AGING POPULATIONS AND THE FUTURE OF LONGEVITY

Legal, Economic, and Policy Implications for Canada



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About the Working Group

This report was written by Benjamin Lee, Camille Lisse, Jithvan Ariyaratne, Kasia Wodz, Keira Lomoro, and Madeleine Zajdlik. It was edited by Julissa Gonzalez and Joshua Morrison.

This report explores the implications of aging populations and advances in health, technology, and longevity for Canadian policy. It examines four interconnected areas—pension sustainability, equitable access to life-extension technologies, genetics and insurance, and intergenerational justice and climate policy—highlighting the challenges and considerations associated with extended lifespans and changing demographics. Drawing on Canadian policy and selected international comparisons, the report considers how existing economic, social, and policy systems may respond as people live longer.

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Aging Populations and the Future of Longevity

Introduction

Advances in health, technology, and longevity have the potential to extend human lifespan and healthspan, reshaping longstanding assumptions about aging longevity. At the same time, aging populations already present challenges for existing economic, social, and policy systems, raising questions about how these systems may need to respond as people live longer.

This report examines these issues across four interconnected areas of Canadian policy: pension sustainability, equitable access to life-extension technologies, genetics and insurance, and intergenerational justice and climate policy. Drawing on Canadian policy and selected international comparisons, each part considers the implications of aging and extended longevity within a different policy context, including how existing systems may respond to changing demographic realities.

Part 1: Pension Systems and Economic Sustainability in an Aging Society

1. The Pension Challenge of Population Aging

Since the 1990s, international organizations like the World Bank and International Monetary Fund have raised concerns about the viability of existing pension plans given the foreseeable demographic shift towards aging populations and baby boomers' retirement. Many industrial economies, including Canada, have public pension plans run on a "pay-as-you-go" (PAYG) basis, where contributions from current workers go to current beneficiaries. With a larger population of retired beneficiaries, contribution rates would similarly have to increase. An IMF analysis in 1994 projected that contribution rates in Canada would rise from 5 percent of eligible earnings to 13 percent in 2030 if the pension system remained a fully PAYG defined benefit model (meaning benefits are fixed, meaning contributions would have to adjust to accommodate retirees).[1]

Following subsequent recommendations to reform the pension system to take pressure off the PAYG system, Canada and many peer economies have incorporated pre-funding into their pension systems. This means that current workers' contributions are used to finance their future benefits. Moreover, scholars note other features of this general phenomenon called "pension financialization", which is associated with (1) increased dependence on capital funding and therefore financial markets, (2) a shift in investment policy away from fixed-income assets like bonds towards higher-risk investments like corporate equities, and (3) a shift away from defined benefit towards defined contribution pensions.[2]

In light of this broader movement, this report includes an overview of how Canada has adapted to the aging population risk, followed by a comparative analysis with the Japanese system. This

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[1] Tayim Bayoumi, "Aging Population and Canadian Pension Plans" (1994) 94:89 IMF Working Papers 1.

[2] Jyri Liukko, Aaron Doyle & Turo-Kimmo Lehtonen, "Pension financialization and collective risk sharing in Canada and Finland" (2023) 76:3 International Social Security Review 91 at 92.

comparison highlights the necessity of the shift towards pre-funded pension systems and the unique benefits of Canada's public pension, which reduces the degree of risk that is placed on individual pension beneficiaries.

2. The Canadian Approach

The Canadian Pension Plan's (CPP) initial response to the looming crisis posed by an aging population was to increase pre-funding as well as its contribution rates pre-emptively, from 3.6% to 9.9% in the late 90s and early 2000s. This was meant to reduce the steep rate of growth that future generations might face. The most significant reform to Canada's system with respect to pre-funding happened in 2016, when the CPP added a fully pre-funded "additional CPP" to enhance future benefit levels.[3] Moreover, in 1997, a major financing reform allowed for greater yield-seeking and riskier investment strategy, resulting in a significant decrease in the share of fixed-income assets for these pension funds (100% down to 25%) just 10 years later. This also proved to be an effective vehicle to invest in and stimulate provincial economies.[4] Much of the remaining share went to equities, as well as real estate and infrastructure following the 2008 financial crisis. This shift towards pre-funding and higher-risk investment strategies falls within the trends noted above, which are generally associated with pension financialization. However, Canada's public pension plan does not share the third trend of financialization, which is to shift towards a defined contribution model. Unlike the US and the UK, which have increasingly emphasized occupational pension programs, which are more often defined contribution programs, Canada has maintained a well-funded public defined benefit program in the CPP.

While the two models are similar in that they both rely on capital funding and invest in non-fixed-income assets, there is a key difference with respect to how risk to beneficiaries is distributed. For instance, in the event of a projected deficit in either the base or additional CPP, measures like weakening price indexation or increasing contribution rates are available, and automatic adjustments are legislated for when finance ministers cannot agree on a response. Moreover, the additional CPP can be adjusted by reducing future benefits by up to 5% or increasing contribution rates. These provide resilience with respect to potential reductions in pension benefits, and pension-related risk is limited to the collective level.

3. Comparative Approach: Japan

Japan uses a modified pay-as-you-go pension structure. The Japanese pension system has a basic universal pension and an earnings-related component, but both are primarily financed by contributions from current workers. Japan operates the Government Pension Investment Fund (GPIF), which is a public pension fund that is similar to the CPP, but fulfils a different objective. The GPIF is primarily a reserve fund that supplements the PAYG system, whereas the CPP underpins the pre-funded component of Canada's pension system. Consequently, the majority of

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[3] *Ibid* at 98.

[4] *Ibid* at 99.

pension benefits in Japan are paid out of contributions from current workers, which exposes the system to pressures from demographic changes.

The primary challenge to the Japanese pension system is the country's aging population. The stability of PAYG systems depends on having a stable or growing ratio of workers to retirees. Japan has a rapidly aging population, a low fertility rate, and a low immigration rate. This amounts to a shrinking ratio of workers to retirees, the opposite of the necessary trend for a stable PAYG system, as there are a growing number of beneficiaries with fewer contributors to fund their pensions. Therefore, to reverse the declining ratio of workers to retirees, the Japanese government is faced with difficult choices, such as raising the retirement age, increasing current contribution levels, increasing government borrowing, or attempting large-scale reforms.

The aforementioned potential solutions to Japan's pension crisis all raise issues pertaining to intergenerational equity. People who were born during the post-World War II baby boom benefited from having to make smaller pension contributions than are currently necessary, as there was a much smaller pool of retirees than currently exists. As the baby boomer generation enters retirement and the fertility rate declines simultaneously, the current generation of workers must support a much larger pool of retirees than previous generations. Solutions such as increasing the retirement age or raising contribution levels would worsen this burden by forcing the current generation to pay for the problem created by the absence of pre-funding.
Pre-funding a pension system is the most efficient approach to the intergenerational equity problem. Having the current generation of workers fund their own retirements protects future generations from needing to make disproportionate contributions to support retirees. However, it is difficult to adopt a pre-funding system in places that have historically relied on a PAYG system, such as Japan. Transitioning to a pre-funded model from a PAYG system would create a "double burden," where the current generation would have to support the current pool of retirees and their own retirements at the same time. Ultimately, there is no simple solution to the intergenerational equity problem that would not create short-term difficulties before the long-term benefits begin to materialize.

4. Key Takeaways for Canada

The Canadian experience highlights the importance of anticipating demographic change rather than responding only after pension pressures materialize. Canada's shift toward greater pre-funding has reduced reliance on future workers to finance the retirement of older generations, while the continued use of a public defined-benefit model allows pension-related risks to be shared collectively.

The comparison with Japan further demonstrates that pension sustainability is closely connected to intergenerational equity. Systems that depend heavily on current workers to support current retirees become increasingly vulnerable as populations age and the ratio of workers to beneficiaries declines. Canada's combination of pre-funding, diversified investment, and collective risk-sharing therefore provides an important measure of resilience as demographic aging continues.

Part 2: Equitable Access to Life-Extension Technologies

1. Ethical and Policy Foundations

Life Extension as a Right or a Market Commodity

Human Rights Framing

Universal access to life-extension technologies, accounting for systemically driven barriers such as cost, aligns with the human right to the highest attainable standards of health (Article 12 of the ICESCR),[5] as well as the rights to life and security of the person embedded in the Canadian Charter of Rights and Freedoms.[6] Such rights are based on an idea of universal beneficence– access to the extended health such technologies provide should not depend on wealth.[7]

Market Framing

The current trends within biomedical innovation, particularly as it pertains to life-extension technologies, is to treat such innovation as a market good, particularly motivated by the costs associated with research and development, as well as intellectual property.[8] However, the commodification inherent to market goods directly conflicts with the conception of universal beneficence, particularly as it pertains to barriers of wealth.[3] Canada does have policies, however, that work to combat this framing. For example, the *Canada Health Act* (1984)[9] directly conflicts with the commodification of life-extension technologies to the extent that the act mandates universal and equitable access to medically necessary care. Moreover, the *Patented Medicine Prices Review Board*, which regulates the maximum prices pharmaceutical companies can charge for patented medicines in Canada,[10] underscores Canada's efforts to both acknowledge and limit the commodification of biomedical innovation more broadly.

A Middle Ground – Proportionate Universalism

Focusing solely on the access of the most disadvantaged will not account for the market and development costs associated with life-extension technologies. Universal access must be proportionate, with a scale and intensity that is proportionate to the level of disadvantage individuals face,[11] and that does not disregard the cost-based burden of such technologies to any party involved. Although Canada currently has policies in place which support this middle-ground approach, they lack specific reference to life extension technologies and the novel,

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[5] International Covenant on Economic, Social and Cultural Rights, GA Res 2200A (XXI), 21 U.N. GAOR Supp (No 16) 49, U.N. Doc A/6316 (Dec. 16 1966) (entered into force Jan. 3 1976).

[6] Canadian Charter of Rights and Freedoms, Part I of the *Constitution Act*, 1982, being Schedule B to the Canada Act 1982 (UK), 1982, c 11.

[7] Norman Daniels, *Just Health: Meeting Health Needs Fairly* (Cambridge: Cambridge University Press, 2008).

[8] James C Robinson, "Biomedical Innovation in the Era of Health Care Spending Constraints" (2015) 34:2 *Health Affairs* 203.

[9] Canada Health Act, R.S.C., 1985, c. C-6.

[10] Government of Canada, Patented Medicine Prices Review Board, online: <https://www.canada.ca/en/patented-medicine-prices-review.html>.

[11] Fair Society, Healthy Lives: The Marmot Review (Sir Michael Marmot ed), *Strategic Review of Health Inequalities in England post-2010* (London: UCL Institute of Health Equity/UK Parliament, February 2010); Allen, Luke N. "The Philosophical Foundations of 'Health for All' and Universal Health Coverage." *International Journal for Equity in Health*, vol. 21, Article #155, 5 Nov. 2022. https://doi.org/10.1186/s12939-022-01780-8.

optional medical care they represent. Future policy work should thus work on reinforcing existing policy frameworks, such as those mentioned above, to both acknowledge the necessary conception of life-extension innovation as a market good, but one that is bound by equitable principles that benefit broader groups within Canada.

