Smokers' Knowledge and Understanding of Advertised Tar Numbers: Health Policy Implications

ABSTRACT

Objectives. This article examines health policy implications of providing smokers with numerical tar yield information in cigarette advertising.

Methods. Results of a national probability telephone survey regarding smokers' knowledge and understanding of numerical tar yields and deliveries are reported.

Results. Few smokers knew the tar level of their own cigarettes (the exception being smokers of 1- to 5-mg tar cigarettes), and a majority could not correctly judge the relative tar levels of cigarettes. Smokers were unsure whether switching to lower-tar cigarettes would reduce their personal health risks. Many smokers relied on absolute numbers in making trade-offs between number of cigarettes smoked and their tar levels, thus confusing machine-rated tar yields with actual amounts ingested.

Conclusions. The wisdom of the present method of providing tar and nicotine numbers in ads and recommendations for modifying the test protocol are now under discussion. This research indicates that these tar numbers and their implications are poorly understood. The paper recommends revisions in tar ratings to make them more useful and a required statement on cigarette packages to more explicitly relate tar levels to major health risks. (*Am J Public Health.* 1996;86:18–24)

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Introduction

Over the previous 30 years, spurred by an increasing awareness of diseases caused by cigarettes, US smokers have exhibited a dramatic shift from high-tar (i.e., total particulate matter, subtracting moisture and excluding nicotine) cigarettes, which averaged 37 mg of tar in the 1950s, to low-tar alternatives.[1] The market share of cigarettes yielding 15 mg of tar or less went from essentially 0 in 1960 to more than 68% in 1992,[2] especially among women and college-educated smokers, who account for 85% of the use of such cigarettes. The shift has followed on the heels of the massive switch to filtered cigarettes: from less than 1% of the domestic market in 1950 to 58% in 1963 and to 97% in 1992.[2] Intense competition among cigarette companies to retain health-concerned smokers eventually produced a category of cigarettes described as "ultra low tar" and "ultra light" (containing 6 mg of tar or less), and these achieved almost a 13% share by 1992.[2]

These trends have occurred against a backdrop of public policy decisions that have enabled cigarette companies to use officially sanctioned numerical tar ratings in their advertising. Growing concerns about the accuracy of advertised tar and nicotine yields and their potential to mislead smokers led both Congress and the Federal Trade Commission (FTC) in 1994 to call for a scientific conference under the auspices of the National Cancer Institute. Both were seeking recommendations as to the appropriateness of continuing the current rating system, and the FTC expressed a particular concern regarding how consumers interpreted tar numbers and incorporated the information into their decisions about smoking. The present study was designed to provide input to that conference with respect to smokers' awareness, interpretation, and use of the numerical tar ratings appearing in cigarette advertising.

Background

In the early 1940s, a number of tobacco companies associated lower tar with less throat irritation in their advertising.[3] The FTC brought several suits against such advertising, and tar and nicotine claims in advertising subsided until *Consumer Reports* published tar and nicotine ratings by brand in the early 1950s. The FTC again brought suit against advertising claims linked to tar and nicotine levels, and in 1955 it published cigarette advertising guidelines that prohibited relative tar and nicotine claims in the absence of "competent scientific proof" that the claim was true "and that the differences among cigarettes were significant."[4] The latter statement reflected the FTC's view that tar and nicotine claims were, in fact, implied health claims.

The dramatic impact of the 1964 surgeon general's report and articles linking tar to lung cancer, together with recommendations from prominent health officials, led the FTC to revise its position in 1966 and to encourage cigarette manufacturers to provide consumers with comparative information about tar and nicotine levels.[3,4] A 1970 commission rulemaking

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that would have required disclosure of tar and nicotine ratings in advertising was suspended when the industry agreed to do so voluntarily. No such commitment was obtained for cigarette packages, however, and this has become increasingly relevant now that discount brands that are being sold with much less advertising support (or none at all) have captured about 30% of the market.

