, municipal and national levels.[34]

For Tools and Resources to implement this goal please visit www.greenhospitals.net

4 ENERGY

Implement Energy Efficiency and Clean,
Renewable Energy Generation

AGENDA INTENT

Reduce fossil fuel energy use as a means to improve and protect public health; foster energy efficiency as well as alternative, renewable energy use with the long-term goal of 100% of energy needs to be supplied by on-site or community renewable energy sources.

The Global Problem

Most of the environmental and public health harm produced by energy consumption is from the combustion of fossil fuels, such as oil, coal and gas. The emissions generated from fossil fuel combustion are major contributors to global climate change and local health problems. In 2007, fossil fuels made up more than 86% of global primary energy consumption, releasing nearly 30 billion metric tons of carbon pollution into the atmosphere.[35]

Greater energy efficiency and transitioning to clean, renewable energy sources, such as solar and wind, can both significantly reduce greenhouse gas emissions and protect public health from the myriad impacts of climate change, including increased heat-related illnesses, the expansion of vector borne diseases, increased droughts and water scarcity in some regions and storms and flooding in others.[36] Moving away from fossil fuels also brings with it the health and

economic co-benefit of reductions in hospital admissions and treatments for chronic illnesses such as asthma, lung and heart disease caused by the pollution created from the extraction, refining and combustion of coal, oil and gas.[3]

Hospital Solutions

The health sector in the industrialized world and in a growing number of developing nations consumes significant amounts of fossil fuel energy, although there are no adequate figures for most countries. There is a need for systematic measuring and benchmarking of health sector energy consumption and associated greenhouse gas (GHG) emissions around the world.[38] Yet some anecdotal evidence does exist. Hospitals are the second most intensive energy-using buildings in the U.S., where the health care sector spends about $6.5 billion on energy each year, and that number is increasing.[39][40] As the health sector expands in many developing countries, its energy consumption grows as

Burning of fossil fuels makes up 86% of total global energy consumption

The health sector in the industrialized world and in a growing number of developing nations consumes significant amounts of fossil fuel energy.

well.   In Brazil, for instance, hospitals account for 10.6% of the country's total commercial energy consumption.[41] At the same time, electricity access and hospital electricity consumption in most hospitals in regions such as South Asia and sub-Saharan Africa reflect far lower energy use rates, while hundreds of thousands of hospitals and health clinics across the world suffer from unreliable electric supplies or no electricity access at all.[42]

Standard operating procedure for most large western-style hospitals requires significant energy use -- for heating water, temperature and humidity controls for indoor air, lighting, ventilation and numerous clinical processes -- with associated significant financial cost and greenhouse gas emissions. Yet gains in energy efficiency can be made without sacrificing the quality of care. For instance, there is a huge variation in healthcare energy use in industrialized nations. The most

efficient hospitals in northern Europe consume roughly 35% of the energy that North American hospitals average (320 kWh/sq m compared to 820 kWh/sq m), while delivering comparable health-care services. A study underway by the University of Washington Built Environment Lab suggest that North American hospitals can achieve 60% reductions in energy consumption through adoption of more efficient system strategies.[43] Hospitals in countries ranging from Mexico and Brazil, to India, Australia and Poland have all demonstrated that they can take basic measures to save money, strengthen facility resiliency and increase energy efficiency by 20 to 30 percent.[44]

Health-care facilities can also significantly cut greenhouse gas emissions and energy costs over time by using alternative forms of clean and renewable energy -- such as solar and wind energy, and biofuels that do not undermine

energy consumption of the most efficient hospitals in northern Europe compared to North American hospitals:
35%

Greater efficiency and transitioning to clean, renewable energy sources, such as solar and wind, can significantly reduce greenhouse gas emissions while protecting public health.

local food production or community land tenure. Alternative energy sources can be used for lighting, heat generation, and pumping and heating water. These can be either for on-site use or integrated with community-wide renewable energy installations.

Alternative clean, renewable energy makes both environmental and economic good sense, especially when financing mechanisms are structured to support this shift. At the same time, given its formidable energy demands, health sector investment can play an important role in shifting the economies of scale and making alternative energy more economically viable for everyone.

For regions that have no access to electricity, alternative energy sources can fuel primary health-care facilities in even the most remote areas. In energy-poor settings, the advent of low-energy and no-energy medical devices can be harnessed, together with deployment of renewable energy sources to improve access to basic health services.[45] Finally, alternative sources of energy give health facilities an advantage in terms of disaster preparedness, since alternative energy sources are less vulnerable to disruption than traditional fossil fuel systems.[46]

Action Items

- For existing buildings, implement an energy conservation and efficiency program that will reduce energy consumption by a minimum of 10% in a single year, and will continue to produce ongoing energy savings of 2% per annum, resulting in a 10% reduction in each five year period. For new buildings, design to achieve building energy performance targets of 320 kWh/sq m or less.

- Conduct regular energy audits and use the results to inform awareness and retrofit programs.

- Once efficiency measures are implemented, investigate the purchase of clean, renewable energy, and if available, purchase at least five percent at the next available opportunity. In existing plants, shift to cleaner boiler fuels.

- Investigate sources of onsite, clean, renewable energy and include its generation in all new building plans.

- Identify potential co-benefits of climate mitigation efforts that reduce greenhouse gas emissions and local health threats, while saving money at the same time.

- Integrate occupant education and awareness programs to reduce energy consumption related to occupancy. In mechanically conditioned spaces, turn thermostats down a few degrees in winter or cool climates, and up in summer or warm climates. Even a slight shift can create significant energy savings.

For Tools and Resources to implement this goal please visit www.greenhospitals.net

5 WATER
Reduce Hospital Water Consumption and Supply Potable Water

AGENDA INTENT

Implement a series of conservation, recycling and treatment measures to reduce hospital water consumption and wastewater pollution. Establish the relationship between potable water availability and healthcare resilience to withstand physical, natural, economic and social disruption. Promote public environmental health by providing potable water for the community.

The Global Problem

In many parts of the world, potable water is a scarce resource presenting a significant global environmental health challenge. More than one billion people lack access to an "improved" drinking water supply, while many more drink water that is grossly contaminated.[47]

Four billion cases of diarrhea occur annually, of which 88% is attributable to unsafe water, and inadequate sanitation and hygiene. Nearly two million people die every year from diarrheal diseases; the vast majority are children under five years old. WHO estimates that "94% of diarrheal cases are preventable through interventions to increase the availability of clean water, and to improve sanitation and hygiene." [48] Climate change, with its accompanying impacts of drought, glacier melt and aquifer depletion, will exacerbate these problems while contributing to greater water scarcity overall.

Hospital Solutions

Much healthcare delivery in developing countries takes place in settings where there are inadequate or non-existent municipal water or treatment facilities. This lack of water and sanitation infrastructure is a major problem that directly impacts hospitals and health care systems -- either overburdening them with more disease in the population, or because they cannot count on basic water, sewage and waste disposal services to carry out their mission, or both.

Ideally, a hospital's wastewater should be treated by a municipal system designed to protect public health more broadly. However, this is not always possible, for example, in rural areas, in areas where no service is available or in cities where the municipality requires onsite treatment. In these situations, a range of affordable waste water treatment technologies are available. For example, sewage can be treated in a bio-digestion system which will generate methane gas that can be utilized as a fuel within the facility. Such simple technology can be appropriate for small-to-medium scale health facilities in developing countries.

The result, if these systems are functional and well maintained, is more resilient healthcare delivery and hospitals that can provide healthcare services as well as potable water within their communities.[49] By providing potable water to the surrounding community, hospitals can offer a major public health benefit, both preventing disease and reducing consumption of medical and natural resources required to treat these diseases.[50]

When water is amply available, hospitals are often prodigious consumers in various facets of their operations. In the US, for instance, as much as 70% of hospitals' water use is for process uses, ranging from mechanical equipment to sanitary sewage conveyance; approximately 30% is used for drinking, food preparation, bathing and hand washing.[51] Overall, there are few reliable global water consumption benchmarks in healthcare.

In general, health facilities can conserve water resources by closely metering water use, installing

water-efficient fixtures and technologies, growing drought-resistant landscape, and making sure that leaks are quickly repaired.

For even greater impact on overall usage, hospitals in a number of countries are harvesting rainwater. Others recycle water for process purposes. In Australia, for example, hospitals are beginning to implement on-site blackwater treatment systems for recycling sewage.

