

project development for the center and overseer of the project. The aim is to “help drive change in how health care buildings are designed and built.”

To that end, it has been involved with 80 organizations, including several in Canada, such as the Trillium Health Centre — Mississauga in Ontario, the St. Michael’s Hospital in Toronto, Ontario, the South Calgary Health Campus under construction in Alberta, the British Columbia Children’s and BC Women’s Redevelopment Project in Vancouver, and the Vancouver Island Health Authority’s Royal Jubilee Hospital Patient Care Centre in Victoria, BC.

“We’ve only scratched the surface with health care providers to actually practice evidence-based design.” — Mark Goodman, vice-president of the Center for Health Design.

The Royal Jubilee had three pillars for design, says Rudi van den Broek, chief project officer and general manager of special projects at the Vancouver Island Health Authority. “The first was to be elder friendly — a hospital designed for the needs of older adult ... the second, to attract and retain staff to provide the services for those older adults and the third was a focus on sustainability.”

Among the two highest-impact features are ceiling-mounted lifts in patient rooms and the creation of colour-contrast environments, van den Broek says. The lifts extend from a patient’s bed to the washroom and help nurses

transfer patients, which in turn, reduces back injuries for staff. Some 38% of all nurses in the United States suffer back injuries at work, according to the American Nurses Association, while studies have indicated dramatic decreases in nursing injury claims and days lost after the installation of ceiling lifts (*Applied Ergonomics* 2006; 37[3]: 377–85).

“We used colour contrast out of the dementia research field to make sure that older adults can pick out where the walls and the ceilings start, where handrails are,” van den Broek says. The hospital also boasts 83% single-patient bedrooms, improved visibility

of patient rooms from nursing areas, handrails throughout the hospital and plenty of natural light and fresh air (www.viha.ca/patient_care_centre). It has also decreased overhead paging by 99% from 12 700 pages per year to fewer than 200 as a result of Ulrich’s research showing that noise has a deleterious effect on patient stress.

“The people that I talk to, the front-line nurses and the hospitalists particularly the doctors that are here 24/7, they just love it. They think it’s wonderful, it’s calming, it’s quiet, it’s peaceful, it’s healing, it’s working very well,” van den Broek asserts.

Ulrich says the Royal Jubilee is one the world’s premier evidence-based design health care facilities, as evidenced by its award as the Best International Project at the 2010 Public Private Finance Awards.

Despite the advances in evidence-based design, Goodman cautions that “we’ve only scratched the surface with health care providers to actually practice evidence-based design.”

But there’s still a need for increased involvement from the health care profession, Goodman believes. “Many doctors get involved when they want to know where plugs are on the head wall,” he chides. “If the physicians and leadership of most health care organizations would be so inclined to learn about how the building, the infrastructure can actually help them increase outcomes, ROI [return on investment] and organizational effectiveness, that there would be substantial benefit for society.” — Nathan Stall, London, Ont.

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Editor’s note: Third of a three-part series.

Part I: Private rooms: A choice between infection and profit

(www.cmaj.ca/lookup/doi/10.1503/cmaj.109-4077).

Part II: Private rooms: The fiscal advantage

(www.cmaj.ca/lookup/doi/10.1503/cmaj.109-4078).

Swallowing the pharmaceutical waters

A prescription drug may begin its life as a pretty little pill, but after a brief detour through a human digestive tract and miles of plumbing, some of it ends up in drinking water. Though the levels of pharmaceuticals in drinking water are minuscule, in the parts per trillion, some researchers are concerned that long-term exposure to this low-dose cocktail could prove harmful.

“If you were to drink two litres of water a day for 70 years, at the end of those 70 years, you would have taken 1% of the normal daily dose of someone taking that prescribed medication. For a variety of standard medications, the concentrations are exceedingly low,” says Sébastien Sauvé, associate professor of environmental chemistry at the Université de Montréal in Quebec. “The question we don’t have the

answer to is: What is the impact of chronic exposure to a very low exposure to a mixture of drugs?”

