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Safety Behavior and Consumer Responses to Cigarette Lighter Safety Mechanisms

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This paper analyzes consumer responses to lighter child-resistant mechanisms using an original sample of 200 households with young children. Results from an in-house placement of lighters indicate that the child-resistant mechanism would diminish consumer care. The child-resistant device reduced risk perceptions, parental concern with lighter safety, the assessed need for precautions, and consumer care. The results provide the most detailed empirical evidence of the mechanisms driving the diminished safety precautions in response to technological improvements in safety. The overall efficacy of the mechanism, however, is sufficient to generate a safety improvement despite the diminished care.

INTRODUCTION

In the 1990s several manufacturers of disposable lighters developed enhanced child-resistant features or devices for lighters. These features in turn were the subject of regulatory efforts by the US Consumer Product Safety Commission (CPSC) to mandate these devices through regulation. The intent of the child-resistant device is to make the lighter more difficult for small children to operate, thus reducing the potential risk of fires if children gain access to the lighters.

The ultimate safety outcome of this technological enhancement hinges not only on the physical characteristics of the product but also on the manner of the product's use. If, for example, parents currently took fully adequate precautions in terms of limiting children's access to lighters or in terms of adequately conveying to their children the importance of not playing with lighters, then any such mechanism would have no constructive role to play because the risk would have already been eliminated. If precautions are not fully effective and this safety behavior does not diminish after the advent of the new lighter design, the introduction of a technological device that enhances the child-resistant characteristics of the lighter product will enhance safety as well. If, however, parents responded to the child-resistant mechanism by increasing children's access to the lighters, then the constructive effect of the innovation could be undercut.

The potential role of individual safety-related actions has been documented in a number of studies. Here we will distinguish three classes of effects. First, increases in the child-resistant characteristics of the product reduce the need for precautions by the product user, creating a safety disincentive effect. The economic mechanism underlying this relationship is not controversial. The advent of the child-resistant device diminishes the expected safety benefits of taking precautions. The cost to the parents of taking precautions is unaffected by the advent of the child-resistant mechanism. As a result, the decreased safety gains from taking precautionary actions relative to these
costs will lead some individuals to strike a differ-
ent balance between the precautions they take
and the effort required to take these precautions.

Although this effect may appear somewhat sur-
prising, a simple example can illustrate the fac-
tors at work. Suppose that streets became icy.
Under these circumstances, most drivers would
exercise greater care to avoid an accident. After
the ice melts, however, the extent of care exer-
cised by drivers will diminish since the expected
reduction in accident risk from taking care has
diminished. The same kinds of economic factors are
at work within the context of child-resistant
mechanisms for lighters. These mechanisms will,
in effect, transform a situation of icy streets into a
situation of dry streets, as the expected accident
risk reduction produced by exercising greater care
has diminished. There should consequently be
some resulting reduction in precautionary behav-
ior.

Although the nature of the linkage is not con-
troversial, the magnitude of the effect is widely
debated. In the case of seatbelt use, Peltzman
(1975) hypothesizes that such diminished precau-
tionary behavior may offset the influence of the
seatbelts, whereas other authors such as Crandall
et al. (1986) recognize the influence but suggest
that its impact is not dominant. Similarly, one
could question whether the advent of child-re-
sistant devices will have an adverse effect on
precautionary behavior for lighters. If, however,
concern with fire safety is a dominant one for the
household, then the level of precautionary behav-
ior may not be too sensitive to the decreased risk.

A second class of effects pertains to what Viscu-
si (1984a,b, 1985, 1992) has termed the ‘lulling
effect.’ In particular, people may overestimate
how safe the safety device is in eliminating acci-
dent risks. If they are lulled into a false sense of
complacency, there is the danger that their pre-
cauutionary behavior will diminish. The possi-
bility of a counterproductive safety device is much
greater in the case of the lulling effect because
people misperceive the safety of the product,
leading them to be much more complacent than
they should be after the introduction of the safety
device.

The case study for the lulling effect was the
advent of child-resistant caps on medicines. These
caps were widely referred to as being ‘child-proof’
both by officials of the CPSC as well as segments
of the population at large. To the extent that
people believe that safety caps on medicines and
other products eliminate the need for precaution-
ary behavior, then the extent of these precautions
will diminish. The net empirical effect is that
after the advent of these caps there has been no
significant decline in the extent of poisonings
associated with the products receiving the caps.
The beneficial effect of the technology has been
diminished by the decreased parental precautions.

The existence of this phenomenon does not
necessarily imply that safety caps and similar de-
vice are undesirable. What it does suggest, how-
ever, is that one cannot always simply introduce
a technological change in the product and achieve
the desired result. If there is the likelihood that
people will misperceive the effectiveness of the
safety device, then one possible policy alternative
is to couple the safety mechanism with a hazard
warning to alert the product users to the contin-
ued need to exercise care.

The third behavioral response that has been
identified in the literature is that if the product
users identify safety-related innovations as being
undesirable, they will often take actions that un-
dermine their effectiveness. In the case of seat-
belts, a large percentage of the population has
simply chosen not to use these belts. It has been
only recently when various states have institut-
ed mandatory requirements for seatbelt use that us-
age has become more prevalent. A similar pheno-
menon could occur in the safety-cap context as
well if people chose to purchase medicine in
bottles without special caps to avoid the precau-
tionary device. In the case of aspirin, for example,
firms are permitted to sell one bottle size—typi-
cally the largest selling container—without a
safety cap.

A much stronger response to technological fea-
tures that are perceived as being undesirable is
that the product users may attempt to thwart the
device in some explicit manner, not only under-
mining its effectiveness but also potentially creat-
ing a greater risk overall from the product. One
phenomenon identified by Viscusi (1984a,b, 1985,
1992) in the case of safety caps is that people
have been more likely to leave the caps off bottles
altogether after the advent of safety caps, thus
leading to an increase in child poisonings from
products receiving the caps.

The design of the lighter child-resistant mecha-
nism eliminates some of these problems. The
mechanism operates in a passive manner so that
it does not have to be consciously activated by the lighter user in order to be effective. Thus, the analog of people not buckling up seatbelts will not be pertinent. Similarly, if the mechanism is included on all lighters and not simply some lighters, people will not be able to selectively avoid purchasing lighters with the child-resistant device.