In areas where high quality potable water is available, health-care facilities can make a tremendous positive environmental impact by eliminating the purchase and sale of bottled water. The California-based Pacific Institute recently estimated that the energy required to produce bottled water in the United States in 2007 was as much as 2000 times that of producing tap water -- an energy equivalent to 32-54 million barrels of oil. Report authors estimate that three times that much energy was required to meet global bottled water demand.[52]

Action Items

- Establish a framework that aspires to "net zero water use" within a hospital system.

- Implement water conservation strategies: install efficient faucets and toilets, routinely check plumbing and pipes to prevent leaks, eliminate seal and cooling water on medical air compression and vacuum pumps, and retrofit refrigeration systems.

- Switch from film-based radiological imaging equipment, which uses large quantities of water, to digital imaging, which uses no water and no polluting radiological chemicals.

- Landscape grounds using drought-resistant plants to minimize water use.

- Consider harvesting rainwater and/or recycling water for process water uses.

- Eliminate bottled water facility-wide if high quality potable water is available.

- Regularly analyze water quality.

- Where the health facility has access to potable water but it is not readily available in the community, develop programs to provide the community with potable water as a public health service.

- Implement on-site wastewater treatment technologies when no municipal service is available.

- Develop joint projects with the community to improve and protect water supplies; support initiatives for public systems to improve water quality, water delivery and wastewater systems for the entire population.

For Tools and Resources to implement this goal please visit www.greenhospitals.net
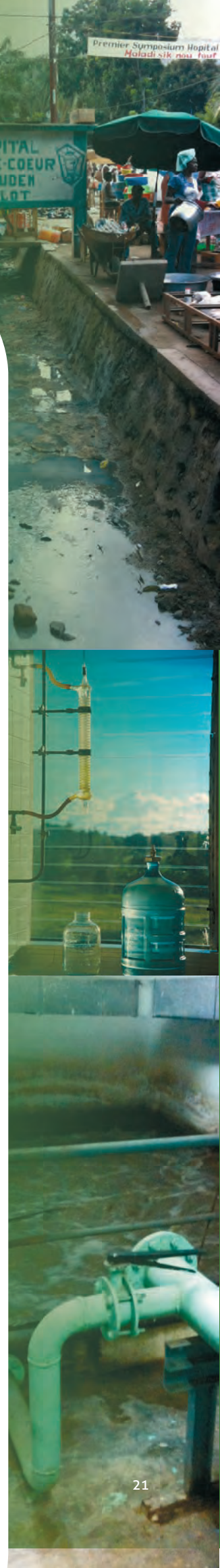
6 TRANSPORTATION

Improve Transportation Strategies for Patients and Staff

AGENDA INTENT

Develop transportation and service delivery strategies that reduce hospitals' climate footprint and their contribution to local pollution.

The Global Problem

Transportation is a major source of air pollution throughout the world, creating significant health impacts, particularly in urban areas. Exposure to carbon monoxide, sulfur dioxide, and nitrogen dioxide can cause respiratory illness and alter the lung's defense systems.[53] Numerous studies link increases in emergency department visits with increases in community ozone levels.[54] Ground level ozone is also linked to increasing temperatures in urban areas, amplifying heat-island impacts.

In developing country mega-cities, in particular, air pollution from transportation is a major health problem. In Delhi, the transport sector accounts for over 70 percent of air pollution. A World Bank study found that the total social cost of air pollution in the cities of Mumbai, Shanghai, Manila, Bangkok, Krakow and Santiago, was as high as US $2.6 billion.[55]

Meanwhile, road transport contributes 18 percent of the world's total CO_2 emissions from fuel combustion. And by 2030, carbon dioxide emissions from transportation are projected to rise by 60 percent. The majority of this CO_2 increase will be in developing regions, particularly China, India, and Southeast Asia.[56]

Hospital Solutions

The health sector -- with its fleets of ambulances, hospital vehicles, delivery vehicles, and staff and patient travel -- is a transportation-intensive industry. Air pollution impacts from health care are concentrated near large-scale hospital facilities.

The UK National Health Service estimates that the CO_2 emissions related to transportation of staff and patients to healthcare settings equal approximately 18% of its total carbon emissions.[57] This significant finding has led them to consider siting facilities near public transportation infrastructure and within communities, thereby reducing vehicle miles travelled by patients.

Telemedicine is another strategy for reducing transportation-related emissions. As WHO notes, "well-designed telehealth schemes can …reduce the travel-related carbon footprint of health care, while improving access and outcomes for vulnerable groups. Simple mobile phone applications supporting emergency assistance and long-distance consultation with health-care workers in remote areas are being used in many developing countries with good results."[58]

Shifting to hybrid technologies, all-electric vehicles, as well as compressed natural gas or some bio-fuels all have the net impact of reducing emissions for fleet vehicles such as ambulances and vans. Encouraging hospital staff and patients to use bicycles, public transportation and carpools can also help reduce the air pollution emissions related to health care facilities.

Supply chain transportation impacts are significant as well. The UK National Health Service estimates that 60% of their carbon footprint is related to supply chain decisions. Purchasing from local suppliers or/and suppliers who use fuel-efficient transportation can all have positive impacts. Waste should also be treated or disposed of as close as possible to where it is generated.[59]

In summary, transportation choices have a huge impact on the communities within which hospitals are situated. Increased traffic, difficult parking, noise, lack of green space or pedestrian access and poor security are all preventable with careful siting and community integration of appropriately scaled, accessible health care within mixed use neighborhoods.

Action Items

- Provide health care in locations that are accessible to patients, staff and visitors without causing them unnecessary travel. Consider community-based primary care, home care and co-locating medical services with related social services or community programs.

- Develop strategies for telemedicine, communication by e-mail and other alternatives to face-to-face encounters between caregivers and patients.

- Encourage staff, patients and visitors to walk or use car pools, public transport or bicycles whenever possible. Install showers, lockers and bicycle storage facilities to encourage staff to adopt healthy modes of transportation

- Negotiate discounts for public transport to provide incentives for its use.

- Optimize the energy efficiency of hospital fleet vehicles by using hybrid, electric or appropriate bio-fuel technologies.

- Purchase from local suppliers, and/or suppliers who use fuel efficient transportation.

- Dispose of waste near the point of generation.

- Advocate for progressive public transportation policies in the interest of environmental health.

For Tools and Resources to implement this goal please visit www.greenhospitals.net

7 FOOD

Purchase and Serve Sustainably Grown, Healthy Food

AGENDA INTENT

Reduce hospitals' environmental footprint while fostering healthy eating habits in patients and staff. Support access to locally and sustainably sourced food in the community.

The Global Problem

The globalization of a western diet based on excessive saturated fats, refined carbohydrates and processed foods, together with increasingly sedentary lifestyles, are contributing to epidemics in obesity, diabetes and cardiovascular disease in many countries. Parallel to this trend is the growing globalization of western industrial medicine to treat such disease.

Globally, obesity has more than doubled since 1980, with 65% of the world's population living in countries where overweight and obesity kill more people than underweight. According to WHO, "many low- and middle-income countries are now facing a 'double burden' of disease. While they continue to deal with the problems of infectious disease and under-nutrition, they are experiencing a rapid upsurge in non-communicable disease risk factors such as obesity and overweight, particularly in urban settings."[60]

This trend of growing obesity, diabetes and cardiovascular disease increases the global demand for resource-intensive therapies, and therefore increases both healthcare costs and the health sector's environmental footprint as it expends more energy and resources to treat these diseases.[61]

Meanwhile, industrial food production is contributing greatly to climate change and other environmental degradation. Globally, livestock for meat and dairy production is estimated by the UN Food and Agriculture Organization to contribute approximately 18 percent of total greenhouse gas emissions.[62] Runoff from animal farms and fertilized fields are polluting water the world over.

Pesticides poison workers, while contaminating fields and food. Antibiotics fed to livestock contribute to antibiotic resistance in the environment. Food waste also contributes significantly to the waste stream, comprising 12% of the total municipal solid waste stream in the United States, for instance.[63]

Hospital Solutions

Health-care facilities in many countries are major consumers of food and can therefore model and promote health and sustainability through their food choices. A growing number of health-care facilities in developed and developing countries that purchase and serve food to patients and workers are reducing their environmental footprint and improving patient and worker health by making changes in hospital service menus and practices. These include limiting the amount of meat in hospital meals, cutting out fast and junk food, composting food waste, buying locally and sustainably farmed produce -- thereby promoting local, sustainable production, producing their own food onsite, and holding farmers' markets for local producers to sell healthy food to the community.

