# Paging Dr. Data

How the coming skills revolution can transform healthcare
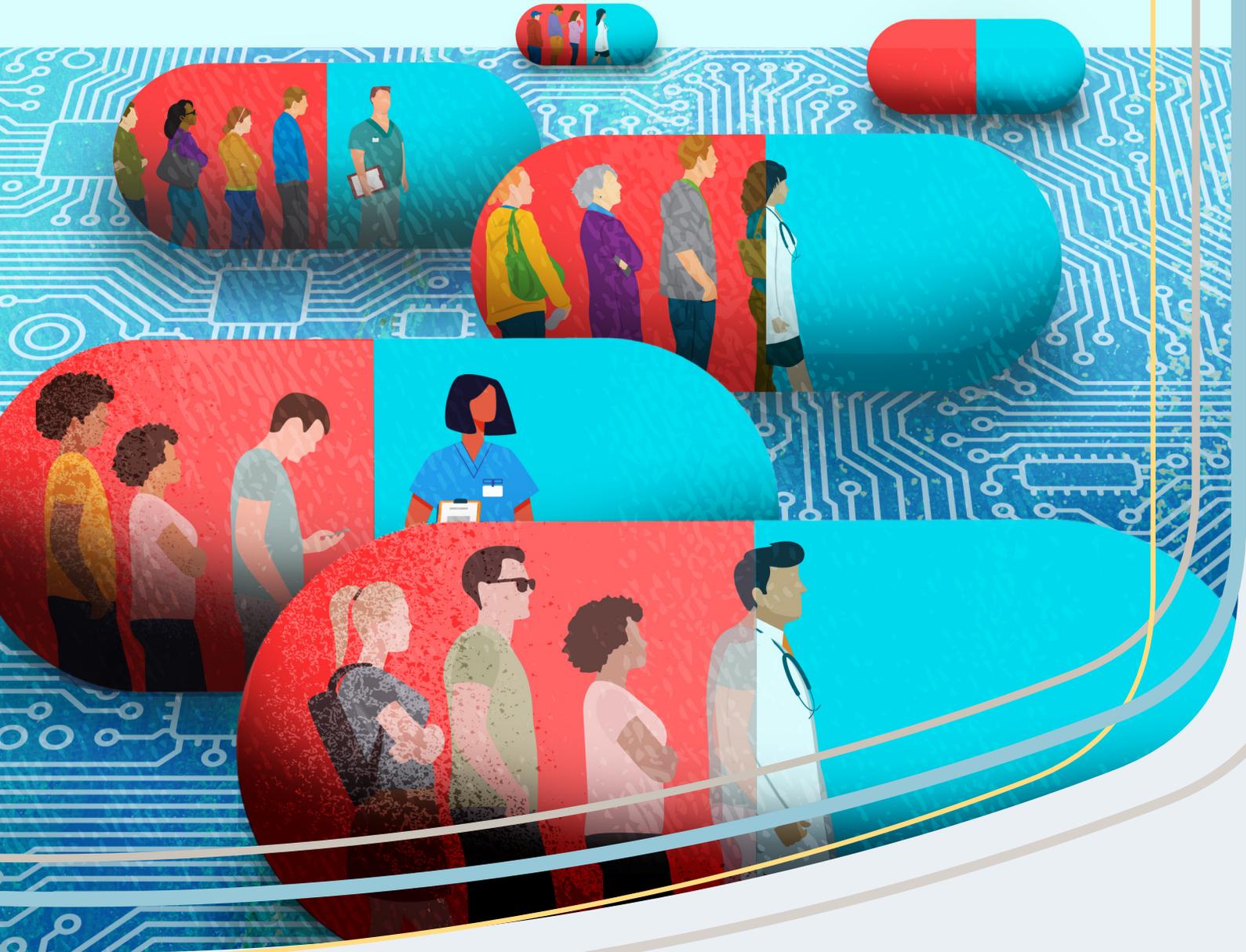
A Skills Remedy

Think back to the last time you were in a hospital, walk-in clinic or medical-imaging office. Chances are you saw people everywhere: conferring at a nursing station, darting in and out of examination rooms, or operating complex equipment.

In a workforce buffeted by technological change, healthcare has an advantage.

Due to the profoundly human nature of the work, automation doesn't pose the same threat to jobs that it does in other sectors. Technology will replace some work, including in administration and lab diagnostics, where it could give a welcome efficiency boost to a sector facing increasing demands. But we don't expect a robot to deliver a cancer diagnosis or replace hands-on homecare anytime soon.