The FTC next established a laboratory to analyze cigarette smoke, adapting the Cambridge Filter Method—typically referred to as the "FTC method"—for this purpose.[4,5] This method relies on a multiport smoking machine, careful nationwide sampling of cigarettes available for sale, and standardized conditions. One 35-mL puff of 2 seconds' duration is taken every minute until a specified butt length is reached. Despite the method's inability to determine the amount of tar and nicotine actually inhaled by a particular smoker—or even an average smoker—there seemed to be widespread agreement that (1) the method, by imposing standardized conditions, does permit valid comparisons across cigarettes, and (2) reductions in yields are associated with a lessening of health risks.[4,6]

Over the ensuing 25 years, both of these assumptions have been challenged. Although an analysis of the second assumption is beyond the scope of this paper, it is important to note that medical research has identified components of cigarette smoke other than tar (e.g., nicotine, carbon monoxide, nitrosamines, hydrogen cyanide, acrolein, catechols) whose risks do not necessarily diminish as a function of lower machine-rated tar yields. In heart disease, for example, the risk seems to be largely independent of cigarette tar level, and even for lung cancer the reduction in risk appears to be modest.[7,8]

Smoking machine parameters, established between 25 and 40 years ago, were based on informal observation when cigarettes were substantially different from today's lower tar products.[5] Manufacturers achieve lower tar yields via the FTC method by modifying tobacco composition (e.g., using reconstituted, expanded, or puffed tobacco), reducing the diameter or smoking length of cigarettes, and increasing cigarette burn rates. Advances in filtration have reduced particulate matter and some harmful smoke constituents. Mainstream smoke is also diluted by means of ventilated filters and more porous paper. Yet even leaving aside explicitly compensatory smoking behavior (to be discussed below), one would have to question the appropriateness of these parameters for today's cigarettes. For example, many of today's "milder" filtered cigarettes draw harder and require more effort, so it is reasonable for smokers to puff more often or with greater intensity.[9] And as inflation-adjusted cigarette prices increase, many smokers may also increase the number of puffs per cigarette, thereby smoking the cigarette closer to the filter and drawing in higher levels of tar.

Some cigarette design features, such as placement of ventilation holes in a manner likely to lead to either inadvertent or deliberate (i.e., compensation-based) blocking, would obviously produce machine-based yields that are quite different from actual tar deliveries. Indeed, in 1983, the FTC brought a lawsuit against Brown and Williamson's Barclay cigarette (which used a channel ventilation system rather than air holes to bring air directly into smokers' mouths) based on competitors' allegations that smokers' lips would cover or crush the channel holes.[4]

A number of studies have identified smokers' compensatory mechanisms associated with nicotine intake.[9-11] Henningfield et al.[12] indicate that all marketed cigarettes *contain* approximately 6 to 11 mg of nicotine, from which smokers obtain, on average, 1 mg of nicotine (regardless of whether the FTC method's estimated yield is 0.1 mg or 2 mg). To obtain the "desired" nicotine delivery from a very low tar and nicotine yield cigarette, smokers appear to compensate by changing their puffing patterns or depth of inhaling. Thus, there is substantial reason to question the existing FTC method from the standpoint of both the accuracy and the meaningfulness of its tar and nicotine yield numbers.

Cigarette industry officials have argued that the machine-estimated yields still provide valuable *relative* information despite variance in smoking behavior both over time and across individuals.[13] This defense of the existing smoking-machine methodology rests on two key assumptions. The first is that the numerical rating system is, in fact, reliable. However, if the true distribution of delivered tar reflects substantial individual variance, there should be a meaningful overlap in deliveries across cigarettes receiving different ratings. Thus, a single tar number may be misleading, even for ordinal judgments (i.e., ranking cigarettes). Further, actual between-cigarette differences might be very small and of little practical importance. The second key assumption is that consumers will use the tar numbers strictly to make relative choices. The main part of this paper examines consumers' understanding of these numbers and their use.

