

Appendix 1 (as supplied by the authors)

Supplementary Table 1. Global Burden of Disease study 2016 risk factor hierarchy and accompanying exposure definitions, theoretical minimum risk exposure level

Risk Level	Risk factors	Exposure definition	Theoretical minimum risk exposure level
1	Metabolic risks		
2	High fasting plasma glucose	Serum fasting plasma glucose measured in mmol/L	4.8–5.4 mmol/L
2	High total cholesterol	Serum total cholesterol, measured in mmol/L	2.78–3.38 mmol/L
2	High systolic blood pressure	Systolic blood pressure, measured in mmHg	110–115 mm Hg
2	High body-mass index	Body-mass index measured in kg/m ²	25 kg/m ²
2	Low bone mineral density	Standardized mean bone mineral density values measured by dual x-ray absorptiometry at the femoral neck in g/cm ²	99th percentile of National Health and Nutrition Examination Survey 2005–14 by age and sex
2	Impaired kidney function	Proportion of the population with ACR >30 mg/g and/or GFR <60 mL/min per 1.73m ² , excluding end-stage renal disease ACR=albumin-to-creatinine ratio GFR=glomerular filtration rate	ACR <30 mg/g and GFR >60 mL/min per 1.73m ²
1	Behavioural risks		
2	Child and maternal malnutrition		
3	Suboptimal breastfeeding		
4	Non-exclusive breastfeeding	Proportion of children younger than 6 months who receive predominant, partial, or no breastfeeding	All children are exclusively breastfed for first 6 months of life
4	Discontinued breastfeeding	Proportion of children aged 6–23 months who do not receive any breastmilk	All children continue to receive breastmilk until 2 years of age
3	Child growth failure		
4	Child underweight	Proportion of children less than –3 SD, –3 to –2 SD, and –2 to –1 SDs of the WHO 2006 standard weight-for-age curve	All children are above –1 SD of WHO 2006 standard weight-for-age curve
4	Child wasting	Proportion of children less than –3 SD, –3 to –2 SDs, and –2 to –1 SD of the WHO 2006 standard weight-for-length curve	All children are above –1 SD of WHO 2006 standard weight-for-height curve
4	Child stunting	Proportion of children less than –3 SD, –3 to –2 SD, and –2 to –1 SD of the WHO 2006 standard height-for-age curve	All children are above –1 SD of WHO 2006 standard height-for-age curve
3	Low birthweight and short gestation		

4	Short gestation for birthweight	Proportion of births occurring in 2 weeks bands starting from <24 weeks to 39–40 weeks	40–41 weeks gestation
4	Low birthweight for gestation	Proportion of births occurring in 500 g categories starting from <500 g to 4000–4499 g	4500–4999 g birthweight
3	Iron deficiency	Peripheral blood haemoglobin concentration in g/L	Counterfactual haemoglobin concentration in the absence of iron deficiency in g/L
3	Vitamin A deficiency	Proportion of children aged 0–5 years with serum retinol concentration <0.7 µmol/L	No childhood vitamin A deficiency
3	Zinc deficiency	Proportion of the population with inadequate zinc intake versus loss	No inadequate zinc intake
2	Tobacco		
3	Smoking	Smoking Impact Ratio method: cumulative exposure to smoked tobacco products, proxied by excess lung cancer mortality; direct smoking: 5 year lagged proportion of the population who currently smoke daily	All individuals are lifelong non-smokers
	Smokeless tobacco	Current use of any smokeless tobacco product	All individuals are lifelong non-users of smokeless tobacco products
	Second-hand smoke	Average daily exposure to air particulate matter in the home from second-hand smoke with an aerodynamic diameter smaller than 2.5 µg, measured in µg/m ³ , among non-smokers living with a current daily smoker	No second-hand smoke exposure
2	Alcohol and drug use		
3	Alcohol use	Average daily alcohol consumption of pure alcohol (measured in g per day) in current drinkers who had consumed alcohol during the past 12 months; binge drinking: proportion of the population reporting binge consumption of at least 60 g for males and 48 g for females of pure alcohol on a single occasion	No alcohol consumption
3	Drug use	Proportion of the population dependent upon opioids, cannabis, cocaine, or amphetamines; proportion of the population who have ever injected drugs	No drug use
2	Dietary risks		
3	Diet low in fruits	Average daily consumption of fruits (fresh, frozen, cooked, canned, or dried fruits, excluding fruit juices and salted or pickled fruits)	Consumption of fruit between 200 g and 300 g per day
3	Diet low in vegetables	Average daily consumption of vegetables (fresh, frozen, cooked, canned, or dried vegetables,	Consumption of vegetables between 290 g and 430 g per day

		excluding legumes and salted or pickled vegetables, juices, nuts, and seeds, and starchy vegetables such as potatoes or corn)	
3	Diet low in legumes	Average daily consumption of legumes (fresh, frozen, cooked, canned, or dried legumes)	Consumption of legumes between 50 g and 70 g per day
3	Diet low in whole grains	Average daily consumption of whole grains (bran, germ, and endosperm in their natural proportion) from breakfast cereals, bread, rice, pasta, biscuits, muffins, tortillas, pancakes, and other sources	Consumption of whole grains between 100 g and 150 g per day
3	Diet low in nuts and seeds	Average daily consumption of nut and seed foods	Consumption of nuts and seeds between 16 g and 25 g per day
3	Diet low in milk	Average daily consumption of milk including non-fat, low-fat, and full-fat milk, excluding soy milk and other plant derivatives	Consumption of milk between 350 g and 520 g per day
3	Diet high in red meat	Average daily consumption of red meat (beef, pork, lamb, and goat but excluding poultry, fish, eggs, and all processed meats)	Consumption of red meat between 18 g and 27 g per day
3	Diet high in processed meat	Average daily consumption of meat preserved by smoking, curing, salting, or addition of chemical preservatives	Consumption of processed meat between 0 g and 4 g per day
3	Diet high in sugar-sweetened beverages	Average daily consumption of beverages with ≥ 50 kcal per 226.8 g serving, including carbonated beverages, sodas, energy drinks, fruit drinks, but excluding 100% fruit and vegetable juices	Consumption of sugar-sweetened beverages between 0 g and 5 g per day
3	Diet low in fibre	Average daily intake of fibre from all sources including fruits, vegetables, grains, legumes, and pulses	Consumption of fibre between 19 g and 28 g per day
3	Diet low in calcium	Average daily intake of calcium from all sources, including milk, yogurt, and cheese	Consumption of calcium between 1.00 g and 1.50 g per day
3	Diet low in seafood omega 3 fatty acids	Average daily intake of eicosapentaenoic acid and docosahexaenoic acid	Consumption of seafood omega 3 fatty acids between 200 mg and 300 mg per day
3	Diet low in polyunsaturated fatty acids	Average daily intake of omega 6 fatty acids from all sources, mainly liquid vegetable oils, including soybean oil, corn oil, and safflower oil	Consumption of polyunsaturated fatty acids between 9% and 13% of total daily energy
3	Diet high in transfatty acids	Average daily intake of trans fat from all sources, mainly partially hydrogenated vegetable oils and ruminant products	Consumption of trans fatty acids between 0% and 1% of total daily energy
3	Diet high in sodium	24 h urinary sodium measured in g per day	24 h urinary sodium between 1 g and 5 g per day
2	Sexual abuse and violence		

3	Childhood sexual abuse	Proportion of the population ever having had the experience of intercourse or other contact abuse (ie, fondling and other sexual touching) when aged 15 years or younger, and the perpetrator or partner was more than 5 years older than the victim	No childhood sexual abuse
3	Intimate partner violence	Proportion of the population who have ever experienced one or more acts of physical or sexual violence by a present or former intimate partner since age 15 years	No intimate partner violence
2	Unsafe sex	Proportion of the population with exposure to sexual encounters that convey the risk of disease	No exposure to a disease agent through sex
2	Low physical activity	Average weekly physical activity at work, home, transport-related, and recreational measured by metabolic equivalent (MET) min per week	All adults experience 3000–4500 MET min per week
1	Environmental and occupational risks		
2	Unsafe water, sanitation, and handwashing		
3	Unsafe water source	Proportion of households with access to different water sources (unimproved, improved except piped, piped water supply) and reported use of household water treatment methods (boiling or filtering, chlorinating or solar filtering, no treatment)	All households have access to water from a piped water supply that is also boiled or filtered before drinking
3	Unsafe sanitation	Proportion of households with access to different sanitation facilities (unimproved, improved except sewer, sewer connection)	All households have access to toilets with sewer connection
3	No access to handwashing facility	Proportion of households with access to handwashing facility with soap, water, and wash station	All households have access to handwashing facility with soap, water, and wash station
2	Air pollution		
3	Ambient particulate matter pollution	Annual average daily exposure to outdoor air concentrations of PM _{2.5}	Uniform distribution between 2.4 µg/m ³ and 5.9 µg/m ³
3	Household air pollution from solid fuels	Individual exposure to PM _{2.5} due to use of solid cooking fuels	No households are exposed to excess indoor concentration of particles from solid fuel use (assuming PM _{2.5} in no fuel use is consistent with a TMREL of 2.4–5.9)
3	Ambient ozone pollution	Seasonal (3 month) hourly maximum ozone concentrations, measured in ppb	Uniform distribution between 33.3 µg/m ³ and 41.9 µg/m ³ , according to inimum/5th percent concentrations
2	Other environmental risks		