By promoting and supporting nutritious, localized sustainable food systems, hospitals can both reduce their own immediate footprint while supporting food access and nutrition, thereby helping to foster the prevention of disease, a reduction in the health sector's environmental health impacts and contributing to a longer-term reduction in the population's need for healthcare. Such an approach can also help to create stable and growing markets for sustainable, locally grown food outside the health care sector.

Action Items

- Modify hospital menus and practices to support healthier food purchases by buying locally produced and organic produce.

- Make the hospital a "fast food free zone"; eliminate sugar-based soft drinks in hospital cafeterias and vending machines.

- Work with local farmers, community-based organizations and food suppliers to increase the availability of locally sourced, sustainably grown food.

- Encourage vendors and/or food management companies to supply food that is produced without synthetic pesticides and hormones or antibiotics given to animals in the absence of diagnosed disease, and which supports farmer and farmworker health and welfare, as well as ecologically protective and restorative agriculture.

- Implement a step-by-step program to identify and adopt sustainable food procurement. Begin where minimal barriers exist and immediate steps can be taken, for example, by introducing organic fresh fruit in the cafeteria.

- Educate and communicate within the hospital or health care system, as well as to patients and community, about nutritious, socially equitable and ecologically sustainable food practices and procedures.

- Minimize and beneficially reuse food waste. For instance, compost food waste or use it as animal feed. Convert cooking oil waste into biofuel.

- Make the hospital a center that promotes nutrition and healthy food by holding farmers' markets for the surrounding community and fostering community gardens on hospital grounds.

For Tools and Resources to implement this goal please visit www.greenhospitals.net

8 PHARMACEUTICALS

Prescribe Appropriately, Safely Manage and Properly Dispose of Pharmaceuticals

AGENDA INTENT

Reduce pharmaceuticals pollution by reducing over-prescription practices, minimizing inappropriate pharmaceutical waste disposal, promoting manufacturer take-back, and ending the dumping of pharmaceuticals as part of disaster relief.

The Global Problem

Pharmaceutical waste can be found in trace amounts in soil and groundwater throughout the world. This waste comes from a variety of sources, including hospitals. In the U.S., for instance, hospital pharmacies can stock between 2,000 and 4,000 different items.[64] Levels of pharmaceuticals in the environment are likely to rise in years to come, as the global demand for pharmaceuticals grows.

Meanwhile, government oversight in most countries has not kept up with modern society's increasing dependence on pharmaceutical drugs. Regulations for pharmaceutical disposal are in many cases outdated and contradictory. In many countries, it is possible to buy almost any drug without a prescription.

Hospital Solutions

In countries and hospitals where there are an abundance of pharmaceuticals, health systems can play an essential role in reducing pharmaceutical waste by reducing the amount of drugs prescribed, and by addressing the waste problem in their own facilities and at the policy level. In Sweden, for example, a system has been set up to rank pharmaceuticals according to their environmental impact.[65] This allows doctors to choose less environmentally harmful medicines when there is a choice of treatments for a given condition.

Lower income countries can suffer from inappropriate pharmaceutical donations -- for example, from 1992 to 1996, Bosnia and Herzegovina received approximately 17,000 metric tons of unusable pharmaceutical donations. The disposal costs were estimated at USD 34 million.[66] After the 2004 Indian Ocean tsunami, several hundred tons of outdated drugs donated to Indonesia were stored in poor conditions. This situation posed the risk of illegal sale and consumption of substandard drugs stocks by unwary patients, and potential environmental pollution from either leakage or poorly conducted disposal.[67]

Healthcare facilities should operate strict stock control (eg first expire, first out), avoid over-procurement, and dispense only the required amount to reduce the generation of pharmaceutical waste. Hospitals and pharmacies can also take back unused pharmaceuticals from patients, products that might otherwise be flushed down the drain or thrown out with ordinary garbage. It may be most efficient to centralize waste pharmaceutical collection systems regionally or nationally, to ensure safe and environmentally responsible treatment and disposal.

There is no universally agreed-upon method for disposing of pharmaceutical waste. In many countries, the legislation demands incineration, but this can be extremely polluting, especially in low-income countries where poorly controlled incinerators or cement kilns are used. Pills are usually packaged in blister plastic material made of PVC , which, when incinerated, produces dioxin.

Non-incineration treatment options also vary with the medicine in question. Highly toxic drugs such as cytostatic cancer drugs, and controlled substances like painkillers, need to be carefully managed. Some pharmaceuticals can be deactivated by using specific chemical reactions, but this is not a common practice.

Chemical-based destruction technologies developed for other waste streams that could be used to dispose of pharmaceuticals have not been able to penetrate a market where legislation requires incineration.

Overall, the best option, recommended by WHO and other organizations, would be for manufacturers to take back waste pharmaceuticals.[68] In the Philippines, hospitals have negotiated this as part of the purchasing contract.[69] Manufactures, who are familiar with the chemistry of their products, are best equipped to dispose of them safely.

Medium and low temperature incineration, uncontrolled landfill and discharge to sewers should be avoided, particularly for antineoplastic drugs. In low-income areas, encapsulation or inertization (mixing with concrete) before landfilling are cheap and effective approaches.

Action Items

- Prescribe small initial quantities for new prescriptions.

- Do not provide samples of medications to patients, as these often end up in the waste stream (or, alternatively, develop a program to reduce free sample waste).

- Inform consumers about safe disposal methods for unused or expired medications.

- Encourage pharmaceutical companies to develop more effective medication delivery systems, so medications are absorbed more efficiently by the body, and chemical excretion is minimized.

- Develop training programs for health care providers to optimize their prescribing practices.

- Adopt a plan for the centralized procurement and distribution of medications that controls the quantities that patients receive and limits waste.

- Wherever possible, establish contracts that ensure the return of excess pharmaceuticals to the manufacturer.

- Ensure that pharmaceutical waste is treated and disposed of in accordance with national and/or WHO guidelines as appropriate. Ensure that pharmaceuticals are only donated on request, and that any donations are in line with WHO policy and the policy of the recipient country.

- Initiate and publicize take-back programs to provide and alternative for patients to disposing of unused medicines down the drain or in municipal waste.

For Tools and Resources to implement this goal please visit www.greenhospitals.net

9 BUILDINGS

Support Green and Healthy Hospital Design and Construction

AGENDA INTENT

Reduce health care's environmental footprint, and make hospitals healthier places to work and visit, by incorporating green building principles and practices into design and construction of health facilities.

The Global Problem

The built environment influences health. In the nineteenth century, early urbanization led to rampant spread of infectious diseases -- smallpox, tuberculosis, typhoid, and rubella. To a large degree, these were controlled through public health interventions disseminated through zoning and building code regulations. Sanitation systems, public water supplies, and requirements for daylight and ventilation in housing are all examples of built environment responses to the health impacts of development.

A host of contemporary environmental health problems -- climate change, toxic pollution, biodiversity loss and more -- can be linked to the production and maintenance of the built environment. As development accelerates in many regions, the production of buildings becomes more resource intensive, stressing local and indigenous building material supplies and methodologies beyond their sustainable capacities.

Indeed, buildings have a huge environmental health footprint. The UN Environment Programme estimates that global building-related activities may be responsible for up to 30 to 40% of carbon dioxide releases.[70] The non-profit Architecture 2030 estimates that global building-related activities, when transportation of materials is factored in, exceeds 48%.[71] While industrial CO2 emissions are leveling off, they continue to rise in the building sector. Achim Steiner, UNEP Executive Director, has suggested that an aggressive global energy efficiency policy might deliver over two billion tons of emission reductions, or close to three times the amount scheduled to be reduced under the Kyoto Protocol.[72]

Building construction activities account for 40% of raw stone, gravel and steel generated; and consume 25% of the world's virgin lumber. Building construction and demolition generates approximately 50% of municipal solid waste. Buildings further deplete the stratospheric ozone layer by using refrigerants and products manufactured with ozone-depleting compounds, including insulation materials.[73] Buildings use over 75% of world production of polyvinyl chloride (PVC). Production of chlorine, a principle ingredient of PVC, is one of the world's most energy intensive industrial processes, and consumes approximately 1% of the world's total electricity output.[74]

Today, in many settings, humans spend as much as 90% of their lives indoors. Estimates suggest that the level of indoor pollutants is up to five times greater than levels of outdoor pollutants.[75] Increasing scrutiny of indoor pollutant sources, ranging from dust to formaldehyde, phthalate plasticizers to cleaning products, is yielding new data about the need for healthier, safer building materials.

