

Genetically Modified Food Labeling:

The Impacts of Message and Messenger on Consumer Perceptions of Labels and Products

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Abstract

We analyze responses to a survey designed to elicit consumer reaction to various approaches to labeling genetically modified (GM) foods. Consumers were shown sample labels that differed with respect to claims concerning the presence and potential effects of GM ingredients and the agency that certified these claims. A sample of 1,898 U.S. consumers rated 3,681 labels with regard to the credibility and adequacy of the information content, with regard to perceived health and environmental impacts of the product and with regard to purchase intent. Simple claims that a product contains GM ingredients are viewed as most credible while simple claims of no GM content are viewed as most adequate. Label claims certified by the U.S. Food and Drug Administration (FDA) are, in general, viewed as most credible and adequate and products with FDA certified claims are perceived to have fewer long-term health problems. Several policy implications of the results are discussed.

Key Words: credibility, genetically modified food, information adequacy, labels, product risk

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Abstract

We analyze responses to a survey designed to elicit consumer reaction to various approaches to labeling genetically modified (GM) foods. Consumers were shown sample labels that differed with respect to claims concerning the presence and potential effects of GM ingredients and the agency that certified these claims. A sample of 1,898 U.S. consumers rated 3,681 labels with regard to the credibility and adequacy of the information content, with regard to perceived health and environmental impacts of the product and with regard to purchase intent. Simple claims that a product contains GM ingredients are viewed as most credible while simple claims of no GM content are viewed as most adequate. Label claims certified by the U.S. Food and Drug Administration (FDA) are, in general, viewed as most credible and adequate and products with FDA certified claims are perceived to have fewer long-term health problems. Several policy implications of the results are discussed.

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Introduction and Background

Genetically modified (GM) foods provide a classic example of the challenges that society and individuals face in evaluating new technologies that may become an unseen but pervasive part of life. Such technologies generate a set of potential benefits (e.g., cheaper production costs, food attribute enhancements) and possible costs (e.g., unintended allergic responses, long-term health and environmental effects, ethical or moral issues). Consumers' perceptions of these potential benefits and costs shape market responses to the new technologies and, eventually, determine how widely the technology is adopted.

Many sources generate informational and persuasive messages about GM technologies that compete to help determine consumer perceptions and adoption of the new technology. In the case of food, the product label is a powerful medium for delivering messages. Indeed, the U.S. government tightly regulates food labels because label messages exert considerable influence on consumer purchases (Degnan 2000). For example, the U.S. Food and Drug Administration (FDA) regulates many components of packaged foods including the weight disclosure, manufacturer's identity, food name, ingredient list, the nutrition facts panel and any health or content claims, while the U.S. Department of Agriculture (USDA) regulates specific information that appears on meat and produce labels including safe handling instructions and grading information.

The FDA has ruled that U.S. food labels are not required to carry information about GM content unless the genetic modification significantly alters the properties of the food, e.g., introduces a potential allergen (U.S. Federal Register 1992). In response to interest from various groups including food manufacturers and private certifying agencies, however, FDA has announced guidelines for food manufacturers who wish to

voluntarily label their products as containing, or not containing, genetically modified ingredients (U.S. Federal Register 2001). While FDA does not require special labeling of GM foods, U.S. consumers can turn to products certified organic by USDA to ensure products do not contain GM ingredients. Furthermore, several state legislatures have introduced bills during the past several years that would require state-level labeling of GM foods (Kohler and Naftzger 2001) while Oregon voters introduced and defeated a state-level GM labeling initiative via public referendum (State of Oregon 2002). Also, an international trend toward mandatory labeling of foods with GM content is building: the European Union, Australia, New Zealand, Japan, South Korea and Brazil all require labels for GM foods. The European Union's insistence upon labeling GM foods has spurred the United States to file suit against the European Union to lift its moratorium on GM foods (Knight 2003).

Given that domestic and international forces could alter U.S. policy toward GM labeling or alter the types of GM label messages that appear on U.S. foods, it is important to evaluate how different GM labels are viewed by consumers with regard to the credibility and adequacy of the information presented and how the foods bearing the labels are viewed by consumers with regard to perceived health and environmental risks. The labels evaluated in this study differ in several ways, including the language that is used (message) and the agency that certifies the label (messenger). The eight messages vary in terms of whether the consumer is informed of the absence vs. presence of GM content; whether a reason for the use of genetic modification is given; and whether a message conveys uncertainty surrounding the long term health or environmental effects of genetic modification. Seven messengers are considered: an unidentified messenger,

three federal agencies, a health organization, a consumer organization, and an independent GM certifying organization.

Several policy and marketing issues arise in the comparison of the different messages. For example, in a particular product market, there may be cost advantages to labeling the presence of GM content, while in another market it may be more efficient to label the absence of GM content. However, if the declaration of absence versus the presence of GM content affects the credibility or adequacy of the message in the eyes of the consumer, the potential cost savings may be dwarfed by the loss of the public's confidence or good will.