3	Residential radon	Average daily exposure to indoor air radon levels measured in becquerels (radon disintegrations per second) per cubic metre (Bq/m ³)	10 Bq/m ³ , corresponding to the outdoor concentration of radon
3	Lead exposure	Blood lead levels in µg/dL of blood, bone lead levels in µg/g of bone	2 µg/dL, corresponding to lead levels in pre-industrial humans as natural sources of lead prevent the feasibility of zero exposure
2	Occupational risks		
3	Occupational carcinogens		
4	Occupational exposure to asbestos	Proportion of the population with cumulative exposure to asbestos	No occupational exposure to asbestos
4	Occupational exposure to arsenic	Proportion of the population ever exposed to arsenic at work or through their occupation	No occupational exposure to arsenic 82·6% 74·9% 87·2%
4	Occupational exposure to benzene	Proportion of the population ever exposed to benzene at work or through their occupation	No occupational exposure to benzene
4	Occupational exposure to beryllium	Proportion of the population ever exposed to beryllium at work or through their occupation	No occupational exposure to beryllium
4	Occupational exposure to cadmium	Proportion of the population ever exposed to cadmium at work or through their occupation	No occupational exposure to cadmium
4	Occupational exposure to chromium	Proportion of the population ever exposed to chromium at work or through their occupation	No occupational exposure to chromium
4	Occupational exposure to diesel engine exhaust	Proportion of the population ever exposed to diesel engine exhaust at work or through their occupation	No occupational exposure to diesel engine exhaust
4	Occupational exposure to second-hand smoke	Proportion of the population ever exposed to second-hand smoke at work or through their occupation	No occupational exposure to second-hand smoke
4	Occupational exposure to formaldehyde	Proportion of the population ever exposed to formaldehyde at work or through their occupation	No occupational exposure to formaldehyde
4	Occupational exposure to nickel	Proportion of the population ever exposed to nickel at work or through their occupation	No occupational exposure to nickel
4	Occupational exposure to polycyclic aromatic hydrocarbons	Proportion of the population ever exposed to polycyclic aromatic hydrocarbons at work or through their occupation	No occupational exposure to polycyclic aromatic hydrocarbons
4	Occupational exposure to silica	Proportion of the population ever exposed to silica at work or through their occupation	No occupational exposure to silica
4	Occupational exposure to sulfuric acid	Proportion of the population ever exposed to sulfuric acid at work or through their occupation	No occupational exposure to sulfuric acid
4	Occupational exposure to trichloroethylene	Proportion of the population ever exposed to trichloroethylene at work or through their occupation	No occupational exposure to trichloroethylene

3	Occupational asthmagens	Proportion of the population currently exposed to asthmagens at work or through their occupation	Background asthmagen exposures
3	Occupational particulate matter, gases, and fumes	Proportion of the population ever exposed to particulates, gases, or fumes at work or through their occupation	No occupational exposure to particulates, gases, or fumes
3	Occupational noise	Proportion of the population ever exposed to noise greater than 85 dB at work or through their occupation	Background noise exposure
3	Occupational injuries	Proportion of the population at risk to injuries related to work or through their occupation	The rate of injury deaths per 100 000 person-years is zero
3	Occupational ergonomic factors	Proportion of the population who are exposed to ergonomic risk factors for low back pain at work or through their occupation	All individuals have the ergonomic factors of clerical and related workers

ACR=albumin-to-creatinine ratio; GFR=glomerular filtration rate; MET=metabolic equivalent; PM=particulate matter; ppb=parts per billion; WHO=World Health Organization.

Supplementary Table 2. Burden of disease attributable to risk factors for Canadians in 2016, expressed as a number value with corresponding 95% Uncertainty Intervals (UIs) and percent of total all-age Disability-Adjusted Life Years (DALYs), deaths, or Years Lived with Disability (YLDs) for causes within each risk factor.

	DALYs			Deaths			YLDs		
	Number	(95% UI)	%	Number	(95% UI)	%	Number	(95% UI)	%
Air pollution	117,489	(76,792-173,281)	1.3	7,630	(4,820-11,466)	2.8	7,452	(3,427-13,101)	0.2
Cardiovascular diseases	73,111	(58,778-89,405)	0.8	4,564	(3,572-5,689)	1.7	4,049	(2,526-5,834)	0.1
Chronic respiratory diseases	22,759	(10,928-39,708)	0.3	1,663	(823-2,817)	0.6	3,051	(790-6,515)	0.1
Diarrhea, lower respiratory, and other common infectious diseases	6,143	(1,215-14,849)	0.1	581	(115-1,402)	0.2	105	(21-264)	0.0
Neoplasms	15,467	(5,865-29,306)	0.2	822	(309-1,559)	0.3	238	(84-474)	0.0
Other non-communicable diseases	9	(6-13)	0.0	0	(0-0)	0.0	9	(6-13)	0.0
Alcohol and drug use	610,682	(389,286-846,178)	6.9	11,210	(4,304-18,442)	4.1	244,229	(142,372-362,883)	5.4
Cardiovascular diseases	-9,922	(-54,859-41,477)	-0.1	-2,090	(-5,084-1,191)	-0.8	8,215	(-643-19,367)	0.2
Cirrhosis and other chronic liver diseases	72,551	(65,814-79,457)	0.8	2,890	(2,626-3,149)	1.1	4,321	(2,972-6,082)	0.1
Diabetes, urogenital, blood, and endocrine diseases	-9,820	(-28,692-11,769)	-0.1	-351	(-778-144)	-0.1	-6,059	(-19,230-8,547)	-
Diarrhea, lower respiratory, and other common infectious diseases	4,128	(-3,199-10,873)	0.0	309	(-363-956)	0.1	104	(-19-238)	0.0
Digestive diseases	2,870	(1,274-4,749)	0.0	108	(30-191)	0.0	484	(218-839)	0.0
HIV/AIDS and tuberculosis	4,205	(3,067-5,746)	0.0	88	(65-110)	0.0	1,604	(760-2,991)	0.0

Mental disorders	300,390	(241,819-359,286)	3.4	2,747	(2,421-3,114)	1.0	200,677	(143,231-260,334)	4.4
Neoplasms	108,695	(88,078-128,408)	1.2	5,017	(3,993-5,981)	1.8	4,877	(3,376-6,776)	0.1
Neurological disorders	9,422	(4,076-18,383)	0.1	98	(63-130)	0.0	5,948	(1,118-14,577)	0.1
Other communicable, maternal, neonatal, and nutritional diseases	191	(111-317)	0.0	6	(4-10)	0.0	7	(3-13)	0.0
Self-harm and interpersonal violence	77,628	(48,693-104,422)	0.9	1,637	(970-2,275)	0.6	5,136	(2,820-8,341)	0.1
Transport injuries	42,399	(20,270-66,340)	0.5	651	(319-1,008)	0.2	14,185	(6,135-25,300)	0.3
Unintentional injuries	7,943	(2,833-14,952)	0.1	101	(39-183)	0.0	4,730	(1,631-9,477)	0.1
Child and maternal malnutrition	87,483	(68,728-110,821)	1.0	857	(695-1,043)	0.3	13,466	(8,468-21,084)	0.3
Diarrhea, lower respiratory, and other common infectious diseases	2,790	(2,041-3,747)	0.0	27	(19-36)	0.0	506	(289-813)	0.0
Maternal disorders	25	(9-45)	0.0	0	(0-0)	0.0	12	(4-23)	0.0
Neonatal disorders	71,351	(58,197-86,328)	0.8	824	(672-996)	0.3	33	(19-53)	0.0
Nutritional deficiencies	13,062	(8,312-20,326)	0.1	4	(2-5)	0.0	12,915	(8,156-20,195)	0.3
Other non-communicable diseases	256	(170-375)	0.0	3	(2-4)	0.0	0	(0-0)	0.0
Dietary risks	825,558	(663,881-1,001,918)	9.4	47,947	(38,938-57,444)	17.6	159,057	(100,807-232,048)	3.5
Cardiovascular diseases	592,386	(498,043-692,367)	6.7	39,121	(32,667-45,911)	14.3	73,089	(46,112-107,168)	1.6
Chronic respiratory diseases	295	(159-526)	0.0	1	(0-1)	0.0	280	(150-502)	0.0
Diabetes, urogenital, blood, and endocrine diseases	127,871	(90,122-171,973)	1.4	2,941	(2,018-3,902)	1.1	80,829	(51,456-117,374)	1.8