2. Access, Cost, and Health Equity

Lessons from Existing High-Cost Therapies

Life-existing technologies may draw parallels to existing high-cost technologies and therapies, including gene editing, cell therapy, and cancer treatment. Cell and gene therapies can cost between several hundred thousand to millions of dollars for a single dose, rendering them inaccessible for many patients. A requirement to pay for many cell and gene therapies upfront makes them an impossible treatment option for uninsured patients.[12] This is an ongoing area of development as more cell and gene therapies are entering the market. Life-extension technologies, which are also expected to come at a high price point, will likely have a similar roll-out to cell and gene therapies, with initial access limited to the wealthy and those who may be able to subsidize the therapy with their insurance.

Ultimately, similar distribution-based challenges exist with other high-cost healthcare interventions: significant individual and thus population health benefits that come with significant cost prohibitions. Canadian precedent policy pertaining to high-cost, novel drugs for rare diseases demonstrates that current national policy prioritizes resolving cost-based health inequities, particularly as it pertains to effective and essential therapies.[13] For similar prioritization to extend to life-extension technologies, their development must require them to be of a similar nature. Some jurisdictions within Canada have policies more supportive to the introduction and coverage of life-extension therapies–for example, Ontario's *Exceptional Access Program* facilitates patient access to drugs not funded on the Ontario Drug Benefit Formulary, including for drugs where strong clinical evidence is not yet available to support efficacy or cost-effectiveness.[14] Such policy would likely facilitate access to life-extension therapies funded via government coverage, reducing cost and equity barriers to access. However, federal health policy lacks a similar nationally applicable framework, let alone one that acknowledges the nuances and uncertainties of life-extension technologies and therapies.

Unequal access and the global longevity gap

Globally, access to necessary health interventions is not currently universal, with wealthier states and individuals already achieving longer, healthier lives–resulting in a recognized longevity

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[12] Rayne H Rouce & Matthew H Porteus, "Cell and gene therapy accessibility" (2024) 385:6708 Science 475–475.

[13] Government of Canada, *The National Strategy for Drugs for Rare Diseases* (Ottawa: Health Canada, 22 March 2023), online: <canada.ca/en/health-canada/services/health-care-systems/national-pharmacare/strategy-drugs-rare-diseases.html>.

[14] Government of Ontario, Exceptional Access Program, (17 July 2023), online: <https://www.ontario.ca/page/exceptional-access-program>.

gap.[15] The development of technologies which can further extend the lives of individuals risks further exacerbating these inequities, particularly at their introductory stages wherein they remain novel, heavily patented, and high cost.[16] Such inequities will have significant ethical consequence, with cost-based distribution barriers undermining recognized ideas of global distributive justice and intergenerational fairness.[17]

Limiting access of life-extension technologies to the wealthy would exacerbate the existing impact of socioeconomic status on life expectancy. Higher poverty levels are associated with lower life expectancy, adjusting for age, gender, and racial group.[18] Even when comparing the access to specific treatments, in the context of diabetes, higher socioeconomic status groups have been shown to have better effective access to lifechanging GLP-1 RA medication, as compared to study participants experiencing poverty.[19] In the context of life extension therapy, unequal access may magnify social stratification, and set the upper class at a further economic advantage, in providing a greater lifespan for wealth accumulation, to the detriment of lower socioeconomic classes. Moreover, if the wealthy were the only ones able to extend their lifespan, that may redirect health resources to supporting the older-aged wealthy minority, reducing the resources available to the poorer majority.

3. Public and Private Responsibilities for Access

Government Role

In line with the role that governments pay towards subsidizing other health interventions–particularly in nations with public healthcare systems, such as Canada–governments should, in this context, ensure equitable access, as well as public oversight of safety and efficacy, particularly as access to these technologies pertains to extended healthy lifetimes.[20]

Private Sector Role

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[15] Mahinur Begum Mimi, Md Golam Kibria & Md Muhaiminul Islam Selim, "How Do Economic, Health, Environmental and Demographic Factors Affect Life Expectancy? — A Novel Attempt for Developed and Developing Economies" (2024) Applied Economics Letters (pre-print) DOI:10.1080/13504509.2024.2335269.

[16] M Siddiqui, "The High Cost of Cancer Drugs and What We Can Do About It" (2012) 87:4 *Mayo Clinic Proceedings 289*.

[17] *Supra*, note 3.

[18] Gopal K Singh & Hyunjung Lee, "Marked Disparities in Life Expectancy by Education, Poverty Level, Occupation, and Housing Tenure in the United States, 1997-2014" (2021) 10:1 Int J MCH AIDS 7–18.

[19] Lauren A Eberly et al, "Racial, Ethnic, and Socioeconomic Inequities in Glucagon-Like Peptide-1 Receptor Agonist Use Among Patients With Diabetes in the US" (2021) 2021;2;(12):e214182 JAMA Health Forum, online: <https://jamanetwork.com/journals/jama-health-forum/fullarticle/2787276>; Michael Blake, "Life Extension and Civic Virtue" (2025) AMA Journal of Ethics.

[20] Prime Minister of Canada, News Release, "Working together to improve health care for Canadians" (7 February 2023), online: <https://www.pm.gc.ca/en/news/news-releases/2023/02/07/working-together-improve-health-care-canadians>.

Conversely, the private sector is responsible for research, development, and production of life-extending technologies, but should employ principles of corporate responsibility in aligning these goals with equity and sustainability targets.[21]

Public-Private Collaboration

The government often plays a role in the commercialization of novel therapies made by private companies, to stimulate the "the production and dissemination of innovative...technologies".[22] In the genetic therapy space, it has been noted that "extensive involvement of the private sector in genetic research is inevitable, unavoidable and essential".[23] However, this may present a conflict between the commercial and social policies in that promoting the production and sale of these therapies through the private sector may limit downstream equitable dissemination of these therapies to the public. The right of access to life-extending technologies, which are currently being developed by private companies, must be balanced against the profit motivations that are funding the research within those private companies and allowing that development to occur. The subsidization of life-extension therapies therefore would require a collaboration between government and private companies.

4. Canada's Approach to Equitable Access

Supporting Life Sciences Innovation

The Ontario government, through its Invest Ontario program, has invested substantial capital into the life sciences and technology industries, having invested over $250M in the 2024-2025 fiscal year[24]. Through Invest Ontario, the provincial government supports the growth of the pharmaceutical R&D and manufacturing sectors in Ontario, prioritizing job creation and strengthening Ontario's position as a leader in life sciences innovation[25]. Ontario has demonstrated its commitment to the production of innovative therapies and willingness to work with private pharmaceutical companies.

While the Ontario government interacts substantially with the private sector in bringing life sciences innovation to the province, there is less clarity in the government's support when it comes to engaging the private sector in reducing the cost of these innovative therapies once they are ready for market.

Drug Pricing and Access to Innovative Therapies

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[21] Global Affairs Canada, *Canada's Enhanced Corporate Social Responsibility Strategy to Strengthen Canada's Extractive Sector Abroad*. (13 May 2021), online: <https://www.international.gc.ca/trade-agreements-accords-commerciaux/topics-domaines/other-autre/csr-strat-rse.aspx?lang=eng>.

[22] Timothy Caulfield, "Sustainability and the Balancing of the Health Care and Innovation Agendas: The Commercialization of Genetic Research"(2003) 66:629 Sask L Rev.

[23] *Ibid*.

[24] Invest Ontario, *Invest Ontario Annual Report 2024-2025* (Ontario: Invest Ontario, 2025), (pdf) online: <investontario.ca/sites/default/files/2025-10/InvestOntario_AnnualReport_2024-25.pdf>.

[25] Invest Ontario, "About Invest Ontario", online: <investontario.ca/invest-ontario>

When a novel therapy is ready for market, the manufacturer must first file for regulatory approval with Health Canada.[26] Prior to approval, the pan-Canadian pharmaceutical alliance (pCPA), which includes representatives from the federal, provincial, and territorial governments of Canada, negotiates with manufacturer, with the specific goal of lowering drug costs.[27] Once negotiations are complete, the "Executive Officer of Ontario's public drug programs makes the final decision on whether or not a drug product should be reimbursed" prior to the drug's final approval for the market.[28]

While the pCPA negotiates with private manufacturers to lower costs prior to market approval, the federal and provincial governments could better incentivize lower market costs in a similar manner how Ontario incentivizes the expansion of the pharmaceutical industry in Ontario. For example, Ontario could engage in price risk sharing with the private companies or cap prices relative to therapeutic benefit and cost of production.

5. Canada's Role in Global Longevity Equity

Global Distributive Duty

In accordance with the role developed countries currently play in bridging gaps in global health equity, particularly through the Quadripartite organizations, developed countries will continue to have a global distributive duty grounded in universal human rights and capacity principles.[293,12] Without adequate policy measures, disparities in the access to life-extension therapies could exacerbate existing global inequities, including life expectancy in richer nations, while poorer nations continue to struggle with preventable diseases.

Proportionate Universalism and Global Health

Connecting back to the idea of proportionate universalism discussed above,[30] developed countries should extend particular bridging efforts to those countries in need, addressing global health burdens within the context of their own financial needs, as well as the financial needs of the technology and research organizations they supervise.
Canada has various foreign policies and international commitments that support its engagement with ideas of global distributive duty and proportionate universalism. Canada has contributed over $900 million over the last ten years to the WHO,[31] which has supported the organization's broader efforts consistent with Canadian policy focused on advancing global health goals, but also those more specific to health equity gaps in developing countries.

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[26] Government of Ontario, "Drug funding review and approval process" (15 November 2023), online: <ontario.ca/page/drug-funding-review-and-approval-process>
[27] *Ibid*; Pan-Canadian Pharmaceutical Alliance, "About pCPA" online: <pcpacanada.ca/about>.
[28] *Supra*, note 22.
[29] Supra, note 3; World Health Organization. [*One Health Joint Plan of Action*]. Geneva: World Health Organization (2022), online: <https://iris.who.int/server/api/core/bitstreams/578db93c-0ada-4c37-bcb5-e1dff68f4a0d/content>.
[30] *Supra*, note 7.
[31] World Health Organization, "Canada, Partner in global health" (last modified 13 May 2022), online: <who.int/about/funding/contributors/can>.

However, Canada still lacks a formal, coherent global health strategy. A 2025 expert report commissioned by the Canadian Academy of Health Sciences and the Royal Society of Canada emphasizes the need for such a strategy. The report discusses "what" issue areas require priority attention and where Canada's leadership could make a substantial contribution, in addition to "how" Canada can effectively take forward these priority issue areas through clear strategy, targeted investments in research and innovation systems, and capacity building to support Canadian leadership.[32] Such a coherent global health strategy should include specific reference to how Canada is uniquely positioned to address longevity gap issues globally, and reference/provision for life-extension technologies access in a global and equitable format has the potential to make the nation a global leader in this space.