Other policy questions arise from FDA's guidance language for voluntary GM labels (U.S. Federal Register 2001). For example, FDA suggests messages that communicate the firm's reason for using genetic modification (e.g., to reduce saturated fat), but discourages messages that convey that the long term effects of GM content are unknown. This guidance is based upon data gathered from a small number of consumers during several focus groups (Levy and Derby 2000). The effect of such statements upon the perceived credibility and adequacy of labels has not been tested on a broader cross section of US consumers, however. The type of message may also impact how consumers perceive the health and environmental risks of products, which will impact consumer acceptance of such products.

The effect of the messenger on consumer response to labels has several public policy and market implications as well. First, there is the issue of how consumer trust in government and non-government entities differs in the sphere of GM labeling. Private certifiers are a potentially important part of the marketplace, given that FDA has

recognized that firms may want to voluntarily label products with regard to GM content and that private certification firms may be enlisted to verify such statements. If public agencies differ from private agencies in the trust/credibility area, this will have major implications for the emergence of non-governmental certification entities. Second, under current law, only the FDA can require special labeling for products that contain GM content while USDA, as part of the certified organic program, is the only federal agency that can communicate that a product is free of GM content. If different government agencies carry more credibility with consumers in communicating a particular message (absence versus presence, for example), it might suggest that policy could be better served if another governmental agency were chosen as the messenger. As there are occasional calls for the federal government to consolidate parts of FDA, USDA and the U.S. Environmental Protection Agency (EPA) that oversee food regulation into a single food safety agency, a reorganization could alter the name of the agency in charge of GM labeling (Food and Drink Weekly 1999).

The current study builds upon several lines of extant research. Considerable research documents consumer acceptance of various biotechnologies including GM foods and the risks consumers associate with various technologies (see Blaine et al. 2002 for a recent review of this expansive literature and Fischhoff and Fischhoff 2001 for a synthesis of consumer opinion research). There has been theoretical analysis of whether certain types GM labels would pass cost-benefit tests (Caswell 1998, Phillips and Isaac 1998), though less analysis of detailed consumer reactions to current (International Food Information Council 2003) or potential alternative GM labeling initiatives (Teisl et al. 2003, Teisl et al. 2002).

Related veins of literature examine consumers' ability to use existing GM (Noussair et al. 2002) and nutrition labeling (Cotugna and Vickery 1998, Kristal et al. 1998, Nayga 2000, Obayashi et al. 2003) and the social efficacy of other food labeling interventions such as warnings (Bushman 1998), health claims (Roe et al. 1999, Mitra et al. 1999, Wansink 2003, Kozup et al. 2003, Garretson and Burton 2000, Caswell et al. 2003), and the nutrition facts panel (Teisl et al. 2001, Burton et al. 1999, Levy et al. 1996).

Significant research has been conducted with regard to whether a given label provides adequate information to facilitate consumer choice (Jacoby et al. 1974 is a seminal piece), though less such research has been conducted with an eye toward public policy implications (Levy et al. 1996, Roe et al. 2001, Schommer et al., 2001, Murphy and Richards 1992, Viswanathan and Hastak 2002).

The role of source credibility in communicating information has generated a substantial literature (see Pornpitakpan 2004 for a recent review) including numerous studies investigating the credibility of various sources of information concerning biotechnologies such as genetic modification (Frewer et al. 1997, Frewer et al. 2003, Eiser et al. 2002, Grobe et al. 1999, Siegrist 2000, Poortinga and Pidgeon 2003, Priest et al. 2003). Several of these investigations are designed to test particular structural models of consumer trust (Frewer et al. 2003, Siegrist 2000, Poortinga and Pidgeon 2003). The current study follows more in the spirit of Priest et al. (2003), where our purpose is to explore a particular data set and derive reduced form connections rather than to test a particular structural model.

Methods

During the summer of 2002 we administered a mail survey to a nationally representative sample of 6,172 U.S. The survey was administered with multiple mailings and with a small incentive paid for complete, returned surveys. In total 2,387 individuals responded to the survey for a response rate of 39 percent. For all analyses, the data are weighted to adjust for differential responses by state of residence.¹ Except for race, our survey respondents have characteristics similar to those of the U.S. adult population (Table I). The stated differences in race may be reflective of a true underlying difference or may reflect differences in the way the race questions are asked across the two surveys.

The survey consists of six sections; we analyze responses to a series of questions contained at the end of section four. The full survey is available in the appendix. The questions from section four allow us to focus on several criteria that can determine the success of a labeling program: the credibility of the label information, the adequacy of label information, and the effect of label information on perceived health and environmental impacts. In addition responses to the purchase intent question provide some indication if the label's message or messenger will impact consumer purchase decisions. One thousand, eight hundred and ninety eight of the respondents provided responses to 3,681 labels; note this smaller than the total response to the survey due to some item non-response.

The exact questions asked of respondents are listed in Table II. We note that each construct (credibility, adequacy, risk perceptions, purchase intent) is calibrated with the

¹ The sample includes an over-sample of consumers from one state to allow the authors to conduct state-level analysis, which is reported elsewhere. Rather than discard usable responses to achieve a more representative sample, we chose to weight all analysis by the respondent's state based upon 2002 projected state populations.

response to a single question. While this permits simple, bottom-line assessments of how different labels impact each construct, it does not allow for nuanced analysis of the pathways by which certain label messages or messengers affect each construct.