Digestive diseases	35	(21-54)	0.0	2	(1-3)	0.0	9	(5-16)	0.0
Musculoskeletal disorders	827	(471-1,375)	0.0	0	(0-0)	0.0	827	(471-1,375)	0.0
Neoplasms	103,888	(74,957-135,152)	1.2	5,859	(4,243-7,583)	2.1	3,961	(2,589-5,490)	0.1
Neurological disorders	251	(104-463)	0.0	23	(9-44)	0.0	57	(21-113)	0.0
Other non-communicable diseases	5	(2-9)	0.0	0	(0-0)	0.0	5	(2-9)	0.0
High body-mass index	796,622	(508,275-1,134,667)	9.0	29,459	(17,410-43,575)	10.8	329,408	(194,420-506,124)	7.3
Cardiovascular diseases	297,148	(195,608-401,718)	3.4	14,497	(8,877-20,586)	5.3	52,168	(30,584-79,922)	1.2
Chronic respiratory diseases	31,324	(17,377-50,824)	0.4	92	(56-138)	0.0	29,663	(15,876-48,635)	0.7
Diabetes, urogenital, blood, and endocrine diseases	234,057	(162,266-316,056)	2.7	5,553	(3,605-7,719)	2.0	143,584	(90,752-208,579)	3.2
Digestive diseases	4,353	(2,899-6,079)	0.0	307	(192-444)	0.1	918	(514-1,487)	0.0
Musculoskeletal disorders	88,876	(50,470-142,178)	1.0	0	(0-0)	0.0	88,876	(50,470-142,178)	2.0
Neoplasms	100,844	(63,811-142,904)	1.1	5,239	(3,289-7,534)	1.9	4,596	(2,632-7,240)	0.1
Neurological disorders	39,301	(15,510-73,600)	0.4	3,770	(1,390-7,154)	1.4	8,885	(3,258-16,773)	0.2
Other non-communicable diseases	717	(334-1,308)	0.0	0	(0-0)	0.0	717	(334-1,308)	0.0
High fasting plasma glucose	643,872	(445,513-919,677)	7.3	30,405	(19,553-46,768)	11.1	248,752	(168,968-349,923)	5.5
Cardiovascular diseases	195,939	(119,950-306,271)	2.2	13,907	(7,901-23,302)	5.1	26,252	(14,956-42,201)	0.6
Diabetes, urogenital, blood, and endocrine diseases	369,736	(305,586-447,546)	4.2	11,309	(10,331-12,345)	4.1	215,942	(152,563-292,211)	4.8
HIV/AIDS and tuberculosis	212	(119-322)	0.0	12	(6-19)	0.0	25	(14-41)	0.0

Neoplasms	60,536	(16,038-126,760)	0.7	3,579	(963-7,473)	1.3	2,077	(533-4,669)	0.0
Neurological disorders	16,752	(3,654-37,166)	0.2	1,598	(352-3,629)	0.6	3,759	(735-9,190)	0.1
Other non-communicable diseases	697	(166-1,611)	0.0	0	(0-0)	0.0	697	(166-1,611)	0.0
High systolic blood pressure	621,898	(532,665-715,967)	7.0	40,160	(33,068-47,337)	14.7	125,527	(89,103-167,651)	2.8
Cardiovascular diseases	562,390	(482,703-646,510)	6.4	36,410	(29,785-43,112)	13.4	102,974	(73,196-138,424)	2.3
Diabetes, urogenital, blood, and endocrine diseases	59,508	(49,963-69,457)	0.7	3,749	(3,283-4,225)	1.4	22,552	(15,907-29,227)	0.5
High total cholesterol	324,651	(258,211-407,350)	3.7	20,922	(14,353-29,030)	7.7	34,727	(21,211-52,968)	0.8
Cardiovascular diseases	324,651	(258,211-407,350)	3.7	20,922	(14,353-29,030)	7.7	34,727	(21,211-52,968)	0.8
Impaired kidney function	181,021	(157,599-203,878)	2.1	12,209	(10,691-13,889)	4.5	55,698	(41,305-71,533)	1.2
Cardiovascular diseases	69,105	(58,705-79,887)	0.8	6,400	(5,262-7,649)	2.3	9,227	(6,511-12,456)	0.2
Diabetes, urogenital, blood, and endocrine diseases	110,408	(97,867-121,923)	1.3	5,809	(5,429-6,240)	2.1	44,962	(33,766-57,010)	1.0
Musculoskeletal disorders	1,508	(1,027-2,067)	0.0	0	(0-0)	0.0	1,508	(1,027-2,067)	0.0
Low bone mineral density	84,886	(62,033-108,751)	1.0	3,985	(2,275-4,737)	1.5	50,567	(34,159-71,009)	1.1
Forces of nature, conflict and terrorism, and executions and police conflict	16	(3-47)	0.0	0	(0-0)	0.0	16	(3-47)	0.0
Self-harm and interpersonal violence	1,730	(1,163-2,478)	0.0	11	(6-13)	0.0	1,527	(983-2,248)	0.0
Transport injuries	18,860	(14,534-24,416)	0.2	346	(318-376)	0.1	12,724	(8,389-18,152)	0.3

Unintentional injuries	64,280	(46,333-81,809)	0.7	3,628	(1,951-4,349)	1.3	36,300	(24,784-50,562)	0.8
Low physical activity	114,148	(52,560-184,811)	1.3	8,366	(4,039-13,181)	3.1	19,403	(6,669-35,251)	0.4
Cardiovascular diseases	98,122	(49,641-152,612)	1.1	7,701	(3,927-11,809)	2.8	13,776	(5,532-24,092)	0.3
Diabetes, urogenital, blood, and endocrine diseases	8,209	(1,650-15,440)	0.1	220	(49-405)	0.1	5,147	(1,053-10,137)	0.1
Neoplasms	7,817	(1,269-16,759)	0.1	445	(63-966)	0.2	480	(84-1,023)	0.0
Occupational risks	426,227	(320,523-549,564)	4.8	11,485	(9,150-14,031)	4.2	185,881	(122,774-264,148)	4.1
Cardiovascular diseases	35,902	(28,081-44,970)	0.4	1,283	(995-1,630)	0.5	2,335	(1,540-3,272)	0.1
Chronic respiratory diseases	41,446	(33,558-50,547)	0.5	1,339	(1,025-1,715)	0.5	20,264	(14,584-27,289)	0.4
Diabetes, urogenital, blood, and endocrine diseases	15,261	(5,499-25,104)	0.2	194	(74-301)	0.1	10,484	(3,620-18,199)	0.2
Diarrhea, lower respiratory, and other common infectious diseases	5,475	(3,453-8,037)	0.1	218	(138-329)	0.1	126	(62-210)	0.0
Musculoskeletal disorders	80,932	(56,155-110,560)	0.9	0	(0-0)	0.0	80,932	(56,155-110,560)	1.8
Neoplasms	129,715	(104,642-155,651)	1.5	7,396	(6,028-8,807)	2.7	2,324	(1,649-3,110)	0.1
Other non-communicable diseases	19,538	(13,444-27,258)	0.2	0	(0-0)	0.0	19,538	(13,444-27,258)	0.4
Transport injuries	45,231	(37,207-55,302)	0.5	667	(563-791)	0.2	13,141	(8,363-19,390)	0.3
Unintentional injuries	52,726	(38,484-72,135)	0.6	388	(326-457)	0.1	36,737	(23,359-54,859)	0.8
Other environmental risks	15,555	(2,595-43,283)	0.2	617	(1-2,091)	0.2	7,651	(2,587-15,993)	0.2
Cardiovascular diseases	6,788	(1-22,886)	0.1	481	(0-1,574)	0.2	1,029	(0-4,045)	0.0

