The Economic Benefits of Fruit and Vegetable Consumption in Canada

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1. Executive Summary

- In 2013, an estimated 27.6 million (78.4%) Canadians did not consume the recommended number of daily servings of fruits and vegetables.
- This low level of fruit and vegetable consumption is associated with an annual economic burden of $4.4 billion.
- A very modest 1% annual relative *increase* in fruit and vegetable consumption would result in $8.4 billion in costs avoided between 2013 and 2036. (This number increases substantially when combined with the impact of the reduction in excess weight. Increased fruit and vegetable consumption is often considered to be associated with a reduction in body weight).

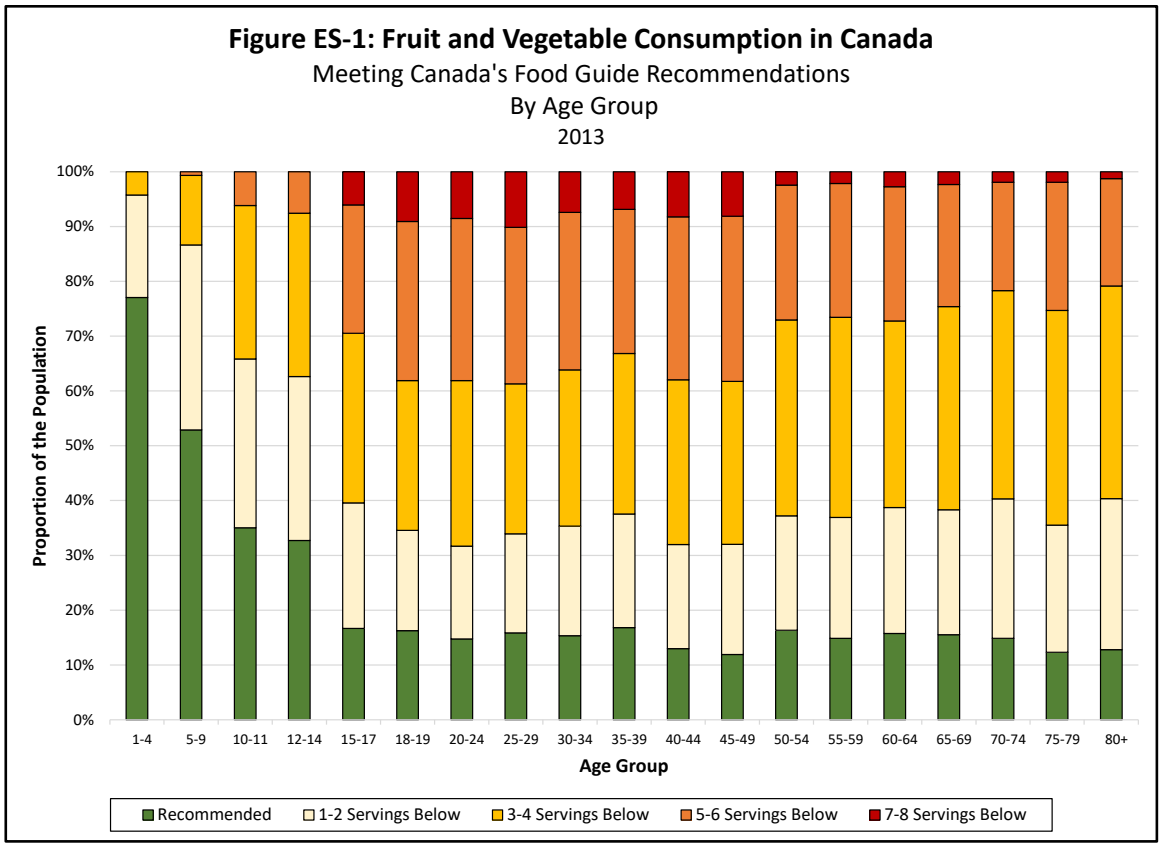
The Canadian Produce Marketing Association (CPMA) has a long history of promoting the consumption of fruits and vegetables (F/V) in Canada. The CPMA, working with its partner organizations, is in the process of developing an integrated, focused, and inspiring *Pan Canadian Fruit and Vegetable Health Policy* which is supported by sound science and data.

The purpose of this report is to provide key aspects of the sound science and data needed to support this policy.