The Meaning of Low Tar to Smokers

Cigarette advertising in the post-1970s voluntary agreement era contains few, if any, explicit claims concerning cigarette "safety."[14] However, many of these advertisements *communicate* health reassurance somewhat more indirectly by stressing mildness and effective filtration.[15] A 1993 Gallup survey reports that 56% of smokers believed that cigarette advertising using terms like *low tar, low nicotine,* or *lower yield* was trying to communicate that the brand was safer, healthier, or less harmful.[16] Research carried out for cigarette companies has made it clear that "milder products translate into somewhat safer smoking alternatives, and safety (low tar and nicotine levels) provides solid rational appeals."[15(p82)] In a 1980 Roper survey, 36% of smokers thought that their low-tar cigarette did not significantly increase a smoker's risk of disease over that of nonsmokers, and another 31% were not sure if this was the case.[15] The 1987 National Health Interview Survey reported that about 46% of those smoking cigarettes with 6 mg or less tar believed that low-tar cigarettes posed reduced cancer risk, compared with about 30% of those smoking higher-tar cigarettes.

A particularly ominous implication of such smoker perceptions is that those who have found it difficult to quit might be tempted to rationalize their shift to an ultra low tar brand. Cigarette industry documents speak to this issue: "We have evidence of virtually no quitting among smokers of those brands, and there are indications that the advent of ultra low tar cigarettes has actually retained some potential quitters in the cigarette market by offering them a viable alternative."[17(p2)] Data from the 1986 Adult Use of Tobacco Survey support this. Whereas 58% of those smoking cigarettes with tar yields of 16 mg or higher had stopped smoking for some period of time, only 34% of those smoking cigarettes with tar yields of 6 mg or less had done so. This relationship is even more startling given the substantially lower prevalence of *perceived* health risks among those smoking these higher-yield cigarettes; that is, 68% of higher-yield

cigarette smokers were concerned about health effects compared with 84% of low-yield cigarette smokers. Moreover, those who *never* switched to reduce tar and nicotine levels were more likely to have stopped smoking than those who had switched for the same purpose (50% vs 37%).[18]

There is little published evidence on smokers' understanding and use of advertised tar numbers. A 1990 study by Gori[19] used two open-ended questions to inquire into the meaning of the tar value of cigarettes and the relevance to health of a 10-mg tar cigarette compared with a 5-mg tar cigarette. The author concludes that smokers believed published tar yields[24] correspond to quantitative assessments of smoke intake, and he expressed concern over such an "unwarranted" belief (in part because of substantial interindividual variance in smoke intake and compensatory behavior focused on nicotine intake).

The study by Chapman et al. of 498 Australian smokers indicated that only 2% correctly recalled their cigarette's tar level (from its pack labeling) while about 70% underestimated it.[20] This is consistent with studies undertaken by both Philip Morris and Lorillard: "There is very little knowledge of the actual tar and nicotine deliveries of leading brands of cigarettes"[21(p1)]; "Smokers do not know actual tar levels, even their own brand's tar level."[22(p1)]

A Survey to Determine Smokers' Beliefs about Cigarette Tar Numbers

In November 1994, a telephone survey was conducted among a national probability sample of 1005 adults (502 men and 503 women) 18 years of age and older living in private households in the continental United States. The data were gathered by Opinion Research Corporation using a random-digit dial sample generated from 35 198 exchanges in 1 652 464 working banks of telephone numbers. This type of sample includes both unlisted and recently established telephone numbers. Only one interview was conducted per household, and up to four attempts were made to complete each interview.

The sample's estimate of everyday smoking (23%) matches current assessments of adult US smoking prevalence (22%).[23] When "everyday" and "some days" smokers are combined, the current smoking percentage (28.7%) is slightly higher than the 26.5% estimate of the Centers for Disease Control and Prevention (CDC) for 1992.

Actual Tar Level of Cigarettes Currently Smoked

Following the procedures used in the Adult Use of Tobacco Survey, we were able to determine the tar levels of respondents' cigarettes by asking a series of questions to identify the brand, size, and other characteristics (i.e., whether it is filtered or menthol) of the cigarette. These answers were compared with the listed tar ratings provided by the FTC.[24] We were successful in all but 15% of the cases, for which necessary product information was unavailable from respondents.* These respondents are likely to come disproportionately from lower-tar categories since cigarettes requiring more detailed information are concentrated in these categories.