At the same time, the health sector is in the midst of a construction boom in many regions of the world, with particular dynamism in a number of developing countries. The global market for health care construction was valued at $129 billion in 2009. It is forecast to top $180 billion in 2014. Overall, the health sector comprises more than one-third of the worldwide institutional building construction market.[76]
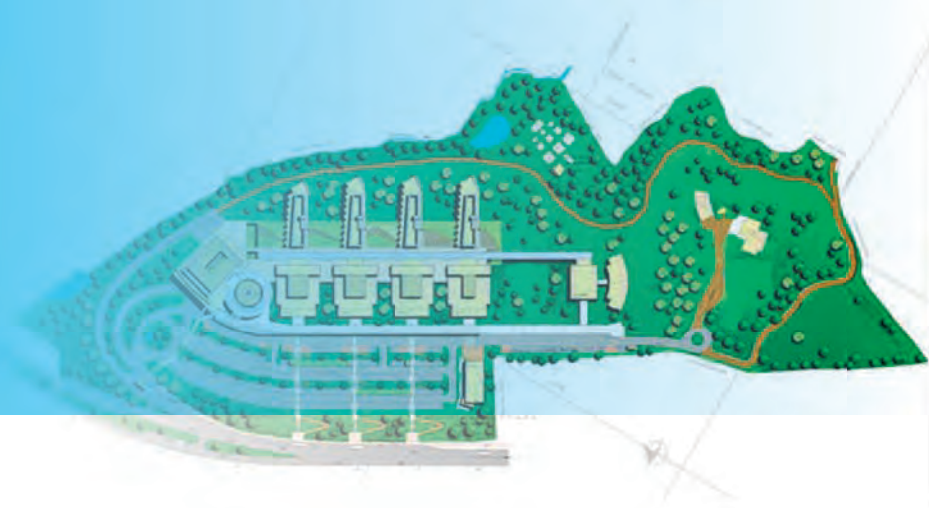
Hospital buildings' environmental and health impacts have catalyzed a growing number of "green building" tools for healthcare.

Hospital Solutions

The health sector has the potential, through its market power, to influence the construction industry to develop safer, more resilient, greener and healthier building products and systems. In some regions. health systems have replaced manufacturing as major local employers. Even in regions where urbanization and residential development outpace medical construction, the healthcare sector can model 'best practices' in sustainable construction.[77]

Buildings that support the delivery of healthcare services are as diverse as the delivery systems that shape them. Facilities vary widely between and within countries. They range from small community outpatient clinics to large acute-care hospitals sponsored by an equally broad range of owners -- including government agencies, philanthropic nonprofits and corporate entities. They include community facilities that operate 24 hours a day, every day, and are intended to operate as "safe havens" in natural disasters.

The significant environmental and health impacts associated with hospital buildings have led to the creation and adoption of a wide variety of "green building" tools and resources related to healthcare. Globally, a number of green building tools and resources have been customized for health care and specific climate zones or

regions. The US Green Building Council's LEED for Healthcare, Australia's Green Star for Health, the United Arab Emirate's Estidama, the UK's BREEAM and NEAT, are all examples of green building rating tools guiding the construction of healthcare facilities. These tools share one common notion: green building principles embody considerations including siting and land use, water and energy consumption, building materials sourcing practices, and indoor environmental quality.

From siting hospitals near public transportation routes, to using local and regional building materials, to planting trees on the site, to incorporating design components like day lighting, natural ventilation, alternative energy and green roofs, existing health facilities can moderate their environmental footprint and their impact on local communities, while new buildings can be designed to use far fewer resources.[78 79] This applies to all healthcare buildings -- from large, centralized hospital facilities to small community clinics.

Research also suggests there is a direct relationship between the built environment and therapeutic outcome; the design of a health facility can positively influence patient health, as well as caregiver performance and satisfaction.

For instance, natural ventilation can be both an effective energy saving strategy and infection control measure.[80] Carnegie Mellon University Center for Building Performance and Diagnostics identified seventeen international studies that document the relationship between improved indoor air quality and positive health impacts on illness, including asthma, flu, sick building syndrome, respiratory problems and headaches; the improvements ranged from 13.5 to 87%.[81]

Green and healthy building also requires looking beyond the initial capital cost to focus on the "total cost of ownership" throughout a structure's lifetime. These "life cycle costs" include operational costs, such as utilities and system maintenance, in order to balance upfront investments in energy and water infrastructure with returns that come through reduced operating costs. Research is also linking improved occupant health and performance to green building strategies such as access to exterior views or increased ventilation. These studies are beginning to create a broader health and performance-based "business case" for green and healthy buildings.

It is important to underscore that green and healthy building strategies are not just for new construction. In many cases, existing buildings can be retrofitted to achieve many of the systemic improvements that new buildings are realizing.

There is much to be learned from green and healthy hospital building projects sprouting up around the world. Green building tools can help create effective, high-performance healing environments. Lessons taken from these guides are beginning to take shape in the production of new, large-scale, acute care hospitals in the developing world. Two of many examples are Rio Negro Hospital in Cali, Colombia, which is targeting LEED Gold; and the Kohinoor Hospital near Mumbai, India, the second hospital in the world to receive a LEED Platinum rating.
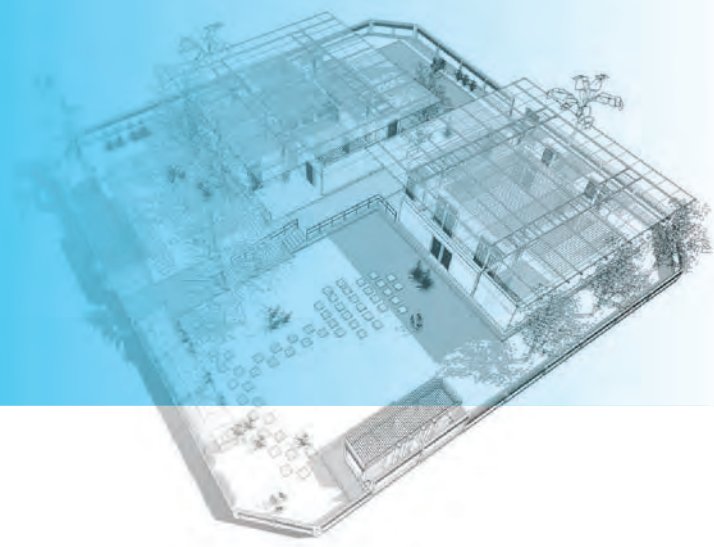
Action Items

- Aspire to carbon-neutral building operation.

- Protect and restore natural habitat; minimize the combined footprint of building, parking, roads and walks.

- Use high reflectance roofing and paving, or "green roof" systems and pervious paving, in order to reduce urban heat island impacts, manage stormwater and promote habitat.

- Design within local natural and social contexts in order to better integrate the building with the community and natural environment. Site facilities in accordance with solar orientation and prevailing wind.

- Employ passive systems wherever possible to provide increased resilience and redundancy -- use narrow floor plates for daylighting and natural ventilation.

- Prioritize health impacts of material extraction, transport, use and disposal in assessing them for use in health care settings, and use materials that are replenishable and support human and ecosystem health in all phases of their life cycle.

- Support the use of local and regional materials (reducing transportation energy), utilize salvaged and recycled materials (reducing energy otherwise expended on new production).

- Avoid materials such as lead and cadmium-containing paint and coatings, as well as asbestos.

- Substitute materials containing persistent bio-accumulative toxic chemicals (PBT's), including PVC, CPVC, and halogenated and brominated flame retardants, with safer alternatives.

- Create civilized built environments that foster inhabitant choice and control, advanced indoor air quality (through natural ventilation and mechanical systems), lighting and acoustical settings that reduce stress and support health and productivity.