The current policy could be improved with enhanced data as follows:

1. A better understanding of current F/V consumption levels by sex, age and province placed in the context of consumption trends over the last decade. This data is critical in establishing future F/V consumption targets that are reasonably achievable.
2. A more complete understanding of the health and economic benefits attributable to F/V consumption.
    a. What is the lack of F/V consumption costing society in terms of poorer health and increased economic burden?
    b. What are the health and economic benefits of increasing F/V consumption?

In 2013, just 20.7% of the population ages 1+ met or exceeded Canada's Food Guide recommendations regarding daily F/V consumption (see Figure ES-1). Consumption varies by sex and age. For example, a higher proportion of females (25.3%) than males (16.0%) met or exceeded Canada's Food Guide recommendations. A much higher proportion of children than adults also met or exceeded Canada's Food Guide recommendations.



There is also a significant variation by province in the proportion of the population age 1+ who met or exceeded Canada's Food Guide recommendations regarding daily F/V consumption, ranging from a low of 10.3% in Newfoundland and Labrador to a high of 25.9% in Quebec.

There has been a statistically significant increase in fruit and vegetable consumption between 2000 and 2007 in Canada, followed by a significant decrease thereafter to 2013. This pattern is observed in virtually every province. A key exception is Prince Edward Island in which a significant increase in consumption was observed between 2000 and 2013. In Saskatchewan and Manitoba, the increase between 2000 and 2007 was also observed but this was not followed by a significant decrease between 2007 and 2013. The reasons for these observed trends are likely multi-faceted. It is interesting to note, however, that the timing of the change in consumption roughly corresponds with the global recession in 2008 and 2009 that also impacted Canada. Furthermore, between 2008 and 2013 the Consumer Price Index increased by 7.6% in Canada. The price of fresh fruit, however, increased by 14.5% during this same period while the price of fresh vegetables increased by 16.7%.

The evidence indicating a protective effect of F/V consumption on **coronary/ischaemic heart disease** and **cerebrovascular disease/stroke** is both consistent and compelling. The evidence indicating a protective effect for **cancers** attributable to increased F/V consumption has had a mixed history. While early studies suggested a significant protective effect of F/V consumption on cancer risk, more recent high quality studies have not found such a relationship. There is a potential protective effect for cancers of the lung, esophagus (but only esophageal squamous cell carcinomas and not esophageal adenocarcinomas), and head and neck. These cancers, however, tend to be caused by smoking and alcohol and the observed

associations may be due to residual confounding by these factors. We have included the potential protective effect for lung cancer, esophageal squamous cell carcinomas and cancers of the head and neck in our modelling, ***but do so with caution***.

While there is a clear relationship between **hypertension** and lifestyle choices and habits, including improved diet, aerobic exercise, alcohol and sodium restriction, and fish oil supplements, the specific role of F/V consumption remains unclear. Most trials assessing hypertension and F/V consumption also focus on weight loss, with weight loss dominating in effectiveness. Maintaining a normal body weight, or losing weight, could be one important pathway through which fruit and vegetable consumption may contribute to hypertension control. The modelling includes hypertension as an important co-morbidity attributable to excess weight and, as such, it is not included with F/V consumption.

The available high-quality evidence also suggest that there is no statistically significant relationship between F/V consumption and the risk of **type 2 diabetes**, although there may be some benefit attributable to specific types of fruits and vegetables.

Finally, in addition to the benefits of F/V consumption on reductions in the risk of coronary heart diseases, stroke and possibly several cancers, increased F/V consumption is often considered to be associated with lower body weight or weight loss, at least partially due to their lower energy density and the possible substitution for other, energy-dense foods in the diet. Current research in this area suggests that increased F/V consumption is most effective if provided in the context of encouraging the reduction in consumption of other, more energy-dense foods.

The annual economic burden attributable to low fruit and vegetable intake, physical inactivity, alcohol use, smoking and excess weight in Canada in 2013 is $67.3 billion ($21.6 in direct costs[1] and $45.7 billion in indirect costs[2]) (see Table ES-1).

