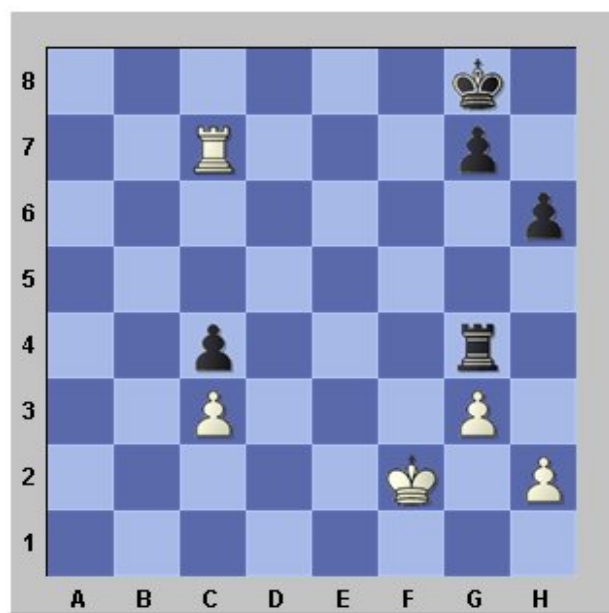


Are we in the endgame for smoking?



Now what?

Endgame: noun

1. Chess. the final stage of a game, usually following the exchange of queens and the serious reduction of forces.
2. the late or final stages of any activity: the end game of the negotiations.

There is a thread of discussion in the world of tobacco control devoted to what is known as the 'endgame'... it is a kind of blue sky thinking about end of tobacco use and the policies needed to bring it about. It includes a set of policy proposals set out in the [May 2013 supplement of the journal Tobacco Control](#) and has become the subject of [conferences](#), [journal papers](#), [presentations](#), [op-eds](#) and [thought pieces](#) by leading academics and [speeches by the Director General of WHO](#) (which actually has some good advice in parts). But what does the data tell us?

I think it is helpful to know where things stand now. There was a great data paper published in JAMA last year: Ng M, Freeman MK, Fleming TD, et al. *Smoking prevalence and cigarette consumption in 187 countries, 1980-2012.*

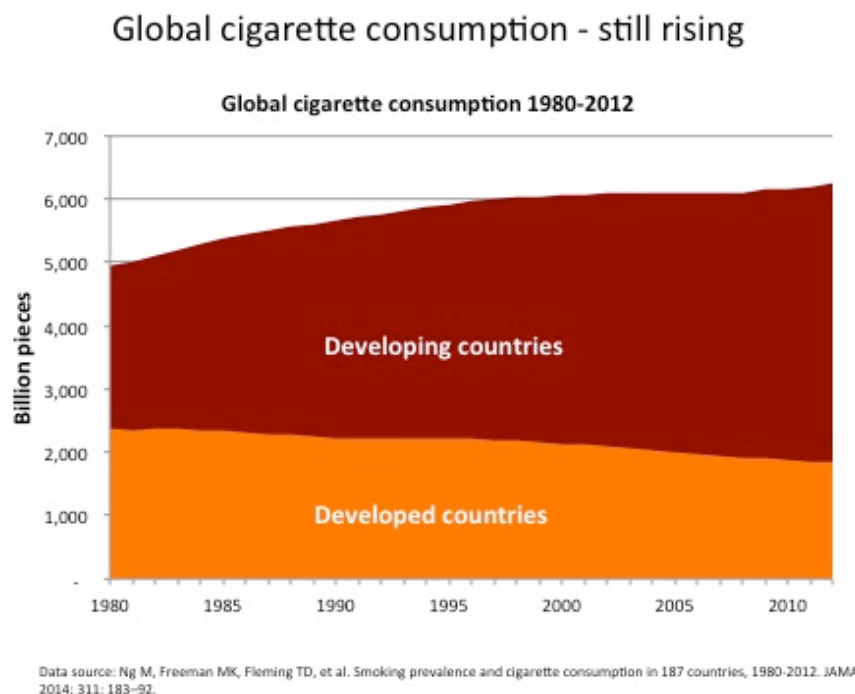
[JAMA 2014; 311: 183-92.](#)

Buried in its supplement is a table with estimates of world cigarette consumption from 1980 to 2012, which I have transcribed into a spreadsheet and made some charts from. Note that while the World Health Organisation talks of the '[Global Tobacco Epidemic](#)', it does not actually do the basic useful job of measuring, monitoring and interpreting it - so academic studies like this are especially valuable, and require knitting together of many data sources. I am taking this paper as the best estimates rather than critiquing it.