There is, however, a final possibility that will occur if the child-resistant mechanism is viewed as an extremely unattractive feature of lighters. Product users may then simply attempt to break it off or remove it. Doing so may create new fire-related hazards. Consumer satisfaction with a safety device is consequently an important consideration in determining its ultimate efficacy.

Unfortunately, one cannot rely solely upon the existing literature to determine the precise magnitude and potential importance of these various effects within the context of lighter safety. Because the risk perceptions and the costs associated with taking precautions differ in different accident contexts, one must ascertain the particular feature affecting lighter safety that will influence the ultimate impact that mechanism will have. To quantify these relationships, the authors undertook an extensive field test of lighters to ascertain how these child-resistant mechanisms influenced attitudes toward lighter safety, perceived needs for precautionary behavior, as well as actual lighter usage. This lighter placement study involved 200 households with completed interviews, where these households represented a broad cross-section of the population using lighters.

The survey design permitted explicit evaluation of each of the three mechanisms discussed above. First, the effect of lighter safety on the need for precautions was addressed both through a series of questions relating to precautionary intentions and fire safety training as well as through questions that ascertained possible changes in precautionary behavior, such as the placement of lighters throughout the house. The study addressed the second issue of creating a false sense of security by ascertaining both the respondent’s risk perceptions before and after the advent of the child-resistant mechanism as well as the need for taking precautionary actions after the advent of the child-resistant device. Finally, a series of questions ascertaining the consumer’s acceptance of the product and willingness to pay for these child-resistant mechanisms provides a detailed assessment of the likelihood of consumer resistance that might undermine the efficacy of the device.

The overall effect of this examination is to provide a comprehensive assessment of the precautionary behavior of the product user group. Moreover, this study provides a more comprehensive assessment of the diverse factors influencing this precautionary behavior than have any published studies of a retrospective nature that have analyzed the precautionary effects of safety devices that have been instituted, such as seatbelts and safety caps. Since the results of this study are based on the findings derived from an actual lighter placement, as opposed to simply intentions with respect to a hypothetical design change, we are confident that the findings of this study provide a reliable index of the expected effect of the child-resistant mechanism on the precautions consumers take with the product.

Our principal finding is that for the great majority of consumers, precautionary behavior will continue to be important, as will their general concern with lighter safety. A minority of the population does, however, represent a potential risk in that they believe that the child-resistant mechanism has eliminated the hazard and diminished the need for precautions. While such behavior is the exception rather than the rule, the need for vigilance in promoting safety is clear.

SAMPLE DESCRIPTION

The sample consisted of 200 households in Memphis, Chicago, and the New York metropolitan area that reflected a broad demographic mix. The respondent unit was a household in which at least one of the parents smoked, and lighters were used in the house. The sample screen for admission into the sample required that lighters be used daily in the home. The sample is roughly evenly divided among those households that use lighters 15 or fewer times per day or more than 15 times per day. Of the young children in the
sample group, 75 lived in Memphis, 68 in Chicago, and 89 in the New York metropolitan area.

The age breakdown of this sample reflects the at risk population. The sample consisted of 135 children aged 40–51 months and 97 children aged 52–60 months—the target ages for a child-resistant mechanism. Thus, just over half of the sample’s children were in the age range of 40–51 months, and the remainder were in the age range of 52–60 months. The age range encompassed by the study consequently ranges from 3½ years to 5 years. There are more than 200 children represented in the sample because some families had more than one child.

The sex split of the sample was fairly even, as 113 children were males and 119 were females. Females may have a higher small motor dexterity at that age, but males may be more inquisitive about fires and be more likely to start fires for that reason.

The dwelling type of the respondents also was quite varied, as 78% of the sample lived in houses, 17% in apartments, and 3% in condominiums or town houses.

The demographic mix of the sample tended to follow the distribution of the US smoking population, which has a strong blue-collar orientation. The most highly represented groups were craftsmen and foremen (25%), operatives (17%), and clerical/sales workers (13%). In contrast, the leading white-collar occupational group, professionals, was represented in only 6% of the households, which is reflective of their minority status among the smoking population.

The great majority of households participating in the study had other children in the home. Finally, the educational level of the sample consisted of 42% of the sample with college or more education, and the remainder had high school education or less. Overall, we conclude that this study draws upon a sample that is broadly representative of lighter users. Moreover, because of the detailed demographic information that we obtained, it will be possible to project our results on populations with a different demographic mix should we wish to extrapolate our results to populations of different composition.

At the time of the recruitment of the subjects, the parent was given a survey to ascertain certain baseline characteristics of the household and aspects of lighter use. The sample then underwent a period of actual usage of the lighter in the home after which the children were tested to see whether the exposure to usage of the test lighter in the home and the ability to observe the usage of the child-resistant mechanism would affect the efficacy of the device.

**LIGHTER RISK BELIEFS**

Rational individuals will choose their precautions on the level of the risk, how effective the precautions are in reducing this risk, and the difficulty of taking precautions. Other factors, such as the severity of the injuries or other outcomes associated with safety precautions also would be of consequence.

The first matter of concern will be to assess the degree to which consumers regard lighters as being dangerous. This survey question provides a useful index of risk perceptions, but it may compound the influence of both the probability that some adverse event may occur as well as the severity of the associated event. The survey interviewers presented respondents with a 10-point scale to rate various products from 1 (not dangerous) to 10 (extremely dangerous). To obtain a meaningful set of reference points, the survey included three different products for rating: matches, conventional lighters, and the test lighter.

Table 1 summarizes the outcome of these responses. Respondents viewed matches as being extremely hazardous, as 76% of all respondents gave matches a rating of 10, the highest value in the scale. In contrast, only 47% of respondents viewed conventional lighters as being extremely dangerous, and a stunningly small 12% of respondents viewed the test lighter with the child-resistant mechanism as being extremely dangerous.

Even if one were to construct measures of more diminished concern, the differences are quite stark. Consider the responses that indicate that there is relatively little danger, such as danger ratings between 1 and 5. Fewer than 5% of the sample viewed matches as qualifying for such a low danger rating, and just 15% of respondents viewed conventional lighters as having a safety rating between 1 and 5. However, 64% of the sample viewed the test lighter as being so safe that it would merit a danger rating of 5 or less. Quite clearly there has been a marked shift in the
attitudes toward lighter safety because of the institution of the child-resistant mechanism. To the extent that consumers base their own safety precautions on the perceived safety of the product, this increased belief in product safety may have an adverse effect on the care that they take with respect to the lighters.