The estimated annual economic burden by risk factor is as follows:

- ***Low fruit and vegetable intake – $4.4 billion***
- Physical inactivity – $9.3 billion
- Alcohol use – $10.6 billion
- Smoking – $19.5 billion
- Excess weight – $23.5 billion

An estimated 27.6 million (78.4%) Canadians are not consuming the recommended number of daily servings of fruits and vegetables. This proportion is higher for males (83.0% or 14.5 million males) than for females (73.9% or 13.1 million females). A higher proportion of males are also in the lowest consumption categories. For example, 36.9% of males are 5 or more servings below Canada's recommended number of daily servings of fruits and vegetables. This compares to 17.9% for females. As a result, the annual economic burden

[1] Direct costs include expenditures on hospital care, physician services and other health care professionals, drugs, public health and healthcare administration.
[2] Indirect costs include estimated costs from lost productivity due to premature mortality and short- and long-term disability.

attributable to low fruit and vegetable intake among males is almost twice as high ($2.9 billion) as females ($1.5 billion).

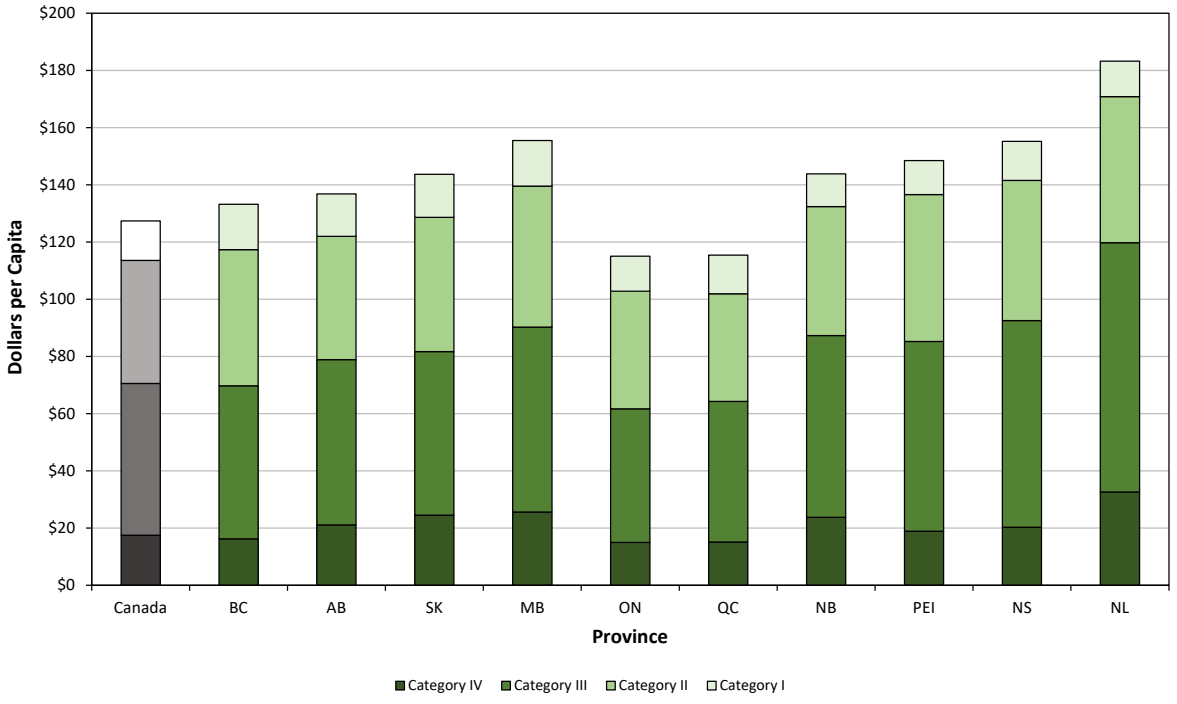
Table ES-1: Estimated Prevalence of RFs, Total Economic Burden for Multifactorial System, and Disaggregated Costs by RF
Canada, 2013, By Sex
Adjusted for Multiple RFs in One Individual