A four-category designation for tar levels was selected. Other studies (e.g., the National Health Institute Survey) have used a threefold breakdown with 1 to 6 mg operationalizing a very low tar level; 7 to 15 mg, a low tar level; and 16 mg or more, a high tar level. The present format allows for somewhat greater differentiation among lower-tar users and has an equal number of rating scale points (i.e., 5) for each of the three categories that together have been construed as "low tar." The format is also consistent with a recent proposal for a four-category system oriented around nicotine levels in which the lowest category is also linked to a maximum of 5 mg of tar.[12] One disadvantage of the four-category format is smaller cell sizes.

Fifty-eight percent of the 288 current smokers smoked a cigarette yielding 15 mg tar or less, and 9% smoked a 1- to 5-mg tar cigarette. The 58% figure is about 10% less than the currently estimated domestic market share of these cigarettes. This difference is probably due to the 15% of smokers who failed to provide sufficiently detailed information about their cigarettes, most of whom are likely to smoke low-tar cigarettes.

High-tar cigarette use was more frequent among males, Blacks, and Hispanics and decreased markedly with educational attainment. Although the number of recent quitters in the sample was quite small (36 people), these people tended to come from relatively higher tar categories rather than from the lowest tar category. These data are consistent with previously cited evidence suggesting that switching to the lowest-tar cigarettes is not necessarily a stepping-stone to quitting but is possibly a substitute.

Smokers' Knowledge of Tar Numbers

The 325 people who reported smoking cigarettes in the past 2 to 3 years were asked to tell the interviewer the tar number of the cigarette they smoked most recently, relying on information from advertising or their own knowledge. Seventy-nine percent indicated that they did not know the tar number of the cigarette they smoked. This increased to about 90% for those having less than a high school education, those aged 55 and over, and Black smokers. Respondents answering "don't know" were then asked to come as close as they could, and interviewers were to probe for their "best guess." Fifty-eight percent still reported not knowing the tar number of their cigarette.

For those providing a tar number in response to both attempts, we compared their answers with the actual tar numbers for each cigarette. Correct answers were defined as plus or minus 1 from the actual tar level. Initial responses were slightly more likely to be underestimates (9%) than correct answers or overestimates (6% in the latter two cases). When probed responses were included in the analysis, underestimated tar levels increased substantially (from 9% to 20%) while correct answers or overestimates changed only slightly. When actual tar numbers were regressed against respondents' initial and probed answers, the relationship was weak (r = .26 and .20, respectively), marginally higher than a chance level of association.

Smokers of 1- to 5-mg tar cigarettes had a much greater awareness of their cigarettes' tar numbers. Thirty-nine percent were correct initially, increasing to 50% for probed responses. This stands in marked contrast to even 6- to 10-mg tar cigarette smokers, whose comparable percentages of correct responses were 4% and 9%. The lowest-tar cigarettes are also most likely to provide this information voluntarily on cigarette packages.

*Tar yields vary within the same brand as a function of length (e.g., king size, 100 mm, 120 mm) and descriptors (e.g., light, special light, ultra light). In addition, tar levels often vary even between hard and soft packs of otherwise identical cigarettes. For example, Marlboro king-size filter cigarettes in a soft pack have an FTC yield of 10, while in the hard pack they have a yield of 16![23] This state of affairs seems likely to create confusion among smokers.

The previous analysis is based on respondents' ability to recall advertised tar numbers. Both attention to information and recall of that information increase with the perceived importance of the information and the frequency with which the information is used. Still, it may be argued that smokers, and consumers in general, do not dwell on such numerical information per se but rather convert it to more meaningful descriptive information,[23] and they may well rely on the labels used by cigarette manufacturers (e.g., ultra light, mild) in doing so. This may result in a type of categorical knowledge that is more extensive than our recall data suggest. However, if there is limited processing and use of numerical information, this has implications for effective presentation of tar information and for the importance of assessing consumers' reliance on terminology and nonverbal cues associated with lightness and mildness in both advertising and package design.[12,15]

A somewhat different approach to assessing knowledge of tar levels is to give respondents tar numbers for cigarettes that are relatively high and low in tar levels and then see if there is correct recognition of this fact. This approach overcomes some of the objections to more demanding recall assessment of knowledge since it focuses on what might be termed "knowledge in practice."