That's a welcome prognosis, and not only for those working in the sector. Canada's healthcare system faces a people crisis. Our society is aging rapidly, and we haven't even seen the first wave of the silver tsunami that's about to hit. The earliest Baby Boomers turned 73 this year, meaning they're still a decade away from the average age at which people start to need long-term care. The healthcare demands from an aging population will be acute for decades after that. We'll need more people caring for more seniors.

Automation presents an opportunity for healthcare—but it also poses a major reskilling challenge. Advances in artificial intelligence and machine learning have strong potential to predict disease. But medical practitioners will first need to understand the underlying algorithms—and their limits. Big data may help hospitals better allocate resources, but they'll have to bulk up on data analysts. Tools exist to help healthcare practitioners collaborate across specialties and institutions, but many doctors still communicate via the fax machine.

The upskilling challenge isn't limited to healthcare. As RBC's Economics and Thought Leadership group has detailed in our research series on the future of work, technological disruption is upending old ways of work, from construction to transportation. It's also showing us the path to new ways of work, and opportunities for Canada to become a global champion in sectors such as agriculture.

The digital natives entering the Canadian healthcare workforce know this. They expect to work with new technologies. If healthcare doesn't offer state-of-the-art systems, or adapt to changing ways of work, it risks losing top talent to other sectors. Meanwhile, those already working in the system must be encouraged to shed ingrained ways of working and to embrace the promise of technology.

Automation won't replace the most human aspects of healthcare. It will enable its practitioners to do the essential, human part of their jobs better than before.

This report complements the findings in RBC's *Humans Wanted* report on the impact of automation on the future of work. *Humans Wanted* and its subsequent research was designed to inform Future Launch, RBC's decade-long commitment to helping Canadian youth prepare for the skills economy of the 2020s and beyond.

For more information about RBC's skills research:
Paging Dr. Data: rbc.com/pagingdrdata
Humans Wanted: rbc.com/humanswanted

Key Findings

1 Healthcare added one-sixth of all new jobs in Canada since 2010, around 400,000.

2 By 2025, there will be another 370,000 job openings in healthcare.

3 Only 17% of jobs in the sector are at significant risk of automation, compared with 34% in the overall economy.

4 Over 1 million Canadians currently in at-risk occupations have at least three of the top five in-demand healthcare skills.

5 The cumulative additional healthcare tab from aging is projected to be $120 billion over the next decade.

6 By 2030, caring for seniors will consume 55% of provincial healthcare budgets, up from 45% now.

7 Upskilling the health workforce will ultimately drive efficiencies but will require upfront investments.

The robots are coming— just not for most healthcare jobs

In our 2018 *Humans Wanted* report and subsequent research, we took a broad look at the rise of the skills economy, in an effort to understand how Canadians can prepare for a future defined by AI and other disruptive technologies.

While we found that one-quarter of Canadian jobs will be heavily disrupted in the next decade, occupations drawing on human skills like critical thinking, active listening and social perceptiveness are far less likely to succumb to automation, even if they are profoundly altered by technology.

Applying our methodology to healthcare, we found that a majority of jobs are at a low risk of automation.

Non-health occupations most at-risk for automation
Employment (thousands)

Healthcare NOC Subgroup
- Assisting occupations
- Medical technologists
- Nurses
- Other health diagnosing and treating professions
- Other technical occupations
- Pharmacists, dieticians and nutritionists
- Physicians, dentists and vets
- Technical occupations in dentistry
- Therapy and assessment professionals
- Total non-health occupations