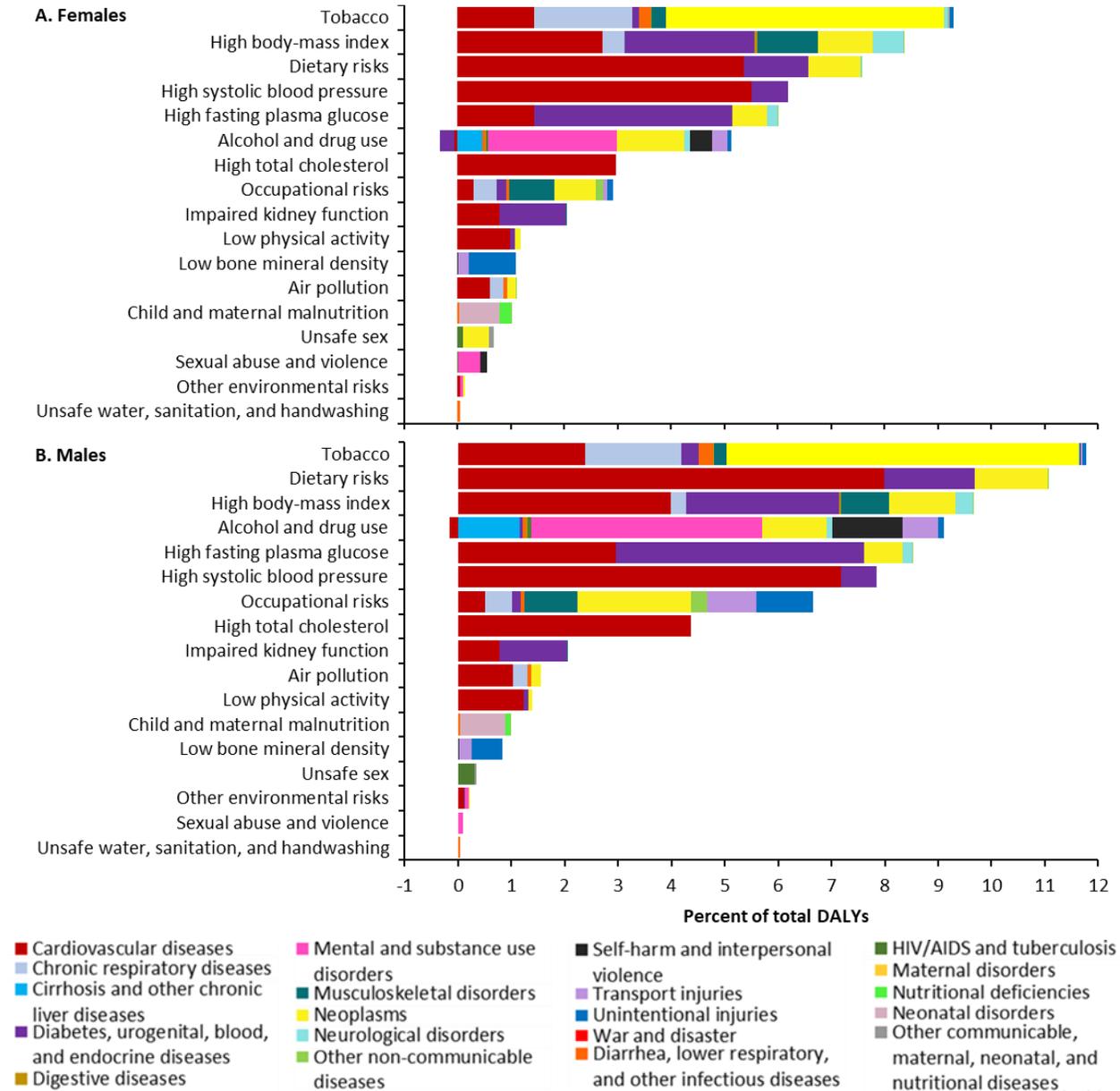
Diabetes, urogenital, blood, and endocrine diseases	530	(0-1,778)	0.0	40	(0-117)	0.0	175	(0-652)	0.0
Mental disorders	6,419	(2,587-11,185)	0.1	0	(0-0)	0.0	6,419	(2,587-11,185)	0.1
Neoplasms	1,818	(7-7,433)	0.0	96	(0-400)	0.0	28	(0-110)	0.0
Sexual abuse and violence	27,468	(19,206-37,087)	0.3	106	(76-139)	0.0	23,304	(15,399-32,249)	0.5
HIV/AIDS and tuberculosis	372	(173-651)	0.0	5	(3-8)	0.0	166	(57-356)	0.0
Maternal disorders	7	(3-12)	0.0	0	(0-0)	0.0	2	(1-4)	0.0
Mental disorders	21,748	(14,931-29,405)	0.2	44	(34-55)	0.0	20,359	(13,494-27,905)	0.5
Self-harm and interpersonal violence	5,341	(4,098-7,020)	0.1	57	(39-76)	0.0	2,778	(1,848-3,985)	0.1
Tobacco	932,456	(826,784-1,051,031)	10.6	47,737	(43,061-52,953)	17.5	129,360	(87,606-180,971)	2.9
Cardiovascular diseases	169,093	(147,672-190,522)	1.9	6,678	(5,886-7,445)	2.4	31,542	(22,255-42,860)	0.7
Chronic respiratory diseases	160,711	(146,412-177,049)	1.8	10,377	(9,389-11,619)	3.8	38,050	(31,278-45,869)	0.8
Diabetes, urogenital, blood, and endocrine diseases	20,770	(10,961-32,046)	0.2	398	(218-596)	0.1	13,462	(6,841-21,789)	0.3
Diarrhea, lower respiratory, and other common infectious diseases	21,264	(17,076-26,161)	0.2	1,483	(1,158-1,870)	0.5	712	(444-1,083)	0.0
Digestive diseases	1,667	(1,131-2,333)	0.0	57	(41-77)	0.0	600	(334-1,010)	0.0
Forces of nature, conflict and terrorism, and executions and police conflict	5	(1-15)	0.0	0	(0-0)	0.0	5	(1-15)	0.0
HIV/AIDS and tuberculosis	147	(84-216)	0.0	6	(3-9)	0.0	22	(11-36)	0.0
Musculoskeletal disorders	22,468	(11,737-35,733)	0.3	10	(4-17)	0.0	22,287	(11,491-35,484)	0.5
Neoplasms	522,401	(484,627-564,324)	5.9	28,399	(26,282-30,714)	10.4	12,522	(9,275-16,518)	0.3

Neurological disorders	4,162	(1,098-7,467)	0.0	220	(19-453)	0.1	1,853	(894-2,973)	0.0
Other non-communicable diseases	517	(313-780)	0.0	0	(0-0)	0.0	517	(313-780)	0.0
Self-harm and interpersonal violence	341	(196-566)	0.0	1	(0-1)	0.0	324	(183-544)	0.0
Transport injuries	2,901	(1,823-4,434)	0.0	18	(13-24)	0.0	2,422	(1,423-3,794)	0.1
Unintentional injuries	6,008	(3,653-9,385)	0.1	90	(48-127)	0.0	5,042	(2,863-8,216)	0.1
Unsafe sex	44,245	(35,762-56,984)	0.5	1,204	(1,099-1,334)	0.4	13,518	(6,867-23,902)	0.3
HIV/AIDS and tuberculosis	18,434	(13,626-25,465)	0.2	255	(237-273)	0.1	8,391	(3,737-15,286)	0.2
Neoplasms	21,115	(19,220-23,580)	0.2	932	(848-1,041)	0.3	739	(507-1,014)	0.0
Other communicable, maternal, neonatal, and nutritional diseases	4,697	(2,916-7,939)	0.1	17	(14-20)	0.0	4,388	(2,622-7,602)	0.1
Unsafe water, sanitation, and handwashing	4,164	(2,427-6,632)	0.0	307	(181-486)	0.1	885	(410-1,578)	0.0
Diarrhea, lower respiratory, and other common infectious diseases	4,164	(2,427-6,632)	0.0	307	(181-486)	0.1	885	(410-1,578)	0.0

This table only presents the causes modelled for each risk factor.