- Refer to guidelines created by national or regional green building organizations.

- Advocate for policy guidelines and public funding that support green and healthy buildings.

For Tools and Resources to implement this goal please visit www.greenhospitals.net

10 PURCHASING

AGENDA INTENT

Source sustainably produced supply chain materials from socially and environmentally responsible vendors.

Hospitals and health systems purchase a broad diversity of products ranging from chemicals, electronics and plastics, to energy, pharmaceuticals and food. Creating and implementing green and ethical purchasing policies can play a central role in implementing many of the goals of the Green and Healthy Hospitals Agenda.

The health sector spends huge amounts of money on purchasing goods. For instance, the worldwide market for medical devices -- one strand of the supply chain -- grew to US $305 billion in 2010, fueled by double digit growth in India, China, Brazil and other developing nations. This number is forecast to continue to increase over the next several years, in part as a result of increasing demand in emerging markets.[82]

Healthcare purchasing results in a significant environmental impact. The NHS in England, for example, calculates that it spends €20 billion a year on goods and services, which translates into a carbon footprint of 11 million tons -- 60% of the NHS's total carbon footprint.[83]

Healthcare purchasing can also have significant human rights impacts. One small region of Pakistan, for instance, produces 100 million surgical instruments every year under unethical conditions. Surgical scissors made there and sold around the world, are ground and filed by 10 year-old children working full-time in small, open garages on the street.[84]

By harnessing its tremendous purchasing power in many countries, the health sector can impact the supply chain, compelling manufacturers to provide safer, more environmentally sustainable products, produced under healthy working conditions and in accordance with international labor standards. Ultimately, the health sector can help shift the markets so that these products -- as well as thousands of related products -- are more widely available, not only to hospitals, but to all consumers, promoting greater health and sustainability.

By harnessing its tremendous purchasing power, the health sector can impact the global supply chain.

Green and ethical purchasing policies can help implement many of this Agenda's goals.

Action Items

- Review facility procurement practices, and patronize local vendors who carry third party certified sustainable products and follow sustainable and ethical practices whenever possible.

- Implement a sustainable purchasing agenda that considers the environmental and human rights impact of all aspects of purchasing, from production to packaging to ultimate disposal.

- Develop coordination between hospitals to increase buying power for environmentally preferable purchasing.

- Utilize a sustainable and certified computer purchasing program for computer and electronic needs.

- Require suppliers to disclose chemical ingredients and safety testing data for product purchases and give preference to suppliers and products meeting these specifications. Limit hospital/health system purchases to products meeting these specifications.

- Utilize purchasing power to obtain environmentally responsible and ethically produced products at cost competitive prices and work with manufacturers and suppliers to innovate and expand the availability of these products.

- Make sure all contracts meet socially-responsible business principles: Follow the guidelines on ethical procurement for health from the Ethical Trading Initiative and the British Medical Association.

- Advocate for Extended Producer Responsibility, and for products to be designed so they generate less waste, last longer, are less disposable, use less hazardous raw materials and include less packaging.

For Tools and Resources to implement this goal please
visit www.greenhospitals.net

A FUTURE VISION
Toward Regenerative Health Care

There is growing consensus that we are consuming natural resources faster than the planet can replenish them. The World Wildlife Fund's 2010 Living Planet Report estimates that the world economy is consuming global resources at 50 percent above carrying capacity.[85] Beyond the public health implications of such an unsustainable model, what does this mean for healthcare?

The Global Green and Healthy Hospitals Agenda, as well as various other health sector environmental sustainability initiatives, represent important steps that hospitals and health systems can take to address this crisis. However, simply consuming fewer resources will not ultimately solve the problem. As long as our health systems are net consumers of non-renewable resources, the system is not sustainable.

But how do we transcend such a daunting paradox? One place to look is the global green building movement.   Many leading architects working on green buildings are moving toward "regenerative design" thinking, in which buildings are designed with inherent capability to become net resource generators rather than resource consumers. Moving from a built environment that "degenerates" natural capital to one that restores or "regenerates" is akin to moving beyond a hospital simply doing "no harm" to a hospital building that "heals"-- a perfect metaphor for the healthcare sector.

Regenerative design offers a global vision for a resilient and restorative healthcare delivery system, one in which hospitals situate themselves within the ecology of their communities and act as a force for healing that contributes to a stronger, fairer and cleaner economy.

> Hospitals can not only sustain life and health, but also repair and restore what has been degraded or lost

RESOURCE GENERATION +

RESOURCE DEPLETION −

TRANSITION ZONE

REGENERATIVE DESIGN

GREEN DESIGN

NET ZERO

High Performance Green Buildings "Do Less Harm" · Living Buildings "Do No Harm" · Regenerative Buildings "Heal"
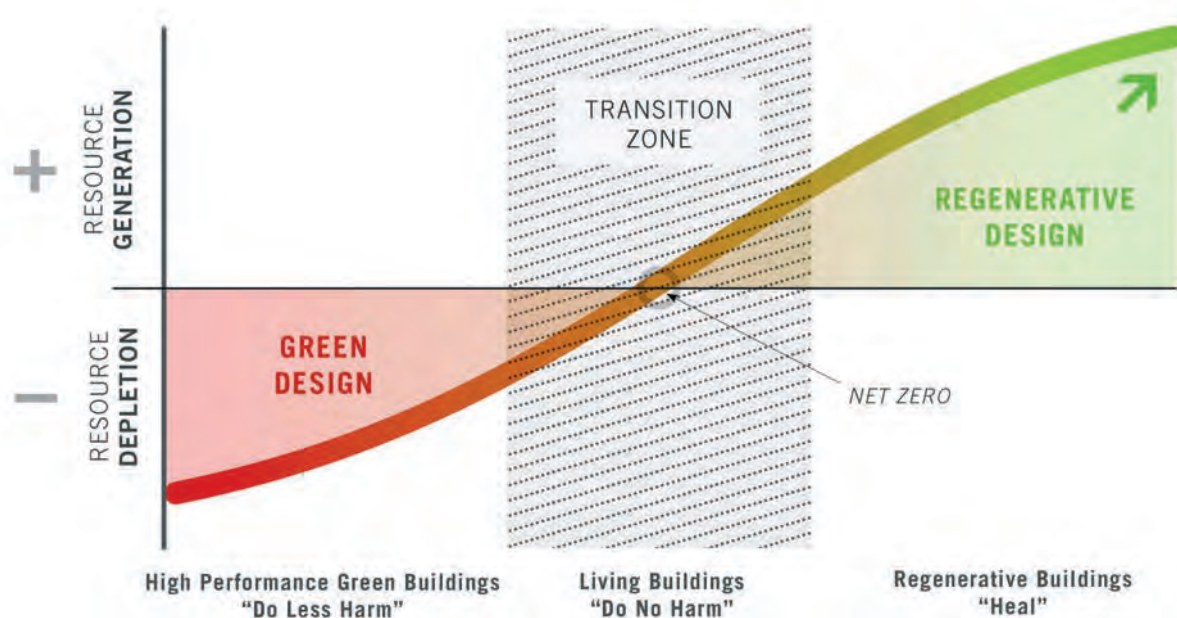
Regenerative design represents the culmination of a transition to a built environment that embodies the capability of not only sustaining life and health, but also repairing or restoring some of what has been degraded or lost. Buildings are not inherently regenerative, but the built environment can be designed to contribute to and support regeneration. Regenerative design offers an opportunity to align the ecological profile of the built environment with the core mission of healthcare -- that is, healing - in a building that delivers all necessary services, while supporting broader ecosystem services as well.

What is necessary to arrive at such a place is a cohesive roadmap toward a truly green and healthy future -- a roadmap postulated in the graph on this page. The challenges are daunting. How, for instance, do we create hospitals and health delivery systems that are carbon neutral, toxic-free, water-balanced and emit zero waste?

While there are no global examples of truly regenerative hospitals, there are many examples of healthcare organizations embracing "regeneration" of health and community. Current practice in low-energy European hospitals, and low energy hospital work in the US, may well represent the beginning of the transition to this net-zero world, and beyond. Community-based prevention initiatives are another example. Revamping national healthcare systems

to focus on community-based prevention and primary care is another way in which the system can be refocused to move beyond "less harm."