Particularly, previous research has dedicated considerable effort to decomposing trust into several contributing components (Frewer et al. 2003, Poortinga and Pidgeon 2003). Hence, we are unable to decipher if, for example, a respondent provides a low credibility rating because they feel the certifying agency may have a vested interest in the process or because the certifying agency lacks the technical expertise to implement certification.

The labels were varied in two substantive ways: to incorporate different types of claims and to incorporate different certifying agencies. We also consider a practical issue: the incorporation of a message that informs consumers how to obtain additional information (e.g., by phone or internet). Because each respondent viewed two labels, we also allow for the potential that the order in which a label was viewed might alter consumer response due to possible learning effects. The different levels for each of these four avenues of variation are outlined in Table III. In theory, 224 label permutations were possible (eight claims by seven authority treatments by two contact information treatments by two orders of presentation); however, to maintain adequate cell sizes, a non-orthogonal set of 80 permutations was chosen and randomly assigned to individual respondents. The 40 permutations of claim-authority-contact information are displayed in Table IV; all permutations in this table appear in both order positions. The 29 different claim-authority combinations are chosen to maintain respondents' believability in the survey instrument. That is, we excluded certain label combinations such as the American Heart Association certifying pesticide reductions or the Environmental Protection

Agency certifying fat reductions that might seem unintuitive to respondents and cause them to not take the survey tasks seriously.

Also in an effort to maintain adequate cell sizes within the experimental design, both contact information treatments are only used for a small subset of claim-authority combinations. Hence, in the analyses, we control for this unbalanced nature of the design by comparing means across groups where all other elements are held constant, e.g., we compare differences in credibility across claims by looking to responses from labels with the same certifying authority and the same contact information treatment.

Analysis proceeds by comparing the average ratings across different treatments (e.g., credibility of the No GM claim versus the GM claim for the same certifying agency). We interpret the respondents' ratings of claims to be significantly different from one another when the 95 percent confidence intervals constructed around two ratings do not overlap. The 95 percent confidence intervals are constructed using Tukey's Studentized Range Test implemented in proc GLM in SAS. The potentially confounding effects of order and individual respondent effects (because most respondents rated two labels) are controlled during the construction of the intervals as is the fact that multiple ratings are being compared simultaneously.

Results

Label Credibility

Figure 1 presents the average and 95 percent confidence interval for credibility ratings for each type of claim with a separate panel for three certifying treatments (no certification, FDA, and USDA) that appear in combination with several claims.

Numerical results are suppressed to improve the clarity of exposition and to conserve space, but are available from the authors upon request.

One pattern that is noticeable is that the simplest claims, that of GM and no-GM content, are viewed as more credible than claims that involve GM content coupled with claims about pesticide use, fat content or long term health and environmental consequences, particularly when these claims are certified by FDA or USDA.

Of the two simple claims, the GM claim (“This product contains genetically modified ingredients”) is more credible than the No-GM claim, though this difference is only significantly different for labels with no certification and for USDA certified labels. Given that 61 percent of respondents in our sample rated the use of GM ingredients as an above-average source of concern while only 15 percent rated them as a below average concern,² this finding is consistent with past findings in which consumers place more trust in messages with negative content (Siegrist and Cvetkovich 2001). Also, if respondents place greater trust in FDA claims than in USDA and uncertified claims (as is confirmed below), the fact that credibility ratings were not significantly different between the GM and No-GM claims for FDA is consistent with findings from White et al.’s study 1 (2003). They found that the difference in respondents’ expressed level of trust between positive and negative messages shrunk when the message was delivered by a more trusted source.

The label message found least credible by respondents was that the product contains 50 percent less fat than the average brand (FAT). This claim was used to

² This statistic is based on analysis of respondent’s answers to question five in the survey (Appendix). The response scale ranged from ‘1 – not at all concerned’, to ‘5 – very concerned,’ with ‘3’ listed as ‘somewhat concerned.’ Seventy-five percent listed pesticides as a ‘4’ or ‘5’ while 36 percent listed pasteurization as a ‘4’ or ‘5.’

compare consumers' responses to GM claims with responses to other types of claims used on food labels. For uncertified labels and labels certified by FDA the low fat claim was significantly less credible than the GM and No-GM claims and significantly less credible than many of the GM claims that featured more nuanced messages (e.g., genetically modified to reduce fat).

Another trend that is noticeable is that labels where genetic modification is mentioned as the means for implementing a more fundamental claim (e.g., 50 percent less fat or 50 percent fewer pesticides used), credibility is higher. That is, the explanation of the means of implementing promised improvements may help to establish credibility in the eyes of the consumer.³ This is congruent with findings forwarded by Roe et al. (2000): when labels communicated food safety improvements, consumers wanted to know how the stated improvements were achieved.