Table 2 explores the distribution of these responses in more detail. The rows in Table 2 provide information pertaining to the rating of the conventional lighter, and the columns indicate the test lighter rating for any given value of the conventional lighter score. If the responses were all on the diagonal, then this would indicate that the test lighters and conventional lighters were rated identically. Since these responses were almost all below the diagonal, there has clearly been a drop in risk perceptions irrespective of the initial base rating for safety. In the case of those who initially gave a danger rating of 3 to the conventional lighter, three respondents now rated the test lighter as 1 and three rated it as qualifying for a danger rating of 2, with no higher values of rating. In the case of ratings of a value of 5, the introduction of the test lighter mechanism tends to drop the danger rating score by 2 points, and a similar decline is exhibited for a rating of 6. By the time the danger rating for the conventional lighter reaches 8, there is more of a dampening in the test lighter danger ratings, which are now clustered from 3 to 5. For the highest danger rating of 10, 24 respondents maintain their high-risk beliefs, but the next largest respondent group gave the lighters a score of 5, and the overall

---

**Table 1. Safety Ratings of Matches and Lighters**

<table>
<thead>
<tr>
<th>Danger scale</th>
<th>Percent distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Matches</td>
</tr>
<tr>
<td>1 = not dangerous</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>1.0</td>
</tr>
<tr>
<td>5</td>
<td>3.5</td>
</tr>
<tr>
<td>6</td>
<td>3.5</td>
</tr>
<tr>
<td>7</td>
<td>3.5</td>
</tr>
<tr>
<td>8</td>
<td>6.0</td>
</tr>
<tr>
<td>9</td>
<td>6.0</td>
</tr>
<tr>
<td>10</td>
<td>76.0</td>
</tr>
</tbody>
</table>

---

**Table 2. Distribution of Respondents by Safety Ratings for Conventional and Test Lighters**

<table>
<thead>
<tr>
<th>Not dangerous</th>
<th>Rating of test lighter</th>
<th>Extremely dangerous</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Not dangerous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Rating</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>of conventional</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>lighter</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Extremely dangerous</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>9</td>
<td>2</td>
</tr>
</tbody>
</table>
Table 3. Reasons for Test Lighter Rating

<table>
<thead>
<tr>
<th>Reason</th>
<th>Percent distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harder to operate</td>
<td>55.5</td>
</tr>
<tr>
<td>Child will learn to use</td>
<td>19.0</td>
</tr>
<tr>
<td>Lighters are still dangerous</td>
<td>11.5</td>
</tr>
<tr>
<td>Unable to operate device</td>
<td>8.5</td>
</tr>
<tr>
<td>Lighter is safer</td>
<td>7.0</td>
</tr>
<tr>
<td>Lighter is less dangerous</td>
<td>4.0</td>
</tr>
<tr>
<td>Other</td>
<td>1.0</td>
</tr>
</tbody>
</table>

The mean response for that group was 6.4. These danger rating patterns indicate a substantial drop in the risk assessed for lighters, with the greatest improvement being experience by individuals who had initially rated lighters as being the riskiest.

To explore in more detail the reasons behind this change in consumer attitudes, the survey included an open-ended question to elicit the reason for the change in the safety rating of the lighters once the child-resistant mechanism had been added. As the information in Table 3 indicates, the main reasons for the reduced risk ratings were that respondents believe that the test lighter was harder to operate (55.5%) and that the test lighter is less dangerous (4%). For individuals who continued to give lighters relatively high-risk scores, the main reasons were that they believe the child will learn to use these lighters (19%) and that lighters are still dangerous (11.5%).

Parents often characterized their assessment of the importance of exercising care in lighter safety in terms of a degree of concern.

Table 4 summarizes information regarding the degree of parental concern ranging from 1 (not concerned) to 10 (very concerned). These concern equations pertain to various specific safety-related lighter and fire precautions. The first set of concern results in Table 4 pertains to whether parents are concerned with their children gaining access to matches and lighters generally, and the second column is whether they are concerned with their children starting fires with lighters. Each of these questions provides a baseline that can be used to provide a reference point for how perceptions have shifted after the new lighter design is considered. Overall, 51% of the sample is very concerned (rating 10) with children gaining access to matches and lighters, with 30% having a concern rating of 3 or below. The concern with access to matches and lighters is less pronounced than the concern with whether the child will start a fire with lighters, as 77% of the sample is at the very concerned (rating 10) end of the spectrum, and only 6% give this concern question a value of 5 or less.

Once the test lighter mechanism is introduced, these responses are distributed throughout the concern range from 1 to 10. Indeed, there are only two categories—ratings of 5 and 10—that receive more than 10% of the respondents, and these are the salient values on the concern scale. The widely dispersed nature of the risk beliefs is apparent, as 54.5% of the sample now gives test lighters a concern rating of 5 or less, but the remainder believe that the concern with children starting fires with test lighters should receive a concern score of 6 or more. Introduction of the test lighter mechanism results in a dramatic flat-
Table 4. Alternative Measures of Concern with Fire Safety

<table>
<thead>
<tr>
<th>Degree of concern</th>
<th>Child gaining access to matches and lighters</th>
<th>Starting fire with lighters</th>
<th>Starting fire with test lighter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (not concerned)</td>
<td>4.5</td>
<td>0</td>
<td>8.0</td>
</tr>
<tr>
<td>2</td>
<td>4.5</td>
<td>1.5</td>
<td>10.0</td>
</tr>
<tr>
<td>3</td>
<td>6.5</td>
<td>0.5</td>
<td>10.0</td>
</tr>
<tr>
<td>4</td>
<td>3.5</td>
<td>0.5</td>
<td>7.5</td>
</tr>
<tr>
<td>5</td>
<td>11.0</td>
<td>3.5</td>
<td>15.0</td>
</tr>
<tr>
<td>6</td>
<td>2.5</td>
<td>1.0</td>
<td>7.5</td>
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<tr>
<td>7</td>
<td>5.5</td>
<td>4.5</td>
<td>7.0</td>
</tr>
<tr>
<td>8</td>
<td>7.0</td>
<td>5.0</td>
<td>9.5</td>
</tr>
<tr>
<td>9</td>
<td>4.0</td>
<td>6.5</td>
<td>3.5</td>
</tr>
<tr>
<td>10</td>
<td>51.0</td>
<td>77.0</td>
<td>22.0</td>
</tr>
</tbody>
</table>

Table 5. Need to Discuss Lighter Safety with Child if Lighters had Child-resistant Feature

| % | Discussions no longer needed since lighters are safer | 1 |
|   | Discussions not as necessary since risk is reduced  | 11 |
|    | Discussions just as necessary                        | 88 |

Tenten out of the concern levels expressed by the sample.