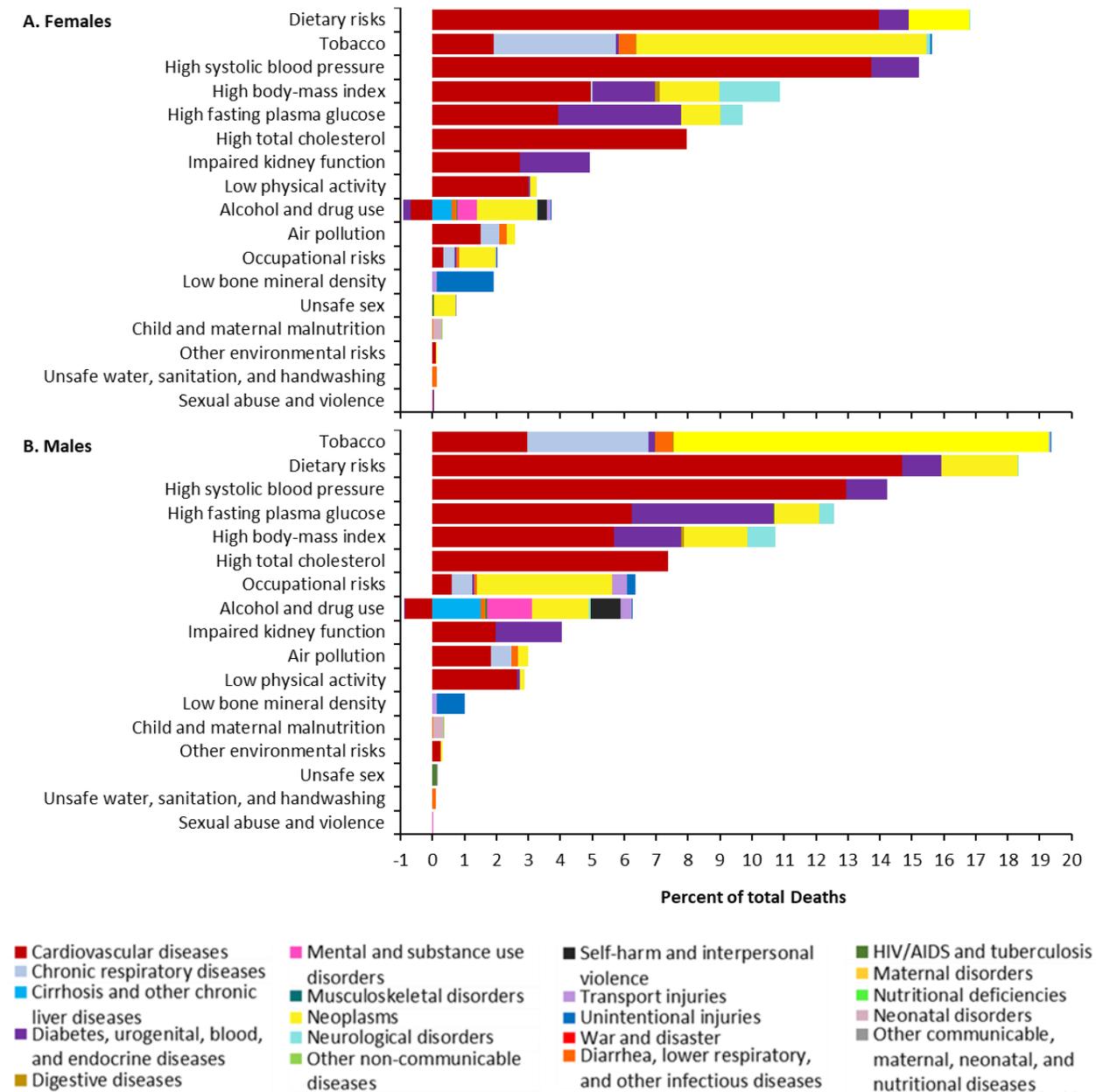
Negative values exist where a risk factor has demonstrated a beneficial impact on a cause.

Supplementary Figure 1. Burden of disease attributable to leading risk factors for Canadians in 2016, expressed as a percentage of total disability-adjusted life years (DALYs) for (A) females (B) males.



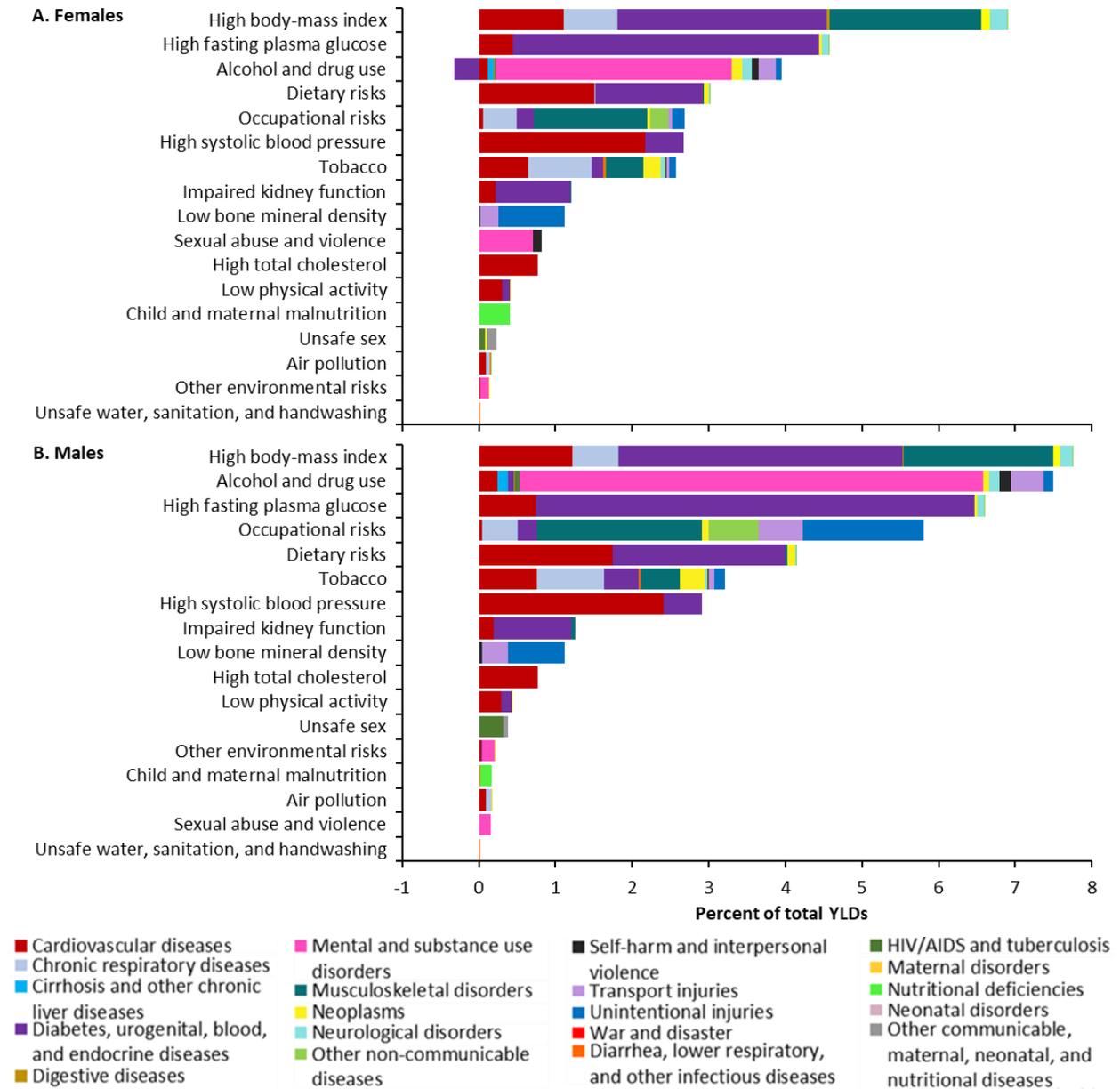
One DALY is equivalent to one year of healthy life (free of disease, injury, or disability) that has been lost. The negative percentage for alcohol is the protective effect of mild alcohol use on risk of cardiometabolic disease.