Half of the sample was asked whether a 16-mg (or, for the other half, a 5-mg) tar cigarette is lower in tar than most other cigarettes on the market (the correct answers being no and yes, respectively). Table 1 reports respondents' answers cross-tabulated by the tar level of their most recently smoked cigarettes. Splitting the sample in this way has made many of the cell sizes quite small, so these results should be interpreted with caution.

Higher-tar cigarette smokers, in particular, displayed a very low level of knowledge regarding the numerical tar ratings. Whereas 35% of the 1- to 5-mg tar smokers did not know that a 16-mg tar cigarette was *not* lower in tar, between 55% and 66% of all other smokers either did not know the answer or gave incorrect responses to this question. For those smoking cigarettes having upwards of 5 mg of tar, between 56% and 74% either did not know that a 5-mg tar cigarette was lower than most other cigarettes or incorrectly said that it was not lower. Of course, very low tar cigarette smokers may not care very much about where a 16-mg tar cigarette falls relative to the majority of cigarettes: their focus is on cigarettes with very low tar levels. Their "don't know" responses to the 5-mg tar cigarette question may also imply a perception of a much larger number of ultra low tar cigarettes now on the market.

TABLE 1—Smokers' Knowledge of FTC Tar Numbers as Corresponding to Lower Tar Levels

	Tar Level* (mg)				
	Very Low (1 to 5)	Low (6 to 10)	Medium (11 to 15)	High (16+)	Cannot Determine
Believe that a 16-mg tar cigarette is lower in tar than most other cigarettes (n = 179)	(14)	(36)	(40)	(64)	(25)
% correct	65	45	44	34	32
% incorrect	0	10	10	16	12
% don't know	35	45	46	50	56
Believe that a 5-mg tar cigarette is lower in tar than most other cigarettes (n = 158)	(14)	(39)	(30)	(52)	(23)
% correct	15	34	44	27	25
% incorrect	13	10	14	19	16
% don't know	73	56	42	55	59

*Tar level of the respondent's most recently smoked cigarette.

Smokers' Interpretations and Use of Tar Numbers

Two approaches were used to better understand how smokers interpreted the advertised tar numbers. The first looks directly at smokers' inferences of reduced health risks from switching to a lower-tar alternative. The second examines smokers' assumptions about what the numbers represent in terms of actual tar deliveries.

Half of the sample was asked whether a pack-a-day smoker could significantly lower health risks by switching from a 20-mg tar cigarette to a 5-mg tar cigarette (for the other half, switching to a 16-mg tar cigarette). In total, 56% of smokers thought that a switch to a 5-mg tar cigarette would significantly lower health risks whereas 28% thought that a switch to a 16-mg tar cigarette would significantly lower health risks.

Table 2 cross-tabulates the answers to these questions against the actual tar levels of smokers' cigarettes. Looking first at the data corresponding to the major shift from a 20-mg tar cigarette to a 5-mg tar cigarette, we see that low- to high-tar cigarette smokers are evenly divided between believing there would be a significant reduction in health risks and either believing this would not be the case or being unsure about it. If one of the major goals of the 25-year program of providing tar numbers is to encourage such major reductions (for those not willing or able to quit smoking), the basic message does not appear to have gotten through to large numbers of smokers.

While more than 60% of smokers did *not* think that switching to a 16-mg tar cigarette would lead to a significant reduction in health risks from smoking, a sizable proportion of low- to high-tar smokers either thought it would or did not know. With no established means of interpreting the "officially sanctioned" tar numbers conveyed in advertising, many smokers may regard a 20% reduction (or even a 10% reduction) in tar as having practical significance.