6. Comparative Analysis: Canada and Japan

Japan as a Comparator

Japan is a key comparator to Canada as it pertains to the ethics of access to life-extension technologies. Japan's population is one of the oldest, on average, globally, with 29% of its population over 65 in 2020–a figure that is projected to increase to 38% by 2065. It has implemented various policy strategies to ensure this broad-scale aging occurs in a health-focused and equitable manner.[33]

Life Extension as a Right or a Market Commodity

In **Canada,** publicly funded healthcare covers essential medical needs, particularly as they pertain to established health interventions.[34] However, longevity interventions–such as anti-aging drugs, and other novel therapies–are absent from healthcare and healthcare funding policy, despite the efforts of advocacy groups such as the Canadian Longevity Association, which works to achieve equitable access and government support in these areas.[35]
In **Japan,** universal health care insurance includes provision for high-cost treatments, including those relating to aging, under the High-Cost Medical Expense Benefit System, which caps out-of-pocket costs based on individual reported income.[36] Japan's health policy highlights the importance of universal health coverage, and "leav[ing] no one behind".[37] Japan's vision for universal health coverage focuses on all individuals, "especially poor people, children, women,

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[32] Tim Evans et al, *Protecting our Collective Future: Renewing Canada's Role in Global Health* (Royal Society of Canada and Canadian Academy of Health Sciences, 2025).
[33] Liu Y, Kobayashi S, Karako K, Song P & Tang W, "The Latest Policies, Practices, and Hotspots in Research in Conjunction with the Aging of Japan's Population" (2024) 18 *BioScience Trends* 219–223 https://doi.org/10.5582/bst.2024.01150
[34] Government of Canada, *The National Strategy for Drugs for Rare Diseases* (Ottawa: Health Canada, 22 March 2023), online: < www.canada.ca/en/health-canada/services/health-care-systems/national-pharmacare/strategy-drugs-rare-diseases.html>.
[35] Canadian Longevity Association, Home, online: <canadianlongevity.ca>.
[36] The Japan News, Yomiuri Editorial, "Review of High-cost Medical Expense Benefit System: How Will The Public's Understanding of Increased Burden Be Expanded?" *The Japan News* (29 January 2025), online: <japannews.yomiuri.co.jp/editorial/yomiuri-editorial/20250129-235902/>.
[37] Global Health Corporation, *Basic Design for Peace and Health (Global Health Cooperation)*, (11 September 2015), (pdf) online: <mofa.go.jp/files/000110234.pdf>.

persons, ethnic and indigenous people, and otherwise vulnerable groups".[38] This underlying thematic emphasis to health policy, one made explicit in the language of relevant acts, should be included in future Canadian health policy that works to rectify gaps in its universal healthcare coverage, particularly policy pertaining to longevity interventions.

Lessons from Existing High-Cost Therapies

In **Canada,** gene therapies are improved by access is limited, with high upfront costs and complex reimbursement processes that impede their universal access at a population level. Comparatively, Canada is behind other countries in speed of reimbursement as well–in a study that measured the time it takes for market-authorized drugs to qualify for public reimbursement, Canada was ranked 15th out of 20 jurisdictions assessed.[39]

In comparison, **Japan** was ranked first. (CCA report). Although Japan, as a similarly publicly funded healthcare jurisdiction, faces similar cost pressures, their emphasis on healthcare innovation, its equitable access to healthcare, as well as the health of aging populations in general[40] highlights policy areas that Canada can target to improve access to high-cost therapies. Japan's strict government-regulated drug pricing system under its National Health Insurance has resulted in drug prices that are 3.2 times lower than those in the US.[41] While this supports the accessibility of drugs, the strict pricing system disincentivizes pharmaceutical companies from bringing innovative products to market in Japan, due to the higher risk of the pharmaceutical company not being able to recoup the costs of bringing the drug to the Japanese market.[42] As a result, some drugs may be slower to enter the Japanese market as compared to the more competitive US market. To reconcile this issue, Japan has implemented frameworks to allow price increases for innovative drugs targeting an unmet medical need, through their Sakigake and Rapid Introduction Premium policies.[43]

Japan's strict approach followed by exemptions for innovative drugs to ensure that Japan remains competitive in the innovative drug market is instructive for Canada's approach. While Canada can improve their access by enforcing stricter negotiations than the ones currently imposed by the pan-Canadian Pharmaceutical Alliance (pCPA), while pre-empting the impact to innovative drugs entering the Canadian market by providing exceptions for drugs targeting unmet medical needs. In this manner, Canada can improve access to drug therapies while promoting innovative products.

Unequal Access and the Global Longevity Gap

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[38] *Ibid*.
[39] Council of Canadian Academies, Report, *From Research to Reality: The Expert Panel on the Approval and Use of Somatic Gene Therapies in Canada* (November 3, 2020), online: <cca-reports.ca/reports/somatic-gene-and-engineered-cell-therapies/>.
[40] *Supra*, notes 28 and 31.
[41] Kento Takamura et al, "Overview of the Japanese Rapid Introduction Premium as a drug pricing framework to enhance patient access to innovative drugs" (2025) 16:1 Health Econ Rev, online: <https://pmc.ncbi.nlm.nih.gov/articles/PMC12777408/>.
[42] *Ibid*.
[43] *Ibid*.

The World Health Organization warns average lifespan gaps between countries could continue to increase over coming years, driven by inequities pertaining to the social determinants of health as well as unequal access to innovative healthcare technologies.[44]

Both Canada and Japan are high-income countries, but inequalities that pertain to factors which drive lifespan exist. In **Canada,** Indigenous and low-income populations have shorter life expectancies and poorer health outcomes overall.[45] In **Japan**, rural regions specifically are burdened by healthcare worker shortages and reduced service capacities.[46] Ultimately, both countries face similar gaps in lifespan-related equity, which could similarly be worsened with unequal access to novel life-extension technologies.

Japan currently works to address rural-related healthcare equity by various policies that allow it to federally, mandatorily redistribute healthcare workers–particularly physicians–to rural regions through legally binding educational/placement programs. For example, the government-created Jichi Medical University recruits students from all prefectures in the country, and offers free tuition in exchange for the requirement that they work in these home prefectures for 9 years (including 6 years of rural service) in exchange for waived tuition.[47] The program has been a strong success, with 69.8% of graduates settling in their home prefectures after their requirements are fulfilled. If Canada wishes to expand its incentive programs towards practicing rural medicine,[48] a binding service requirement-based model like Japan's, combined with education pertaining to equity-based lifespan gaps in these environments, would provide a framework of educated medical professionals ready to implement life extension technologies in these underserved environments as they become available.

<u>Public and Private Responsibilities for Access</u>

Both countries demonstrate significant investment in biomanufacturing and life sciences, which supports innovation in life extension technologies, with private companies also playing a significant role.[49] Ultimately, both sectors are obligated to partake in this research in an equity-

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[44] World Health Organization, "Health Inequities Are Shortening Lives by Decades" (6 May 2025) World Health Organization, online: <https://www.who.int/news/item/06-05-2025-health-inequities-are-shortening-lives-by-decades>.

[45] Canadian Public Health Association, "*Addressing Health Inequities in Canada*" (online) https://www.cpha.ca/health-inequities [accessed 29 November 2025].

[46] Mitsubishi Research Institute, "*Making Japan's Medical and Long-Term Care Systems Self-Sustaining and Efficient*" (September 2024) Mitsubishi Research Institute, online: <https://www.mri.co.jp/en/knowledge/article/202409_1.html>.

[47] Masatoshi Matsumoto, Kazuo Inoue & Eiji Kajii, "Long-term effect of the home prefecture recruiting scheme of Jichi Medical University, Japan" (2008) Jul-Sep;8(3):930 Rural Remote Health, online: <https://pubmed.ncbi.nlm.nih.gov/18643712/>.

48 Government of Ontario, Office of the Premier, News Release, "Ontario Expanding Learn and Stay Grant to Train More Family Doctors in Ontario" (25 October 2024), online: <https://news.ontario.ca/en/release/1005226/ontario-expanding-learn-and-stay-grant-to-train-more-family-doctors-in-ontario>.

[49] Tri-agency Institutional Programs Secretariat, "Government of Canada Funds New Projects to Further Grow the Domestic Biomanufacturing and Life Sciences Sector" *PR Newswire* (6 May 2024), online: <https://www.newswire.ca/news-releases/government-of-canada-funds-new-projects-to-further-grow-the-domestic-biomanufacturing-and-life-sciences-sector-823826717.html>; Japan External Trade Organization (JETRO),

focused manner, particularly as is pertinent to their electoral and corporate responsibility obligations respectively, and must remain collectively focused on equity for access to remain equitable globally.[50]

As discussed above, Japan balances (1) subsidizing access by negotiating price decreases with drug manufacturers with (2) the desire to incentivize innovative drug products to enter the Japanese market. In Japan, drug prices are revised based on the mean market price of comparable products, with the sale price limited to a range from that mean.[51] For new drugs entering the market, the price is limited to the price of comparable drugs on the market, with possible corrections for the innovativeness, usefulness, and marketability of the product compared to its competitors.[52] For new drugs without a comparable existing drug on the market, the costs of producing the drug are instead taken into account as part of the assessment, with adjustments to the price made depending on the novelty and innovativeness of the product.[53]

Japan's strict pricing system has received pushback from Japanese pharmaceutical companies. In December 2025, the Japan Pharmaceutical Manufacturer's Association (JPMA), representing 68 R&D-oriented pharmaceutical companies, released a statement in response to Japan's pricing system asking that Japan's Central Social Insurance Medical Council (Chuikyo) reconsider its pharmaceutical pricing system.[54] The JPMA submitted that the pricing system has caused Japan's R&D and innovative drug industries to decline as compared to the global market, and that the restrictions imposed on pharmaceutical companies by the pricing system restrict the number of companies hoping to bring their products to Japan.[55] The strict pricing system has also disincentivized foreign manufacturers from introducing their products to the Japanese market while also reducing the number of new drugs being brought to the market overall.[56] The JPMA's statement highlights the clash between accessibility to drugs and the drug manufacturers' commercial incentives in bringing these products to the market.

The competing interests between innovation in the pharmaceutical industry and bringing low costs to the market highlights an important balance for Canada to reconcile in its own drug pricing policy. While enforcing strict rules about drug costs can improve access to new drugs entering the market, the lack of incentive for pharmaceutical companies to pursue innovative,

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"Government Initiatives | Life Science – Industries – Investing in Japan" online: <https://www.jetro.go.jp/en/invest/attractive_sectors/life_science/government_initiatives.html>.