Supplementary Figure 2. The burden of disease attributable to leading risk factors for Canadians in 2016, expressed as a percentage of total deaths for (A) females (B) males



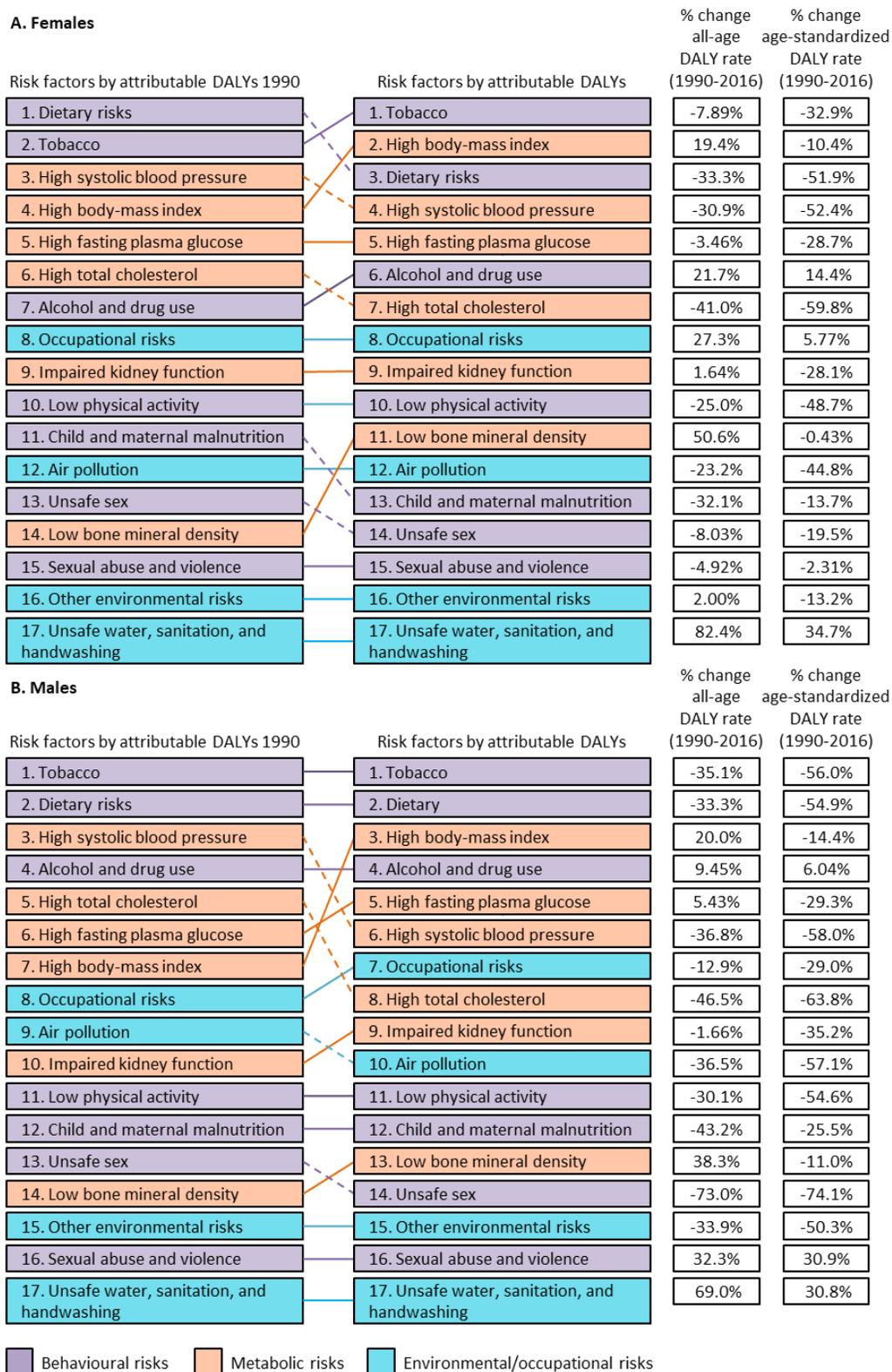
The negative percentage for alcohol is the protective effect of mild alcohol use on risk of cardiometabolic disease.

Supplementary Figure 3. The burden of disease attributable to leading risk factors for Canadians in 2016, expressed as a percentage of years lived with disability (YLDs) for (A) females (B) males



The negative percentage for alcohol is the protective effect of mild alcohol use on risk of cardiometabolic disease.

Supplementary Figure 4. Rank changes in disability-adjusted life years (DALYs) attributable to leading risk factors and percent change in all-age and age-standardized DALY rates in Canada between 1990 and 2016, for (A) women and (B) men



Supplementary Figure 5. Rank changes in total deaths attributable to leading risk factors and percent change in all-age and age-standardized death rates in Canada between 1990 and 2016, for (A) women and (B) men

A. Females

Risk factors by attributable deaths 1990	Risk factors by attributable deaths	% change all-age death rate (1990-2016)	% change age-standardized death rate (1990-2016)
1. Dietary risks	1. Dietary risks	-27.7%	-56.3%
2. High systolic blood pressure	2. Tobacco	12.3%	-24.4%
3. Tobacco	3. High systolic blood pressure	-22.3%	-54.3%
4. High total cholesterol	4. High body-mass index	26.9%	-20.8%
5. High fasting plasma glucose	5. High fasting plasma glucose	-3.47%	-40.0%
6. High body-mass index	6. High total cholesterol	-30.8%	-60.1%
7. Impaired kidney function	7. Impaired kidney function	11.9%	-36.6%
8. Low physical activity	8. Low physical activity	-15.0%	-51.2%
9. Air pollution	9. Alcohol and drug use	120%	56.3%
10. Occupational risks	10. Air pollution	-11.1%	-43.9%
11. Alcohol and drug use	11. Occupational risks	34.6%	-0.78%
12. Low bone mineral density	12. Low bone mineral density	91.4%	3.33%
13. Unsafe sex	13. Unsafe sex	-2.51%	-27.1%
14. Child and maternal malnutrition	14. Child and maternal malnutrition	-37.5%	-17.6%
15. Other environmental risks	15. Other environmental risks	-17.5%	-51.0%
16. Sexual abuse and violence	16. Unsafe water, sanitation, and handwashing	292%	126%
17. Unsafe water, sanitation, and handwashing	17. Sexual abuse and violence	-26.1%	-28.5%

B. Males

Risk factors by attributable deaths 1990	Risk factors by attributable deaths	% change all-age death rate (1990-2016)	% change age-standardized death rate (1990-2016)
1. Tobacco	1. Tobacco	-27.8%	-54.1%
2. Dietary risks	2. Dietary risks	-30.8%	-57.4%
3. High systolic blood pressure	3. High systolic blood pressure	-31.8%	-58.4%
4. High total cholesterol	4. High fasting plasma glucose	3.16%	-37.2%
5. High fasting plasma glucose	5. High body-mass index	18.0%	-24.0%
6. High body-mass index	6. High total cholesterol	-41.0%	-63.7%
7. Occupational risks	7. Occupational risks	-8.63%	-36.9%
8. Air pollution	8. Alcohol and drug use	48.0%	30.4%
9. Impaired kidney function	9. Impaired kidney function	5.55%	-39.6%
10. Low physical activity	10. Air pollution	-28.2%	-55.3%
11. Alcohol and drug use	11. Low physical activity	-23.4%	-54.6%
12. Unsafe sex	12. Low bone mineral density	82.3%	-1.89%
13. Child and maternal malnutrition	13. Child and maternal malnutrition	-44.8%	-27.3%
14. Low bone mineral density	14. Other environmental risks	-38.1%	-61.4%
15. Other environmental risks	15. Unsafe sex	-81.9%	-83.4%
16. Unsafe water, sanitation, and handwashing	16. Unsafe water, sanitation, and handwashing	216%	76.8%
17. Sexual abuse and violence	17. Sexual abuse and violence	66.8%	23.8%