Data to inform the 'endgame'

How much smoking is there now?

First up... the consumption of cigarettes is more than *six trillion* (6.25 trillion) and *still rising globally*. That is equivalent to just over three cigarettes per day for every adult alive in 2012.

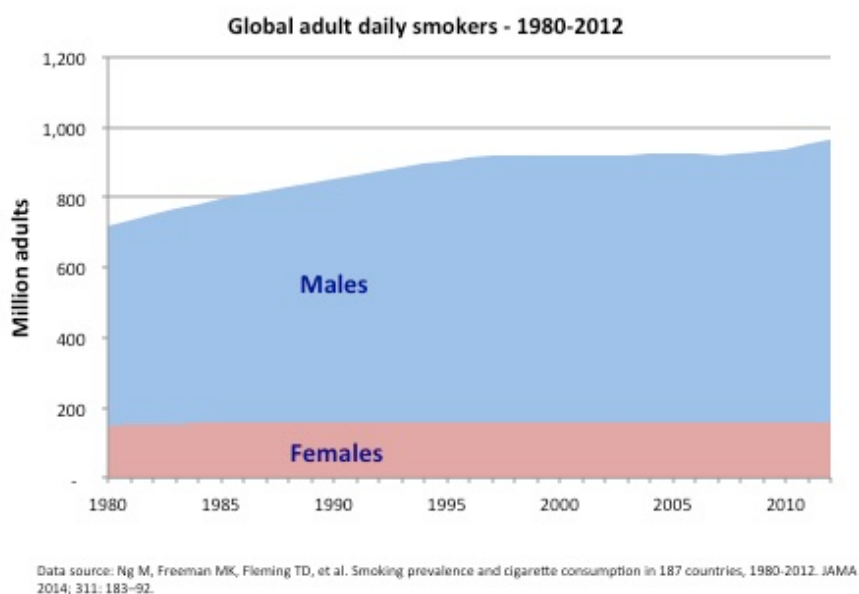


Actual data 1908-2012

Global smoking prevalence was 18.7% - 31.1% among men, 6.2% among women - down from 25.9% in 1980 (41.2% men, 10.6% women). While smoking *prevalence*

is declining, population and incomes are rising and pushing the other way: the *number of smokers has risen* since 1980 from 721 million to 967 million in 2012, and the *number of cigarettes consumed has risen* from 4.96 trillion to 6.25 trillion. We are not in an endgame: the most we can say is that we may be seeing a slowing of growth.

Number of smokers - still rising

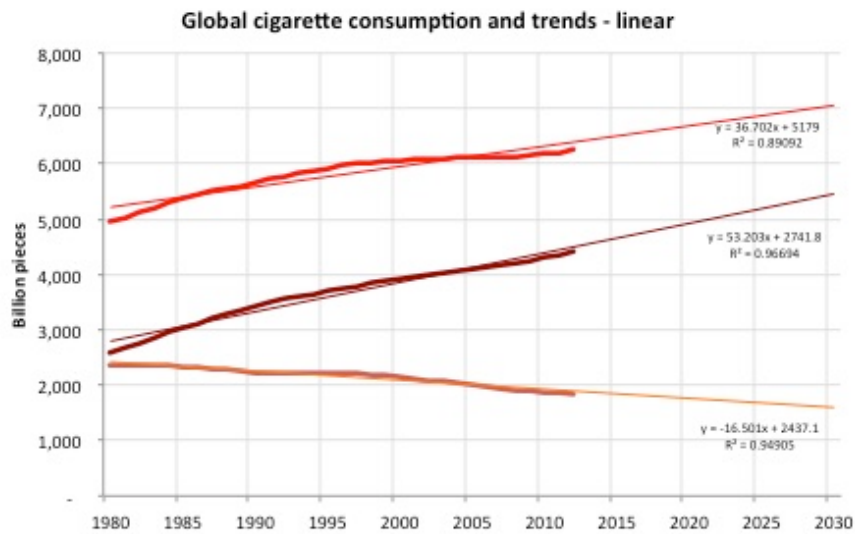


Now approaching 1 billion daily adult smokers

Trends

The chart below shows linear trend lines...