The interpretation of data in Table 2 is complicated by the almost certainly differing beliefs of smokers in the four tar categories about the risks of smoking a 20-mg tar cigarette and hence about the gain from any reduction in tar level. Since this factor is likely to be a constant in the two versions of this question, it is useful to examine the relative reduction in health risk (i.e., the difference in benefits between switching to the 5-mg tar alternative compared with the 16-mg tar alternative), shown in the last row of the table. Once again, the evidence points to a clear difference between the 1- to 5-mg tar smokers and all other smokers. These very low tar smokers believe that it takes a substantial reduction in tar yields to significantly reduce health risk, while this does not appear to be true for a substantial number of smokers in other categories. Unfortunately, this belief may also support a judgment that a substantial

TABLE 2—Smokers' Inferences about Health Risks as a Result of Switching to Lower Tar Cigarettes

	Tar Level[a] (mg)				
	Very Low (1 to 5), %	Low (6 to 10), %	Medium (11 to 15), %	High (16+), %	Cannot Determine, %
Switching from a 20-mg to a 5-mg tar cigarette would significantly reduce health risks	83	49	49	55	60
Switching from a 20-mg to a 5-mg tar cigarette would not significantly reduce health risks	13	32	35	25	29
Don't know	4	19	15	20	12
Switching from a 20-mg to a 16-mg tar cigarette would significantly reduce health risks	18	35	28	25	33
Switching from a 20-mg to a 16-mg tar cigarette would not significantly reduce health risks	68	61	61	61	37
Don't know	14	4	10	14	31
Relative difference in health risks between switching to a 5-mg and a 16-mg tar cigarette	65	14	21	30	27

[a]Tar level of the respondent's most recently smoked cigarette.

TABLE 3—Smokers' Inferences about Trade-Offs between Tar Deliveries and Number of Cigarettes Smoked

	Tar Level[a] (mg)				
	Very Low (1 to 5), %	Low (6 to 10), %	Medium (11 to 15), %	High (16+), %	Cannot Determine, %
The person probably could smoke more than 1, but these numbers can't tell you how much less tar the person would take in from the 1-mg tar cigarette	28	33	31	40	39
The person could smoke more than 1 or 2 but fewer than 9 or 10 of the 1-mg tar cigarettes without taking in more tar	18	33	22	25	22
The person could smoke about 10 of the 1-mg tar cigarettes without taking in more tar	44	25	31	21	21
None of these/don't know	10	10	16	14	18

[a]Tar level of the respondent's most recently smoked cigarette.

reduction in tar levels may be a reasonable substitute for quitting.

From the consumer standpoint, tar numbers "must" have some health significance, or they would not *seemingly* be required in cigarette advertisements; nor would cigarette brands build advertising appeals and product descriptions around them. The cigarette industry continues to argue that advertised tar ratings give consumers useful comparative information, which they define as information about *yields*, perhaps assuming that consumers understand both that these are not the same as the actual amount ingested and that they are only valid for cigarettes smoked in exactly the same way.[13] By comparison, the FTC and private party lawsuits alleging misleading/deceptive advertising are routinely validated by evidence that 20% to 25% of the relevant public has been misled.[26] Since there has been a substantial reduction in sales-weighted average tar and nicotine yields (approximately 60% since 1955, but at a considerably slower rate of decrease since 1981), one could also say that there has been a desirable macrolevel change in behavior despite widespread confusion over the meaning and health significance of these tar numbers. Another way of looking at this is that the existing policy has been somewhat effective in sending directionally correct signals, but it has left individuals confused about the relative risks they incur by smoking cigarettes having different tar yields.

To further investigate smokers' interpretation of the numerical ratings, we examined their understanding of the distinction between tar yield and actual delivery, together with their willingness to treat the numerical information as if it had ratio scale properties rather than merely ordinal properties. Since these ratings were originally introduced, those supporting their value and continued use have assumed that consumers would use the numbers essentially as if they were rank-ordered data.[4,13,27] Ordinal scales do not possess the property that each numerical interval is of the same magnitude (i.e., that the difference between 1 and 2 is precisely equal to the difference between 10 and 11). The FTC method may produce tar ratings that have this interval-scale property for tar yields, but it cannot be said to have it for actual deliveries of tar because smokers' inhalation patterns seem to vary as we move lower on the scale. A ratio scale has the further property of having a genuine zero point, making it proper to regard a scale score of 10 as being twice as high as a scale score of 5.