	% Population with RF	# Individuals with RF	Direct Cost per Individual with RF ($'s)	Indirect Cost per Individual with RF ($'s)	Total Cost per Individual with RF ($'s)	Total Direct Cost of RF (million$)	Total Indirect Cost of RF (million$)	Total Cost of RF (million$)
Males								
Smokers								
Light	7.7%	1,335,866	$787	$1,536	**$2,323**	$1,052	$2,052	**$3,103**
Moderate	5.8%	1,017,398	$1,300	$2,514	**$3,814**	$1,323	$2,558	**$3,880**
Heavy	6.4%	1,116,660	$1,599	$3,065	**$4,663**	$1,785	$3,422	**$5,207**
Subtotal - Male Smokers	**19.9%**	**3,469,923**	**$1,199**	**$2,315**	**$3,513**	**$4,160**	**$8,032**	**$12,191**
Excess Weight								
Overweight	36.8%	6,412,877	$200	$559	**$758**	$1,281	$3,583	**$4,864**
Obese	16.1%	2,810,973	$725	$1,658	**$2,383**	$2,037	$4,661	**$6,698**
Subtotal - Male Excess Weight	**52.9%**	**9,223,850**	**$360**	**$894**	**$1,253**	**$3,318**	**$8,244**	**$11,562**
Inactive	**40.9%**	**7,123,822**	**$217**	**$387**	**$604**	**$1,547**	**$2,759**	**$4,306**
Low Fruit & Vegetable Intake								
Category I	17.9%	3,121,563	$25	$52	**$77**	$78	$162	**$240**
Category II	28.6%	4,993,202	$56	$114	**$170**	$280	$570	**$851**
Category III	28.8%	5,015,097	$86	$170	**$256**	$431	$855	**$1,286**
Category IV	7.7%	1,341,277	$130	$254	**$384**	$175	$341	**$516**
Subtotal - Male Below Recommended Intake	**83.0%**	**14,471,139**	**$67**	**$133**	**$200**	**$965**	**$1,927**	**$2,892**
Alcohol								
Category I - Low	48.1%	8,379,818	$77	$199	**$276**	$647	$1,666	**$2,313**
Category II - Hazardous	6.4%	1,113,332	$488	$1,060	**$1,548**	$543	$1,181	**$1,724**
Category III - Harmful	6.0%	1,046,732	$1,235	$2,225	**$3,460**	$1,292	$2,329	**$3,621**
Subtotal - Male Drinkers	**60.5%**	**10,539,882**	**$236**	**$491**	**$727**	**$2,483**	**$5,176**	**$7,658**
Subtotal - Males						**$12,472**	**$26,138**	**$38,610**
Females								
Smokers								
Light	7.5%	1,335,280	$600	$1,147	**$1,748**	$802	$1,532	**$2,334**
Moderate	4.8%	858,947	$1,037	$2,004	**$3,041**	$890	$1,721	**$2,612**
Heavy	2.8%	489,908	$1,638	$3,161	**$4,799**	$802	$1,549	**$2,351**
Subtotal - Female Smokers	**15.1%**	**2,684,135**	**$929**	**$1,789**	**$2,718**	**$2,494**	**$4,802**	**$7,296**
Excess Weight								
Overweight	23.8%	4,218,077	$293	$762	**$1,055**	$1,234	$3,216	**$4,450**
Obesity	15.0%	2,651,956	$887	$1,931	**$2,818**	$2,352	$5,121	**$7,473**
Subtotal - Female Excess Weight	**38.8%**	**6,870,032**	**$522**	**$1,214**	**$1,736**	**$3,586**	**$8,337**	**$11,923**
Inactive	**46.3%**	**8,214,148**	**$184**	**$425**	**$609**	**$1,509**	**$3,494**	**$5,003**
Low Fruit & Vegetable Intake								
Category I	25.7%	4,551,633	$17	$35	**$52**	$78	$158	**$237**
Category II	30.5%	5,412,903	$39	$78	**$117**	$211	$422	**$634**
Category III	16.0%	2,838,335	$65	$127	**$192**	$183	$360	**$544**
Category IV	1.7%	297,623	$99	$189	**$288**	$29	$56	**$86**
Subtotal - Female Below Recommended Intake	**73.9%**	**13,100,495**	**$38**	**$76**	**$114**	**$502**	**$997**	**$1,499**
Alcohol								
Category I - Low	41.9%	7,435,139	$36	$88	$124	$266	$653	**$919**
Category II - Hazardous	5.1%	905,236	$279	$565	**$845**	$253	$512	**$764**
Category III - Harmful	2.3%	403,673	$1,153	$1,955	**$3,108**	$465	$789	**$1,255**
Subtotal - Female Drinkers	**49.3%**	**8,744,048**	**$113**	**$223**	**$336**	**$984**	**$1,954**	**$2,938**
Subtotal - Females						**$9,077**	**$19,584**	**$28,660**
Both Sexes								
Smokers								
Light	7.6%	2,671,146	$694	$1,342	**$2,035**	$1,853	$3,584	**$5,437**
Moderate	5.3%	1,876,344	$1,180	$2,281	**$3,460**	$2,213	$4,279	**$6,492**
Heavy	4.6%	1,606,568	$1,611	$3,094	**$4,705**	$2,587	$4,971	**$7,558**
Subtotal - Smokers	**17.5%**	**6,154,058**	**$1,081**	**$2,085**	**$3,167**	**$6,654**	**$12,833**	**$19,488**
Excess Weight								
Overweight	30.2%	10,630,954	$237	$640	**$876**	$2,515	$6,799	**$9,314**
Obesity	15.5%	5,462,929	$804	$1,790	**$2,594**	$4,390	$9,781	**$14,171**
Subtotal - Excess Weight	**45.8%**	**16,093,882**	**$429**	**$1,030**	**$1,459**	**$6,904**	**$16,581**	**$23,485**
Inactive	**43.6%**	**15,337,970**	**$199**	**$408**	**$607**	**$3,056**	**$6,253**	**$9,309**
Low Fruit & Vegetable Intake								
Category I	21.8%	7,673,196	$20	$42	**$62**	$157	$320	**$476**
Category II	29.6%	10,406,104	$47	$95	**$143**	$492	$993	**$1,484**
Category III	22.3%	7,853,433	$78	$155	**$233**	$615	$1,215	**$1,830**
Category IV	4.7%	1,638,900	$125	$242	**$367**	$204	$397	**$601**
Subtotal - Below Recommended Intake	**78.4%**	**27,571,634**	**$53**	**$106**	**$159**	**$1,467**	**$2,924**	**$4,392**
Alcohol								
Category I - Low	45.0%	15,814,957	$58	$147	**$204**	$913	$2,319	**$3,232**
Category II - Hazardous	5.7%	2,018,568	$394	$838	**$1,233**	$796	$1,692	**$2,488**
Category III - Harmful	4.1%	1,450,405	$1,212	$2,150	**$3,362**	$1,758	$3,118	**$4,876**
Subtotal - Alcohol	**54.9%**	**19,283,929**	**$180**	**$370**	**$550**	**$3,467**	**$7,130**	**$10,597**
Total						**$21,549**	**$45,722**	**$67,270**