One way in which parents could implement their concern with safety is through the various lighter safety precautions. A typical precaution that was the subject of substantial parental discussion pertained to the importance of discussing lighter safety with their children, as well as the overall dangers posed by fires. Table 5 indicates the responses to questions intended to directly elicit from parents their intention with respect to undertaking such safety discussions. Only 1% of the sample believed that discussions were no longer needed since the lighters are safer. This low value is not surprising given the fact that most respondents would want to appear to be responsible parents. A greater amount—11% of the sample—believe that such lighter safety discussions were not as necessary as before since the risk has been reduced by the child-resistant mechanism. Although the total of 12% of the sample who believe that discussions are not as necessary as before may appear to be a modest amount of slippage, when these percentages are applied to millions of lighter users the result may be quite consequential.

Questions that are less self-incriminating for the respondent suggest that the degree of slippage with respect to precautionary behavior may be even greater. Table 6 summarizes the level of agreement of the respondent with various statements made about the enhanced child-resistant lighters. The responses were on a scale 1 (strongly agree) to 5 (strongly disagree). Focus group discussions suggested that concern with safety precautions often took the phraseology 'peace of mind.' In particular, subjects wanted to obtain peace of mind with respect to lighter safety through proper safety precautions and safety education. Overall, more than 80% of the sample
agreed either somewhat or strongly that the lighters with the enhanced child-resistant features would give greater peace of mind.

Much of the diminished safety will arise because of a greater belief in the safety of cigarette lighters in the presence of these child-resistant mechanisms. Overall, almost half the sample strongly agreed that lighters with enhanced child-resistant features would reduce fires and injuries, and most of the rest of the respondents at least somewhat agreed with that statement.

The third question listed in Table 6 is intended to be a less self-incriminating variant of a safety precaution question. In many survey contexts in which the survey requires that the respondent give information that may reflect adversely upon his or her behavior, it is often useful to ask how other similarly situated respondents may act. For example, in studies of crime, researchers frequently ask whether one’s friends commit criminal acts rather than ask whether the respondent commits criminal acts. Questions about friends are less prone to survey response bias and often provide a useful index of the respondent’s own likely behavior. In this case the question that was asked was whether parents would be less careful about keeping lighters away from children. A fairly substantial 15% of the sample strongly agreed with the statement, and 32.5% somewhat agreed. This slippage in precautionary behavior is much greater than that reflected in the results in Table 5.

Would, however, parents react by spending less time teaching their children about fires? This task is viewed as so fundamental that there would be less change in behavior. Thirteen percent somewhat agreed or strongly agreed with that statement, which was similar to the 11% of the respondents in Table 5, who indicated that the discussions of lighter safety are not as necessary since the risk is reduced. However, the 88% of the sample in Table 5 who believe that safety discussions are just as necessary may overestimate somewhat the actual percentage who hold these beliefs quite strongly, as only 69% of the respondents in Table 6 strongly disagreed with the statement that parents will spend less time teaching their children about fires.

THE EFFECT ON PRECAUTIONARY BEHAVIOR

If parents change their attitudes about lighter safety and their concern with the need to undertake various kinds of precautions after the new lighter design is in place, these shifts should in turn affect the precautions people actually take with lighters. Parents must make a decision with respect to whether the costs associated with the precautions exceed the expected benefits. As the perceived risks associated with precautions decline, the expected benefits of precautions will also diminish, making precaution taking less desirable.

In addition to the precaution intention ques-
tions, such as those discussed in the previous section, the survey also explored lighter placement in a variety of ways. Table 7 reports results pertaining to how individuals place lighters in the home before the test lighter was introduced, as well as where they place the test lighter. For each household location, the first entry gives the percentage in the sample who kept the lighter in that location. Since there may be lighters in more than one location, these percentages add up to more than 100. Parents are more likely to have multiple conventional lighters in the home than test lighters so that the overall number of lighter locations is greater for the conventional lighter situation. To adjust for this discrepancy, the total percentage values for all the rooms were added and the lighter percentages were divided by this amount to normalize the room distribution percentages. For example, 63% of the households had conventional lighters in the kitchen, but after adjusting for the placement of lighters in multiple locations only 35.8% of all conventional lighters in the home were located in the kitchen.

After making the adjustments for lighter location, there did not appear to be very stark differences between the two sets of lighter distributions. The most salient difference is that conventional lighters are less likely to be kept on the person, which is an effect which appears attributable to the parent's concern with losing the test lighter that was the object of the experiment. Otherwise, the lighter distributions appear to be fairly similar. To better disentangle the relationships between placement and related precautions and the advent of the child-resistant mechanism it will be necessary, however, to undertake a multiple regression analysis that isolates these different influences.