Low Risk | Moderate Risk | High Risk

Source: Statistics Canada, Frey and Osborne (2017), RBC Economics

Automation risk across major sectors

Hospitality & Food
57%

Manufacturing
35%

All Industries
34%

Healthcare
17%

Educational Services
10%
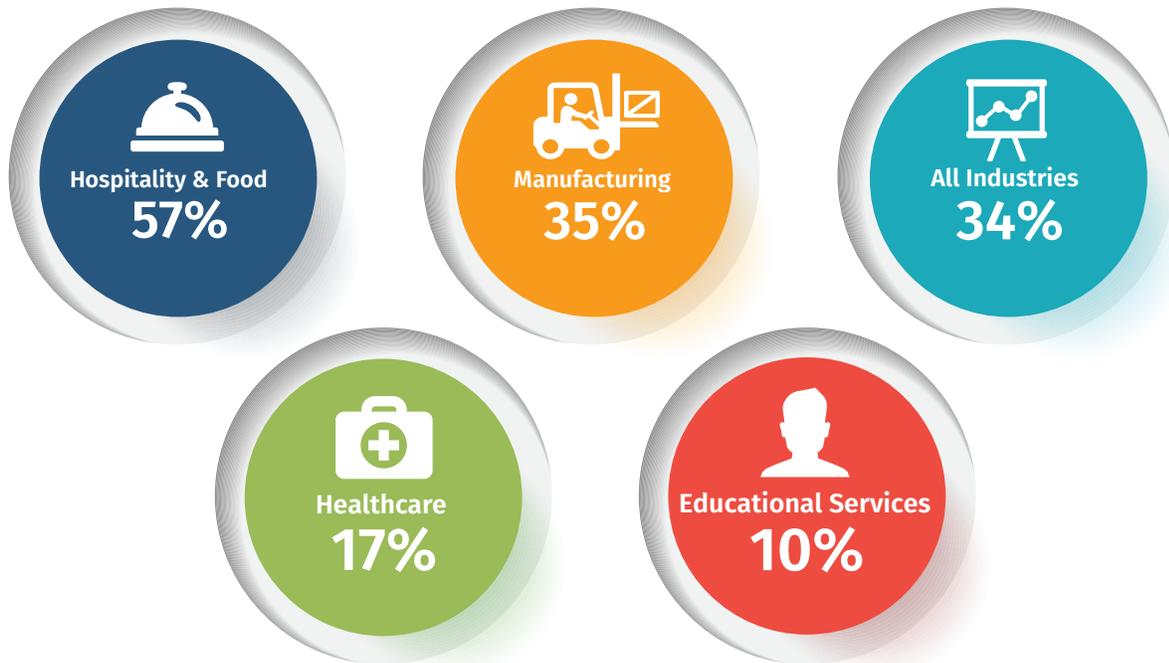
Automation is a significant risk for only about 17% of the healthcare workforce over the coming decade. Those jobs (about 340,000) fall largely within healthcare support—including administrative assistants and food-counter attendants.

Automation isn't going to replace the complex interplay of active listening, evidence-based decision-making, intuition and empathy that arises in the most basic of visits to the family doctor, let alone in bigger health emergency requiring a team of medical specialists.

That means the majority of healthcare jobs aren't going away anytime soon.

What's more, technological advances will create new jobs in the sector. They include the data scientists who can mine hospitals' growing databases for key insights on how to improve patient outcomes, the 3D printing technologists who can create anatomical models for surgical planning, and the machine-learning specialists who can teach a smart prosthetic arm to anticipate an amputee's movements.

The healthcare job machine isn't about to slow down

If you include not only doctors and nurses but the lab technicians, administrators, food-service workers and others who provide all manner of direct care or support for healthcare, Canada's healthcare sector employs more than 2 million people.

And it's getting bigger, representing 13% of total Canadian employment, compared with 8% in 1980. Healthcare has accounted for one-sixth of all job growth in Canada since 2010: that's 400,000 more jobs. About 340,000 of those are in direct medical care rather than support jobs.

Percentage of total employment accounted for by the healthcare industry in Canada
Percent (%)
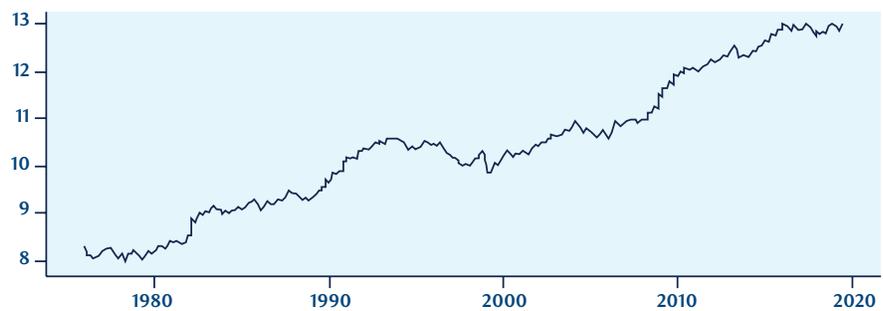
Source: Statistics Canada, RBC Economics

The sector's pace of job growth will continue to exceed that of the overall Canadian economy. There will be another 370,000 new jobs in healthcare by 2025, Employment and Social Development Canada (ESDC) predicts, as an aging Canada needs more physicians, nurses, medical technicians and nurse's aides.