RF = Risk Factor

On average, the annual economic burden attributable to low fruit and vegetable intake ***per capita*** is $127 in Canada, ranging from a low of $115 in Ontario and Quebec to a high of $183 in Newfoundland and Labrador (see Figure ES-2).

Figure ES-2: Estimated Annual Economic Burden *per Capita*
Attributable to Low Fruit and Vegetable Intake
Canada and the Provinces
2013



The 4.38 servings of fruits and vegetables consumed per day by Canadians in 2013 equates to approximately 55.6 billion servings that year. This (relatively) low level of consumption is associated with an annual economic burden of $4.4 billion ($1.5 billion in direct and $2.9 billion in indirect costs) in 2013. If the consumption of fruit and vegetables were to increase by 20%, then average daily consumption would be 5.26 servings and annual total consumption would increase to 66.7 billion servings. If we assume that this increase would only be by the 78.4% of the population not consuming the recommended daily servings, then we could expect an approximate reduction in economic burden of 20% or $878 million annually.

Changing unhealthy behaviours at the population level takes time. Reductions in the prevalence of tobacco smoking, for example, have occurred over a half century from their peak in the late 1950s. We have therefore modelled a longer term (23 years) reduction involving a 1% annual relative increase in fruit and vegetable consumption. The focus of the model is on annually moving 1% of individuals closer to the recommended number of servings of fruits and vegetables. We assume that anyone who was previously in category I (1-2 servings below Canada's Food Guide) or II (3-4 servings below Canada's Food Guide) would consume the recommended number of servings of F/V (and therefore incur no costs associated with the RF). Anyone who was previously in category III (5-6 servings below Canada's Food Guide) or IV (7-8 servings below Canada's Food Guide) would move into

category II (and therefore would incur the costs associated with category II). The model also takes into account projected population growth. Finally, the results for fruit and vegetable consumption are placed in the context of tobacco smoking, excess weight, alcohol consumption and physical inactivity. All future costs (and costs avoided) are provided in 2013 constant Canadian dollars.