Table 8 presents a summary of probit estimates pertaining to the probability that the parent will undertake various kinds of precautionary actions, including decisions regarding lighter placement. The regression results in Table 8 explore the linkage between the natural logarithm of the danger and concern ratings for the test lighter and different measures of precautionary behavior. Rational consumers who compare the expected benefits of precautions with the cost of precautions will undertake diminished precautions if the perceived riskiness of the lighter has diminished because of the advent of the child-resistant mechanism. Whether or not this decreased risk is due to an actual change in the risk level is a misperception of the efficacy of the safety mechanism is not consequential in determining whether individuals will be responsive to their subjective perceptions. However, the presence of a misperception regarding the efficacy of the child-resistant mechanism may lead consumers to believe that it is more effective than it actually is and to be lulled into a false sense of complacency.
Table 8. Summary of Probit Estimates for Precautionary Actions

<table>
<thead>
<tr>
<th>Precaution/placement variable</th>
<th>Coefficient (SE)</th>
<th>Coefficient (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In (danger rating</td>
<td>In (concern rating</td>
</tr>
<tr>
<td></td>
<td>for test lighter)</td>
<td>for test lighter)</td>
</tr>
<tr>
<td>Respondent took precautions</td>
<td>0.195&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.197&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>with test lighter</td>
<td>(0.060)</td>
<td>(0.052)</td>
</tr>
<tr>
<td>Lighter is within reach</td>
<td>−0.237&lt;sup&gt;b&lt;/sup&gt;</td>
<td>−0.312&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>of the children</td>
<td>(0.080)</td>
<td>(0.088)</td>
</tr>
<tr>
<td>Respondent believes parents</td>
<td>−0.063&lt;sup&gt;b&lt;/sup&gt;</td>
<td>−0.079&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>in general will be less</td>
<td>(0.035)</td>
<td>(0.031)</td>
</tr>
<tr>
<td>careful with the test lighter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respondent believes parents</td>
<td>−0.073</td>
<td>−0.029</td>
</tr>
<tr>
<td>will spend less time teaching</td>
<td>(0.049)</td>
<td>(0.040)</td>
</tr>
<tr>
<td>their children about fires</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respondent kept the lighter</td>
<td>0.082&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.091&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>on the person</td>
<td>(0.035)</td>
<td>(0.032)</td>
</tr>
<tr>
<td>Respondent kept the lighter</td>
<td>−0.058</td>
<td>−0.068&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>living room/kitchen</td>
<td>(0.039)</td>
<td>(0.036)</td>
</tr>
<tr>
<td>Respondent kept the lighter</td>
<td>−0.043</td>
<td>−0.014</td>
</tr>
<tr>
<td>in bedroom/bathroom</td>
<td>(0.039)</td>
<td>(0.034)</td>
</tr>
<tr>
<td>Respondent kept the lighter</td>
<td>−0.081</td>
<td>−0.127</td>
</tr>
<tr>
<td>in some other room</td>
<td>(0.078)</td>
<td>(0.070)</td>
</tr>
<tr>
<td>Test lighter will provide</td>
<td>−0.260&lt;sup&gt;b&lt;/sup&gt;</td>
<td>−0.141&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>more peace of mind</td>
<td>(0.050)</td>
<td>(0.040)</td>
</tr>
<tr>
<td>Test lighter would reduce</td>
<td>−0.124&lt;sup&gt;b&lt;/sup&gt;</td>
<td>−0.076&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>fires</td>
<td>(0.035)</td>
<td>(0.031)</td>
</tr>
</tbody>
</table>

<sup>a</sup>Each equation also includes the following explanatory variables: Respondent is the father, respondent is college educated, child is male, child is in the young age group, child is black, child is Hispanic, income level of the family, dummy variable for income greater then $60,000, income missing dummy variable, Chicago area dummy variable, and New York metro dummy variable.

<sup>b</sup>Statistically significant at the 5% level, one-tailed test.

The results in Table 8 suggest that there is a strong influence of the various risk belief variables for the test lighter and various measures of the precautionary behavior and placement of these lighters. Consider each of these measures in turn. The first precaution variable listed in Table 8 is whether the respondent indicated that he or she took some kind of precautions with respect to the lighter. This question did not elicit a specific response concerning the particular precaution taken but rather was a measure of whether overall there was some effort to exercise care with the lighters. Precaution taking was not universal, but it was quite prevalent, as 88% of the respondents indicated that they took such precautions. In the case of both danger perceptions and levels of concern with lighter safety, respondents who gave the test lighter a higher score on either of these risk scales were more likely to exercise precautions than those who did not. Thus, in terms of the mechanism of influence, the greater extent to which the introduction of the test lighter diminishes the danger and concern scores, which was a phenomenon documented earlier, the less likely respondents will be to exercise precautions. This linkage, consequently, is directly in line with the prediction of an optimizing economic choice model in which respondents take into account the risk level when making their precautionary behavior decisions.

The next variable pertaining to access of children to the lighters likewise shows a significant
influence of the two risk measures. Increasing the risk assessment for the test lighter decreases the propensity to allow children access to the lighter, as the dependent variable is inversely related to precautions. Thus, the significant negative sign that is observed is also in line with theoretical predictions. Only a small segment of the sample — 7% — left a lighter in a place where the child could reach it so that the extent of the influence of the diminished risk perceptions affected the behavior of only a small minority of the sample.

The third precaution measure in Table 8 is the indicator variable of whether the respondent believes that parents in general will be less careful with the test lighter. The greater the risk perception for the best lighter the lower is the probability that the respondent will believe that parents will be less careful, which is the expected influence. This precautionary influence may be more consequential than those already discussed, as 48% of the sample believes that parents would be less careful once the child-resistant mechanism for lighters was in place. The higher percentage here may also be a more honest reflection of the likely diminished precaution taking that would take place to the extent that people are more willing to respond honestly to questions regarding other parents rather than to give self-incriminating responses with respect to their own.

In a similar vein, the variable pertaining to whether parents would undertake less teaching about lighter safety is an attempt to capture such influences, but there is no significant effect observed here. Apparently, the respondents believe that fire safety education was still important, notwithstanding the introduction of the test lighter.

As was indicated above, our respondents were much more likely to keep the test lighter on their person. This phenomenon may not be solely the result of a desire to exercise care with respect to our field experiment, as there is a significant positive linkage of assessed dangers of the test lighter and whether the parent kept the lighter on his or her person. Apparently a desire to avoid leaving the lighter in a place where the child could be at risk also could be a factor in influencing this decision. Another possibility is that the parental preferences that give rise to more responsible handling of the test lighter for purposes of the field test are correlated with preferences for safety in general.

In terms of lighter placement, the only significant influence of the risk variables were that parents with greater concern regarding the safety of the test lighter were less likely to place the lighter in the living room or kitchen. The focus group suggested that these locations were very high traffic areas in the household and were areas of particular concern with respect to child access.

The peace of mind variable captures the phraseology respondents use to characterize how they often thought about their own concerns regarding lighter safety. Higher risk perceptions for the test lighter are associated with less peace of mind, which may be an overall proxy for their attitude toward their need for taking precautions. The extent to which the peace of mind response was influenced by test lighters is reflected in the fact that 84% of the respondents believe that the test lighter gave them more peace of mind than did lighters currently on the market.