Labels that mention a promised product improvement, the means for obtaining the improvement (genetic modification), and the possibility of long term health or environmental effects from genetic modification are not seen as any more or less credible than labels that mention only these first two elements. Hence, the marginal addition of warnings concerning long term risks appears to do little in terms of engendering greater respondent credibility.

Analysis of Figure 2 illustrates that different messengers deliver the same message with different levels of credibility. For example, the credibility of the no-GM

³ Alternatively, respondents may simply assign greater credibility to longer claims. One might try to test this alternative explanation by comparing the difference in credibility between GMPEST and GMPESTLE or between GMFAT and GMFATLH, where the second claim in each of these pairs is longer than the first. Such tests generally suggest these longer claims are not seen as more credible. However, the additional information included in the longer claims specifically mentions that the long term environmental or health effects of genetic modification is unknown, which might cause respondents to lose credibility in the certifying agency. Hence, given the current experimental design, a clean test of this alternative explanation is not possible but should be recognized.

content claim is significantly higher if it is delivered by FDA than if it is delivered by USDA, one of the independent agencies (Organic Consumers Association [OCA] and Identity Preservation Program [IPP])⁴, or if it is uncertified. A similar effect holds for the GM content claim. Information credibility is often connected, in part, to perceptions that the messenger is knowledgeable and has no vested interest in the choice. We conjecture, though are unable to test, that consumers' view FDA as knowledgeable because of the agency's public role in regulating food products and because of their capability to provide scientific review of both drugs and food additives. Consumers may view FDA as having no vested interest because of the agency's periodic recalls of foods and drugs that cause firms substantial financial loss.

For claims of reduced pesticide usage, labels certified by FDA were deemed more credible than those certified by the US Environmental Protection Agency (EPA) or USDA and similarly credible as those certified by OCA. Once the claim was expanded to mention genetic modification as the means for implementing the reduction in pesticide use, however, FDA and USDA become similarly credible while OCA is significantly less credible. We are unclear why OCA's credibility relative to USDA and FDA is lower when the pesticide claim is made along with the genetic modification claim. One conjecture is that consumers do not believe an organic consumers group such as OCA would certify the presence of GM ingredients in a product; i.e., consumers might only find it credible for an organic consumer group to verify that there are no GM ingredients.

⁴ The Organic Consumers Association is a grassroots non-profit public interest organization consisting of more than 500,000 members, subscribers and volunteers and hundreds of companies in the natural marketplace. The group was founded in 1998 in response to USDA's organic labeling initiative to make the voices of existing organic producers and consumers heard during the rule making process. The Identity Preservation Program is a private certification scheme administered by Société Générale de Surveillance (SGS), a Swiss testing and certification firm. Survey respondents were given each certifying agencies full name but no other information concerning each group.

Adequacy of Label Information

Credibility provides a crucial first step in establishing a labeling program that can benefit consumers. However, even if deemed credible, the information contained on a label may not provide enough information to help consumers make an informed decision. In Figure 3 we explore whether consumers deemed the information provided on labels to be adequate; recall that smaller numbers reflect label-authority combinations deemed more adequate (less inadequate).

For the three agencies in Figure 3 the no-GM claim was deemed to be the most adequate of claims while claims of large reductions in fat content or pesticide usage without further elaboration were deemed most inadequate. Simple GM content claims were significantly less adequate than simple No-GM claims, perhaps reflecting the simpler message of a No-GM claim, i.e., if there's no GM content, then there is no need for further information about what GM is or what it might mean for the consumer.

As genetic modification was added as the explanation for these promised product improvements, consumers viewed the information on the labels to be significantly more adequate. The inclusion of information that genetic modification may involve long-term health or environmental consequences had no significant marginal impact on adequacy beyond the simple mentioning that GM was the means of the improvement.

Consumers felt more adequately informed when information was delivered by FDA (Figure 4) and least adequately informed when claims are not certified. One exception is for the claim GMPEST, where EPA and USDA certifications are viewed as similarly adequate to FDA while OCA is viewed as significantly less adequate than the three federal agencies. This finding may be an outgrowth of source credibility; i.e., if

FDA is overseeing this process, then the consumer might feel protected and demand less information than if the consumer doesn't trust the agency overseeing the process.

Perceived Health and Environmental Consequences

Consumers generally perceive that products with no-GM content will cause fewer long term health problems than products that explicitly claim GM content, though this difference in perception is only significantly different for claims certified by USDA (Figure 5). When the claim explicitly states that genetic modification may have long term health consequences perceived health ratings are not significantly different from similar claims that omit this language, suggesting the language has little impact on consumers' health perceptions for the product.

Some mild trends appear in terms of the messenger's impact on respondent health ratings for the product (Figure 6). First, claims certified by FDA often invoke the lowest perceived health problem ratings, though this difference is only significant in a few instances. For two claims – GM and GMPEST – perceived health problem ratings were highest when USDA certified the claims and, in each instance, the USDA's average health problem perception was significantly higher than uncertified and FDA claims.

Inspection of Figures 7 and 8 reveal no significant differences in respondents' perceptions of environmental effects based on the type of claim made or on the agency certifying the claim.