If a 1% annual relative reduction occurred annually between 2013 and 2036, the *cumulative reduction* in economic burden would be $148.0 billion. The estimated cumulative reduction by risk factor is as follows (see Table ES-2 and Figure ES-3):

- ***Low fruit and vegetable intake – $8.4 billion***
- Physical inactivity – $25.9 billion
- Alcohol use – $25.7 billion
- Smoking – $35.4 billion
- Excess weight – $52.6 billion

As noted above, increased F/V consumption is often considered to be associated with lower body weight or weight loss, especially if the fruits and vegetables replace other, more energy-dense foods. The estimated $8.4 billion in reduced economic burden attributable to increased F/V consumption does not take into account this association.

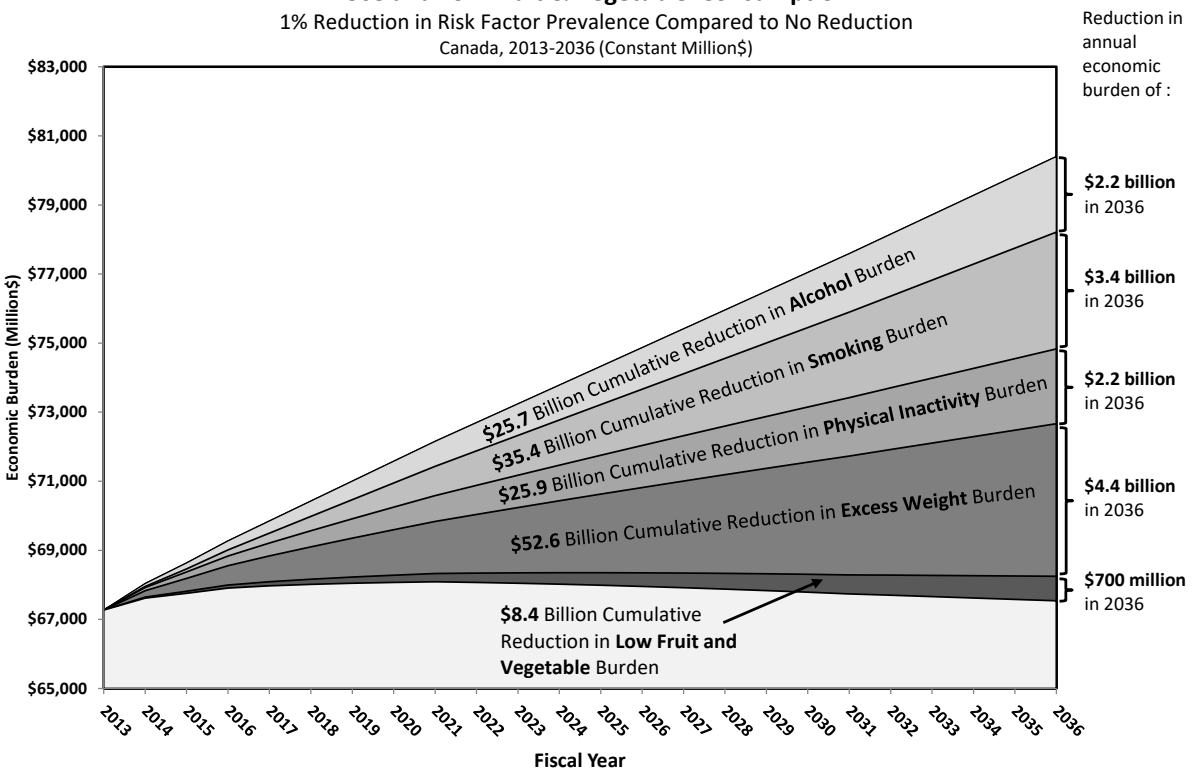
Table ES-2: Reduction in Economic Burden of Smoking, Excess Weight, Physical Inactivity, Alcohol Use and Low Fruit & Vegetable Consumption
1% Annual Reduction in Risk Factor Prevalence Compared to No Reduction
Canada, 2013-2036 (Constant Million$)