Needed by 2025

| Doctors 47,000 | + | Nurses 123,000 | + | Technicians & Support 108,000 | + | Nurse Aides &Orderlies 93,000 |

ESDC expects many of those openings to be filled by new graduates (250,000), immigrants (50,000) or workers migrating into healthcare from other industries (50,000). Even under the most optimistic scenario, where all those people do enter the sector, healthcare will need even more workers—almost 20,000—than will be available.

# A path for disrupted workers?

The risk of being displaced by automation is twice as high in the overall Canadian workforce as in healthcare. Does healthcare—a growing field— provide opportunities for disrupted workers in other industries? We believe it does, especially when viewed through a skills lens.

The importance of skills mobility, and the increasing need for it, was the central finding of our 2018 *Humans Wanted* report. We've championed a skills focus that will allow Canadians to weather technological change by focusing on some core skills that underpin groups of occupations, making career transitions easier and more apparent.

By our count, more than 1 million Canadians in at-risk jobs have at least three of five key skills that will be especially important for the healthcare jobs of the 2020s. Those skills are speaking, active listening, service orientation, social perceptiveness and monitoring—very human skills. Potentially available to them: around 330,000 healthcare jobs needing at least three of those five skills.

Transferable skills

Skills in at risk jobs
Operation and control
Operations monitoring
Repairing

Skills in healthcare jobs
Critical thinking
Judgment and decision-making
Science
Complex problem solving
Instructing
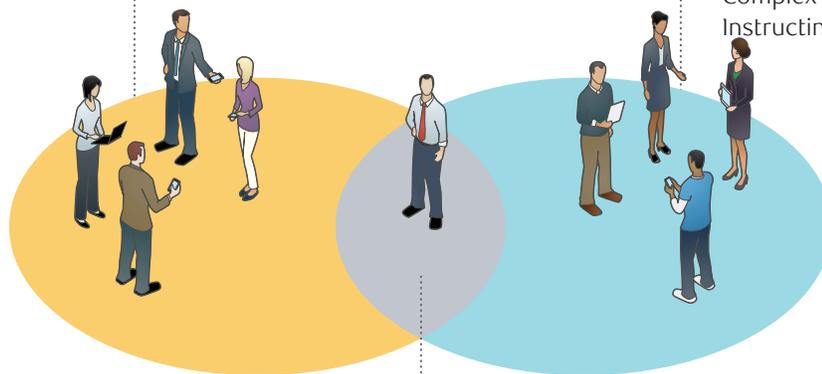
Skills overlap
Speaking
Active listening
Service orientation
Social perceptiveness
Monitoring

Does that mean legions of truck drivers displaced by self-driving technology will become doctors? No. Could a displaced retail worker become a patient-flow coordinator in a busy outpatient clinic? Yes. We believe that, with the right training, many at-risk workers are well positioned to cross into the healthcare field. The individuals facing the easiest path will be the ones with a combination of the social skills we've cited and some digital skills. But the opportunity is broader than that.

Transitioning between occupations isn't easy. It calls for individuals to find time and money to retrain, a significant personal commitment. But it's do-able, particularly with the right support. In the case of healthcare, it will be up to educators, employers and policymakers to recognize

the transferability of skills, and to provide opportunities to help bridge any skills gaps.

Some educators are already doing this. Computek, a Toronto-area private career college that offers diplomas in personal support care, medical office administration and medical IT, says the majority of its students are in the middle of their career, and looking either to upskill or to find a Canadian healthcare job after having held one in another country. Meanwhile, the number of fast-track nursing programs in Canada has almost tripled over the last 15 years, drawing in candidates who've already completed some relevant studies and want to pursue a career as a nurse without having to undertake a full four-year program.

Possible transitions

Delivery/courier service driver
Drives automobiles, vans and light trucks to pick up and deliver various products.

Risk of automation: high
The rise in autonomous vehicles, and the implementation of drone delivery, will shift employment away from human delivery.

Currently employed: 70,000
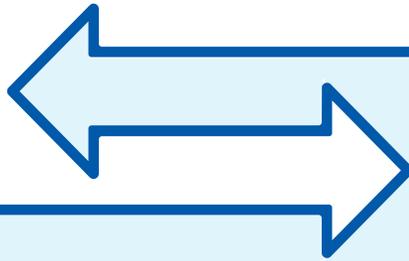
Paramedic
Administers pre-hospital emergency medical care to patients with injuries or medical illnesses and transports them to hospitals for further care.