Global cigarette consumption – linear trend



Data source: Ng M, Freeman MK, Fleming TD, et al. Smoking prevalence and cigarette consumption in 187 countries, 1980-2012. JAMA 2014; 311: 183-92.

Actual data 1980-2012 with linear trend lines projected to 2030 and equations displayed for gradients

The gradients of the trend lines give the average annual change. In round numbers, since 1980, the annual changes have been:

- Developed countries: -16.5 billion/year
- Developing countries: +53.2 billion/year
- Net global change: +36.7 billion per year

The rate of decline even in developed countries is not that fast. If we use geometric rate of change (like compound interest but for an annual decline) the decline in developed countries is just 0.8%/annum on average over 1980-2012 - and at that rate it would take until *2100 to halve consumption in developed countries**. Even at the faster rate of decline in later years (2005-12 = 1.3%) it would still take until 2067 to halve consumption. Of course these rates may change in future, but the history provides valuable perspective.

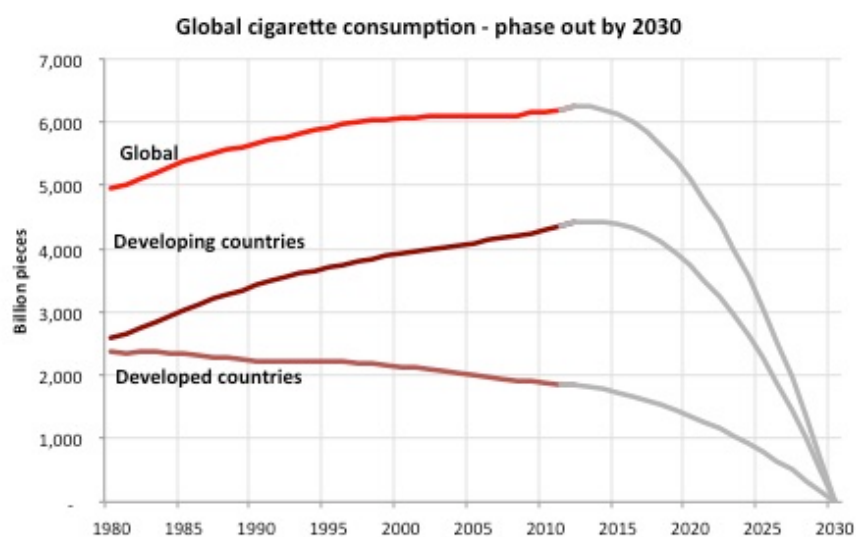
(Note decline calculated: $C_t = C_0 / (1+r)^t$ where C_0 is consumption in a given year, C_t is consumption t years later, r is rate of decline - e.g. 1.3%).

An end to smoking by 2030!

You'll occasionally hear people saying that we should aim for the end of tobacco

by 2030 or some other date in most people's mental planning horizon - this is not unique to tobacco by the way. But often these bold sounding aims require implausible changes to deeply rooted trends. Smoking simply does not change rapidly as there are large numbers of smokers already in the population and history shows it is difficult to stop young people emulating adults, meaning the flow of new smokers changes slowly too - though change it does. The chart shows a 'forced curve' pathway to 'tobacco free' by 2030 - these curves uses a steadily increasing decrease so that the gradient changes evenly