Purchase Intent

Purchase intent ratings were significantly higher for products claiming to contain no GM ingredients than for products simply claiming to contain GM ingredients for all three certifying treatments in Figure 9. When the GM claim was expanded to include the

reason for the genetic modification, respondents' purchase intent tended to be higher and, in several instances, significantly higher. For example, when a reduction in pesticides was given as the reason for genetic modification, products certified by FDA and products with no certifying agency received significantly higher purchase intent ratings than products that merely stated that content was genetically modified. Furthermore, these same products' purchase intent ratings were not significantly lower than those products certified to be free of GM ingredients.

With regard to differences across certifying agencies (Figure 10), significant differences only arise for products brandishing the GM claim. For this category of products, products certified by USDA have significantly higher purchase intent ratings than products certified by FDA; the independent certifier's (IPP's) ratings lie in between and are not significantly different from either of the two federal agencies. Note that this rank-ordering of agencies is opposite of the rank-ordering of agencies with regard to perceived long-term health problems (Figure 6), suggesting that perceived health problems need not be tightly correlated with purchase intent.

Contact Information

Numeric results concerning the effect of the provision of contact information on ratings of labels are presented in Table V (tabular presentation was more efficient than graphical presentation because there are only two treatment levels). These results focus on the ratings of simple GM and No-GM claims, as these were the only two claims for which both contact and no contact information permutations were included in the experimental design. Also note that we pool results across different certifying agencies though this fact is controlled when testing for significant differences among ratings.

The provision of contact information, in the form of a toll free telephone number and web address, significantly improves the credibility and adequacy ratings of both the GM and No-GM claim. In the case of label credibility, the provision of contact information has a particularly strong impact on the credibility of the No-GM label. In fact, it is so strong that the credibility of the GM and No-GM label are not statistically different when contact information is presented whereas, without contact information, the GM label is significantly more credible than the No-GM label.

The provision of contact information also increases respondents' perceptions of the amount of environmental damage associated with the product. While this difference is statistically significant, the magnitude of the difference in ratings is small when compared to the change in credibility and adequacy ratings created by the addition of contact information. Moderate and statistically significant increases in purchase intent are also associated with the use of contact information for both GM and NO-GM claims.

Discussion and Conclusions

Food labeling programs can entail significant costs to industry and society (Lin et al. 2000) that must be carefully weighed against the benefits such labeling could generate. Few benefits will accrue to a labeling program unless the information conveyed to the consumer is viewed as credible and adequate. Furthermore, food labeling programs often induce large changes in the type of products that manufacturers make available to the consumer (Moorman 1998). Understanding how the particular implementation of a labeling program can affect consumers' perceptions of key product characteristics such as the healthfulness or environmental impact can be crucial to forecasting how labels affect future offerings.

One relevant question is whether society is best served by a label that highlights the presence of GM ingredients or notes the absence of GM ingredients. While the relative costs of each type of label will depend upon the prevalence of GM and GM-free products and the technical requirements of product segregation and testing, the benefits may hinge on which message can be believed by consumers.

Our data suggests that simple GM labels are generally viewed as more credible than simple No-GM labels, but consumers are more likely to judge the simple No-GM label as having provided an adequate amount of information to make an informed decision. This paints a difficult tradeoff: does one place a greater value on the credibility of label information or on the adequacy.

Our data suggests that the adequacy of the simple GM label is increased if the label also declares the reason why GM techniques are being used, e.g., to reduce the fat content of a product or lower pesticide usage. Indeed, we find several significant improvements in adequacy when the label mentions the purpose of GM usage compared to just mentioning that the product contain GM content. However, this addition of the reason onto the label also significantly erodes the label's credibility ratings and, hence, retains the opposition of label credibility and label adequacy.

Our analysis of the data suggests that the provision of contact information may be one avenue for resolving the credibility-adequacy trade-off, and it tends to tip in favor of No-GM labels. GM and No-GM claims that both provide contact information receive similar credibility ratings while No-GM claims retain their superiority in terms of information adequacy. The provision of contact information that provides access to more details about genetic modification and the labeling and verification system allows

interested consumers a means to better understand exactly how the certifying agency supports the label's claim. The simple act of promising greater transparency seems to improve credibility, which is crucial to the success of labeling policies.

In one scenario featuring USDA as the certifying agency, respondents rated products with simple No-GM labels to have a lower risk of causing health problems than the same product with a GM label. This might suggest that there is some hesitation by consumers with respect to the long term health implications of GM ingredients. Similar reservations with respect to environmental consequences did not arise. One question that was not explored by this analysis is how the GM and No-GM labels affect consumer health and environmental perceptions for products that don't carry such a label, i.e., would the widespread appearance of products with No-GM labels heighten consumer concern with non-labeled products?