[50] *Supra*, notes 16 and 17.

[51] Yukio Abe, Deputy Director for Pharmaceutical Industry Promotion and Medical Information Management, Health Policy Bureau, Ministry of Health, Labour and Welfare of Japan, "Japan's NHI Drug Price System" online: <https://www.pmda.go.jp/files/000248690.pdf>.

[52] *Ibid*

[53] *Ibid*

[54] Japan Pharmaceutical Manufacturers Association, Joint Statement by the Pharmaceutical Manufacturers' Associations of Japan, the United States, and Europe, *"Opinion on Reform of the NHI Drug Price System and Cost-Effectiveness Evaluation System for Fiscal 2026"* (16 December 2025), online: <https://en.jpma.or.jp/news_room/release/2025/251216.html>

[55] *Ibid*

[56] Shotaro Kinoshita & Taishiro Kishimoto, "Challenges introduced by Japan's drug pricing policy" (2024) 51:101212 *The Lancet Regional Health-Western Pacific*, online: <https://www.thelancet.com/journals/lanwpc/article/PIIS2666-6065(24)00206-2/fulltext>

risky drugs in a price-capped market may limit the amount of innovative products entering the market. As evidenced by the JPMA's statement, private companies can apply pressure to the government to limit price regulation to allow these pharmaceutical companies to maximize profits and incentivize bringing new innovative products, such as life-extension therapies, to market. As a result, the Canadian government should strike a balance between access and innovation, by continuing to negotiate with private companies to keep costs low, while also incentivizing new products to enter the market by providing time-limited exemptions to price decreases.

Global Responsibility for Longevity Equity

Both Canada and Japan are high-income countries with advanced healthcare research and healthcare systems. The Quadripartite organizations, particularly the World Health Organization and the United Nations, stress the ethical obligation of such countries in preventing the worsening of health equity divides, which include those pertaining to aging as established above.[57]

As established above, both countries invest heavily into health-focused research, and have effective healthcare systems despite their aforementioned gaps. Further refinement of healthcare equity as it pertains to aging domestically, particularly as is strong within the Japanese model, could serve as a valuable model globally, but further international collaboration and policy efforts are needed.

In contrast to Canada, Japan has developed and implemented a dedicated, comprehensive *National Global Health Strategy*, providing a comprehensive framework with explicit policy goals directed towards developing global health architecture for international security and health emergency resilience.[58] If Canada wishes to support life-extension research and address its moral responsibilities towards longevity gaps with developing countries simultaneously, a similar comprehensive plan or act, with provisions specific to life extension technologies, is recommended. Canada will be most effectively able to respond to these twin pressures if, within a proposed global health policy strategy, it proactively addresses life extension technologies as a policy goal, and structures the plan's subgoals and policies around this goal and the Canadian health policy reality.

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[57] *Supra*, note 39; Norman Daniels, *Just Health: Meeting Health Needs Fairly* (Cambridge: Cambridge University Press, 2008); World Health Organization. [*One Health Joint Plan of Action*]. Geneva: World Health Organization (2022), online: <https://iris.who.int/server/api/core/bitstreams/578db93c-0ada-4c37-bcb5-e1dff68f4a0d/content>.

[58] "White Paper on Development Cooperation 2022: Part 3 promoting efforts to address global issues and human security: Ministry of foreign affairs of Japan", online: White Paper on Development Cooperation 2022 | Part 3 Promoting Efforts to Address Global Issues and Human Security | Ministry of Foreign Affairs of Japan, online: <https://www.mofa.go.jp/policy/oda/white/2022/html/honbun/b2/s3_1.html>.

Part 3: Genetics, Insurance and Longevity Risk

1. Predictive Genomics and Insurance Risk

Ethical Risks

Of the many ethical considerations involved in allowing predictive genomics, there are three core risks that warrant consideration. These risks include privacy, fraud, and discrimination. From a privacy perspective, the concern is that if insurance companies could demand or strongly incentivize genetic testing and disclosure, the only way to avoid sharing one's highly personal health information would to be uninsured – which can create catastrophic consequences for the individual.[59] Another ethical issue is discrimination. Scholars caution that allowing predictive genomics would discriminate against people with 'bad genes' as their insurance fees would rise. This potential for discrimination implores us to consider whether insurance should be seen as a social good accessible to everyone or purely a commodity.[60] The last consideration surrounds fraud. Some theorists suggest that policyholders who have genetic information but do not disclose it to insurance companies are engaging in fraud by purchasing insurance policies when they have significantly more information than the company.[61]

Economic Risks

The chief economic concern that surfaced during our research interestingly had to do with *not* allowing predictive genomics. Some argue that disallowing insurance companies to use genetic testing would create an information asymmetry where policyholders have more information than the companies. As a result, some argue that applicants with high health risks are getting a bargain price, while seemingly healthy applicants are overcharged. [62],[63]

2. Genetic Testing and Life Insurance in Canada

Life insurers have a financial incentive to have their prospective clients undergo genetic testing because such testing would allow insurers to assess more personalized premiums and make more informed decisions about whether to insure high-risk individuals. However, given the aforementioned ethical concerns, governments have acted to protect privacy and prevent discrimination. The Canadian government placed extensive restrictions on the use of genetic testing by insurance companies through the 2017 *Genetic Non-Discrimination Act* (GNDA). The

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[59] Alexander Nill, Gene Laczniak & Paul Thistle, "The Use of Genetic Testing Information in the Insurance Industry: An Ethical and Societal Analysis of Public Policy Options." (2019) 156 Journal of Business Ethics 105

[60] Alexander Nill, Gene Laczniak & Paul Thistle, "The Use of Genetic Testing Information in the Insurance Industry: An Ethical and Societal Analysis of Public Policy Options." (2019) 156 Journal of Business Ethics 105

[61] Anya E.R. Prince, "Tantamount to Fraud?: Exploring Non-Disclosure of Genetic Information in Life Insurance Applications as Grounds for Policy Rescission" (2016) 26 Health Matrix 255.

[62] Tiller, J., & Delatycki, M. B. (2021). Genetic discrimination in life insurance: a human rights issue. *Journal of Medical Ethics*, *47*(7), 484–485. https://www.jstor.org/stable/27350529

[63] Anya E.R. Prince, "Tantamount to Fraud?: Exploring Non-Disclosure of Genetic Information in Life Insurance Applications as Grounds for Policy Rescission" (2016) 26 Health Matrix 255.

Act prohibits insurance companies from requiring clients or prospective clients to undergo genetic testing as part of the underwriting process and from requiring clients to disclose the results of any genetic tests they have previously obtained. Contravention of the *GNDA* is punishable by a fine of up to $1,000,000 or a prison term of up to five years.

Given the penalties for contravention of the GNDA, Canadian insurers have adhered to the terms of the Act. However, since the Act only prohibits insurers from *requiring* clients to undergo genetic testing, there remains ambiguity that insurance companies may exploit to manipulate clients into providing genetic information. Fernando et al. found that life insurance underwriting questionnaires often ask for information disclosure using vague terms, such as by asking for "screening results" or "medical tests" without qualifiers exempting genetic testing. Prospective clients who are uninformed of their rights regarding genetic testing may reasonably interpret these questions as asking them to disclose previous genetic test results. Therefore, as private genetic testing for disease risk screening and ancestral DNA tests become more common, it is possible that insurers will use vague language to manipulate clients into providing genetic test results while still complying with the *GNDA*.

Furthermore, the validity of the *GNDA* is a contentious issue in constitutional law. The Government of Quebec argued that the Act was an attempt by the federal government to regulate the insurance industry, which is a power delegated to the provinces through s.92 of the *Constitution Act, 1867*. While the Supreme Court rejected this argument, it did so in a 5-4 split decision, indicating that the validity of the Act may change with future developments in the jurisprudence of Canadian federalism. If the Act were to be found *ultra vires* in the future, insurers would be able to implement genetic testing requirements without the threat of criminal liability.

3. Longevity Insurance and Longer Retirements

Currently, longevity insurance is not that widespread, with only about 10% of the Canadian population receiving income from a lifetime annuity.[64] However, insurance companies do offer innovative plans in the form of longevity insurance and customized insurance packages meant to accommodate a longer retirement period.[65] Some researchers suggest that one reason for this low figure is that to make good financial decisions, policyholders need to have a good sense of both longevity and life expectancy risks.[66] Many people are only aware of average life expectancy, potentially not factoring in the possibility that they exceed this age. Furthermore, many policyholders, upon learning about the possibility of longevity insurance, expressed regret in their financial decisions.[67] Therefore, if longevity insurance is to become widespread, it is likely

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[64] Abigail Hurwitz & Olivia S. Mitchell, "Financial Regret at Older Ages and Longevity Awareness" (2025) 92 *Journal of Risk and Insurance* 719–739, DOI: 10.1111/jori.70008.

[65] Schaffner, A & Ra, M, "The Role of Financial Institutions in Longevity Finance" in K Wendt & M Ra, eds, *Longevity Finance*, Sustainable Finance (Cham: Springer, 2025) https://doi.org/10.1007/978-3-031-95870-0_10.

[66] Abigail Hurwitz, Olivia S Mitchell & Orly Sade, "Testing Methods to Enhance Longevity Awareness" (2022) 204 *Journal of Economic Behavior & Organization* 466, online: https://doi.org/10.1016/j.jebo.2022.10.014.

[67] Abigail Hurwitz & Olivia S. Mitchell, "Financial Regret at Older Ages and Longevity Awareness" (2025) 92 *Journal of Risk and Insurance* 719–739, DOI: 10.1111/jori.70008.

that insurance companies and other financial institutions will need to educate clients on potential longevity risks to ensure that the plans they purchase best suit their needs throughout the aging process.[68] Further research can be done on whether incorporating longevity into financial education programs could contribute to longevity insurance becoming more widespread.

4. Comparative Approaches to Genetic Information and Insurance

Australia: From Self-Regulation to Legislative Protection

With respect to genetic testing and insurance, Australian legislation is an important case study because their policies have shifted considerably in recent years.

Historical Approach to Genetic Disclosure

Prior to 2019, insurance companies were allowed to oblige customers to disclose any known genetic test results when applying for insurance policies. This obligation existed even for insurance for "critical care" and death[69]. Advocacy organizations like the Human Genetics Society of Australia (HGSA) had significant concerns with this approach. For example, they cautioned that when insurance companies require genetic testing, it disincentivizes Australians from getting tested for research and/or clinical purposes[70]. The lack of testing would have significant impacts on scientific research and individual health.

In response to these concerns, a Parliamentary Joint Committee concluded a hearing focused on the life insurance industry. The committee recommended a ban on requiring the disclosure of genetic testing information.[71] Despite this recommendation, it remained legal under the Disability Discrimination Act for insurance companies to require genetic testing information.[72]

The 2019 Industry Moratorium

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[68] Abigail Hurwitz & Olivia S. Mitchell, "Financial Regret at Older Ages and Longevity Awareness" (2025) 92 *Journal of Risk and Insurance* 719–739, DOI: 10.1111/jori.70008.