A 2030 'endgame' requires implausible declines



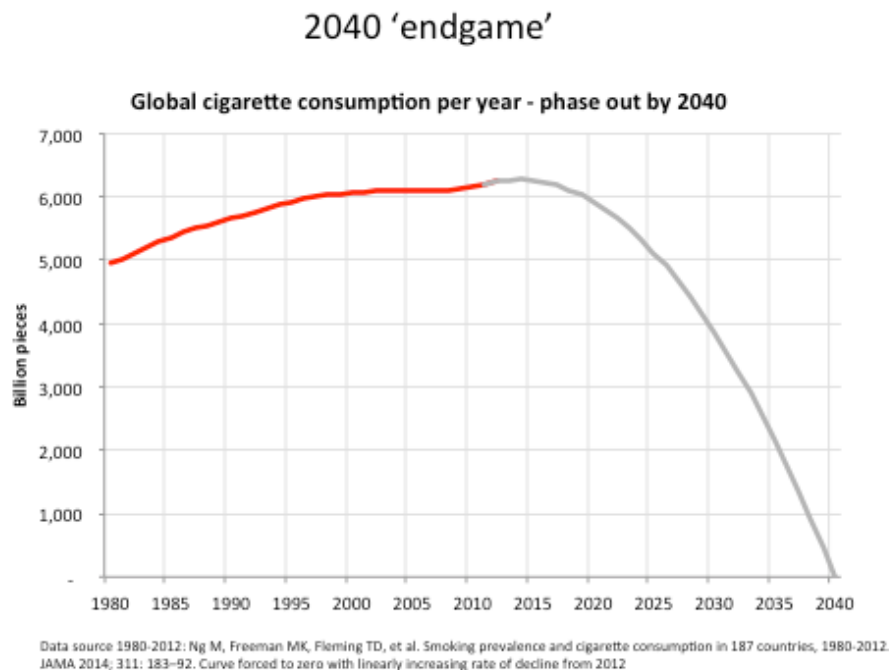
Data source: Ng M, Freeman MK, Fleming TD, et al. Smoking prevalence and cigarette consumption in 187 countries, 1980-2012. JAMA 2014; 311: 183-92.

Actual data 1980-2012 with curves forced to zero by 2030.

What thing would conceivably cause this? These sort of changes to large scale trends would only be realistic following major human catastrophes, such as global nuclear war, a pandemic, asteroid collision or a rapture. So far no-one in tobacco control has included these ideas in the endgame narrative.

Even if the curve for developed countries looks vaguely plausible (it was drawn to minimise rate of change of gradient), please take some care. It requires very rapid decline in the late 2020s - far steeper than achieved previously. The decline in developed countries has averaged 25 billion/year in the 8 years 2005-2012, but this curve requires an average decline of 145 billion/year in the 8 years to 2030 - more than five times as great.

Update: 13 March 2015. The Lancet has called for phase out of tobacco sales by 2040: [What will it take to create a tobacco free world?](#) Here's how that would look, just for cigarettes:



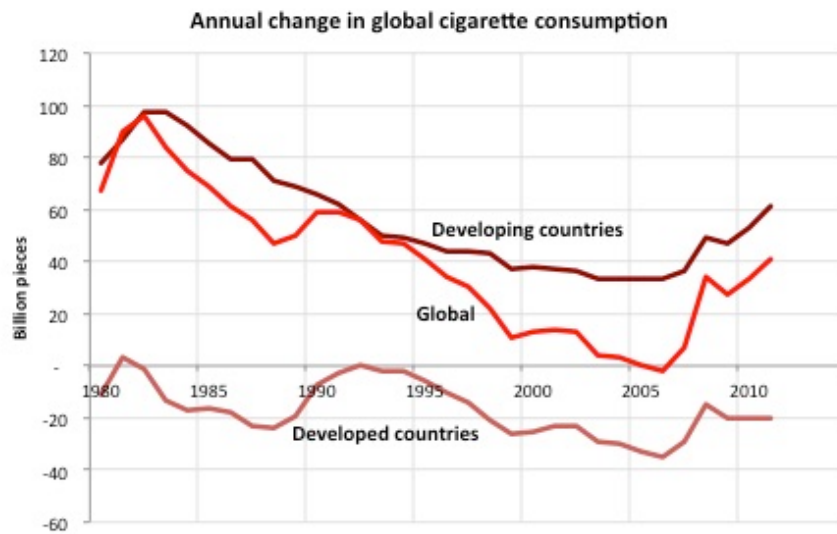
Actual data 1980-2012 with curve forced to zero by 2040

Of course a phase out of tobacco products is more difficult than a phase out of cigarettes because the former cannot be used to substitute for the latter.

Has enhanced tobacco control forced smoking into a new phase of decline?

Perhaps the recent intensification of global tobacco control efforts through the FCTC means that the past is an unreliable guide to the future? Actually, the annual increase has itself been *increasing* since the FCTC came into force - it is too early to tell if that is a persistent trend. This chart plots the annual *change* in consumption in billions.

Recent increase in growth of cigarette consumption



Data source: Ng M, Freeman MK, Fleming TD, et al. Smoking prevalence and cigarette consumption in 187 countries, 1980-2012. JAMA 2014; 311: 183-92.

