Building resilience - the health footprint of a healthy doctor

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45 Billion tonnes of CO2

- No slow down in last decade
- Oil crises
- Post-war boom
- Great depression
- Cuts required for 50% chance of not exceeding 2°C
A beginner’s guide to carbon footprinting


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Carbon footprinting is one of the foremost methods available for quantifying anthropogenic environmental impacts and for helping tackle the threat of climate change. However, for any person undertaking a carbon footprinting analysis for the first time, they will almost certainly be struck by the broad array of definitions, approaches and terminology surrounding the field. This paper provides an introductory guide to some basic concepts in carbon footprinting for researchers and lay people interested in the area. Each stage of calculating a carbon footprint is considered and an introduction to the main methodologies is provided. The advantages and disadvantages of the various approaches are discussed and a rough framework of procedures is provided for the calculation of carbon footprints over a variety of subjects. Some general data sources are included and a glossary of key carbon footprinting terminology is available in supplementary data online.
A tool for climate change management

A carbon footprint is a measure of greenhouse gas emissions, [specifically carbon dioxide and methane, calibrated for CO$_2$ equivalent], produced by actions of an entity.
The central reason for estimating a carbon footprint is to help reduce the risk of climate change through enabling targeted reductions of greenhouse gas emissions.
A tool for climate change management

A carbon footprint:

- Promotes accountability
- Is an advocacy tool
- Monitors change
A tool for climate change management

- Carbon footprints of nations, regions and cities
- Carbon footprints of sectors and organizations
- Carbon footprints of products and services
- Personal carbon footprints
A tool for health governance

A health footprint is proposed as a measure of disability adjusted life years (DALYs) produced by actions of an entity.
A health footprint:

- Footprints of nations, regions and cities
- Footprints of sectors and organizations
- Footprints of products and services
- Personal footprints
Risk factors for disability adjusted life years, world, 2010

Source: Lim et al 2012
Human evolution would suggest that we are

“active and functional”

in relation to the drugs that we take, including alcohol and nicotine, rather than being

“passive and vulnerable”
1. Co-evolution with nicotine, a plant toxin
2. Functional use of alcohol, as part of a fruit-eating diet
In the story of life over the last 400 million years, one of the main plot lines has been the battle between plants, and the animals that eat them.
Of many defense mechanisms, plants produce secondary metabolites, including nicotine, morphine, and cocaine, potent neurotoxins that evolved because they punished and deterred consumption by plant-eating animals.

Source: Sullivan & Hagen 2014
To inhibit and kill their own parasites, animals have evolved to counter-exploit the products of hundreds of millions of years of "research' by plants by subsisting on a mixed diet of palatable and toxic plants, trading off diet quality (and thus growth) for what is termed enemy-reduced or enemy-free space.

Source: Sullivan & Hagen 2014
When parasitized, hornworm survives better by eating nicotine than by not eating nicotine.

Source: Singer et al. 2009
When unparasitized, hornworm survives better when not eating nicotine than when eating nicotine.

Source: Singer et al. 2009
Nicotine treatment for helminth worms in humans

Cotinine concentration by worm burden (log scale) in Congo basin male hunter gatherers

Source: Roulette et al. 2014
Impact of albendazole on cotinine concentration by baseline worm burden in Congo basin male hunter gatherers

Source: Roulette et al. 2014
On average, each individual **ripe** fruit (weight 30g) contains 100 mg ethanol and each individual **over-ripe** fruit contains 400mg ethanol.

Source: Dudley 2004
The presence of ethanol within ripe fruit suggests low-level but chronic dietary exposure for all fruit-eating animals.

Volatilized alcohols from fruit could potentially serve in olfactory localization of nutritional resources.

Source: Dudley 2014
Primate ancestors living 16-21 million years ago could not effectively metabolize consumed ethanol.

However, by 6-12 million years ago, human’s last common ancestor with gorillas and chimpanzees had evolved a digestion fully capable of metabolizing consumed ethanol, at levels found in fermenting fruits.

Source: Benner 2013
Thus, human evolution would suggest that we are

“active and functional”

in relation to the drugs that we take, including alcohol and nicotine
“Active and Functional” speak to \textbf{potency}, \textbf{quantity} and \textbf{availability} (economic and physical) as being primary drivers of drug use and related harm.
Proportion (%) nicotine dependent persons by number of cigarettes smoked per day

Source: Rehm et al. 2013
Number of DSM-IV criteria for alcohol dependence by grams alcohol per day (NESARC data)

Source: Rehm et al. 2013
Risk factors for disability adjusted life years, world, 2010

High blood pressure
Tobacco smoking, including second-hand smoke
Household air pollution from solid fuels
Diet low in fruits
Alcohol use
High body-mass index
High fasting plasma glucose
Childhood overweight
Ambient particulate matter pollution
Physical inactivity and low physical activity
Diet high in sodium
Diet low in nuts and seeds
Iron deficiency
Suboptimal breastfeeding
High total cholesterol
Diet low in whole grains
Diet low in vegetables
Diet low in seafood omega-3 fatty acids
Drug use
Occupational risk factors for injuries

Source: Lim et al 2012
Risk of dying prematurely (up to age 70) due to alcohol consumption in European Union

Source: Rehm et al. 2014
Margin of Exposure analysis compares the ratio of a toxic dose with the dose consumed. The toxic dose can be defined as the dose in animals that increases death rates by 10%.

MoE=1: consuming toxic dose
MoE=100: consuming 1/100\textsuperscript{th} toxic dose
MoE = 1.3; EU adults, on average, consume 77% of toxic dose.

MoE = 1.0; Based on 1.5% increased risk liver cirrhosis death.