For instance, in many countries, emphasis on primary health care demonstrably lowers the need for more resource-intensive therapies later on.[86] Reducing the demand for more intensive therapies through disease prevention strategies reduces the ecological footprint of the health sector. This simple interrelationship creates a positive spiral, reducing the burden of disease that the health sector's resource consumption contributes to. By reducing the need for energy and resource-intensive health-care services, primary health care and disease prevention can be seen as forms of green and healthy regenerative design.

The health sector should not need to argue that delivering high quality healthcare requires a passport for waste and energy intensity-- or that saving lives is somehow outside of broader eco-systems and ecological concerns. Indeed, the healthcare sector is in a pivotal position to lead the twenty-first century reintegration of environment, health, and economic prosperity. By critically reinventing the hospital as a regenerative place of healing, the healthcare sector can signal a new relationship to healing and health.

Envisioning SUSTAINABLE, REGENERATIVE, EQUITABLE Health Systems

The UK National Health Service Route Map for Sustainable Health

IMAGINE A TIME

when going to hospital is seen as a failing of the health and social care system. When most of the care and support you need can be offered at home. When you can get instant medical help online, by phone or at a local health centre. When health inequalities are low and well-being is key.

IMAGINE A PLACE

where the few buildings that support the health system are in tune with the environment. They use almost no carbon and are integrated into the community and with nature. They are inviting for patients and a pleasure to work in.

IMAGINE A WORLD

where friends, family and society help promote healthy living. Where we all support the local health and social care system to recycle, re-use and minimize waste. Where we know that delivery of services takes the long term financial, social and environmental costs into account.

IMAGINE KNOWING

that we have done our best to improve health and minimize our impact on the environment.

GLOSSARY

Carbon footprint

The 'carbon footprint' measures the total greenhouse gas emissions caused directly and indirectly by a person, organization, event or product. The footprint considers all six of the Kyoto Protocol greenhouse gases: Carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Sulphur hexafluoride (SF_6). A carbon footprint is measured in tons of carbon dioxide equivalent (tCO_2e).[87]

Carbon neutral

The concept of cancelling out the harm done to the earth's atmosphere by one type of greenhouse gas-generating human activity, through another human activity that either reduces CO_2 emissions by an equal amount; or prevents an equal amount being generated by an 'essential' CO_2 producing human activity by substituting a non- or low-carbon producing alternative.[88]

Carrying capacity

The maximum number of individuals that a given environment can support indefinitely, without detrimental effects to environmental state. If exceeded, organisms may become locally extinct and environment may be permanently altered or destroyed.[89]

Clean Energy

Clean energy includes energy efficiency and clean energy supply options like highly efficient combined heat and power as well as renewable energy sources.[90]

Energy Efficiency

Something is more energy efficient if it delivers more services for the same energy input, or the same services for less energy input. For example, when a compact florescent light (CFL) bulb uses less energy than an incandescent bulb to produce the same amount of light, the CFL is considered to be more energy efficient.[91]

Environmental Footprint (*Ecological Footprint*)

The Ecological Footprint is an estimate of human pressure on global ecosystems, expressed in 'area units'. Each unit corresponds to the number of hectares of biologically-productive land required to produce the food and wood people consume, the infrastructure people use, and to absorb the CO_2 produced from burning fossil fuels; thus the footprint takes into account the total impact people have on the environment. The world's Ecological Footprint is a function of population size, average per capita consumption of resources, and the resource intensity of the technology used.[92]

Extended Producer Responsibility (*EPR*)

EPR is an environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle. An EPR policy is characterized by: (1) the shifting of responsibility (physically and/or economically; fully or partially) upstream toward the producer and away from municipalities; and (2) the provision of incentives to producers to take into account environmental considerations when designing their products. While other policy instruments tend to target a single point in the chain, EPR seeks to integrate signals related to the environmental characteristics of products and production processes throughout the product chain.[93]

Heat Island (*Urban Heat Islands*)

The modified land surface in cities affects the storage and radiative and turbulent transfers of heat and its partition into sensible and latent components. The relative warmth of a city compared with surrounding rural areas, known as the urban heat island (UHI) effect, arises from these changes and may also be affected by changes in water runoff, pollution and aerosols. Urban heat island effects are often very localized and depend on local climate factors such as windiness and cloudiness (which in turn depend on season), and on proximity to the sea.[94]

Millennium Development Goals

The eight Millennium Development Goals (MDGs) [Eradicate extreme poverty and hunger, Achieve universal primary education, Promote gender equality and empower women, Reduce child mortality rates, Improve maternal health, Combat HIV/AIDS, malaria, and other diseases, Ensure environmental sustainability, and Develop a global partnership for development by the target date of 2015] form a blueprint agreed to by all the world's countries and all the world's leading development institutions.[95]

Net-zero water use

Harvesting sufficient water to meet the needs of a given population while respecting the natural hydrology of the land, the water needs of the ecosystem it inhabits, and those of its neighbors. One hundred percent of occupants' water use must come from captured precipitation or closed loop water systems that account for downstream ecosystem impacts and that are appropriately purified without the use of chemicals.[96]

Renewable Energy

The International Renewable Energy Agency defines the term "renewable energy" as all forms of energy produced from renewable sources in a sustainable manner, which include: inter alia; bioenergy,; geothermal energy; hydropower; ocean energy; including inter alia tidal, wave and ocean thermal energy; solar energy and wind energy.[97]

Substances of Very High Concern (*SVHC's*)

SVHC's are substances that have been identified as carcinogenic, mutagenic or toxic for reproduction, or that are persistent and bioaccumulative or warrant similar concern according to the EU chemicals REACH. REACH is the European Community Regulation on chemicals and their safe use. It deals with the Registration, Evaluation, Authorization and Restriction of Chemical substances. The law entered into force on 1 June 2007.[98]

Thermal comfort

The British Health and Safety Executive defines Thermal Comfort as a 'condition of mind which expresses satisfaction with the thermal environment.' The term 'thermal comfort' describes a person's psychological state of mind and is usually referred to in terms of whether someone is feeling too hot or too cold. Thermal comfort is very difficult to define because the range of environmental and personal factors when deciding what will make people feel comfortable must be taken into account.[99]

Unsustainable resource use

The use of resources "faster than they are created or when we begin to deplete high-quality stocks".[100]

NOTES

1   Millennium Ecosystem Assessment, 2005. "Ecosystems and Human Well-being: Synthesis."Island Press, Washington, DC., 2005. http://www.maweb.org/en/index.aspx

2   A. Pruss-Ustun and C. Corvalan, "Preventing Disease Through Health Environment: Towards an Estimate of the Environmental Burden of Disease." WHO, Geneva, 2006.

3   A. Pruss-Ustun, et. al. "Preventing Disease…."

4   "Managing the Health Effects of Climate Change." The Lancet and University College London Institute for Global Health Commission. The Lancet, Vol. 373, May 16, 2009.

5   "Saving carbon, improving health: NHS carbon reduction strategy." National Health Service, Sustainable Development Unit, Cambridge, January 2009.

6   "Energy consumption indicators and CHP technical potential in the Brazilian hospital sector." Energy Conversion and Management, 2004, 45:2086.

7   "China's Healthcare Construction Market." http://www.ita.doc.gov/td/health/china_healthcare_construction05.pdf, nd.

8   "Health in the Green Economy: Co-Benefits to Health of Climate Change Mitigation." Health Facilities, World Health Organization, 2010.

9   Relevant MDGs include Child Health, Maternal Health and Environmental Sustainability http://www.un.org/millenniumgoals/. The Green Economy in the context of Poverty Eradication and Sustainable Development is one of the key themes to be addressed by the UN Conference on Sustainable Development in 2012. http://www.earthsummit2012.org/

10 "GREEN and CLEAN Hospital." Dr. TwisukPunpeng, Senior Adviser, Ministry of Health, Thailand.Presentation to the Asia Regional Conference for Mercury Free Health Care, March 2011, Manila, Philippines.

11 "Route Map for Sustainable Health." National Health Service Sustainable Development Unit, Cambridge, February 2011.