Risk of automation: low
Currently employed: 28,000
New openings: 4,000 until 2025

Skills in common:
Operation and control of equipment or systems, active listening, speaking, monitoring, time management, service orientation

Reskilling steps:
- Completion of a one- to three-year college, hospital-based or other recognized paramedical or emergency medical or emergency medical technology program
- Licensing by a regulatory body

Possible transitions

Accounting technician/bookkeeper

Maintains complete sets of books, keeps records of accounts, verifies the procedures used for recording financial transactions, and provides personal bookkeeping services.

Risk of automation: high
Increased use of computer software, rise in e-business, and blockchain technology will lower the demand for intermediaries in financial transactions.

Currently employed: 170,000
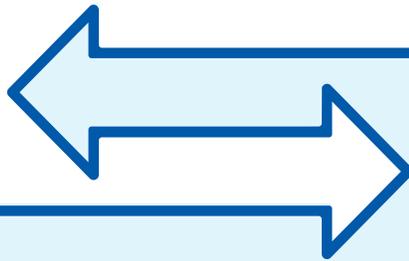
Dietitian/nutritionist

Plans, implements and oversees nutrition and food service programs.

Risk of automation: low
Currently employed: 13,000
New openings: 3,000 until 2025

Skills in common:
Information ordering, active listening, critical thinking, reading comprehension, monitoring

Reskilling steps:
- Bachelor's or Master's degree in dietetics, nutrition, or a related field such as food and nutritional science, along with a period of supervised training.
- Dieticians must register with a regulatory body, while nutritionists need to register in certain provinces

The upskilling imperative: an aging Canada

Remember the population pyramid? In 1961, children gave Canada's a wide base, reflecting a well-established Baby Boom. One-year-olds outnumbered 80-year-olds about 12:1. Fast-forward to today, and the distribution of ages doesn't look anything like a pyramid. In 2018, seniors accounted for a bigger percentage of Canada's population than children aged 14 and under: 17.5% versus 16.1%.

By the end of the 2020s, nearly one in four Canadians will be seniors. Some regions, especially Atlantic Canada and Quebec, will be greyer than others, but all of Canada will be in the company of what the United Nations has dubbed "super-aged societies": those in which more than 20% of the total population is 65 or older.

More Canadians will be dealing with multiple diseases (or other consequences of aging) simultaneously. Aging will place additional demands on our hospitals. It will further strain our ability to provide in-home care—a subsector that will face increasing demand given the trend towards aging in place. That's a concern for an industry that struggles to attract personal support workers (PSWs), not least because of low pay and physical demands. It's imperative that we look to new technologies and new ways of working to help meet the challenge.
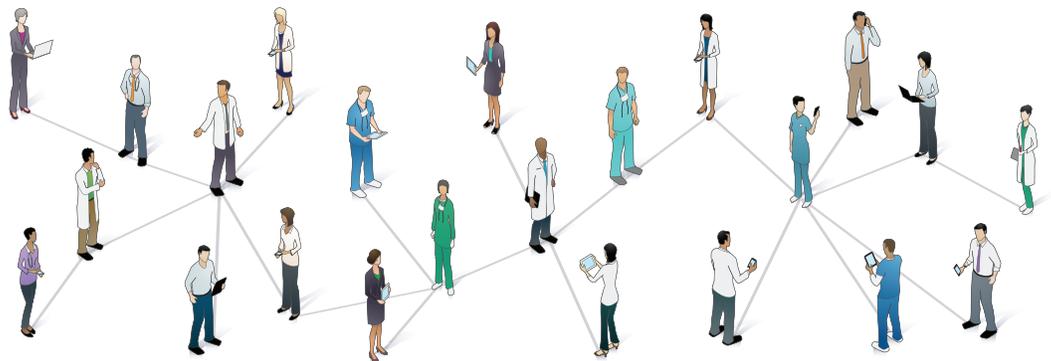
Percent of population 65 and older and 14 and younger (projected out of 2030)
Percent (%)
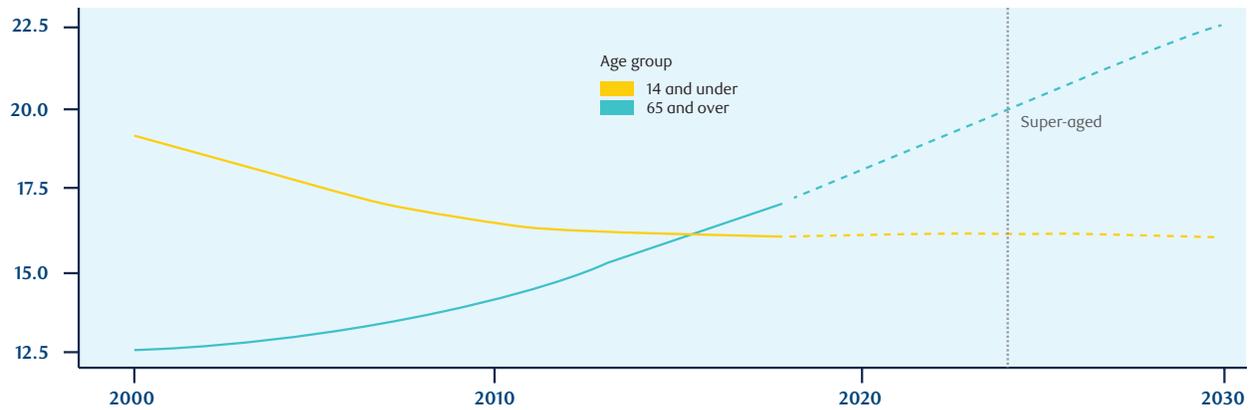