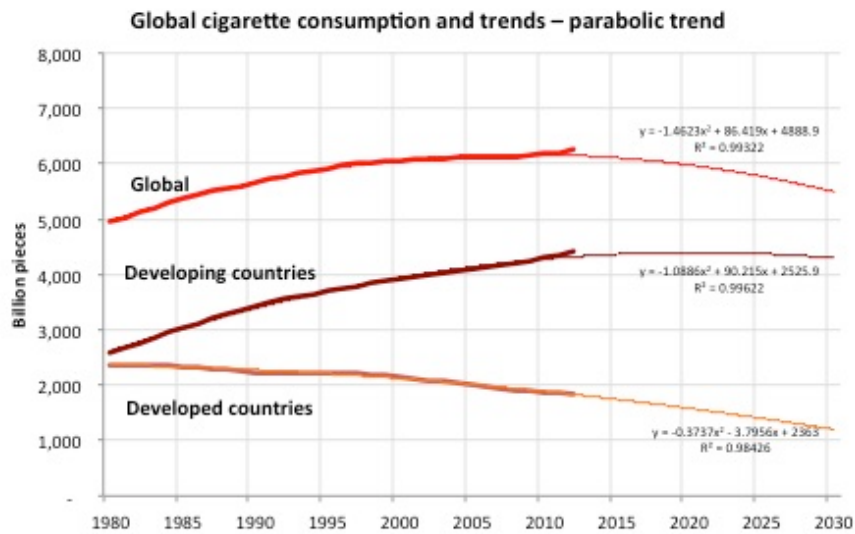
Annual change in unit cigarette consumption 1980-2012

Using more sophisticated trend lines

What would be a more realistic trend projection? It is sometimes better to use a more sophisticated type of trend line for data like this, in which consumption changes steadily, but also the rate of change of consumption varies too.

Spreadsheets allow different types of curve-fitting - I got the best fit and most plausible trend with a 'polynomial equation', in this case a parabola.

Global cigarette consumption – trend to 2030

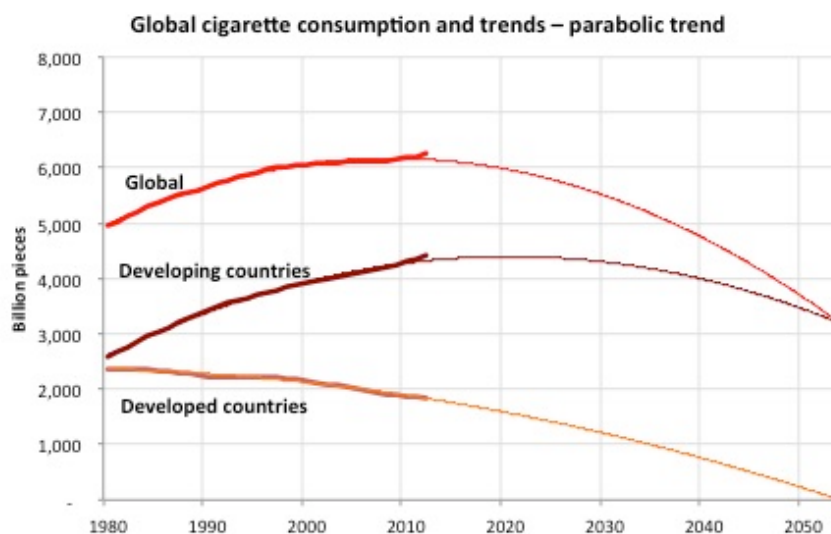


Data source: Ng M, Freeman MK, Fleming TD, et al. Smoking prevalence and cigarette consumption in 187 countries, 1980-2012. JAMA 2014; 311: 183-92.

Actual data 1980-2012 with parabolic trend projection 2013-2030

Or taking this out to 2053 the developed country curve intercepts with zero... (note this is a *projection* and not a forecast or prediction, but you can use it as starting point).