12 See http://www.who.int/hia/green_economy/en/index.html

13 See www.healthierhospitals.org

14 Janssen S, Solomon G, Schettler T. The Collaborative on Health and the Environment Toxicant and Disease Database.http://www.healthandenvironment.org/tddb_about. Updated December 20, 2010. ; Office of Environmental Health Hazard Assessment, California Environmental Protection Agency. "Chemicals Known to the State to Cause Cancer or Reproductive Toxicity as of January 7, 2011." http://www.oehha.ca.gov/prop65/prop65_list/files/P65single010711.pdf. Updated January 7, 2011.

15 The President's Cancer Panel, U.S. Department of Health and Human Services.Reducing Environmental Cancer Risk: What We Can Do Now. April 2010. http://deainfo.nci.nih.gov/advisory/pcp/annualReports/pcp08-09rpt/PCP_Report_08-09_508.pdf

16 "Asturias Declaration: A Call to Action." International Conference on Environmental and Occupational Determinants of Cancer, Asturias, Spain, March 17-18, 2011.

17 Prss-Ustn A, Vickers, C., Haefliger, P., &Bertollini, R.. "Knowns and unknowns about the burden of disease due to chemicals: A systematic review." Environ Health. 10:9.-24, 2011

18 "Provisional draft strategy for strengthening the engagement of the health sector in implementation of the Strategic Approach to International Chemicals Management," SAICM, Geneva, April 11, 2011. http://www.saicm.org/documents/meeting/grulac/

Panama%202011/Meeting%20documents/LAC3_INF7_health%20strategy.pdf

19 "Provisional draft strategy…" SAICM,, Geneva, April 11, 2011.

20 "Provisional draft strategy…" SAICM, Geneva, April 11, 2011.

21 SVHC's are a category under the EU chemicals REACH.   REACH is the European Community Regulation on chemicals and their safe use (EC 1907/2006). It deals with the Registration, Evaluation, Authorization and Restriction of Chemical substances. The law entered into force on 1 June 2007. http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm

22 "Core Principles for achieving safe and sustainable management of health-care waste." World Health Organization, Geneva, 2007. http://www.who.int/water_sanitation_health/medical-waste/hcwprinciples.pdf

23 Improving health through safe and environmentally sound waste management. World Health Assembly 126th Session, 22 January 2010, EB126.R12, document EB126/20. 3pp, http://apps.who.int/gb/ebwha/pdf_files/EB126/B126_R12-en.pdf

24 United Nations General Assembly, Human Rights Council, Eighteenth session, Agenda item 3: "Promotion and protection of all human rights, civil, political, economic, social and cultural rights, including the right to development." A/HRC/18/31, July 4, 2011

25 Harhay, M.O., Halpern, S.D., Harhay, J.S. & Olliaro, P.L. "Health care waste management: A neglected and growing public health problem worldwide." Tropical Medicine and International Health 14(11): 1414-1417, 2009.

26 Ruth Stringer, et.al., "Medical Waste and Human Rights." Submission to the UN Human Rights Council Special Rapporteur, Health Care Without Harm, May 2011.

27 "Addressing climate change in the health care setting," Health Care Without Harm, p.9, 2009.

28 "Safe health care waste management." Policy paper. Geneva, World Health Organization, 2004.

29 Calculations from United States Environmental Protection Agency's waste reduction model (http://epa.gov/climatechange/wycd/waste/calculators/Warm_home.html, accessed 20 April 2009).

30 Statement by Mr. Calin Georgescu, "Special Rapporteur on the adverse effects of the movement and dumping of toxic and dangerous products and wastes on the enjoyment of human rights. " Eighteenth session of the Human Rights Council, Geneva, 14 September 2011

31 "Guidelines on best available techniques and provisional guidance on best environmental practices relevant to Article 5 and Annex C of the Stockholm Convention on Persistent Organic Pollutants: Waste incinerators." Secretariat of the Stockholm Convention on Persistent Organic Pollutants, 2008. http://chm.pops.int/Programmes/BAT/BEP/Guidelines/tabid/187/language/en-GB/Default.aspx

32 "Safe health care waste management." Policy paper. Geneva, World Health Organization, 2004.

33 Annette Pruess, E. Giroult, P. & Rushbrook . "Safe management of wastes from healthcare activities." WHO - Geneva, ISBN 92 4 154525 9, 228pp, 1999. Jorge Emmanuel "Best Environmental Practices and Alternative Technologies for Medical Waste," Eighth International Waste Management Congress and Exhibition, Institute of Waste Management of Southern Africa-Botswana Chapter, 25TH to 28TH June 2007, Kasane, Botswana. Jorge Emmanuel and Ruth Stringer, "For Proper Disposal: A Global Inventory of Alternative Medical Waste Treatment Technologies."

Health Care Without Harm, January 2007, http://noharm.org/lib/downloads/waste/For_Proper_Disposal.pdf

34   See for instance http://www.grrn.org/zerowaste/zw_world.html http://www.buenosaires.gov.ar/areas/med_ambiente/basura_cero/, http://www.zerowaste.lacity.org/home/index.html

35   U.S. Energy Information Administration (EIA).http://www.eia.gov/totalenergy/data/annual/pdf/sec11_38.pdf. Retrieved 2011-09-05.

36   "Managing the Health Effects of Climate Change." The Lancet and University College London Institute for Global Health Commission, The Lancet, Vol. 373, May 16, 2009.

37   See for instance, "Acting Now for Better Health: A 30% Reduction Target for EU Climate Policy." Health Care Without Harm Europe and Health & Environment Alliance, Brussels, September 2010.

38   "Health in the Green Economy: Co-Benefits to Health of Climate Change Mitigation." Health Facilities, World Health Organization, 2010. [see earlier question on this citation]

39   Department of Energy, U.S. Energy Information Administration (EIA). "Commercial Buildings Energy Consumption Survey."

40   "Energy Star, Health Care: An Overview of Energy Use and Energy Efficiency Opportunities." (www.energystar.gov)

41   "Energy consumption indicators and CHP technical potential in the Brazilian hospital sector." Energy Conversion and Management, 2004, 45:2086.

42   "Health in the Green Economy: Co-Benefits to Health of Climate Change Mitigation." Health Facilities, World Health Organization, 2010.   [see note 37 above]

43   "Advanced Energy Efficient Building Technologies For High Performance Hospitals." Presentation by the University of Washington College of Built Environment's Department of Architecture Integrated Design Lab. 03/22/2011.PDF accessible online at www.gotham360.com/NYC_Logistics_agenda.pdf

44   "Healthy Hospitals, Healthy Planet, Healthy People: Addressing climate change in health care settings." World Health Organization and Health Care Without Harm, Discussion Draft, 2008. http://www.noharm.org/lib/downloads/climate/Healthy_Hosp_Planet_Peop.pdf

45   "Health in the Green Economy: Co-Benefits to Health of Climate Change Mitigation." Health Facilities, World Health Organization, 2010.

46   "Healthy Hospitals, Healthy Planet, Healthy People…" 2008.

47   "Combating Waterborne Disease at the Household Level." The World Health Organization, Geneva, 2007.

48   Combating Waterborne Disease at the Household Level." The World Health Organization, Geneva, 2007.

49   Robin Guenther, FAIA, LEED AP and Walt Vernon, PE. "Global Lessons in Healthcare." Healthcare Design Magazine, October 1, 2010, http://www.healthcaredesignmagazine.com/article/global-lessons-healthcare

50   Robin Guenther et. al. "Global Lessons …" October 1, 2010.

51   Reed, C. "Saving Water Counts in Energy Efficiency." Inside ASHE, Sept/Oct, 2005.http://www.energystar.gov/index.cfm?c=healthcare.ashe_sept_oct_2005.

52   Gleick P.H., Cooley H.S.. "Energy implications of bottled water." Environmental Research Letters, February 2009.

53   US Global Change Research Program (USGCRP) National Assessment Synthesis Team. Climate Change Impacts on the United States: The Potential Consquences of Climate Variability and Change, 2001. Washington, DC: USGCRP.

54   Frumkin, H., Frank,L., and Jackson, R. Urban Sprawl and Public Health. Washington, DC: Island Press, 2004.

55   Institute for Transportation and Development Policy, http://www.itdp.org/

56   Institute for Transportation and Development Policy, http://www.itdp.org/

57   "Saving carbon, improving health." National Health Service, pp. 54 -55.

58   "Health in the Green Economy: Co-Benefits to Health of Climate Change Mitigation." Health Facilities, World Health Organization, 2010.