Labels featuring explicit language that admits the uncertainty of long term health or environmental impacts associated with GM ingredients did not receive significantly different health, environmental risk or purchase intent ratings from our sample of respondents. One possible explanation for this lack of response is that consumers may have become desensitized to warning statements on products as has occurred in cigarettes (Robinson and Killen). Alternatively, the lack of explicitness in the warning may have undermined the credibility of the intended message, i.e., a message that explicitly linked product use to a particular illness or environmental outcome would have increased perceived risks. Yet another possible explanation is that, because consumers know that GM food is a new technology, they automatically assume that the long-term effects are unknown (unknowable) with any degree of certainty. As a result, adding this information

to a label may be of little use for most people – i.e., it is not new information. While our data cannot discriminate among these possible explanations, it suggests that the inclusion of general disclaimers of long-term health and environmental uncertainties does little to improve consumer satisfaction with the label or to alter key consumer judgments, which reinforces conclusions Levy and Derby (2000) drew from focus group research.

In terms of messengers, FDA received the highest scores in credibility and adequacy for simple GM and No-GM claims from our sample of respondents. Note, however, that under current regulations only USDA (via the organic certification program) or private certifying firms can validate No-GM claims, which suggests that a change in labeling policy that allows FDA to certify No-GM claims could improve labels' credibility with consumers. We speculate that consumers may be most familiar with FDA because of its role in regulating the safety of food and drugs and that this aids in establishing credibility. Because FDA regulates the food industry, consumers may believe that their certification of the label also implies safety of the GM technique, which may reduce demand for additional information and, hence, improve adequacy ratings. Purchase intent ratings for products involving simple GM labels were highest when certified by USDA, while these ratings did not show significant variation across agencies for other types of label claims.

These results also suggest that consumers may hold different regard for FDA and USDA in terms of safeguarding consumer health: respondents rated perceived health problems significantly higher for the GM and GMPEST claims when the claims were certified by USDA than when certified by FDA or when certified by no agency or firm.

The lack of sensitivity in respondents' environmental risk perceptions to different GM messages and messengers is also notable, particularly given that significant differences across messages and messengers arise in the health risk perceptions scale. One possible interpretation is that consumers don't view GM ingredients as having a significant impact on the environment or that, in sum, GM practices could have offsetting positive and negative impacts.

In summary, both the message contained in GM labels and the messenger may have significant impacts on how successful such a labeling program might be and how consumers perceive GM foods. This, of course, will affect the adoption of GM technologies and, potentially, the shape of the emerging GM food sector. The label viewed as most credible and adequate by our respondents was a No-GM label certified by FDA that included contact information which would direct consumers to details of the certification process. A product carrying such a claim was viewed by our respondents as having fewer long-term health impacts, similar environmental risks and similar purchase intent than products with alternative labels. Under currently regulatory policy, no such label could appear on food sold in the United States.

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Table I. Socio-economic Characteristics of Respondents

	General Survey	Label Questions	2000 U.S. Census
Percent male	46	45	48
Average age	53	53	47
Average years of education	14	14	13
Percent white	89	88	75
Average household income	\$60,900	61,186	\$57,000

Table II. Response Variables.

Question	Variable	Scale
In your opinion, how believable is the information on this label?	Credibility	Not believable = 1 Very Believable = 5
How much information does this label provide so you can make an educated product choice?	Adequacy*	Not enough information = 1 Just enough information = 3 Too much information = 5
In your opinion, how likely are you to develop long-term health problems because of eating this food?	Health	Highly unlikely = 1 Highly likely = 5
In your opinion, what are the environmental effects of this product?	Environment	Beneficial to the environment = 1 Harmful to the environment = 5
If you were to see this label displayed on a food product that you normally buy, what is the likelihood that you would buy this product if the price and other qualities of the product were the same as your regular brand?	Purchase Intent	Highly unlikely = 1 Unsure = 3 Highly likely = 5

* The numeric value of this variable is transposed as such: Adequacy = $|\text{raw rating} - 3|$ or, in words, the absolute deviation from 3, “Just enough information”.

Table III. Label Variations Used in Survey.

Variable	Levels	Abbreviation
Claim	<ul style="list-style-type: none"> • ‘This product contains genetically modified ingredients’ • ‘This product does not contain genetically modified ingredients’ • ‘Certified: Contains half the fat of the average brand’ • ‘Certified: Contains half the fat of the average brand’ and ‘This product is genetically modified to reduce fat’ • ‘Certified: Contains half the fat of the average brand’ and ‘This product is genetically modified to reduce fat’ and ‘Long-term health effects are currently unknown’ • ‘Certified: Grown with 50 % fewer pesticides’ • ‘Certified: Grown with 50 % fewer pesticides’ and ‘This product is genetically modified to reduce the need for pesticides’ • ‘Certified: Grown with 50 % fewer pesticides’ and ‘This product is genetically modified to reduce the need for pesticides’ and ‘Long-term environmental effects are currently unknown’ 	GM No-GM FAT GMFAT GMFATLH PEST GMPEST GMPESTLE
Certifying Authority	<ul style="list-style-type: none"> • None • American Heart Association • Environmental Protection Agency • Food and Drug Administration • Identity Preservation Program • Organic Consumers’ Association • US Department of Agriculture 	NONE AHA EPA FDA IPP OCA USDA
Contact Information	<ul style="list-style-type: none"> • No statement • Information on how to obtain more information presented 	NONE CONTACT
Order of Presentation	<ul style="list-style-type: none"> • Seen first by respondent • Seen second by respondent 	FIRST SECOND

Table IV. Claim-Authority-Contact Information Combinations Viewed by Respondents.