Year	Smoking	Excess Weight	Physical Inactivity	Alcohol Use	Fruits and Vegetables	Combined
2013	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2014	$29.5	$185.6	$93.1	$85.5	$29.4	$423.1
2015	$88.5	$372.2	$186.4	$173.3	$59.0	$879.4
2016	$176.8	$559.6	$279.8	$262.6	$88.7	$1,367.4
2017	$286.0	$747.8	$373.2	$353.1	$118.6	$1,878.6
2018	$415.8	$936.6	$466.8	$444.6	$148.5	$2,412.3
2019	$553.5	$1,126.2	$560.4	$537.0	$178.7	$2,955.9
2020	$699.1	$1,316.5	$654.2	$630.3	$208.9	$3,509.0
2021	$847.4	$1,507.4	$748.0	$724.4	$239.3	$4,066.5
2022	$998.5	$1,699.0	$842.0	$819.2	$269.8	$4,628.4
2023	$1,152.1	$1,891.0	$936.0	$914.7	$300.4	$5,194.2
2024	$1,308.4	$2,083.5	$1,030.1	$1,010.6	$331.2	$5,763.8
2025	$1,467.2	$2,276.5	$1,124.4	$1,106.9	$362.1	$6,337.1
2026	$1,628.8	$2,469.9	$1,218.7	$1,204.5	$393.1	$6,915.0
2027	$1,793.0	$2,663.7	$1,313.2	$1,302.2	$424.3	$7,496.4
2028	$1,960.0	$2,857.8	$1,407.7	$1,400.2	$455.6	$8,081.2
2029	$2,129.3	$3,052.1	$1,502.2	$1,498.2	$487.0	$8,668.8
2030	$2,300.8	$3,246.6	$1,596.9	$1,596.4	$518.5	$9,259.2
2031	$2,476.0	$3,441.3	$1,691.6	$1,694.8	$550.1	$9,853.9
2032	$2,654.9	$3,636.3	$1,786.4	$1,793.3	$581.9	$10,452.8
2033	$2,837.5	$3,831.4	$1,881.2	$1,892.0	$613.8	$11,055.8
2034	$3,019.4	$4,026.6	$1,976.1	$1,990.9	$645.7	$11,658.7
2035	$3,200.7	$4,221.9	$2,071.0	$2,089.9	$677.8	$12,261.2
2036	$3,381.3	$4,417.3	$2,166.0	$2,189.1	$710.0	$12,863.6
Cumulative Reduction	**$35,404.5**	**$52,566.4**	**$25,905.3**	**$25,713.8**	**$8,392.3**	**$147,982.3**

Figure ES-3 should be interpreted as follows: Given population projections and the assumption that risk factor rates are stable between 2013 and 2036, the economic burden attributable to the five RFs would increase from $67.3 billion to $80.4 billion in 2036. This is represented by the very top line in the chart. But if we assume a relative reduction of 1% each year, then we see that line remains fairly stable, from $67.3 billion in 2013 to $67.5 billion in 2036, represented by the very bottom line.

The *cumulative reduction* in economic burden between 2013 and 2036 of $148.0 billion is represented by the shaded area(s) between the top and bottom lines. The *annual reduction* in 2036 of $12.7 billion is represented by the numbers in the far right under "reduction in annual economic burden of".

Figure ES-3: Changes in Economic Burden of Smoking, Excess Weight, Physical Inactivity, Alcohol Use and Low Fruit & Vegetable Consumption



Other research indicates that fruit and vegetable consumption has been consistently and positively associated with being female, married and of higher socio-economic status. It is perhaps also no surprise that the children of parents who positively model fruit and vegetable consumption, have higher consumption levels than their peers.

A range of stand-alone interventions have been shown to be modestly effective in increasing F/V consumption, ranging from an increase of between 0.25 and 0.50 serving per day. **Promotional campaigns tend to be most successful when they used a multi-faceted approach with collaboration between industry, retail, government and not-for-profit organizations promoting public health.**