[69] Kristine Barlow-Stewart, Mark Liepins, Anna Doble & Michael Otlowski, How are genetic test results being used by Australian life insurers? (2018) 26 European Journal of Human Genetics 1248 (online) doi:10.1038/s41431-018-0198-z https://www.nature.com/articles/s41431-018-0198-z

[70] Kristine Barlow-Stewart, Mark Liepins, Anna Doble & Michael Otlowski, How are genetic test results being used by Australian life insurers? (2018) 26 European Journal of Human Genetics 1248 (online) doi:10.1038/s41431-018-0198-z https://www.nature.com/articles/s41431-018-0198-z

[71] Jane Tiller, Andrew Bakshi, Grace Dowling, Louise Keogh, Aideen McInerney-Leo, Kristine Barlow-Stewart, Tiffany Boughtwood, Penny Gleeson, Martin B. Delatycki, Ingrid Winship, Margaret Otlowski & Paul Lacaze, Community concerns about genetic discrimination in life insurance persist in Australia: A survey of consumers offered genetic testing (2024) 32 European Journal of Human Genetics 286 (online) doi:10.1038/s41431-023-01373-1 https://www.nature.com/articles/s41431-023-01373-1

[72] Jane Tiller, Andrew Bakshi, Grace Dowling, Louise Keogh, Aideen McInerney-Leo, Kristine Barlow-Stewart, Tiffany Boughtwood, Penny Gleeson, Martin B. Delatycki, Ingrid Winship, Margaret Otlowski & Paul Lacaze, Community concerns about genetic discrimination in life insurance persist in Australia: A survey of consumers offered genetic testing (2024) 32 European Journal of Human Genetics 286 (online) doi:10.1038/s41431-023-01373-1 https://www.nature.com/articles/s41431-023-01373-1

Despite a lack of a legal restriction on genetic disclosure, in 2019, the Financial Services Council (FSC), who creates and sets standards for companies operating within the financial sector introduced a "partial, self-regulated moratorium for applications up to …AUD $500,000 for death and total permanent disability cover".[73] The moratorium prevents insurance companies from requesting genetic tests up to the given limit. Importantly, since this moratorium was self-regulated, there was no government oversight to ensure the rule was enforced.[74] Research about the effectiveness of the partial moratorium suggests that the Australian public does not fully trust the internally regulated system to protect their best interests. Many Australians did not know about the moratorium or its contents, limiting the moratorium's ability to assuage fears about how genetic tests would be used.[75] Australians also argued that because of a high cost of living, the $500,000 limit would be inadequate to compensate the financial needs of policy holders. Furthermore, research indicates that among policy holders, despite the moratorium, there is still fear about how genetic information will be used, causing people to avoid genetic testing altogether or test even despite discomfort and apprehension.[76] Furthermore, Australians worried that since this practice is self-regulated, it can easily be revoked.[77] A report, developed by the University of Monash, found that there was low trust in the moratorium and significant "uncertainty and confusion" over how it operates.[78] The Australian government drew on this report to determine a need for increased government regulation and oversight.

Legislative Reform

[73]Jane Tiller, Andrew Bakshi, Grace Dowling, Louise Keogh, Aideen McInerney-Leo, Kristine Barlow-Stewart, Tiffany Boughtwood, Penny Gleeson, Martin B. Delatycki, Ingrid Winship, Margaret Otlowski & Paul Lacaze, Community concerns about genetic discrimination in life insurance persist in Australia: A survey of consumers offered genetic testing (2024) 32 European Journal of Human Genetics 286 (online) doi:10.1038/s41431-023-01373-1 https://www.nature.com/articles/s41431-023-01373-1

[74]Jane Tiller, Andrew Bakshi, Grace Dowling, Louise Keogh, Aideen McInerney-Leo, Kristine Barlow-Stewart, Tiffany Boughtwood, Penny Gleeson, Martin B. Delatycki, Ingrid Winship, Margaret Otlowski & Paul Lacaze, Community concerns about genetic discrimination in life insurance persist in Australia: A survey of consumers offered genetic testing (2024) 32 European Journal of Human Genetics 286 (online) doi:10.1038/s41431-023-01373-1 https://www.nature.com/articles/s41431-023-01373-1

[75]Cassandra Muller, Lyndon Gallacher, Louise Keogh, Aideen McInerney-Leo, Tiffany Boughtwood, Penny Gleeson, Kristine Barlow-Stewart, Martin B. Delatycki, Ingrid Winship, Kristen J. Nowak, Margaret Otlowski, Paul Lacaze & Jane Tiller, "Uninsurable because of a genetic test": a qualitative study of consumer views about the use of genetic test results in Australian life insurance (2024) 32 European Journal of Human Genetics 827 (online) doi:10.1038/s41431-024-01602-1 https://www.nature.com/articles/s41431-024- 01602-1

[76]Cassandra Muller, Lyndon Gallacher, Louise Keogh, Aideen McInerney-Leo, Tiffany Boughtwood, Penny Gleeson, Kristine Barlow-Stewart, Martin B. Delatycki, Ingrid Winship, Kristen J. Nowak, Margaret Otlowski, Paul Lacaze & Jane Tiller, "Uninsurable because of a genetic test": a qualitative study of consumer views about the use of genetic test results in Australian life insurance (2024) 32 European Journal of Human Genetics 827 (online) doi:10.1038/s41431-024-01602-1 https://www.nature.com/articles/s41431-024- 01602-1

[77]Cassandra Muller, Lyndon Gallacher, Louise Keogh, Aideen McInerney-Leo, Tiffany Boughtwood, Penny Gleeson, Kristine Barlow-Stewart, Martin B. Delatycki, Ingrid Winship, Kristen J. Nowak, Margaret Otlowski, Paul Lacaze & Jane Tiller, "Uninsurable because of a genetic test": a qualitative study of consumer views about the use of genetic test results in Australian life insurance (2024) 32 European Journal of Human Genetics 827 (online) doi:10.1038/s41431-024-01602-1 https://www.nature.com/articles/s41431-024- 01602-1 (accessed 31 December 2025).

[78]Consultation Paper: Ban on the use of adverse genetic testing results in life insurance (Commonwealth of Australia, The Treasury, February 10 2025) (online) https://treasury.gov.au/sites/default/files/2025-02/c2024-626785-cp.pdf

As of February 2025, the Australian government indicated that they would opt for a total legislative ban on insurance companies asking for and using genetic testing.[79] The driving policy reason behind this decision was to avoid chilling Australians' desire to participate in clinical or research testing. The ban, which will be regulated by the government aims to provide Australians a more definitive and comforting answer about genetic testing, ensuring that their decisions to get genetic testing will not affect their insurance premiums.[80] In making this decision, the government relied on Canadian modelling that illustrated there would be a negligible impact on insurers if the complete ban went into effect.[81]

This ban also accords with Australia's privacy Act of 1998.[82] The ban does not mean that insurance companies have no way to obtain genetic information. They may still take family histories and draw inferences from diagnosed conditions.[83] They just cannot request genetic testing. However, policyholders can volunteer their data, which they may choose if it could be used to their advantage.

Implications for Canada

The Australian case study suggests positive implications about the current state of Canadian policy on this topic. Since Canada has a legislated total ban on insurance policy companies requesting genetic information, Australia has moved to a policy that accords with the Canadian legal landscape. Australia provides a valuable case study to illustrate the confusion and distrust that results from a partial ban set up which can inhibit testing for clinical and research purposes. Therefore, Canadian policy makers should be encouraged to continue a fully government legislated total ban.

United States: Federal and State Approaches to Genetic Protection

Comparing the American genetic testing regulation regime to Canada's is relevant because while Canada and the US both have federal governance structures, the two countries have taken markedly different approaches to regulation. While the federal governments of both countries have enacted legislation prohibiting the use of genetic testing results by insurers, some American

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[79]Consultation Paper: Ban on the use of adverse genetic testing results in life insurance (Commonwealth of Australia, The Treasury, February 10 2025) (online) https://treasury.gov.au/sites/default/files/2025-02/c2024-626785-cp.pdf

[80]Consultation Paper: Ban on the use of adverse genetic testing results in life insurance (Commonwealth of Australia, The Treasury, February 10 2025) (online) https://treasury.gov.au/sites/default/files/2025-02/c2024-626785-cp.pdf

[81] Consultation Paper: Ban on the use of adverse genetic testing results in life insurance (Commonwealth of Australia, The Treasury, February 10 2025) (online) https://treasury.gov.au/sites/default/files/2025-02/c2024-626785-cp.pdf

[82] *Consultation Paper: Ban on the use of adverse genetic testing results in life insurance* (Commonwealth of Australia, The Treasury, February 10 2025) (online) https://treasury.gov.au/sites/default/files/2025-02/c2024-626785-cp.pdf

[83] *Consultation Paper: Ban on the use of adverse genetic testing results in life insurance* (Commonwealth of Australia, The Treasury, February 10 2025) (online) https://treasury.gov.au/sites/default/files/2025-02/c2024-626785-cp.pdf

states also have their own regulations, whereas the regulation of genetic testing is an exclusively federal undertaking in Canada.

Federal Protection under GINA

In 2008, Congress enacted the Genetic Information Nondiscrimination Act (GINA). GINA prohibits the use of genetic information by health insurers and employers, preventing health insurers from increasing premiums on the basis of genetic predisposition to a certain condition[84]. However, GINA is less comprehensive than the Canadian GNDA, as GINA applies exclusively to health insurers, while the GNDA applies to all forms of insurance. Therefore, per US federal law, it is legal for life, disability, and long-term care insurers to use genetic test results to assess premiums for clients.[85] These gaps in GINA's application may have an effect on the willingness of Americans to undergo genetic testing, with a 2008 New York Times report finding that some people refuse genetic testing because of fears that the results affect their ability to purchase insurance or obtain employment[86].

State-Level Protections

However, while the regulation of the use of genetic testing by insurers is exclusively a federal undertaking in Canada, the United States also has a patchwork of state statutes that regulate the use of genetic testing. For instance, in response to the gaps in GINA, California passed "CalGINA," which extends the prohibition on the use of genetic test results to life and disability insurance[87]. Oregon went a step further by prohibiting the use of genetic test results for any policy of insurance.

Federal versus Multi-Jurisdictional Regulation

The American approach of regulating genetic testing in insurance has pros and cons when compared to the exclusively federal approach taken in Canada. One benefit of having regulation at both the federal and state levels is that if the federal statute is ever repealed, citizens will still have some level of protection provided by the state statutes. For residents of states with comprehensive regulations, such as California and Oregon, their right not to have genetic information be used in insurance decisions would not be affected if GINA were to be repealed. This is significant for the Canadian comparison because the constitutionality of the GNDA has been questioned. In a 2020 reference case, the Supreme Court of Canada held that the GNDA was constitutional but did so in a 5-4 split decision. If a future Court were to find that the Act is ultra vires, then all legislative prohibitions of genetic discrimination in insurance in Canada would be erased. While having a patchwork of state or provincial laws does not protect all

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[84] Hudson, Kathy L, M.K Holohan, & Francis S Collins, "Keeping Pace with the Times — The Genetic Information Nondiscrimination Act of 2008" (2008) 358 The New England Journal of Medicine 25.