A 1994 FTC settlement with the American Tobacco Company is directly pertinent to this issue. The complaint alleged that Carlton advertising containing statements such as "Ten packs of Carltons have less tar than one pack of these brands" (picturing single packs of five other brands) represented that consumers could possibly smoke 10 packs of 1-mg Carltons without taking in more tar than they would from one pack of various brands rated at 12 to 17 mg tar.[28] No evidence was formally presented to support this message "takeaway" by smokers.

Nevertheless, the FTC's willingness to prosecute and American Tobacco's willingness to refrain from making such verbal and pictorial representations in the future suggest that both sides are sensitive to concerns that smokers might be making inappropriate (i.e., ratio scale) inferences about tar *deliveries*.

We examined consumers' understanding of this matter by asking respondents to assume that a person switched from a 10-mg tar cigarette to a 1-mg tar cigarette. We then read the three statements shown in Table 3 twice and asked respondents to decide which of them came closest to their opinion. Primacy and recency effects were controlled by rotating the order of the first and third statements. The first answer is the correct choice, and the second answer suggests some reluctance to rely on the absolute numerical values when thinking about such trade-offs.

However, at least one quarter of smokers (i.e., those selecting the third interpretation) clearly have been misled about the meaning of the tar yield numbers. Interestingly, this increases to 44% for very low tar smokers, in line with other evidence presented here and with our concern about the safety reassurances that such very low tar cigarettes appear to provide.

The final issue under study in this survey was whether smokers report having used these tar numbers to make judgments about the relative safety of different brands of cigarettes. In answering this question, only 14% of the sample indicated doing so. Once again, however, the 1- to 5-mg tar smokers were quite different: 56% of them reported doing so.

Conclusion

Authorities agree that there is no safe cigarette, and that tar ratings bear almost no relationship to cardiovascular illness and bear an ambiguous relationship to pulmonary disease. Despite this, an implied "safer cigarette" message continues to be communicated in a variety of ways, including tar ratings endorsed by the FTC. For cigarette companies, the low tar and nicotine cigarette has been one of the principal means of retaining health-concerned smokers.

Recent efforts to evaluate machine-measured tar yields have revealed significant shortcomings in the resulting numbers. An ad hoc committee of the President's Cancer Panel has recommended modifying the FTC test protocol to produce a numerical *range* that is based on more realistic puffing parameters and that incorporates the effects of compensation and inadvertent lessening of aeration.[29] The results of this study suggest that communicating the meaning of such a range would be difficult. Moreover, the range would include a "best case" set of smoking conditions, although smokers have no real basis to know whether those conditions should apply to them. Further, smokers are more likely to want to believe the more optimistic assessment. Hoping for a substantial public education program to help people interpret the meaning of such cigarette yield information may be unrealistic at this time. Accordingly, modifying the FTC's test parameters to reflect the smoking behavior of, say, the upper 25% in terms of smoking intensity and reporting that result (probably in non-numerical terms) might be a more appropriately conservative procedure.

Data from the survey also raise concerns about health implications of the absolute level of the FTC tar numbers. Numbers of 1 to 5 mg of tar are not only *lower;* they are *low!* Unless we are willing to have consumers develop the belief that such cigarettes are, for all intents and purposes, safe to smoke, there is some value in adopting a rating system that does not convey a virtual absence of what many smokers presume to be the primary harmful element.

There are inherent difficulties in communicating tar yield information by means of numerical ratings. This gives added support to proposals that might convert appropriately arrived at numerical ratings to category-descriptive labels.[12] Such proposals would also permit multifactor standards for assessing cigarettes, analogous to some of the Food and Drug Administration's requirements for health-related terms in food advertising. A multifactor rating system may be a useful way of dealing with compounds whose significance is not widely appreciated. It might also be feasible to require a statement on all cigarette packages to the effect that cigarettes with reduced tar have a slightly lower cancer risk but do not reduce the risk of heart attack, stroke, or other lung disease.

Finally, we should think about the FTC testing methodology as a means to an end rather than as a system that might require technical modifications to report variability accurately. The system was put in place to provide a standardized basis for information thought to be helpful to consumers. Whatever changes are made should be responsive to what we know about consumers' understanding and use of this and related types of information. □

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