In addition to having effects in the expected direction that are statistically significant, the magnitudes of the influence generated by the introduction of the child-resistant mechanism are often substantial as well. Consider, for example, the following sets of changes in precautionary behavior frequency resulting from changes in the mean values of either the danger or concern variables after the introduction of the test lighter. In terms of general precautions, the introduction of the test lighter leads respondents to reduce the probability that they will take precautions by 0.08 for both the danger and the concern variables. Similarly, the probability that the child will have access to the lighter increases by 0.05, the probability that the parent will be less careful diminished by 0.08 for danger and 0.09 for concern, and the probability that the parent will experience increased peace of mind because of the safety mechanism increases by 0.19 for danger and 0.11 for concern. These influences, which are calculated using the probit estimates above, imply that there may in fact be a substantial swing in the frequency of precautionary behavior.

Clearly not all of the lighter user population is affected. Indeed, not even a majority of the population is affected. However, even modest percentages on the order of 5–10% of parents who will now become more lax with respect to lighter safety will lead to millions of children being exposed to lighter safety risks even though they would not have been exposed before.
Overall, 87.5% of the respondents indicated that they would exercise the same precautions with the test lighter as with conventional lighters. However, 12.5% indicated that they would not exercise these same precautions but would instead behave differently. The reasons for this slackening off of precautionary behavior differed in terms of their character, but they all were linked with a diminished belief in the riskiness of the lighter. For example, 56% of those who would undertake different precautions left the lighter where the child could reach it, 32% simply indicated that they were less concerned with lighter safety, and 12% let the child try the lighter, whereas they would not have done so with the conventional lighter.

THE MARKETABILITY OF THE TEST LIGHTER

An interesting aspect of introducing a new kind of lighter is consumers' overall valuation of the product. In particular, would they be willing to pay more for the test lighter given its enhanced child-resistant features than they would otherwise? The disadvantage of test lighters is that they are more difficult to operate and, particularly for families without children, the added child-resistant features may offer little prospective benefits. This survey only provides information on valuation of the lighter by families with young children so that it will overstate the value of the lighter to a more general population. The consumer acceptance measures ultimately relate to product safety in that they indicate whether the respondent would voluntarily purchase a child-resistant lighter and whether the child-resistant mechanism would be thwarted in some manner.

Table 9 summarizes the distribution of the respondents' additional willingness to pay for the test lighter. Overall, 8.0% of the sample would not be willing to pay more for the lighter, and an additional 6.5% would be willing to pay 10 cents or less for such an enhanced child-resistant lighter. However, it is noteworthy that many respondents would be willing to pay substantially more for this product. Indeed, 40% of the sample would be willing to spend $1 or more per lighter for a lighter that employed these features.

Explanations of the underlying rationale for this enthusiasm suggested that two features were at work. First, the lighter did offer the prospect of greater safety benefits, at least from the standpoint of the perception of the parents making the purchases. Second, the lighters also provided greater peace of mind with respect to lighter safety, which in turn may diminish the precautions respondents believed were required.

These high dollar values also are corroborated by the overall satisfaction consumers experience with respect to being able to use the product. Unlike some kinds of product safety caps with which consumers often grapple without much success, this respondent group did not find the child-resistant mechanism particularly difficult to operate. The breakdown of the sample was that 12% believe that the child-resistant mechanism was very easy to operate, 60% found it easy to operate, 23% found it hard to operate, and 5% found it very hard to operate. The 28% of consumers who found the lighter 'hard' or 'very hard' to operate should, nevertheless, be a signal that

<table>
<thead>
<tr>
<th>Dollar amount</th>
<th>Distribution of additional willingness to pay for test lighter (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 10 cents</td>
<td>1.5</td>
</tr>
<tr>
<td>10 cents</td>
<td>5.0</td>
</tr>
<tr>
<td>11–24 cents</td>
<td>4.5</td>
</tr>
<tr>
<td>25 cents</td>
<td>13.0</td>
</tr>
<tr>
<td>26–49 cents</td>
<td>2.5</td>
</tr>
<tr>
<td>50 cents</td>
<td>24.0</td>
</tr>
<tr>
<td>51–99 cents</td>
<td>1.5</td>
</tr>
<tr>
<td>$1.00 or more</td>
<td>40.0</td>
</tr>
<tr>
<td>Would not pay more</td>
<td>8.0</td>
</tr>
</tbody>
</table>
there is some consumer demand for easier operation. In many marketing contexts, researchers find it useful to ask respondents to rate the desirability of a product on a 10-point scale. Here the product fared relatively well, where a rating of 1 meant the lighter was not very desirable and a rating of 10 that the lighter was very desirable. The overall average score for the sample was 8.4, which put it close to the very desirable end of the spectrum.

Although consumers indicated that they were willing to pay more for the product and view the product as desirable, it is also useful to inquire whether they would buy it at all. To address this issue, the survey also included a specific question to ascertain the likely propensity the consumer would have to purchase the lighter as a way to corroborate the willingness to pay greater amounts and product rating results. The great majority of the sample indicated they would definitely buy the lighter—57.5%. An additional 26.0% indicated that they would probably buy the lighter and 9.0% indicated that they might buy it. Although there was not universal enthusiasm for the test lighter, these percentages meshed quite closely with the percentage distribution in Table 9 for the willingness to pay greater amounts for the lighter.

In terms of the rationales given for purchasing the lighter, 49.5% indicated that they would buy the lighter because it was safer, 12.5% that it would provide greater peace of mind, and 21% that they would buy the lighter because it was harder for the child to operate. All three of these responses reflect different valuations of the increased safety features of the test lighter.

A final variant on this attractiveness measure was to explore whether there was widespread support for government regulations that would mandate that such lighters be marketed by lighter manufacturers, though not all lighters would be subject to this requirement. The government did in fact require that only enhanced child-resistant lighters be manufactured or imported after July 1994. In response to the question of whether the government should require lighters to have child-resistant features, 63% strongly agreed that this should be the case, 17% somewhat agreed, and only 9.5% strongly disagreed. As a result, there is likely to be substantial consumer acceptance of the product which in turn bodes well for

anism since consumers do not appear to be so averse to this device that they would attempt to thwart it in some manner.