Source: Statistics Canada, RBC Economics

The growing healthcare burden associated with aging underscores the urgency. Canada's provinces and territories spend about $160 billion a year on healthcare. Our research indicates that, even if we keep per capita healthcare spending constant, all those new seniors will raise—in real terms—the annual bill to $193 billion in 2030. That year, the healthcare tab will be $20 billion higher than it would have been if Canada's age distribution remained at today's levels.

Over the course of the decade, the cumulative additional cost will be $120 billion.

In 2030, caring for seniors will consume some 55% of provincial and territorial healthcare budgets, compared with 45% now. Governments will look to extract more efficiency and productivity from the healthcare system. They won't get those savings from automating away jobs. Because at-risk positions fall at the lower end of the salary range in healthcare, their replacement won't move the dial much in a system facing rising costs. Of the roughly $100 billion annual salary tab for Canada's public healthcare, the wage savings from automating all 340,000 at-risk jobs would be around 12%.

Some common skills remedies

In the course of preparing this report, we held roundtable discussions and talked to dozens of people with a deep interest in the future of healthcare skills: from employers and practitioners, to educators preparing the next generation of healthcare workers, to the startups aiming to disrupt established care-delivery models. Some common upskilling themes emerged.

Digital fluency

As healthcare relies increasingly on data, more workers will need digital literacy and digital fluency: the ability to interact with and analyze data, not just collect it. Physicians will require a working knowledge of the machine learning models being developed to help them make better diagnoses. Nurses, for whom bedside documentation is already a big part of the job, will need to learn more about big data.

With everyone from doctors to PSWs engaging with data, educators are building digital fluency training into their programs. Lori Cranson, Dean of Community Services and Health Sciences at Toronto's George Brown College, says one goal is to ensure students have "the core skills to adapt to any technology, as opposed to a specific technology."

Understanding the benefits, and limits, of AI in medicine

The Royal College of Physicians and Surgeons of Canada convened a task force on AI and emerging digital technologies to understand how machine learning could change the profession, and to inform the training of current and future doctors. The goal isn't to make every one of them an AI specialist, but to strengthen physicians' ability to interpret data and identify outliers, says Tanya Horsley, Associate Director of the College's Research Unit. Part of the impetus for the effort, according to her colleague Ken Harris, Executive Director of Specialty Education, is aging. The task force, which includes leading Canadian AI experts, will help the College "understand the skills we need for a future where more people will be at home," Harris says.

Morgan Lim, PhD
Manager, Data, Insights & Advanced Analytics
Trillium Health Partners, Mississauga, ON

Morgan's impressive academic credentials include a Bachelor's in Health Economics, an MA in Economics and a PhD in Health Research Methodology. At Trillium Health Partners, she leads the development of a big data platform whose goal is to improve the hospital network's understanding of its patient population, to help it plan for the care needs of today, and tomorrow.