Researchers have detected all sorts of drugs in drinking water — antibiotics, antidepressants, contraceptives and on down the list. The presence of endocrine disruptors, found in drugs such as steroids, has been shown to seriously mess with hormones in fish, decreasing fertility and even causing

sex change. Sauv e contributed to one study that found the presence of six antidepressants in brook trout (concentrated in the liver and brain) exposed to municipal effluent (*Chemosphere* 2011; 83:564–71).

The presence of certain drugs in water may have a cumulative effect, warns Sauv e. If antibiotics accumulate in the environment and work their way back into the human population, for instance, it could contribute to antibiotic resistance. Another concern is that exposure to even trace amounts of drugs could have a negative impact on the health of more vulnerable members of the population, such as babies who drink formula mixed with tap water.

One step that countries could take, and likely will in the future as research in this area grows, is to establish guidelines that limit the amount of drugs permitted to enter the water supply, suggests Sauv e.

“There is a total absence of thresholds. There are no guidelines,” he says, adding that “there is not enough literature or data to derive good-quality guidelines.”

Still, there are enough data to convince some experts that chronic exposure to even small amounts of drugs is best avoided, suggests Chris Metcalfe, professor of environmental and resource studies at Trent University in Peterborough, Ontario, who led a study that found traces of six antidepressants downstream from waste water treatment plants on the Grand River in southern Ontario (*Environ Toxicol Chem* 2010;29:79–89).

“The only way to fix the problem is to invest in better wastewater treatment to remove the pharmaceuticals before discharge,” Metcalfe writes in an email. “Of course, this focuses on the issue of effects on humans. What about aquatic organisms that are exposed?”

For its part, Health Canada is conducting a two-year national survey, to be published in 2012, of disinfection by-products and other contaminants in drinking water. The survey is looking for the presence of a number of pharmaceuticals, including atorvastatin, carbamazepine, diclofenac and gemfibrozil.

“The results of the study will help the department determine if new or



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emerging disinfection by-products and other emerging contaminants (e.g., pharmaceuticals) identified in the scientific literature are present in Canadian drinking water supplies and establish the priorities for guideline development. The survey will help determine the need for any action to minimize risk to human health from pharmaceuticals in drinking water,” St ephane Shank, a senior media relations advisor, writes in an email. “While there are no known adverse human health effects attributed to the extremely low presence of pharmaceuticals in drinking water, research continues to focus on detection and removal from drinking water.”

Provincial governments are also responsible for keeping drinking water drinkable and several have made efforts to monitor the levels of pharmaceuticals in the water supply. In Ontario, for example, the Ministry of the Environment has tested water for pharmaceuticals and personal care products (PPCPs) in the past, and has found contaminants, such as bisphenol A, but only at very low levels. The province takes a “source-to-tap” approach to testing water and plans to continue its efforts, according to ministry spokesperson Kate Jordan.

“We are continuing to study PPCPs

in water to help us better understand the potential environmental and health effects of these products,” Jordan writes in an email. “Studies are underway to continue to investigate the effectiveness of water treatment technologies to reduce pharmaceuticals and other emerging contaminants in source water.”

In the United States, government agencies are ramping up their efforts to monitor drugs in drinking water. “There is enough information to suggest there is potential for concern,” says David Trimble, a director in the natural resources and environment group of the US Government Accountability Office, which recently released a report calling for various government agencies, including the Drug Enforcement Administration, the Environmental Protection Agency and the Food and Drug Administration, to collaborate on monitoring drug levels in drinking water (www.gao.gov/new.items/d11346.pdf).

“These interagency efforts have been largely informal. We have made recommendations to establish a formal mechanism to coordinate this research,” says Trimble. “You have to do that to get the data to decide if you need to regulate or not. You need the data first.”

— Roger Collier, *CMAJ*

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