[85] Hudson, Kathy L, M.K Holohan, & Francis S Collins, "Keeping Pace with the Times — The Genetic Information Nondiscrimination Act of 2008" (2008) 358 The New England Journal of Medicine 25.

[86] "*Insurance Fears Lead Many to Shun DNA Test*", *The New York Times* (24 February 2008), online: <https://www.nytimes.com/2008/02/24/health/24dna.html >.

[87] Tenenbaum, Jessica D & Kenneth W Goodman, "Beyond the Genetic Information Nondiscrimination Act: ethical and economic implications of the exclusion of disability, long-term care and life insurance" (2017) 14 Personalized Medicine 2.

citizens in a country, it does provide an extra layer of protection should the equivalent federal laws be repealed or found to be unconstitutional.

While having regulations at both the state and federal levels provides more protection against genetic discrimination in insurance, it may also cause confusion among citizens regarding their rights. Having one legislative source regarding genetic testing regulations allows governments to streamline their communications to citizens, as all citizens will have the same right not to have their genetic information used in insurance decisions. Conversely, if there are multiple sources of legislation, then people in states with state regulations will have enhanced protections whereas people in states without state regulations will only be entitled to the baseline protections provided by the federal statute. The discrepancy in the level of protection from state to state could lead to confusion, with people either overestimating or underestimating their rights. Studies following the enactment of the GNDA have shown that there is already a low level of understanding amongst Canadians regarding their right not to have genetic information used by their insurers. Adding provincial legislation that would cause standards to vary from province to province could exacerbate this pre-existing confusion.

5. Policy Implications for Canada

Public Awareness of Genetic Rights

Canada has very strong legal and policy frameworks to regulate insurance companies' access to genetic testing results to prevent genetic discrimination. However, one area that can be improved upon is public awareness. Though the sample size was limited to those with hereditary cancer syndromes, one research study found that there is a "disconnection" between the protective efforts of anti-discrimination genetic legislation and ongoing discrimination faced by those with hereditary conditions.[88] The study therefore encourages public outreach so that individuals are aware of their legal rights, rather than feeling obligated to present their genetic testing results.[89] While the legal landscape is one of the best, without public awareness, it will be challenging for this legislation to be enforced.

Maintaining Comprehensive Federal Protection

Despite having room for improvement in public awareness, Canada's genetic testing regulation regime is strong in the international context. Therefore, it is in the best interest of Canadians that Canada's current regulatory scheme remains in place. Compared to the mixed-jurisdictional approach used in the United States, Canada's approach of regulating solely at the federal level prevents differences from arising in the regulatory framework from province to province.

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[88] Ridhi Gopalakrishnan et al, "Should I Let Them Know I Have This? Multifaceted Genetic Discrimination and Limited Awareness of Legal Protections among Individuals with Hereditary Cancer Syndromes" (2024) 27:1 *Public Health Genomics* 240

https://karger.com/phg/article/27/1/240/915246

[89] Ridhi Gopalakrishnan et al, "Should I Let Them Know I Have This? Multifaceted Genetic Discrimination and Limited Awareness of Legal Protections among Individuals with Hereditary Cancer Syndromes" (2024) 27:1 *Public Health Genomics* 240 https://karger.com/phg/article/27/1/240/915246

Furthermore, the blanket prohibition of the use of genetic testing information by insurers provides Canadians with more comprehensive protection than Americans receive, as GINA only prohibits the use of this information for particular types of insurance.

Part 4: Intergenerational Justice, Population Change and Climate Policy

1. Intergeneration Justice in a Longer-Lived Society

Extended life expectancy will necessarily shift our concept of obligations to future generations towards being more focused on obligations to a current, longer-lived generation. This will have necessary implications for climate modelling and climate policy motivations.

A Necessary Shift in Intergenerational Justice

Traditionally, the concept of intergenerational justice–the concept of ethical obligations to other generations–has been centered on a temporal separation between current generations and future generations such obligations are owed to.[90] However, as lifespans extend, these traditional generational boundaries will become increasingly blurred, with the concept of climate preservation obligation thus necessarily centered on mutual responsibility across one extended human life course[91,92]–an obligation to both ourselves and those we will live alongside.

Policy and Legal Implications in Canada

Current climate policy reflects the historic conception of intergenerational justice, through policy decisions made to preserve the planet for future generations to a limited extent.[93,94,95,96] Such policy is further limited as it pertains to its reference to the idea of extended lifespans. Although the concept of aging populations is referred to in current climate modelling–the statistical projections that inform climate policy decisions–is well established, this is limited to conceptions of aging populations as increasing numbers of individuals living normal lifespans, and does not reflect the novel idea of significantly extended life expectancy.[97,98] To ensure modelling-influenced climate policy meets the necessary shift in views of intergenerational justice, climate modelling must address this gap.

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[90] Pranay Sanklecha, "*Our Obligations to Future Generations: The Limits of Intergenerational Justice*" (2017) 47:4 *Can J Phil*479.
[91] Elizabeth Cripps, Population, Climate Change, and Global Justice (Oxford: Oxford University Press, 2017).
[92] Roberto Mordacci, "Intergenerational Justice and Lifespan Extension" (2011) 9:2 Ethical Perspectives 241.
[93] Government of Canada, Environment and Climate Change Canada, Environment and Climate Change Canada's 2025-26 Departmental Plan (8 August 2025), online: https://www.canada.ca/en/environment-climate-change/corporate/transparency/priorities-management/departmental-plans/2025-2026.html (accessed 13 February 2026).
[94] Environment and Climate Change Canada, 2030 Emissions Reduction Plan: Canada's Next Steps to Clean Air and a Strong Economy (Gatineau, QC: Environment and Climate Change Canada, 2022), online: https://publications.gc.ca/collections/collection_2022/eccc/En4-460-2022-eng.pdf (accessed 13 February 2026).
[95] Environment and Climate Change Canada, Draft Implementation Framework for the Right to a Healthy Environment (Gatineau: ECCC, 2024).
[96] Douglas Scott, "Intergenerational Environmental Justice and the Climate Crisis" (2021) Osgoode Hall Law School Research Paper No 53.
[97] Valeria Lupi et al, "Population Growth and Climate: A Dynamic Relationship" (2021) 178 Ecol Econ 106838.
[98] Nathan Scovronick et al, "Impact of Population Growth and Population Ethics on Climate Change Policy" (2017) 114:46 Proc Natl Acad Sci USA 12345.

The concept of a shift in intergenerational justice has implications for the motivations of Canadian actors regarding climate policy as well. To the extent that current climate policy is predicated upon the concept of ethical obligations to future generations,[99,100] it can and must be given the more concrete reframing of being predicated upon obligations to generations we live alongside. Doing so will, ideally, make climate change and the necessity of related more policy implementation more salient to individual, government, and corporate actors.[101]

2. Extended Longevity and Climate Reform

Extended longevity and climate reform are compatible to the extent that the Canadian government and associated climate actors develop a policy response focused on the consumption patterns and realities of what will become an aging population demographic.

Burdens of Extended Longevity

Extended longevity will result in population growth, particularly when combined with natural birth rates. Current Canadian population projections for the next 50 years reflect the idea that increased life expectancy is a major demographic factor, with an aging population already driving population growth–a phenomenon also influenced by fertility and reduced mortality.[102] Population growth, both globally and within the Canadian context, presents a climate change burden, with increasing resource consumption and greenhouse gas emissions per capita necessary to support such population growth resulting in negative climate impacts.[103,104] However, the resource and consumption burdens different generational categories present are themselves varied. For example, Canadian household emissions–which comprise 38.5% of Canada's total greenhouse gas emissions[105]– vary with factors such as household size, income level, and consumption patterns–all of which are factors that vary with generational

[99] Government of Canada, Environment and Climate Change Canada, Environment and Climate Change Canada's 2025-26 Departmental Plan (8 August 2025), online: https://www.canada.ca/en/environment-climate-change/corporate/transparency/priorities-management/departmental-plans/2025-2026.html (accessed 13 February 2026).
[100] Environment and Climate Change Canada, 2030 Emissions Reduction Plan: Canada's Next Steps to Clean Air and a Strong Economy (Gatineau, QC: Environment and Climate Change Canada, 2022), online: https://publications.gc.ca/collections/collection_2022/eccc/En4-460-2022-eng.pdf (accessed 13 February 2026).
[101] Trisha R. Shrum, "The Salience of Future Impacts and the Willingness to Pay for Climate Change Mitigation: An Experiment in Intergenerational Framing" (2021) 165 Climatic Change 18, doi: 10.1007/s10584-021-03002-6.
[102] Statistics Canada, Population Projections: Canada, Provinces and Territories, 2023 to 2073 (The Daily, 24 June 2024), online: https://www150.statcan.gc.ca/n1/en/daily-quotidien/240624/dq240624b-eng.pdf?st=q8VGybuB (accessed 18 February 2026).
[103] Hannah Ritchie & Pablo Rosado, Canada: CO_2 and Greenhouse Gas Emissions (Our World in Data, updated 2025), online: https://ourworldindata.org/profile/co2/canada (accessed 20 February 2026).
[104] Climate Change Tracker, Canada — Progress and Recent Impact (Climate Change Tracker, 20 February 2026), online: https://climatechangetracker.org/nations/greenhouse-gas-emissions/canada/progress-and-recent-impact (accessed 20 February 2026).
[105] Édith Hovington, Eleen Daraji & Geoffrey Li, Greenhouse Gas Emissions Attributable to Canadian Households, 2021 (Statistics Canada, 22 April 2025), online: https://www150.statcan.gc.ca/n1/pub/11-627-m/11-627-m2025027-eng.htm (accessed 20 February 2026).

demographics.[106,107] These consumptions present a collective climate burden in Canada, which only further localized climate change impacts including negative burdens on Canadian natural resources such as northern forest timber.[108,109,110]

A Path Towards Climate Reform

Extended longevity does not inherently undermine climate reform. It is not the fact itself that individuals live longer that is driving increased per-capita carbon footprints; it is their consumption patterns throughout these extended lifespans that are ultimately responsible.[111,112] Although current Canadian climate policy does acknowledge these demographic-related factors as sources of Carbon emissions to be addressed;[113,114] there still exist more nuanced factorial gaps within Canadian climate policy as it pertains to its systematic integration of demographic aging. This is particularly true as it pertains to infrastructure, health systems, and community resilience within an aging population demographic. Therefore, climate reform must grow to include policy responses that address the nuances of low-carbon reforms in the context of aging populations.[115]

3. Population Aging, Growth and Carbon Emissions

Aging populations might have a significant impact on carbon emissions. However, due to gaps in the literature and Canadian public policy, the extent of the impact is largely unknown.