Behavioural risks
 Metabolic risks
 Environmental/occupational risks

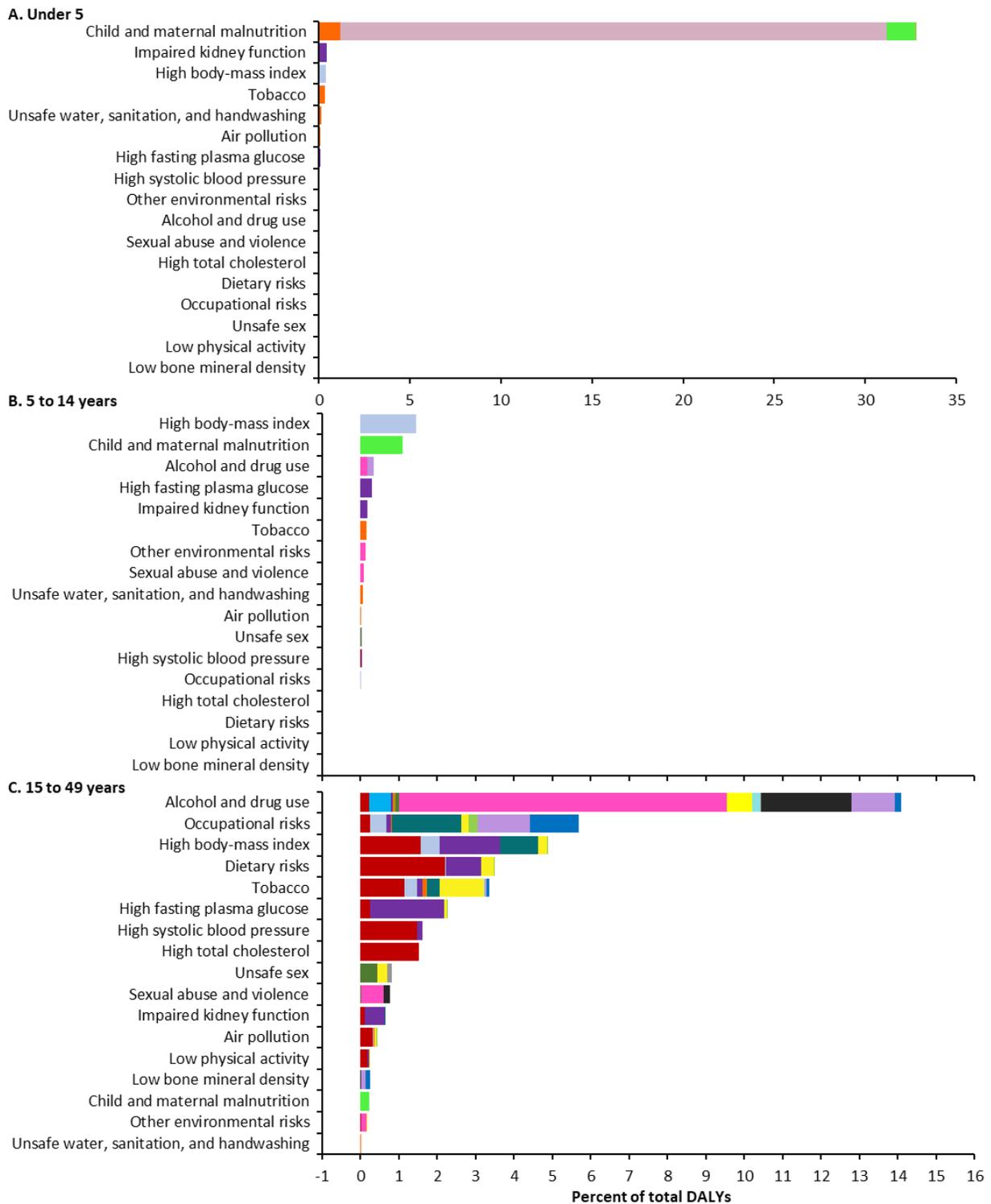
Supplementary Figure 6. Rank changes in years lived with disability (YLDs) attributable to leading risk factors and percent change in all-age and age-standardized YLD rates in Canada between 1990 and 2016 for (A) females (B) males

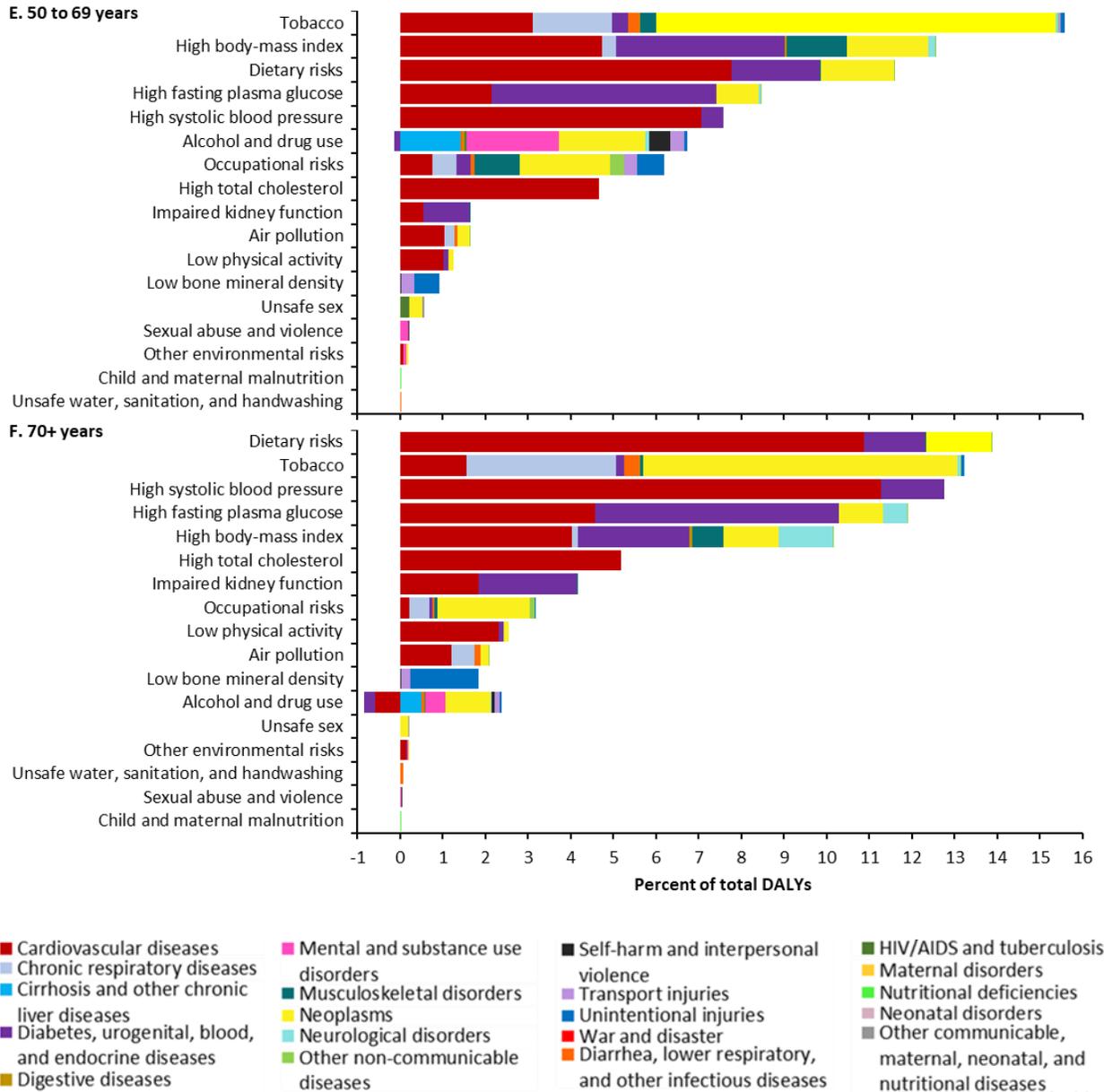
A. Females		% change all-age YLD rate (1990-2016)	% change age-standardized YLD rate (1990-2016)
Risk factors by attributable YLDs 1990	Risk factors by attributable YLDs 2016		
1. High body-mass index	1. High body-mass index	53.0%	20.4%
2. High fasting plasma glucose	2. High fasting plasma glucose	28.1%	-2.34%
3. Alcohol and drug use	3. Alcohol and drug use	11.4%	17.3%
4. Tobacco	4. Dietary risks	6.44%	-18.6%
5. Dietary risks	5. Occupational risks	32.8%	19.3%
6. High systolic blood pressure	6. High systolic blood pressure	5.76%	-24.8%
7. Occupational risks	7. Tobacco	-16.0%	-34.4%
8. Impaired kidney function	8. Impaired kidney function	34.8%	1.50%
9. Sexual abuse and violence	9. Low bone mineral density	50.4%	4.13%
10. High total cholesterol	10. Sexual abuse and violence	3.28%	5.75%
11. Low bone mineral density	11. High total cholesterol	3.49%	-26.1%
12. Child and maternal malnutrition	12. Low physical activity	27.7%	-8.54%
13. Low physical activity	13. Child and maternal malnutrition	-3.48%	11.7%
14. Unsafe sex	14. Unsafe sex	25.2%	25.5%
15. Air pollution	15. Air pollution	33.3%	-1.47%
16. Other environmental risks	16. Other environmental risks	68.7%	54.2%
17. Unsafe water, sanitation, and handwashing	17. Unsafe water, sanitation, and handwashing	-18.0%	-15.3%