Global cigarette consumption – trend to 2050



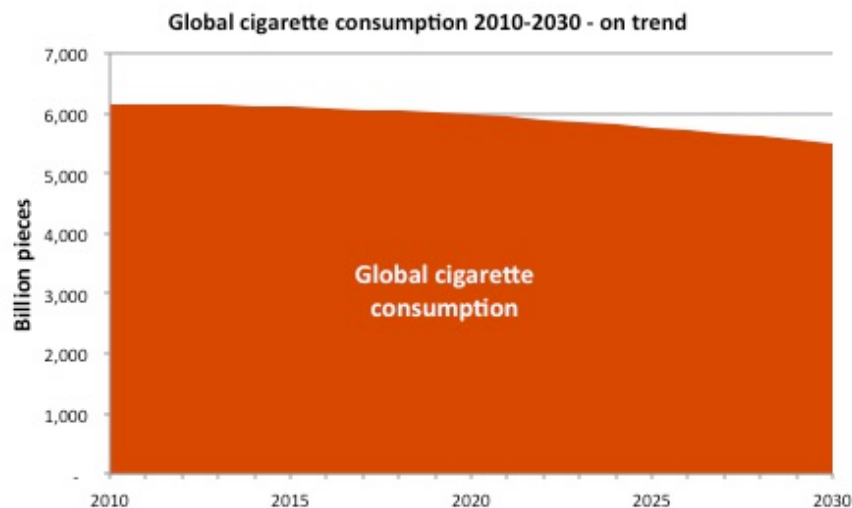
Data source: Ng M, Freeman MK, Fleming TD, et al. Smoking prevalence and cigarette consumption in 187 countries, 1980-2012. JAMA 2014; 311: 183-92.

Actual data 1980-2012 with parabolic trend projection to

Why does this matter?

One consequence of a view of an imminent end to smoking can be a kind of impatience with alternatives to smoking or the sense these are an irritating distraction from the teleological certainties of an end of tobacco some date soonish. So I think it is worth looking at what current data and trends reveal. The current data suggest smoking will persist for several decades.

Cigarette global consumption trend projection to 2030



Consumption 2010-2030 on parabolic trend projection from 1908-2012 data from Ng M, Freeman MK, Fleming TD, et al. Smoking prevalence and cigarette consumption in 187 countries, 1980-2012. JAMA 2014; 311: 183-92.

Visualises total cigarette consumption under current parabolic trend 2010-2030.

The red area can be thought of as a rough proxy for smoking-related harm to health - *and it is going to continue.*

Introduction of new nicotine delivery technologies

It's hard to know at present the long term impact of new non-combustible nicotine products like vapour products - or what role existing much safer products, like

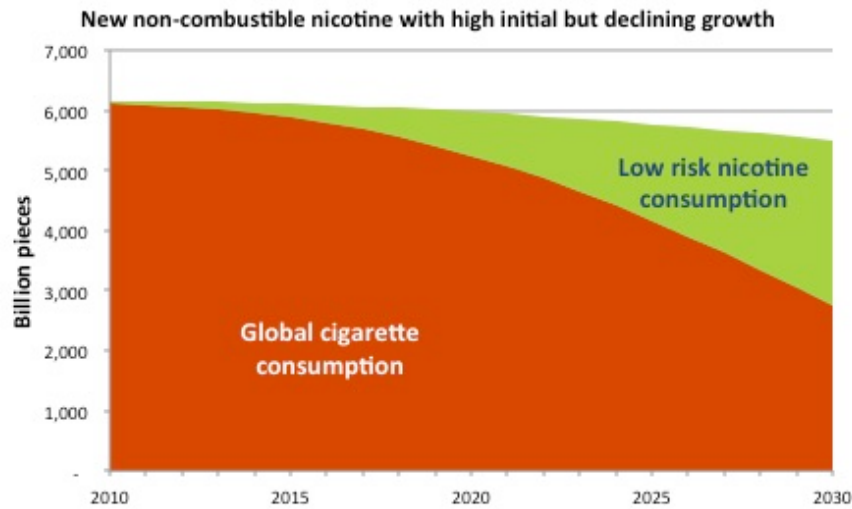
snus or other form of non-combustible tobacco, could play. Investment analysts believe vaping products are displacing about 4% of US cigarette consumption (for a sense of proportion, this might be compared to the European Commission's estimate that its Tobacco Products Directive would reduce consumption by 2% in five years). However, this figure has been achieved despite a massive well-funded relentlessly hostile campaign against these products by many American public health organisations and academics, and comes at the early stage of what is bound to be a prolonged period of innovation.

In fact the future of these products depends on many things other than the products themselves and interplay of manufacturers and consumers. It will particularly depend on the role played by regulators and by the 'public health establishment', which has in most cases taken a very hostile approach. However, these products offer a terrific opportunity to change the pattern of consumption of nicotine to less harmful technologies, to disrupt the entrenched cigarette trade, and to reduce risk to health.