	NONE	AHA	EPA	FDA	IPP	OCA	USDA
GM	X / X			X / X	X / X		X / X
No-GM	X / X			X / X	X / X	X / X	X / X
FAT	X /	X /		X /			
GMFAT	X /	X /		X /			
GMFATLH	X /	X /		X /			
PEST	X /		X /	X /		X / X	X /
GMPEST	X /		X /	X /		X / X	X /
GMPESTLE				X /			

* 'X / X' denotes that the claim-authority combination is used in the experimental design both with and without contact information; 'X / ' denotes that the combination appears only without contact information; and a blank cell denotes that the claim-authority combination is not used in the experimental design, i.e., is never viewed by respondents. All combinations denoted in the table are randomized between being seen first and second.

Table V. Effect of Contact Information
on Credibility and Adequacy of GM and No-GM Claims.

Contact Info/Claim Type	Credibility	Adequacy	Health	Environment	Purchase Intent
Yes/GM (N=368)	3.67	1.10	3.03	3.10	2.60
Yes/No-GM (375)	3.62	0.61	2.77	2.97	3.59
No/GM (382)	3.50	1.38	3.04	3.04	2.50
No/No-GM (365)	3.16	0.92	2.80	2.88	3.38
H ₀ : Yes/GM = Yes/No-GM*	Fail to reject	Reject	Reject	Reject	Reject
H ₀ : No/GM = No/No-GM	Reject	Reject	Reject	Reject	Reject
H ₀ : Yes/GM = No/GM	Reject	Reject	Fail to reject	Reject	Reject
H ₀ : Yes/No-GM = No/No-GM	Reject	Reject	Fail to reject	Reject	Reject

*Each null hypothesis refers to the equality of mean ratings for the two treatments listed after 'H₀'. Each hypothesis is tested at the five percent level using a Tukey's Studentized Range Test.

Figure 1. Effect of Label Claim on Information Credibility for Three Certifying Authorities

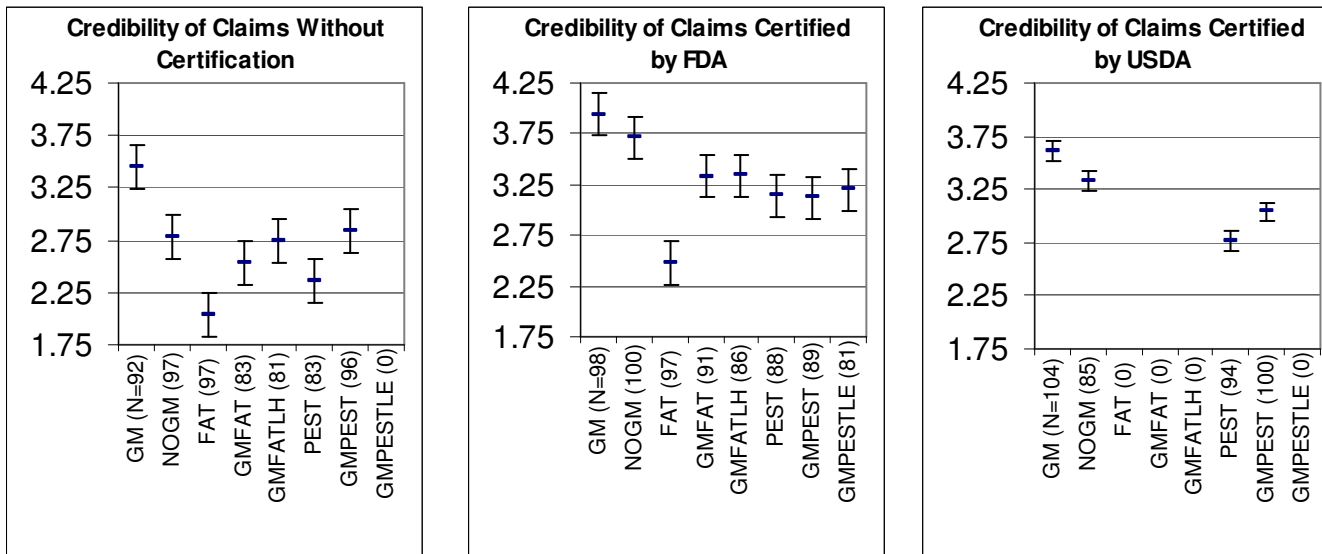


Figure 2. Effect of Certifying Authority on Information Credibility for Eight Label Claims