The Emissions Effects of Population Aging

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[106] Canadian Centre for Policy Alternatives, Income Inequality Is Driving Carbon Emissions in Canada (28 January 2025), online: https://www.policyalternatives.ca/news-research/income-inequality-is-driving-carbon-emissions-in-canada/ (accessed 20 February 2026).
[107] Édith Hovington, Eleen Daraji & Geoffrey Li, Greenhouse Gas Emissions Attributable to Canadian Households, 2021 (Statistics Canada, 22 April 2025), online: https://www150.statcan.gc.ca/n1/pub/11-627-m/11-627-m2025027-eng.htm (accessed 20 February 2026).
[108] Valeria Lupi et al, "Population Growth and Climate: A Dynamic Relationship" (2021) 178 Ecol Econ 106838.
[109] Nathan Scovronick et al, "Impact of Population Growth and Population Ethics on Climate Change Policy" (2017) 114:46 Proc Natl Acad Sci USA 12345.
[110]Don Kerr, "Energy, Resource Consumption, and Climate Change" (2018) 45:1-2 Can Stud Popul 83.
[111] Édith Hovington, Eleen Daraji & Geoffrey Li, Greenhouse Gas Emissions Attributable to Canadian Households, 2021 (Statistics Canada, 22 April 2025), online: https://www150.statcan.gc.ca/n1/pub/11-627-m/11-627-m2025027-eng.htm (accessed 20 February 2026).
[112] Canadian Centre for Policy Alternatives, Income Inequality Is Driving Carbon Emissions in Canada (28 January 2025), online: https://www.policyalternatives.ca/news-research/income-inequality-is-driving-carbon-emissions-in-canada/ (accessed 20 February 2026).

[113] Canadian Net-Zero Emissions Accountability Act, Canada.ca (last modified 29 March 2022), online: https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/net-zero-emissions-2050/canadian-net-zero-emissions-accountability-act.html (accessed 27 February 2026).
[114] Environment and Climate Change Canada, 2030 Emissions Reduction Plan: Canada's Next Steps to Clean Air and a Strong Economy (Gatineau, QC: Environment and Climate Change Canada, 2022), online: https://publications.gc.ca/collections/collection_2022/eccc/En4-460-2022-eng.pdf (accessed 13 February 2026).
[115] Dalia Streimikiene, "Review of Barriers and Drivers for an Ageing Society in Low-Carbon Transition" (2026) 22:1 Montenegrin Journal of Economics 241.

Aging populations present unique challenges and opportunities when developing policy to address climate change. Determining the net effect is complex of aging populations on carbon emissions is complex. Aging populations tend to increase carbon in healthcare, while reducing them in sectors like transportation and labour-intensive industry.[116] Aging populations tend to use more high-energy equipment and have a higher use of the health sector and medical technologies, which increase emission.[117] Older populations tend to engage in less fossil-fuel intensive activities and are not as active in the market, hindering economic growth, and consequently.[118]

Gaps in Canadian Climate Policy

The key policy document in Canada is the Canadian Net-Zero Emissions Accountability Act. This act argues sets out a framework for Canada to reach net-zero emissions by 2050. Key policy outlined in *Canada's 2030 Emissions Reduction Plan* include:

- Making it easier for Canadians to switch to electronic vehicles
- Decreasing carbon emissions from the oil and gas sector
- Using renewable electricity to power the economy
- Pollution pricing schemes[119]

Importantly, this policy scheme makes no reference to population growth, aging demographics, or the climate implications of longer life and health spans. Although certain policy documents, including the Pan-Canadian Framework on Clean Growth and Climate Change, acknowledge health, they do so in terms of how climate change will affect human health.[120] They do not address the converse relationship of how improvements in health and longevity may shape emissions patterns and climate outcomes.

Longevity-Driven Population Growth and Climate Change

While population growth indisputably contributes to climate change, existing scholarship largely focuses on expansion driven by high birth rates and migration rather than increases due to longer

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[116] Yang Xiyue, Li Nan, Mu Hailin, Ahmad Mahmood and Meng Xueying, "Population aging, renewable energy budgets and environmental sustainability: Does health expenditures matter?" (2022) 106 *Gondwana Research* 303-314

[117] Yang Xiyue, Li Nan, Mu Hailin, Ahmad Mahmood and Meng Xueying, "Population aging, renewable energy budgets and environmental sustainability: Does health expenditures matter?" (2022) 106 *Gondwana Research* 303-314 https://doi.org/10.1016/j.gr.2022.02.003

[118] Zhou, Yang, Heng Wang & Huanguang Qiu. *2023*. *Population aging reduces carbon emissions: Evidence from China's latest three censuses*. Applied Energy 351: 121799. https://doi.org/10.1016/j.apenergy.2023.12179

[119] Government of Canada, *Canada's 2030 Emissions Reduction Plan – Overview* (22 June 2022), online: https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/climate-plan-overview/emissions-reduction-2030/plan/overview.html

[120] Government of Canada, Fourth Annual Synthesis Report on the status of the implementation of the Pan-Canadian Framework on Clean Growth and Climate Change (Report, 2020) (online) https://www.canada.ca/en/services/environment/weather/climatechange/pan-canadian-framework/fourth-annual-report.html

life expectancy. The source of population growth shapes both patterns of carbon consumption and, in turn, the appropriate policy response. Therefore, since there is limited information about aging-population driven population growth, there are also gaps in Canadian policy for this topic.

In Canada, population growth has been closely associated with urbanization. Migration into cities often corresponds with higher incomes and greater access to social amenities, consequently driving carbon consumption.[121] The spatial organization of cities further influences emissions.[122] Together, these factors link migration-driven growth to rising urban greenhouse gas emissions.

By contrast, population growth resulting from aging likely operates differently. Since older populations tend to participate less in the workforce,[123] they may exhibit distinct carbon consumption patterns, potentially altering aggregate emissions in ways that are not captured by models focused on migration.

Effective climate policy must therefore be responsive to the underlying drivers of demographic change. In the Canadian context, this requires recognizing longevity-driven population growth as a distinct and underexamined research area, and tailoring mitigation strategies accordingly.

4. Integrating Longevity into Canadian Climate Policy

Synthesizing our preliminary findings, climate policy should integrate assumptions about longer-lived populations and the cumulative emissions associated with population growth resulting from extended life and health spans. Aging population driven population growth presents distinct structural challenges and new intergenerational motivations, and mitigation strategies must meet these unique challenges, rather than relying on models designed for birth rate or migration-based growth.

Effective policy responses will require balancing objectives. Policymakers must address the emissions implications of an aging and longer-living population, while safeguarding the ability of older adults to age with dignity, autonomy, and social support.

Canadian policy has not yet implemented concerns about longevity-driven population growth into its climate reforms. Mitigation efforts therefore risk overlooking an increasingly significant factor that could influence emissions.

5. Comparative Approaches to Population Change and Climate Policy

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[121] Ejiagha, I.R., Ahmed, M.R., Dewan, A., Gupta, A., Rangelova, E. & Hassan, Q.K., *Urban Warming of the Two Most Populated Cities in the Canadian Province of Alberta, and Its Influencing Factors*, Sensors, 22(8) (2022) 2894. DOI: 10.3390/s22082894.

[122] Ejiagha, I.R., Ahmed, M.R., Dewan, A., Gupta, A., Rangelova, E. & Hassan, Q.K., *Urban Warming of the Two Most Populated Cities in the Canadian Province of Alberta, and Its Influencing Factors*, Sensors, 22(8) (2022) 2894. DOI: 10.3390/s22082894.

[123] Yang Xiyue, Li Nan, Mu Hailin, Ahmad Mahmood and Meng Xueying, "Population aging, renewable energy budgets and environmental sustainability: Does health expenditures matter?" (2022) 106 *Gondwana Research* 303-314 https://doi.org/10.1016/j.gr.2022.02.003

There is limited research available from other countries that explores the connection between extended lifespan-driven population growth and climate change. However, we can examine case studies of countries experiencing rapid population growth alongside those with already aging populations. By synthesizing this research, we can better predict the potential implications of increased lifespan on population dynamics.

India: Population Growth and Climate Pressures

Demographic Context

With a population of 1.4 billion, India is one of the most densely populated countries in the world. Fifty years ago, it was among the fastest-growing countries, reaching a peak growth rate of 2.3% in 1975. While the growth rate has steadily declined since then, India's population continues to grow, and due to its historical growth, it is currently the most populated country in the world.[124]

Population Growth and Environmental Pressures

Typically, more rapid population growth and dense populations are found in developing countries where there are higher birth rates .[125] However, it is important to remember that, even with a growing population, it is historically the wealthier economies that have contributed the most to CO_2 emissions—accounting for roughly 80%.[126] In 2016, India was responsible for about 6.6% of CO2 emissions .[127] Among other factors, two core reasons for emissions include agriculture expansion and increased urbanization/industrialization.[128] Furthermore, population growth, coupled with industrialization, leads to increased demand for natural resources and increased energy consumption, which leads to increased emissions.[129]

However, in India, there is also some public pressure toward increased environmental consciousness. For example, a 2020 survey found that 70% of the population said they preferred

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[124] *Macrotrends*, *India Population (1950–2025)* (online), https://www.macrotrends.net/global-metrics/countries/ind/india/population

[125] G Nargund, *Declining birth rate in Developed Countries: a radical policy re-think is required* (2009) 1 *Facts, Views & Vision in ObGyn* 191 (online: PubMed Central) PMC4255510 https://pmc.ncbi.nlm.nih.gov/articles/PMC4255510/

[126] Swati Sharma, *Climate change attitudes and the world's biggest CO_2 emitters* (2024) 26 *Environment, Development and Sustainability* (online) DOI:10.1007/s10668-024-05360-4https://link.springer.com/article/10.1007/s10668-024-05360-4

[127] Swati Sharma, *Climate change attitudes and the world's biggest CO_2 emitters* (2024) 26 *Environment, Development and Sustainability* (online) DOI:10.1007/s10668-024-05360-4https://link.springer.com/article/10.1007/s10668-024-05360-4

[128] D. Rusikesan. *2022*. "Impact of Population Growth on Environment in India – A Case Study." *Think India (Quarterly Journal) 22* (10): page-range. https://thinkindiaquarterly.org/index.php/think-india/article/view/10831/6540

[129] D. Rusikesan. *2022*. "Impact of Population Growth on Environment in India – A Case Study." *Think India (Quarterly Journal) 22* (10): page-range. https://thinkindiaquarterly.org/index.php/think-india/article/view/10831/6540

the environment over the economy.[130] There are also laws in place, including the Environmental Protection Act (1986) that aim to protect the environment. However, scholars argue this framework, last amended in 1991, has not been able to keep up with developments in climate science, particularly since it conflates broad environmental protection with climate law. [131]

Relevance to Canadian Policy on Technology-Extended Lifespans

In India, while there is some pressure to reduce emissions, the key drivers of climate change appear not to be due to population growth but rather the increased demand on resources and increased carbon emissions that result from the process of industrialization and the resulting socioeconomic power. This finding connects to policy considerations surrounding technology-extended lifespans because we can predict that it is not so much the growth in population that will predict carbon emissions and climate change, but rather it will depend on what resources older populations will depend on and what quality of life they will expect. Navigating this tension requires a careful policy analysis to determine how people can age with dignity without overindulging in activities that create high carbon emissions and natural resource extraction. India's policy suggests a need for a tailored and pre-emptive approach to the issue. Since scholars suggest that the Environmental Protection Act is unable to meet contemporary climate science and thus can be ineffective in addressing climate change. If Canada does not begin to consider this issue, they will be in a similar situation where scientific advances render current legislation outdated and ineffective.