This experience is much more favorable than the frequent difficulty consumers have with safety caps. As a result, consumers commonly leave these caps off products, thus negating the potential safety-enhancing features of this safety cap mechanism. This kind of rejection of the safety device was not observed for any respondents in the lighter study and the overall consumer assessment of the attractiveness of the product appeared to be quite high.

DO LIGHTERS ENHANCE SAFETY?

Whether lighters with child-resistant mechanisms are worth any additional money to consumers depends in part on their ultimate safety consequences. The presence of the child-resistant mechanism enables some consumers to slack off on their precautions, at least in their own view. Thus, the child-resistant device may enhance the underlying safety features of the lighter, but this enhancement may be diminished or possibly offset by the diminished precaution taking. A key concern with respect to assessing the safety consequences is the magnitude of the improvement in lighter safety that will result from the introduction of the child-resistant mechanism and the extent of the decline in safety that will result from the diminished precaution taking. To calculate the ultimate effect on safety, one must necessarily make strong assumptions, but it is possible to undertake an illustrative analysis based on the results of this study. These estimates will be suggestive of the likely impact of the child-resistant mechanism.

The risks now posed by lighters are not great in terms of the absolute probabilities involved. Estimates using CPSC data on the number of fire-related injuries to children 0–14 years of age indicate that the annual probability of a lighter-related injury serious enough to be reported to a participating hospital is only $2.23 \times 10^{-5}$. This number will form the backdrop of the subsequent calculations. In addition, this small probability highlights the importance of diminished precaution taking on the part of 5% or 10% of the lighter-using population. Percentages in this range
orders of magnitude larger than the percentage of children who are currently injured by lighters.

The overall risk posed by the test lighter will be the product of three influences: the probability that the respondent does not take precautions, the probability that the child will start a fire with a test lighter given that the parent has not taken a precaution, and the probability of injury given that the child started the fire. For purposes of the calculation we have assumed that there is no risk of injury if the parents take precautions. This assumption will lead to an estimate that will understate the overall riskiness of lighters.

The key magnitude affecting the success of the mechanism if there is no change in parents' current level of precautions is the probability that the child will be able to start a fire given that the parents did not take precautions. To estimate this probability, we assume that it was the same probability as was observed in the sample when the children were asked to operate the lighter within two five-minute test periods, where the first test period did not include a lighter demonstration and the second period did. After these two tests, 38% of the children were able to get a 'light' from the conventional lighter, whereas only 5% of the children were able to 'light' the test lighter. If these percentages accurately reflect the percentage of children who will actually be able to operate these two types of lighters, then there will be a 33% improvement in the number of children who would light the lighter assuming they attempted to start it. In practice it may be that these results underestimate the degree to which children are able to operate the test lighter since it is less familiar to them than lighters they see daily. If it becomes more familiar over time. There may be greater adaptation to the test lighter features.

Nevertheless, if we take these results at face value, one obtains the estimate that if there is no change in the precautionary behavior on the part of parents then the test lighter reduces the risk of a fire-related injury to \((2.23 \times 10^{-5}) \times (5/38)\), which equals \((2.93 \times 10^{-6})\).

One of the missing components of this estimate for the risk associated with the test lighter is the probability that the child would suffer an injury assuming that the child started a fire. This magnitude will ultimately be needed to calculate the safety of the test lighter if precautions decline. This probability will be the same for both the conventional lighter and the test lighter. Consequently, we can use the current experience with conventional lighters to estimate the riskiness of lighters given that they are activated or operated. We noted that overall the risk of injury is \(2.23 \times 10^{-5}\). This estimate is the product of three numbers: (1) the probability that parents do not take precautions, which is now 0.042 for conventional lighters; (2) the probability that the child is able to start a fire given no precautions, which we take to be 0.38 based on the percentage of children who could operate the conventional lighter, after the ten-minute test; and (3) the probability that the child suffers an injury after starting a fire, which is the unknown in this equation. Thus we obtain the following expression:

\[
2.23 \times 10^{-5} = (0.42) (0.38) (\text{Probability of injury | start fire})
\]  

which one can solve for the conditional probability of an injury given that the child has started a fire which is

\[
(\text{Probability of injury | start fire}) = 1.40 \times 10^{-3}
\]

In view of the decreased precaution taking with respect to the test lighter, one must then calculate the probability that the child will suffer an injury from the test lighter given the precautionary response. As before, the risk injury is the product of three components: (1) the probability that the parents will not take precautions, which is now 0.125 for the test lighter; (2) the probability that the child starts a fire given the parents do not take precautions, which is the 5% probability that the children could operate the lighter during the test; and (3) the probability that an injury would occur if the child started a fire with a lighter, which was found above to be \(1.40 \times 10^{-3}\). Combining these estimates yields the equation

\[
\text{Risk of injury} = (0.125)(0.05)(1.40 \times 10^{-3})
\]

\[
= 8.73 \times 10^{-6}
\]  

The key assumption in this calculation, however, is that there will only be 5% of the children who are able to operate the test lighter, which is a dramatic improvement from the 38% for the conventional lighters. Since this percentage drop is
much greater than the threefold increase in parents who do not exercise care with respect to the lighters, then the influence on balance will be to enhance lighter safety. If the increase in parental precaution taking was greater than the diminished ability of children to operate the lighter, which would occur if children became more accustomed to the test lighter mechanism over time, then this risk of injury calculation would indicate a higher risk of injury than that calculated above. However, based on the results of the experiment, the net effect of the test lighter mechanism is to enhance safety, but by less of an extent than would be the case if there were no drop in parental precautions.

If one were to disentangle the influences at work, the effect of the diminished precautions and the probability of injury would be to increase the risk of injury by $5.80 \times 10^{-6}$. The overall change in the risk of injury because of the test lighter is to reduce the injury risk by $1.36 \times 10^{-5}$. As a result, the overall share of the moral hazard influence is the ratio of these two amounts, or the value of the moral hazard effect divided by the change in the probability of injury, which is 0.43.