B. Males		% change all-age YLD rate (1990-2016)	% change age-standardized YLD rate (1990-2016)
Risk factors by attributable YLDs 1990	Risk factors by attributable YLDs 2016		
1. Alcohol and drug use	1. High body-mass index	70.3%	28.5%
2. Occupational risks	2. Alcohol and drug use	11.2%	15.0%
3. High body-mass index	3. High fasting plasma glucose	51.2%	6.35%
4. High fasting plasma glucose	4. Occupational risks	8.92%	-3.05%
5. Tobacco	5. Dietary risks	22.9%	-13.4%
6. Dietary risks	6. Tobacco	-19.4%	-40.9%
7. High systolic blood pressure	7. High systolic blood pressure	7.97%	-27.8%
8. Impaired kidney function	8. Impaired kidney function	44.7%	1.64%
9. High total cholesterol	9. Low bone mineral density	39.5%	-7.5%
10. Low bone mineral density	10. High total cholesterol	-5.9%	-36.3%
11. Low physical activity	11. Low physical activity	30.4%	-15.4%
12. Unsafe sex	12. Unsafe sex	36.0%	24.4%
13. Child and maternal malnutrition	13. Other environmental risks	58.7%	42.1%
14. Air pollution	14. Child and maternal malnutrition	-14.9%	6.29%
15. Other environmental risks	15. Air pollution	28.1%	-12.9%
16. Sexual abuse and violence	16. Sexual abuse and violence	26.6%	30.6%
17. Unsafe water, sanitation, and handwashing	17. Unsafe water, sanitation, and handwashing	-21.9%	-15.0%

 Behavioural risks	 Metabolic risks	 Environmental/occupational risks
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Supplementary Figure 7. The burden of disease attributable to leading risk factors in 2016 for Canadians, expressed as a percentage of total disability-adjusted life years (DALYs) stratified by age group





The negative percentage for alcohol is the protective effect of mild alcohol use on risk of cardiometabolic disease.

Supplementary Figure 8. Rank changes of disability-adjusted life years (DALYs) attributable to leading risk factors and percent change in DALY rates and number of DALYs in Canada between 1990 and 2016, in age categories

A. Under 5

Risk factors by attributable DALYs 1990	Risk factors by attributable DALYs 2016	% change DALY rate (1990-2016)	% change in number of DALYs (1990-2016)
1. Child and maternal malnutrition	1. Child and maternal malnutrition	-24.2	-22.2
2. Tobacco	2. Impaired kidney function	39.9	43.5
3. Impaired kidney function	3. High body-mass index	28.8	32.1
4. High body-mass index	4. Tobacco	-54.9	-53.7
5. Air pollution	5. Unsafe water, sanitation, and handwashing	8.30	11.1
6. Unsafe water, sanitation, and handwashing	6. Air pollution	-57.0	-55.9
7. High fasting plasma glucose	7. High fasting plasma glucose	-37.8	-36.1
8. High systolic blood pressure	8. High systolic blood pressure	-2.43	0
9. Other environmental risks	9. Other environmental risks	140	146
10. Alcohol and drug use	10. Alcohol and drug use	59.1	63.2
11. Sexual abuse and violence	11. Sexual abuse and violence	18.29	21.2

B. 5-14 years

Risk factors by attributable DALYs 1990	Risk factors by attributable DALYs 2016	% change DALY rate (1990-2016)	% change in number of DALYs (1990-2016)
1. High body-mass index	1. High body-mass index	16.6	11.6
2. Child and maternal malnutrition	2. Child and maternal malnutrition	14.0	9.20
3. Alcohol and drug use	3. Alcohol and drug use	-9.04	-12.9
4. High fasting plasma glucose	4. High fasting plasma glucose	-12.7	-16.4
5. Tobacco	5. Impaired kidney function	-18.2	-21.7
6. Impaired kidney function	6. Tobacco	-43.9	-46.3
7. Other environmental risks	7. Other environmental risks	-8.50	-12.4
8. Unsafe water, sanitation, and handwashing	8. Sexual abuse and violence	17.6	12.7
9. Sexual abuse and violence	9. Unsafe water, sanitation, and handwashing	-16.1	-19.7
10. Air pollution	10. Air pollution	-56.2	-58.0
11. Unsafe sex	11. Unsafe sex	-50.8	-52.9
12. High systolic blood pressure	12. High systolic blood pressure	-13.6	-17.2
13. Occupational risks	13. Occupational risks	-3.36	-7.44

Behavioural risks
 Metabolic risks
 Environmental/occupational risks

C. 15-49 years

Risk factors by attributable DALYs 1990	Risk factors by attributable DALYs 2016	% change DALY rate (1990-2016)	% change in number of DALYs (1990-2016)
1. Alcohol and drug use	1. Alcohol and drug use	1.14	13.9
2. Occupational risks	2. Occupational risks	-15.7	-5.09
3. Tobacco	3. High body-mass index	1.55	14.3
4. Dietary risks	4. Dietary risks	-36.4	-28.4
5. High body-mass index	5. Tobacco	-49.4	-43.1
6. High total cholesterol	6. High fasting plasma glucose	0.60	13.3
7. High systolic blood pressure	7. High systolic blood pressure	-42.7	-35.5
8. Unsafe sex	8. High total cholesterol	-46.7	-40.0
9. High fasting plasma glucose	9. Unsafe sex	-64.2	-59.7
10. Sexual abuse and violence	10. Sexual abuse and violence	1.58	14.4
11. Air pollution	11. Impaired kidney function	-7.94	3.65
12. Impaired kidney function	12. Air pollution	-44.9	-38.0
13. Low physical activity	13. Low physical activity	-33.3	-24.9
14. Low bone mineral density	14. Low bone mineral density	-1.12	11.3
15. Child and maternal malnutrition	15. Child and maternal malnutrition	6.94	20.4
16. Other environmental risks	16. Other environmental risks	17.7	32.5
17. Unsafe water, sanitation, and handwashing	17. Unsafe water, sanitation, and handwashing	-1.83	10.5

D. 50-69 years

Risk factors by attributable DALYs 1990	Risk factors by attributable DALYs 2016	% change DALY rate (1990-2016)	% change in number of DALYs (1990-2016)
1. Tobacco	1. Tobacco	-52.3	-1.10
2. Dietary risks	2. High body-mass index	-20.4	64.8
3. High systolic blood pressure	3. Dietary risks	-56.4	-9.71
4. High body-mass index	4. High fasting plasma glucose	-31.7	41.5
5. High total cholesterol	5. High systolic blood pressure	-60.0	-17.1
6. High fasting plasma glucose	6. Alcohol and drug use	10.5	129
7. Occupational risks	7. Occupational risks	-26.2	53.0
8. Alcohol and drug use	8. High total cholesterol	-65.8	-29.1
9. Air pollution	9. Impaired kidney function	-37.4	29.8
10. Low physical activity	10. Air pollution	-57.4	-11.7
11. Impaired kidney function	11. Low physical activity	-56.4	-9.67
12. Low bone mineral density	12. Low bone mineral density	-13.9	78.4
13. Unsafe sex	13. Unsafe sex	-26.4	52.5
14. Other environmental risks	14. Sexual abuse and violence	-0.43	106
15. Sexual abuse and violence	15. Other environmental risks	-59.8	-16.8
16. Unsafe water, sanitation, and handwashing	16. Child and maternal malnutrition	80.4	274
17. Child and maternal malnutrition	17. Unsafe water, sanitation, and handwashing	41.2	193

Behavioural risks
 Metabolic risks
 Environmental/occupational risks

E. 70+ years

Risk factors by attributable DALYs 1990	Risk factors by attributable DALYs 2016	% change DALY rate (1990-2016)	% change in number of DALYs (1990-2016)
1. Dietary risks	1. Dietary risks	-52.0	-9.96
2. High systolic blood pressure	2. Tobacco	-38.0	16.2
3. Tobacco	3. High systolic blood pressure	-50.6	-7.35
4. High fasting plasma glucose	4. High fasting plasma glucose	-29.5	32.2
5. High total cholesterol	5. High body-mass index	-5.35	77.4
6. High body-mass index	6. High total cholesterol	-57.1	-19.6
7. Impaired kidney function	7. Impaired kidney function	-26.6	37.6
8. Low physical activity	8. Occupational risks	-19.5	50.8
9. Occupational risks	9. Low physical activity	-46.5	0.20
10. Air pollution	10. Air pollution	-46.7	-0.02
11. Low bone mineral density	11. Low bone mineral density	16.9	119
12. Other environmental risks	12. Alcohol and drug use	1220	2375
13. Unsafe sex	13. Unsafe sex	-29.6	31.9
14. Alcohol and drug use	14. Other environmental risks	-46.1	0.98
15. Sexual abuse and violence	15. Unsafe water, sanitation, and handwashing	130	332
16. Unsafe water, sanitation, and handwashing	16. Sexual abuse and violence	-10.5	67.8
17. Child and maternal malnutrition	17. Child and maternal malnutrition	7.89	102

Behavioural risks
 Metabolic risks
 Environmental/occupational risks