Morgan is often called on to educate others within the hospital system on the use of data and ethical issues around AI.

Morgan says data projects need to be co-designed with those who will actually use the models. Getting buy-in and building trust are critical. She relies heavily on communication and knowledge-translation skills, or the "storytelling" around big data. Decision-makers need to be given the full picture, she says, not just data points. "We need champions to help bring new approaches to the front lines. My role is create the environment where we can turn data into insights, and turn those into action."

Virtual caring

Virtual care has the potential to increase the healthcare system's reach and offset some of the cost and labour burdens being placed on the healthcare system by our aging population. It could also serve as a vital lifeline for the millions of Canadians who will age, often with complex health problems, at home. Or to extend healthcare services to remote First Nations communities. Getting it right will require ensuring that workers have the skills to assess and treat patients in a virtual environment. And making more of healthcare's client base—older Canadians—comfortable with the associated technologies.

Extending access to healthcare professionals

eShift—a Canadian technology—links a registered nurse in a centralized setting to one or more PSWs in the field, typically via a handheld device. The PSW acts as the "hands, eyes and ears" of the nurse, who directs specific actions. The delivery model requires more training and judgment on the part of the PSW, who is in turn more connected to the patient's care-delivery team. The program was designed to address a shortage of nurses available to provide in-home care to children with complex medical needs and to those needing palliative care.

John Pawlovich, MD
Medical Director,
Family Physician
Carrier Sekani Family Services, Abbotsford, BC

John spends a week a month on the road, serving five First Nations communities in northern British Columbia. The rest of the time, he practices telemedicine from his home in southern B.C., using technology to provide the same services. John says that when virtual care is done right, the technology "melts away," allowing physician and patient to develop a deep and genuine relationship.

Digital fluency is important in this work, but John says the key skill is relationship-building: from knowing how to establish eye contact and to actively listen, to being consistent and clear in one's communications.

As a pioneer in telemedicine, John is training a new generation of doctors, both in Canada and elsewhere, to build virtual care into their practices. "Providing telehealth is not a technical question, it is a human one. The tech facilitates the relationship, but does not define it."

Bridge building

Healthcare is siloed. Practitioners—specialized, with a defined focus and skillset—can be somewhat disconnected from other parts of the system. Uneven progress on the implementation of electronic medical records in Canada hasn't helped, even though they have the potential to increase collaboration and transparency across the system. Workers say they sometimes lack the ability, and language, to share information with those in other specialties. What's more, older patients tend to experience comorbidities (multiple diseases), so in an aging Canada, healthcare workers will need a greater understanding of multiple diseases and to communicate with numerous practitioners or specialists in different fields.

The need for connectors has given rise to new roles, notably nurse navigators, pivot nurses and system navigators. Workers in these roles are essentially bridge-builders, helping patients interact with different parts of the healthcare system.

Post-secondary healthcare programs for systems navigators

York University and Humber College are among the institutions offering a patient navigator-type certificate. They're training a new generation of healthcare professionals to assist patients dealing with cancer or other major diseases as they make their way through the complexities of the healthcare system. The role requires understanding and communicating the availability of services, coordinating with inter-disciplinary teams, and assisting patients in decision-making.

Sabrina Lavoie
Pivot nurse
L'Hôtel-Dieu de Québec, Quebec City, QC

Sabrina is an oncology-focused pivot nurse at L'Hôtel-Dieu, a teaching hospital affiliated with Université Laval. She acts as a central resource for patients suffering from gynecological cancers.

Most of Sabrina's work is by phone. She handles around 15 calls a day, evaluating symptoms, providing information on drug side effects and supporting distressed patients. Sabrina says her job requires her to learn continuously. She's the patient's direct link with numerous parts of the healthcare system, from the doctors treating the patient's cancer to the social workers, psychologists and PSWs a patient may at some point need.

Sabrina has both a nursing diploma and a Bachelor's degree in Multidisciplinary Studies. She came to her role after stints in nephrology and administering chemotherapy. "I love my job," she says, "because it's one of the only roles that responds to all of a patient's specific needs."

Empathy and resiliency

Healthcare work isn't for everyone. It can be messy, stressful and emotionally difficult, and regularly draws on human traits that robots will never possess. Empathy is the most commonly cited, but empathy in healthcare isn't the same as empathy in retail. As technology complicates the challenge, educators are preparing. More schools are incorporating soft skills training into the curriculum, and reinforcing the need for problem-solving, resiliency and especially, adaptability.