South Korea: Population Aging and Carbon Emissions

Demographic Context

The proportion of elderly adults (individuals aged 65+) has rapidly increased in South Korea, as population/healthcare interventions and policy continue to support the longevity of older adults, and the birth rate continues to decline. This demographic shift both directly and indirectly affects population-level carbon emissions–and thus affects climate change–due to its impacts on individual consumption needs and workforce productivity, respectively.[132]

Direct Effects on Carbon Emissions through Consumption

As is both intuitive, and demonstrated within South Korea/other aging populations, longer-lived individuals have longer lifespans of consumption. In South Korea, this is manifested as increased resource consumption as elderly persons, a fact which results in unique patters of consumption. However, this does not directly correlate with an increased per-capita carbon footprint. Older

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[130] Swati Sharma, *Climate change attitudes and the world's biggest CO_2 emitters* (2024) 26 *Environment, Development and Sustainability* (online) DOI:10.1007/s10668-024-05360-4https://link.springer.com/article/10.1007/s10668-024-05360-4

[131] Yadav, Shashi Kant, Rosalind Malcolm & Noreen O'Meara. 2024. *Conceptualizing Climate Law in India*. SSRN Working Paper, 14 January. https://doi.org/10.2139/ssrn.4858809

[132] Sangwon Choi & Brian H. S. Kim, Population aging and carbon dynamics: investigating emissions trends in South Korea(13 Sept 2025) Population and Environment (2025) 47:33 doi:10.1007/s11111-025-00500-y https://link.springer.com/article/10.1007/s11111-025-00500-y

South Korean individuals, being less active, have decreased transportation-related carbon footprints, particularly when less healthy/affluent and thus unable to travel.[133,134] This decrease is coupled with an increase in residential and healthcare resource consumption. Ultimately, this metes out to a net decrease in individual carbon emissions at the regional level, with a 1% increase in the proportion of the elderly resulting in a 0.4% decrease in carbon dioxide emissions.[135]

Indirect Effects on Carbon Emissions through Production

Longer-lived individuals in South Korea can contribute to the workforce and its economic outputs for a greater period of time, a fact which increases the per-capita carbon emissions. This is due to both increased health spans fostered by increased lifespans, as well as structural inefficiencies in the pension system that drive older adults to make use of this extended healthspan and work into older age.[136]

Relevance to Canadian Policy on Technology-Extended Lifespans

Although South Korea has government policy pertaining to aging, these policies are not tied to or part of its national climate policy. For example, it has already implemented population-level aging strategy policy, exemplified through its Basic Plan for an Aging Society with Low Birth Rate.[137,138,139] A response to the low birth rate that is significantly to blame for its aging population demographic, the policy, updated every five years, is notable in is comprehensive nature. Core policy directions include:[140]

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[133] 김동구 & 박선영, The Impact of Population Aging on Energy Use and Carbon Emissions in Korea (2014) 13 환경정책연구 99–129, DOI:

[134] Sangwon Choi & Brian H. S. Kim, Population aging and carbon dynamics: investigating emissions trends in South Korea(13 Sept 2025) Population and Environment (2025) 47:33 doi:10.1007/s11111-025-00500-y https://link.springer.com/article/10.1007/s11111-025-00500-y

[135] Jaehyeok Kim, Hyungwoo Lim & Ha-Hyun Jo, Do Aging and Low Fertility Reduce Carbon Emissions in Korea? Evidence from IPAT Augmented EKC Analysis (2020) 17(8) International Journal of Environmental Research and Public Health 2972 doi:10.3390/ijerph17082972 https://www.mdpi.com/1660-4601/17/8/2972

[136] Sangwon Choi & Brian H. S. Kim, Population aging and carbon dynamics: investigating emissions trends in South Korea(13 Sept 2025) Population and Environment (2025) 47:33 doi:10.1007/s11111-025-00500-y https://link.springer.com/article/10.1007/s11111-025-00500-y

[137] Republic of Korea, Framework Act on Low Birth Rate in an Aging Society, English translation (Korea Legislation Research Institute), online: https://elaw.klri.re.kr/eng_service/lawView.do?hseq=25680&lang=ENG (accessed 27 February 2026).

[138] Susan Kreimer, “South Korea’s Plan to Avoid Population Collapse” (5 September 2024), Think Global Health (online), online: https://www.thinkglobalhealth.org/article/south-koreas-plan-avoid-population-collapse (accessed 27 February 2026).

[139] Kim Hee-Jung & Lee Sung-Jin, “The Fourth Basic Plan for an Ageing Society in Korea: Policy Directions and Challenges” (2022) Annals of Geriatric Medicine and Research 26(4): 234, online: PubMed Central https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9334168/ (accessed 27 February 2026).

[140] Republic of Korea, Framework Act on Low Birth Rate in an Aging Society, English translation (Korea Legislation Research Institute), online: https://elaw.klri.re.kr/eng_service/lawView.do?hseq=25680&lang=ENG (accessed 27 February 2026).

- Improving support systems for the elderly, including those that pertain to elderly care, financial stability, and housing.
- Creating a sustainable and engaged workforce, including policies enabling older adults to work longer.
- Reforming social welfare programs to adjust for older population demographics, including pension, healthcare, and long-term care systems.

Ultimately, the success South Korea has been able to have in supporting an aging population is due to its explicit policy focus and resultant concrete actions on the subject and the comprehensive suite of factors an effective response necessarily entails. Although the Plan does not contain climate or carbon emissions within its objectives, the actions and policies contained therein have been able to mete out in a net decrease in individual carbon emissions, as outlined above.

If Canada wishes to support an aging population and climate reform simultaneously, a similar comprehensive plan or act focused on aging populations is recommended. Canada will be most effectively able to respond to these twin pressures if, within a proposed aging population plan, it prioritizes emissions and climate reform as a policy goal and structures the plan's subgoals and policies around this goal and the Canadian climate reality.

6. Comparative Lessons for Canada

Examining both case studies below–that of a population increasing in size, India; and that of a population whose median age is increasing, South Korea–it is evident that a larger and older population, brought about by the invention of life-extending technologies, does not uniformly increase a population's carbon footprint. It is the patterns of activity within these populations that will truly drive the impact of life extension innovation on the climate, with law and policy which can shape these patterns in manners which Indian and South Korean evidence demonstrates as positive thus imperative.

7. A Framework for Canadian Policy: The DPSIR Model

The main policy issue we have identified is that aging-population driven growth is not on the radar of Canadian policymakers. Therefore, one policy framework we recommend is a model to assess this issue and determine if it requires further legislation or engagement. This model is called the Driving force – Pressure – State – Impact – Response (DPSIR) framework.[141]
This framework has been adopted and implemented to address a variety of different climate issues, including the protection of European water resources and analysis of the effects of climate change on ecosystems.[142]

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[141] M Spanò et al, "The DPSIR Framework in Support of Green Infrastructure Planning: A Case Study in Southern Italy" (2017) 21:1 *Land Use Policy* 543.
https://www.sciencedirect.com/science/article/abs/pii/S0264837716303258?via%3Dihub
[142]M Spanò et al, "The DPSIR Framework in Support of Green Infrastructure Planning: A Case Study in Southern Italy" (2017) 21:1 *Land Use Policy* 543.
https://www.sciencedirect.com/science/article/abs/pii/S0264837716303258?via%3Dihub

The framework seeks to identify a causal root of the issue, urging policy makers to consider the "*driving forces"* (D) that exert "*pressures"* on the environment, leading to changes in the "*state"* (S) of the environment. These changes give rise to "*impacts"* (I) on ecological systems, human health and society that may elicit a societal "*response"* (R).[143]

Driving Forces: At this stage, the government would engage in modelling to determine what the *driving forces* of longevity-driven growth likely are. For example, it could be an increase in life expectancy, an increase in health span, or aging technologies.

Pressures: This stage would involve identifying what *pressures* this phenomenon would put on the climate. For example, increased healthcare-related carbon emissions or increased demand for resources due to a larger population.

State: At this stage, we determine what *state* would result from these pressures. For example, maybe due to population growth there is increased emissions, and strain on healthcare resources.

Impact: At this stage, policy makers are asked to consider the *impact* of the state. For example, maybe the healthcare system is overburdened, or Canada's goal of becoming carbon neutral by 2050 is not met.

Response: Lastly, with the driving forces and pressures identified, the emphasis shifts to policy makers determining how they want to respond to the issue. Policy makers could consider how to incentivize sustainable living for older adults and efficiency within hospitals.

While the responses are too complex to analyze here, this framework does assist policy makers in isolating and identifying the potential issue, assessing its climate and other impacts, and beginning to think about strategies to approach the issue. This framework therefore represents a promising first step for Canada to begin thinking about this issue.

Conclusion

The four areas examined in this report illustrate the range of considerations associated with population aging and the prospect of extended human lifespan and healthspan. Aging populations create challenges for pension sustainability and intergenerational equity; access to life-extension technologies raises questions about affordability, health equity, and the respective roles of governments and private actors; developments in predictive genetics and longevity raise implications for insurance and the distribution of risk; and longer-lived populations may affect intergenerational obligations, patterns of population growth and consumption, and climate policy.

Across these areas, the report identifies ways in which existing Canadian systems and policy frameworks interact with changing demographic conditions. The international comparisons considered throughout the report provide additional examples of how other jurisdictions have approached pension sustainability, access to healthcare and innovative therapies, genetic

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[143] M Spanò et al, "The DPSIR Framework in Support of Green Infrastructure Planning: A Case Study in Southern Italy" (2017) 21:1 *Land Use Policy* 543.
https://www.sciencedirect.com/science/article/abs/pii/S0264837716303258?via%3Dihub

information and insurance, population aging, and environmental pressures. Together, these analyses highlight the range of considerations relevant to Canadian policy as population aging continues and advances in lifespan and healthspan develop.



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