

NOTES ON STRATEGIES FOR LESS HEALTH-CONTENTIOUS PRODUCTS

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The Case for Reducing Smoke Dose

From epidemiology, lower cigarette consumption correlates with reduced risk of certain diseases. These notes assume the contention of a causal basis for the correlation, though this has not been validated.

Lower cigarette consumption is equivalent to lower total smoke dose, provided it is not offset by:

1. Higher cigarette delivery (machine);
2. Greater human smoking intensity (compensation type A).

Early epidemiological data were obtained at a time when the current range of deliveries was not available. Therefore the first condition probably held. The second condition probably held as well, but no justification is given here.

Total smoke dose = Unit dose x units consumed

Therefore there should be a lower epidemiological risk from lower total smoke delivery products provided this is not offset by:

1. Greater smoking intensity (compensation type A);
2. Greater unit consumption (compensation type B).

Hence the need for research to understand what people smoke for, e.g.:

Nicotine dose (pharmacological);
Nicotine impact (sensory);
Flavour;
"Smoke";
Something to do;
Other, or combination.

Studies of the effects of such factors on compensation types A and B behaviour are also indicated.

However, smoke is a complex mixture, so when we talk about lower dose or delivery, do we need to reduce everything, or can we be more selective?

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Three Strategies

Strategy 1

Identify the risk-causing substances in tobacco smoke and remove them selectively. This has the advantage of leaving the positive features, what people smoke for, assuming there is no serious overlap between "desirable" and "undesirable" substances or characteristics.

Strategy 2

The opposite of the above. Reduce all deliveries by "broad spectrum" methods, i.e. mainly filtration, ventilation and reduction in the weight of tobacco or similar materials. Build back selectively desirable sensory and other elements. This has the advantage of not identifying risk causes, or finding selective reduction methods. However, it does imply identification of positive elements for add-back.

Strategy 3 ("Alternative product")

This recognises some of the limitations of 1 and 2, both of which burn tobacco or similar to give a highly complex pyrolysis-based aerosol.

Do not burn tobacco, but find a way to deliver some or all of the sensory characteristics of tobacco smoke in a simple chemically defined form allowing similar usage patterns to a cigarette.

The Three Strategies - Further Contrasts/Problems etc.

In reverse order:

Strategy 3

1. It could be labelled a drug delivery system.
2. Added nicotine - new hazards (health or political) - limits to nicotine quantity and concentration. A non-nicotine option?
3. Other "new" hazards?
4. Despite above, greatest potential on bio activity.
5. Greatest new technology requirement.
6. Full tobacco sensory property range unlikely to be realised from a relatively simple "smoke" composition?

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Strategy 2

1. The evolutionary approach implemented over 20-30 years.
2. Some encouragement from the epidemiology.
3. But compensation is a continuing issue. A particular problem if consumer smokes for "smoke", see earlier - Smoke = PMWNF!
4. Points to more radical efforts in sensory adjustment, e.g. GREENDOT.
5. Benefits from some residual tobacco smoke, hence some residual sensory character, unlike Strategy 3.
6. However, residual tobacco smoke means residual biological activity.
7. Less chance of new hazards than Strategy 3, unless sensory adjustment at very low PMWNF introduces Strategy 3 issues.
8. Lower new technology requirement than Strategy 3, though "extreme" options may move technology towards Strategy 3, e.g. sensory adjustment.

Strategy 1

This would be the ideal, indeed the only, option if smokers smoke for "smoke" and a substitute simple chemically defined aerosol such as glycerol could not be found which would replace tobacco smoke sensory attributes. However, there are two major and related problem areas - identifying the risk causes and removing them selectively.

A. Identification of the risk causes

1. Smoke contains thousands of chemicals - weighting their contributions to the risk.
2. Probability that health effects are not additive, i.e. interaction, the whole not equal to the sum of the parts.
3. Part of the risk may not be chemically based, e.g. physical irritation by smoke in a more holistic sense.
4. At least 3 disease types.
5. Problem of proof that selective reduction of certain substances or substance classes lessens risk. Epidemiology may be the most definitive, but would agree that bio tests offer some measure of progress, some method of "weighting".

B. Selective removal if target substances identified

1. In many cases there are multiple tobacco sources of a given noxa, e.g. catechol probably from polyphenols, sugar, cellulose and others.

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2. In many cases there are multiple smoke components from a given tobacco source, e.g. catechol, CO and aldehydes from sugar. Some of these smoke components will be desirable as well as undesirable.
3. From 1 and 2, as the number of target noxae increases, the number of precursor substances for removal or modification will increase rapidly with probable rapid effect on desirable smoke components as well. Indeed, the ability to reduce noxae relative to tar (= smoke) will decrease because some of the precursors may be major tar producers, e.g. cellulose.
4. Limits to specificity in tobacco modification.
5. The above points explain why Strategy 2 has been adopted so far.

Some Conclusions on Programmes Related to Strategy 1

The selective reduction of a finite group of substances will not attract a strong consistent scientific or political consensus that it is "safer" than Strategy 2 products which give non-selective reduction of all components and therefore must reduce the dose of other unknown risk-causing variables, provided compensation is controlled.

However, there will continue to be scientific/political hypotheses creating pressures for the reduction of certain smoke components, even though it cannot be proved that such reductions give a safer smoke. An example might be the numerous papers from the Hoffmann school pressing the case for nitrosamine reduction, even though certain epidemiology based considerations may suggest no measurable contribution of these to the epidemiological risk.

The hypothesised smoke components will change from time to time, in part due to the changing research interests of influential workers, making prediction difficult and literature awareness important. However, to allow any focused research activity, some guesstimate must be made of the likely substances in terms of current and potential interest, e.g. the SRG list.

Potential "Other Noxae" Goals

1. Maintain a Company knowledge base, supported by our own research, on the health-contentious substances in smoke and the factors which influence their levels. This is part of a wider activity to maintain a knowledge base on the smoking and health part of the environment in which the Company must operate, and to interact with it as necessary. Another aspect of this goal may be "due diligence" in understanding the properties of the product we sell.
2. As an extension of 1, to provide background research information on the opportunities for, and limitations to, the selective reduction of smoke levels of health-contentious substances.

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3. As an extension of 2, to develop products giving selective reductions in target substances.

Further Notes

A particular Regulatory Authority whim to "league table" one specific substance, e.g. nitric oxide, or one specific biological parameter, e.g. Ames activity, may offer product opportunities, but is quite different to a "GRAS" (generally recognised as safer) product. The feasibility of meeting a particular whim will depend on whether the noxa has finite, preferably one, main source (e.g. nitric oxide) or is multisourced (e.g. aldehydes). For many vapour phase noxae, the simple vapour phase selective property of carbon filters should not be forgotten. This represents "cure", removal after formation, whereas the other noxae programme concentrates on "prevention", by tobacco modification. The sensory and process cost/noxa benefit ratio is likely to favour carbon filtration (existing technology) for substances such as acrolein. If our research goal is to effect additional reductions beyond current technology, which it is, then the carbon argument can be ignored, though not if there were a product development need now. However, this is getting a bit detailed and I rest my case. I hope it provides food for thought.

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