Medical schools are re-focusing on the core purpose of the physician

Trevor Young, Dean of the Faculty of Medicine at the University of Toronto, says the school is moving away from a focus on the perfect GPA and looking at medical school candidates' social and inter-personal skills. The president of the Medical Council of Canada, Jay Rosenfield—who's also vice-dean of medical education at Western University—adds that the medical field is re-thinking the way it evaluates physicians-in-training. It's looking to put a great effort on "fluid intelligence"—the ability to problem-solve in new situations—rather than on "crystallized intelligence" or acquired knowledge and facts. Crystallized intelligence, or foundational knowledge, isn't going away, but the balance is shifting. "Master adaptive learners is who we are looking to train," Rosenfield says.

Grace Cummings
Continuing Care Assistant
Shannex Corp., Enfield, NS

For Grace, an aging Canada isn't some future concept: she works at a long-term care facility in the province with the highest proportion of seniors. She provides the most intimate, hands-on care one can give— waking, dressing, assisting with eating and toileting— for patients coping with multiple health challenges. Grace says patience and empathy are crucial for work that's physically and emotionally taxing.

Grace cultivated these traits even before studying at Nova Scotia Community College to become a continuing care assistant. Time in customer service gave her the skills to resolve challenging situations. As a former waitress, she's able to quickly record people's needs. And as a cook in the military, Grace acquired knowledge of nutrition and food preparation, which she draws on for occasional kitchen work for her employer. "People arrive in long-term care now with more complex needs, demanding a wider skill set for care."

Toward a healthier agenda

What today's skills can do for tomorrow's healthcare

The key players in Canadian healthcare have seen the diagnosis, and it's troubling. Our aging population is about to become a silver tsunami, bringing with it a new burden on hospitals, clinics and long-term care facilities. Technology can help meet some of those needs, if you consider the rise of elder-care robots and automated pill dispensers, or the potential of AI-powered diagnostics and video-enabled remote care. But for all the promise of technology, it won't displace the vast majority of front-line care jobs. As this report has laid out, we'll need more people than ever working in healthcare—and the demand will surge at a time when there may be fewer people available. If we don't develop a new and urgent approach to skills in the health sector, the results could be painful.

A thoughtful prescription will require more than numbers. New skills are needed. Across every line of care, there are new demands emerging that we're not adequately training for. Data analytics, sensor monitoring and wearable-device coding are just a few. And even though technology will play a leading role, there will be a growing demand for the very human qualities that have always defined good care: skills like active listening, critical thinking and complex problem solving. As the sector automates mundane and repetitive tasks—record keeping, for instance—those skills will be more valuable than ever. They'll be needed as well, to augment the advances in AI and machine learning that offer the potential to deepen our understanding of disease, along with its detection and prevention.

The healthcare sector doesn't need to tackle this on its own. As a start, it can learn from other sectors in the throes of a skills revolution, and share its own discoveries. That's already underway among the many healthcare educators adapting courses from other disciplines, be they hard skills like coding and robotics or soft skills like empathy and cultural awareness. Educators will also need to do more with those already at work, helping them update their skills on an ongoing basis. The biggest challenge, though, will be to find ways to help workers from other sectors transition into healthcare. It's an enormous, albeit complex, opportunity that will require governments and professional bodies to challenge themselves to think well beyond traditional career paths and compensation models.

Properly designed, this mix of technology, skills and innovative management can soften the landfall of the silver tsunami, and further prevent the cresting cost of healthcare from overwhelming government budgets. It may even attract a new generation to healthcare, restoring balance to a sector that's critical to our society's health.

Calls to Action

- Encourage the provinces to work together on a national skills strategy for healthcare and to identify common talent shortages

- Develop a system of elder-care leave, so that family members can take time to care for aging parents easing pressures across the healthcare system

- Create and expand second-career bridge programs (such as second-entry nursing programs) to attract professionals into healthcare without requiring years of additional schooling

- Encourage the healthcare sector to partner with innovation labs on cutting-edge AI and data projects to solve healthcare inefficiencies

- Develop industry-wide data governance standards and give workers the tools to handle the ethical and privacy challenges particular to healthcare

- Create a dashboard of public labour market information detailing the location of labour shortages across the Canadian healthcare sector

- Create more work-integrated-learning opportunities in healthcare for students in non-health disciplines, to inject new ideas and ways of working into the sector

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