59   See Proximity Principle, Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, Geneva, Switzerland. http://www.basel.int

60   "Obesity and overweight, Fact sheet N°311." World Health Organization, Updated March 2011, http://www.who.int/mediacentre/factsheets/fs311/en/

61   Jamie Harvie, Ted Schettler, Leslie Mikkelsen, Cornelia Flora. "Common Drivers, Common Solutions: Chronic disease, Climate Change, Nutrition and Agriculture." Institute for a Sustainable Future, Duluth, January 31, 2011.

62   UN Food and Agriculture Organization. "Livestock's Long Shadow." 2006 (http://www.fao.org/docrep/010/a0701e/a0701e00.htm)

63   "Menu of change: Healthy food in health care." Health Care Without Harm, Arlington, p.18, 2008,.

64   "Managing Pharmaceutical Waste: A 10 Step Blueprent for Healthcare Facilities in the United States." Practice Greenhealth, August 2008. http://www.practicegreenhealth.org/page_attachments/0000/0102/PharmWasteBlueprint.pdf

65   See http://www.fass.se/LIF/miljo_splash/index_en.jsp

66   WHO "Guidelines for drug donations." (1999). http://apps.who.int/medicinedocs/pdf/whozip52e/whozip52e.pdf

67   WHO & FAO, "Sound management of hazardous wastes from health care and from agriculture." Joint WHO and FAO Regional Workshop, Jakarta, Indonesia, (2006).   http://www.searo.who.int/LinkFiles/Publications_and_Documents_Hazardous_Report.pdf

68   WHO. "Guidelines for safe disposal of unwanted pharmaceuticals in and after emergencies.", Geneva, 31pp. (1999). http://www.who.int/water_sanitation_health/medicalwaste/unwantpharm.pdf

69   HCWH SEA . "BEST PRACTICES in HEALTH CARE WASTE MANAGEMENT: Examples from Four Philippine Hospitals." Health Care Without Harm South East Asia, 69pp, (2007). http://noharm.org/lib/downloads/waste/Best_Practices_Waste_Mgmt_Philippines.pdf

70   United Nations Environment Programme. "Buildings and Climate Change: Status, Challenges and Opportunities." 2007

71   Architecture 2030. http://www.architecture2030.org

72   UNEP. "Buildings Can Play a Key Role in Combating Climate Change." Oslo: 29 March, 2007, http://www.unep.org/Documents

73   Guenther, R. and G. Vittori. Sustainable Healthcare Architecture. New York: Wiley, 2008.

74   Thornton, J. "The Environmental Impacts of Polyvinyl Chloride (PVC) Building Materials." Washington, DC: Healthy Building Network. http://www.healthybuilding.net/pvc/ThorntonPVC-Summary.html

75   EPA. "Buildings and their Impact on the Environment: A Statistical Summary." April 22, 2009. www.epa.gov/greenbuilding/pubs/gbstats.pdf

76   "Global Healthcare Building Construction: Market Snapshot to 2014." World Market Intelligence, London, September 2010.

77   Robin Guenther and Gail Vittori: Sustainable Healthcare Architecture. New York: Wiley, 2008.

78   "Green guide for health care: best practices for creating high performance healing environments." Austin, Center for Maximum Potential for Building Systems, 2007. http://www.gghc.org/

79   Saving carbon, improving health." National Health Service, pp. 54 -55.

80   "Health in the Green Economy: Co-Benefits to Health of Climate Change Mitigation." Health Facilities, World Health Organization, 2010.

81   Summarized in Guenther, R. and G. Vittori. Sustainable Healthcare Architecture, New York: Wiley (2008). See also. European Concerted Action Environment and Quality of Life. Report No. 10. "Effects of Indoor Air Pollution on Human Health," prepared by Working Group 4. Bert Brunekreef (ed.), Commission of the European Communities, Joint Research Centre, Environment Institute (EUR 14086 EN, 1991).

82   The Global Market for Medical Devices, 2nd Edition. Kalorama Information, April 1, 2011. http://www.kaloramainformation.com/Global-Medical-Devices-6211502/

83   "Saving carbon, improving health." National Health Service, p.45.

84   "Ethical Procurement for Health: Overview, Ethical Trading Initiative." Ethical Trading Initiative, Medical Fair and Ethical Trade Group, British Medical Association, 2010 http://www.ethical-trade.org/sites/default/files/resources/EPH_Overview.pdf; Adrian O'Dowd, "BMA urges better awareness of use of child labour in NHS supplies," British Medical Journal, 2010; 340:c637.

85   "World Wildlife Fund's 2010 Living Planet Report." http://wwf.panda.org/about_our_earth/all_publications/living_planet_report/2010_lpr

86   Rawaf S. De Maeseneer J. Starfield B. "From Alma-Ata to Almaty: A new start for primary health care." The Lancet, 2008, 18,372(9647):1365_1367.

87   Carbon Trust, UK. http://www.carbontrust.co.uk/cut-carbon-reduce-costs/calculate/carbon-footprinting/pages/carbon-footprinting.aspx

88   The University of Sydney, Centre for Integrated Sustainability Analysis. "Carbon neutral - sense and sensibility." www.isa.org.usyd.edu.au/publications/CarbonNeutral.pdf

89   UNEP. www.unepscs.org/.../11-Carrying-Capacity-Mangrove-Management.pdf

90   U.S. Environmental Protection Agency. http://www.epa.gov/cleanenergy/

91   International Energy Agency. http://www.iea.org/efficiency/whatisee.asp

92   UNEP. "GEO-3: Global Environment Outlook." http://www.unep.org/geo/geo3/english/086.htm

93   The Organization of Economic Development. http://www.oecd.org/document/19/0,3746,en_2649_34281_35158227_1_1_1,00.html

94   IPCC. http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch3s3-2-2-2.htmlLEED

95   http://www.un.org/millenniumgoals/

96   "Living Building Challenge 2.0." International Living Future Institute: https://ilbi.org/lbc/standard

97   "Conference On The Establishment Of The International Renewable Energy Agency." 26 January 2009, Bonn, World Conference Center, IRENA/FC/Statute http://www.irena.org/documents/uploadDocuments/Statute/IRENA_FC_Statute_signed_in_Bonn_26_01_2009_incl_declaration_on_further_authentic_versions.pdf

98   http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm

99   United Kingdom Health and Safety Executive. http://www.hse.gov.uk/temperature/thermal/explained.htm

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Photos

p. 3: Smokestacks of a Coal Power Plant: pixelperfectdigital.com; Bikers in China wearing face masks: images.epochtw.com; Asthma Child: istock photo.

p. 7: clockwise:, photo: HCWH/Joshua Karliner; Photo: Nic Bothma/Kuyasa CDM; Butterfly Garden, Hospital San Ramon, Costa Rica; Changi General Hospital: Singapore.

p. 9: Hospital Nacional de Niños, Mexico, photo: HCWH.

p. 11: Laboratory chemicals: stock.xchng; digital thermometer, Philippines, photo: HCWH SE Asia/Pam Chua; Laboratory chemicals: stock.xchng.

p. 13: Waste management course, Bir Hospital, Nepal, photo: Ruth Stringer.

p. 14: clockwise: waste picker child, photo HCWH; burning medical waste, autoclave in Bagamoyo Hospital, Tanzania; medical waste segregation in Nepal, photos: HCWH/Ruth Stringer.

p. 17: Clinica Davila, Santiago, Chile, Photo: www.portaleconomico.cl.

p. 18: clockwise: Coal Power Plant: coal-is-dirty.com; Energy efficiency project, photo: Centro Medico La Raza, Mexico; China air pollution : photoeverywhere.co.uk; solar hot water heaters, Third Hospital, Nan Chang, China, photo: Walter Vernon.

p. 21: Hospital SacreCouer, Milot, Haiti, photo: Walter Vernon; Clinica Las Gaviotas, Colombia; water treatment, Apollo Hospital, Bangalore, India, photo: Walter Vernon.

Acknowledgements

About Health Care Without Harm

Health Care Without Harm is an international coalition of more than 500 members in 53 countries that works to transform the health care sector so that it is no longer a source of harm to human health and the environment.

We collaborate with doctors, nurses, hospitals, healthcare systems, professional associations, NGOs, governments and international organizations to promote the development and implementation of safe and environmentally healthy practices, processes and products in the health care sector.

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