An aspirational scenario

So rather than present a *projection* or *forecast* (it is too soon for either) let me present an *aspiration* - what I believe would be a great but realistic public health achievement if everyone involved worked to achieve it instead of obstructing it. This '*scenario*' involves rapid growth while the category is small, with a gradually declining growth rate as it advances, with the parameters set to meet 50% of the market by 2030. It is purely illustrative. In reality, achieving this degree of displacement of cigarette use would require continuing innovation to make widely acceptable compelling alternatives to smoking - so by 2030, the low-risk products, like vapour or heat not burn tobacco products, might be very different to those available today.

Hypothetical introduction of new nicotine products

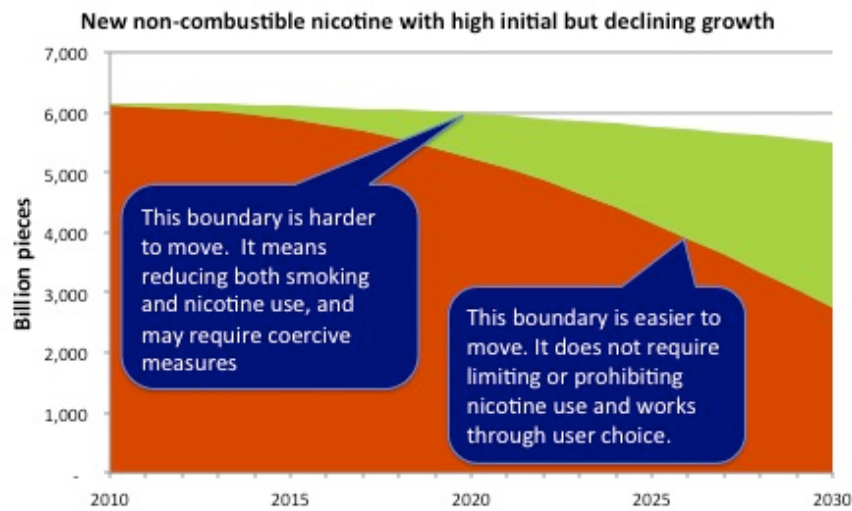


Consumption 2010-2030 on parabolic trend projection from 1908-2012 data from Ng M, Freeman MK, Fleming TD, et al. Smoking prevalence and cigarette consumption in 187 countries, 1980-2012. JAMA 2014; 311: 183-92.

Keeps cigarette-equivalent nicotine consumption as before but introduces a different set of technologies for nicotine delivery. This scenario uses a high initial growth rate for new nicotine (40%) which deflates over time (at 9%pa) to reach 50% of the market by 2030

In this case, the red is still the harm, but it is significantly reduced (it is far from clear that *any* material harm is associated with the green wedge in this diagram - but if there is, it is likely to be 95-100% lower per unit). If this was achieved by 2030, the prospects for the rest of the century would be very positive - and major inroads would be made into the forecast of 1 billion smoking related deaths in the 21st Century.

Hypothetical introduction of new nicotine products



Consumption 2010-2030 on parabolic trend projection from 1908-2012 data from Ng M, Freeman MK, Fleming TD, et al. Smoking prevalence and cigarette consumption in 187 countries, 1980-2012. JAMA 2014; 311: 183-92.

Switching nicotine delivery technologies is more 'tractable' than rapidly reducing nicotine use, because it doesn't require people to give up things they like or may be dependent on.

The idea is that changes to the boundaries *within* nicotine-using technologies (the inner boundary) are more tractable than changes to the total nicotine-using envelope (the outer edge). The reason for that is that they require much less of the consumers - people who wish to use nicotine or are dependent on it. It also does not require highly coercive policy measure that force radical cultural or behavioural changes, which are either unlikely to work politically or legally, or would violate dearly held values. Not in this scenario, the upper boundary matters little for health, it is the easier more tractable lower boundary that counts.

Coming shortly...

In a second posting on 'the endgame', I will examine some of the endgame policy proposals that are under discussion by tobacco control experts. Some believe that the sea of red in the charts above justifies a 'force majeure' approach to policy. But somehow I doubt it will be that simple... *à bientôt!*

Appendix - graphics on Slideshare