These calculations utilize the findings in Table 8 with respect to the precaution-taking response. They do not reflect the maximum potential impact on lighter safety. The upper-bound influence is reflected in calculations based on the access question. Estimates using this set of responses indicate that the change in lighter safety resulting from the test lighter introduction will be to diminish the probability of fire-related injury by $1.11 \times 10^{-5}$. However, given the higher probability that the child will have access to the lighter based on the responses to this question, the overall estimate is that the moral hazard effect on the probability of injury will be to increase this risk by $8.32 \times 10^{-6}$. As a result, the moral hazard influence relative to the change in the probability of risk would result if there were no diminished precaution taking is 0.75, which is almost a direct offset.

The sensitivity of these results to the particular response variable used in the analysis is suggestive of the likelihood that these estimates do not pinpoint the exact influence that diminished precautionary behavior will have. The estimates presented here are based on precautionary intentions expressed by respondents, and these are indicative of the likely range of responses based on the test lighter placement, whereas actual experience may be different. However, at this juncture two conclusions seem apparent. First, because the test lighter child-resistant mechanism is highly effective, even some diminishing in parental care with respect to access to the lighters will not totally offset the beneficial safety-enhancing consequences. The net effect will be to reduce fires.

However, these results also highlight a second, more cautionary conclusion. In particular, if children learn to adapt to the child-resistant mechanism over time or if there is a greater laxity in precautions than is implied by these results, then in fact the test lighter mechanism may be counterproductive in its effect on safety. However, even if this counterproductive level is not reached, there will be a substantial increase in the risk that arises because parents have become more lax with respect to lighter safety. This increased concern with precautions highlights a potential role for government intervention with respect to lighters. To the extent that such safety mechanisms lull parents into a false sense of security, the government could have a constructive role to play through hazard warnings and related information efforts to apprise the public of the continued risk from lighters. Care with respect to the placement and use of lighters is still required even in the aftermath of the child-resistant mechanism introduction. Recognition of the importance of continued vigilance with respect to lighter safety will enhance the overall safety gains that will be achieved.

CONCLUSION

Lighters with the accompanying child-resistant mechanism are no longer hypothetical products. In particular, since 1992 they have been incorporated in some lighters marketed in the USA. The design of the enhanced child-resistant lighters differs across companies, but the overall intent is the same, as is the general approach of introducing an additional mechanical device that must be disengaged by the user before the lighter can be operated.

What is perhaps most striking about the advent of the child-resistant device for lighters is the lack of fanfare that was created when the devices were first marketed. The introduction of seat belts for automobiles was the object of substantial public
discussion, in part because of the novelty of these mechanisms. Voluntary usage of these devices remained low for several decades after their introduction. It was not until a variety of states began passing laws making seatbelt usage mandatory and imposing fines for failure to buckle the belt that widespread usage was attained. Even now, compliance is less than complete as many consumers are simply too forgetful or find the practice of buckling the belts unduly burdensome.

The introduction of safety caps provide a somewhat different experience. There was widespread resistance to the safety mechanism, not simply by longtime opponents of regulation. Consumer groups, such as the American Association of Retired Persons, opposed the types of caps on many products because they were difficult to operate for individuals who had arthritis, including many elderly. These mechanisms could potentially promote safety, but they were not user-friendly for populations not at risk. The result is that many parents left the caps off bottles, and the net effect that was observed from this safety device introduction was that there was no evidence of a significant beneficial impact. There is evidence of an offsetting negative influence, as parents appear to have become more lax about products that posed real risks to children because of the excessive belief in the efficacy of safety caps in eliminating the need for parental care.

In the context of these similar kinds of efforts, the child-resistant mechanism for lighters is particularly interesting. Consumer resistance to the product has been minor, as our survey indicated would be the case. This receptivity may have stemmed from the ease of operation of the child-resistant mechanism for adults. Consumers who view the new child-resistant mechanisms as a beneficial feature of the product also do not appear to be tempted to void their efficacy by removing or undermining the functioning of the safety device, as was the case in the cap experience.

There is, however, a continuing danger that parents may diminish their precautions with respect to lighters and fire safety more generally. Parental confidence in the efficacy of the child-resistant mechanism has given them less reason to be concerned with safety, diminished incentive to take precautions, and a decreased need to prevent access to children. These types of effect are not mere theoretical speculation. Rather, the results of the actual placement of lighters in homes and the monitoring of parental reactions to these lighters highlighted the potential adverse consequences that child-resistant mechanisms could have.

These results do not mean that child-resistant devices will cause more fires than conventional lighters. Indeed, the inability of children to operate these lighters bodes well for their safety. However, our findings do suggest that the behavioral response to the introduction of child-resistant mechanisms is more complex than regulators have traditionally assumed. Technological improvements in product safety do eliminate the need for user care. Regulations that lull consumers into a false sense of security because of the technological safety improvements may fail to achieve all that is possible through such regulatory improvements. Rather than relying solely on technological approaches to safety, regulators also need to incorporate the potential behavioral response into the assessment of the consequences of regulation and the design of regulatory policy. Hazard warning efforts, consumer education programs, and similar measures that could accompany improved safety mechanisms could diminish the counterproductive slackening of consumer care.

In the case of lighter safety the great majority of consumers would continue to exercise care. Moreover, the test lighter results suggest that, on balance, child-resistant lighter mechanisms would enhance safety even in the presence of some diminished precautions. However, this result is sensitive to the assumption that children are not better able to operate such enhanced child-resistant lighters after they have had more experience over a longer period of time than the test period in this experiment.

The fundamental issue at stake here is not whether safety regulations are good or bad. This characterization has frequently put the US Consumer Product Safety Commission in a defensive posture with respect to the diminished care resulting from its regulations. Rather, the fundamental policy issue is whether we could do better than we are now doing with regulations that fail to apprise consumers of the continued need for safety. The results here suggest that many consumers—by some measures on the order of 10% or more—will decrease the care they will take with lighters. Millions of children consequently
will be at greater risk than they were before the child-resistant mechanisms were introduced. The CPSC should acknowledge and publicize this risk.

NOTES

1. In addition to the economic models below, authors have also proposed non-optimizing models that would generate this effect. See the discussion of risk homeostasis by Wilde (1982).


3. For a preliminary assessment of these findings, see Viscusi and Cavallo (1994).

4. See, for example, Davison (1983) and Ennis (1967).

5. The test lighters used in this experiment did not emit a flame but did signal that the lighter would have been activated.

REFERENCES