Source: Lachenmeier & Rehm 2014
European Food safety Authority: MoE for cancers based on human studies and voluntary exposure

EFSA MoE for non-cancers

Source: Lachenmeier & Rehm 2014
Risk factors for disability adjusted life years, world, 2010

Source: Lim et al 2012
Relative nicotine harms

Source: Nutt et al. 2014
Prevalence of nicotine/cigarette use in UK

% smoking cigs or using nicotine

- Cigarettes
- Nicotine or cigarettes

Source: West et al. 2014
“For every million smokers who switched to an e-cigarette we could expect a reduction of more than 6000 premature deaths in the UK each year”

Source: West & Brown 2014
Risk factors for disability adjusted life years, world, 2010

High blood pressure
Tobacco smoking, including second-hand smoke
Household air pollution from solid fuels
Diet low in fruits
Alcohol use
High body-mass index
High fasting plasma glucose
Childhood underweight
Ambient particulate matter pollution
Physical inactivity and low physical activity
Diet high in sodium
Diet low in nuts and seeds
Iron deficiency
Suboptimal breastfeeding
High total cholesterol
Diet low in whole grains
Diet low in vegetables
Diet low in seafood omega-3 fatty acids
Drug use
Occupational risk factors for injuries

Disability-adjusted life-years (%)

Source: Lim et al 2012
SALT
Recommended salt daily intake

**Sodium** intake RANGES from:

- **1500 mg sodium day** (IOM)
- **2000 mg sodium day** (WHO)
- **2300 mg sodium day** (USA Government)

**Salt** intake:

2000 mg sodium = 5 gr salt or 1 teaspoon

Any one of these reach your daily limit

- **Arby's Mozarella Sticks**: 3 sticks = 1200mg sodium
- **Soy Sauce**: 1 1/3 lbs = 1200mg sodium
- **Chipotle Carnitas Burrito**: 2/5 burrito = 1200mg sodium
- **McDonald's Cheeseburger**: 1 3/5 burger = 1200mg sodium
- **Ramen Noodles**: 3/4 package = 1200mg sodium
- **Chicken Breast**: 3 pieces = 1200mg sodium
- **Cottage Cheese**: 1 cup = 1200mg sodium
- **Cereal**: 5 1/5 cups = 1200mg sodium
- **Ketchup**: 7 4/5 lbs = 1200mg sodium
SUGAR
Recommended sugar daily intake: many disagreements

• At least 10% of daily calorie intake = 50 gr of sugar a day (for adult of normal weight)

• Better if 5% of daily calorie intake = 25 gr sugar a day (for adult of normal weight)

Upper limit:
= 12 sugar cubes
= 12 teaspoons

IDEAL RECOMMENDED limit:
= 6 sugar cubes
= 6 teaspoons sugar

Source: (WHO guidelines)
Most sugary drinks exceed daily recommendation

We gathered a few popular drinks from our canteen’s refrigerator to check how much sugar each one contains. The results were surprising. Even ‘healthier’ drinks, such as flavoured mineral water and drinking yogurt, contain a large amount of sugar.
Other comparisons to the 6 cubes daily recommendation

![Food items with sugar cubes](Image1.png)
Fruit and Vegetables:

5 a day
What is 5 a day?

- **Tomatoes**: 1 medium tomato
- **Oranges**: 1 orange
- **Bananas**: 1 medium banana
- **Strawberries**: 7 strawberries
- **Asparagus**: 5 spears
- **Avocado**: Half an avocado
- **Peppers**: Half a pepper
- **Kiwis**: 2 Kiwis
OLIVES
Thirty olives. Although

LEeks
One leek (white)

CAULIFLOWER
Quarter of a cauliflower.

WATERCRESS
One x 75g pack.

GREEN BEANS
Four tablespoons.
Frozen beans (27p per

TOMATO
One medium or seven cherry. Fresh tomatoes

ASPARAGUS
Seven spears. A very good source of

SWEET POTATO
One large potato.
Rich in antioxidants, so
Risk factors for disability adjusted life years, world, 2010

Source: Lim et al 2012
Physically Inactive Children

30% of children obese
Misses school 2 days higher than average
Lower fitness associated with lower test scores
Earns less at work
$2,741/yr higher health care costs
1 week/yr of extra sick days taken
5.3 million premature deaths/yr. due to inactivity

Girls: 51% more likely to be held back a year in school
Boys: 46% more likely to see themselves as poor students

2x as likely to be obese as adults
Preschoolers with inactive parents are far less likely to be active

Early Childhood

Adolescence

Adulthood

Intergenerational Cycle

May live up to 5 years less
Guidelines for adults aged 19-64

To stay healthy, adults aged 19-64 should try to be active daily and should do:

- At least 150 minutes (2 hours and 30 minutes) of moderate-intensity aerobic activity such as cycling or fast walking every week, and
- muscle-strengthening activities on 2 or more days a week that work all major muscle groups (legs, hips, back, abdomen, chest, shoulders and arms).

- 75 minutes (1 hour and 15 minutes) of vigorous-intensity aerobic activity such as running or a game of singles tennis every week, and
- muscle-strengthening activities on 2 or more days a week that work all major muscle groups (legs, hips, back, abdomen, chest, shoulders and arms).

- An equivalent mix of moderate- and vigorous-intensity aerobic activity every week (for example 2 30-minute runs plus 30 minutes of fast walking), and
- muscle-strengthening activities on 2 or more days a week that work all major muscle groups (legs, hips, back, abdomen, chest, shoulders and arms).
Risk factors for disability adjusted life years, world, 2010

Source: Lim et al 2012
Thank you for your attention

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