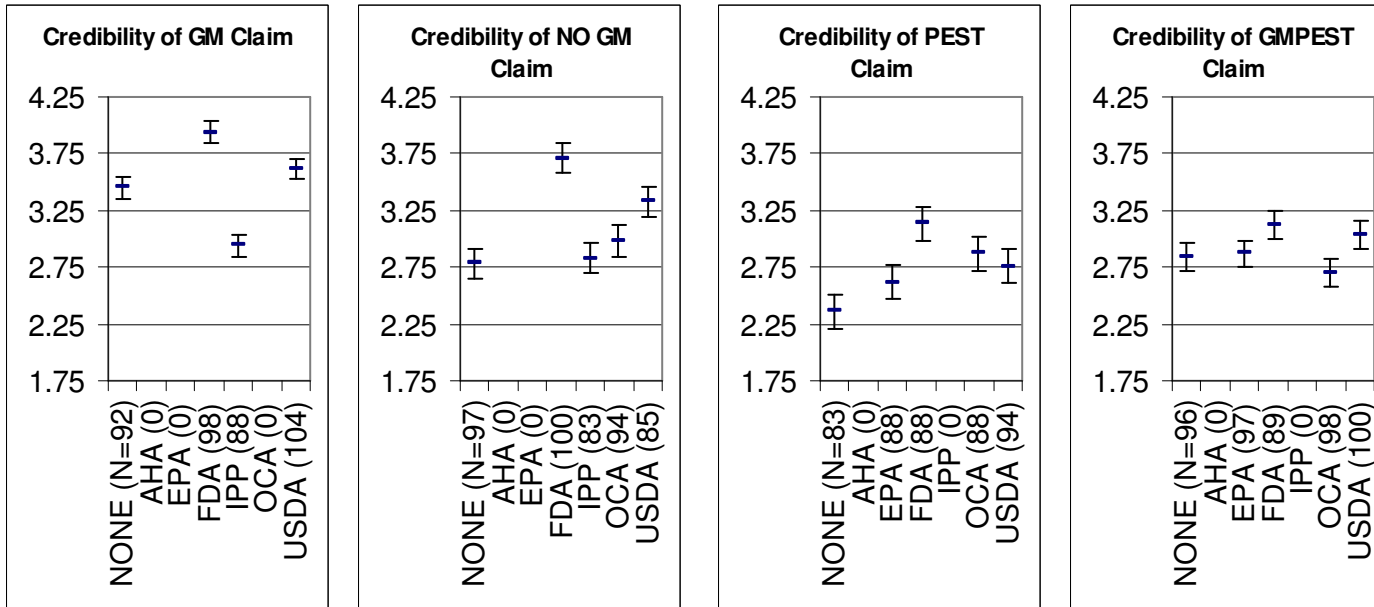


Figure 3. Effect of Label Claim on Information Adequacy for Three Certifying Authorities.

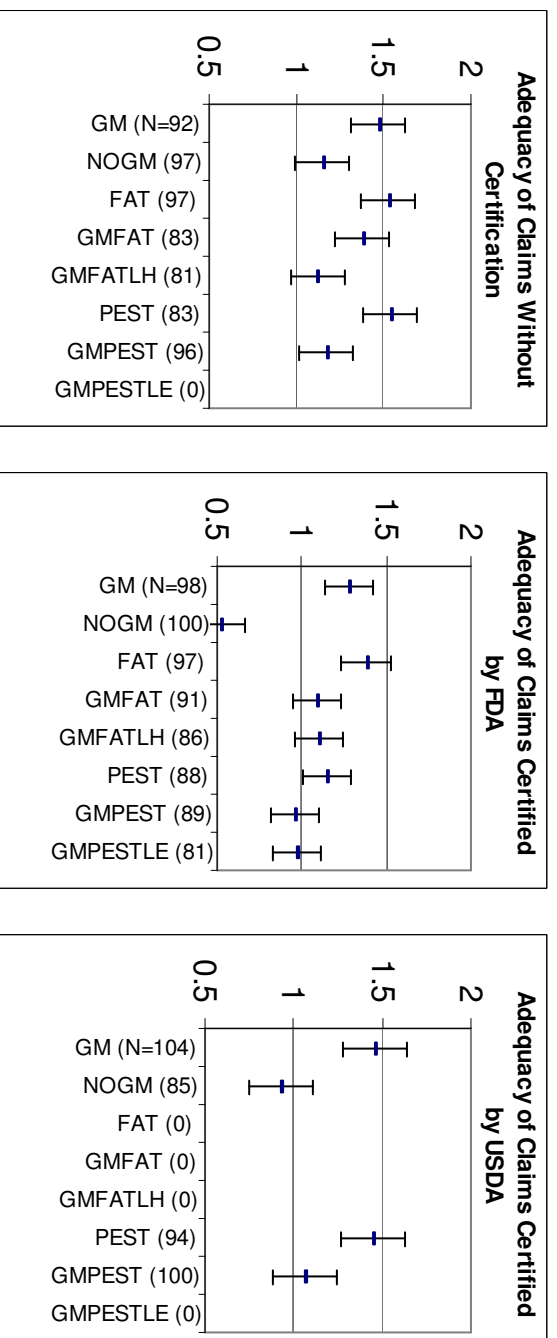


Figure 4. Effect of Certifying Authority on Information Adequacy for Eight Different Claims.

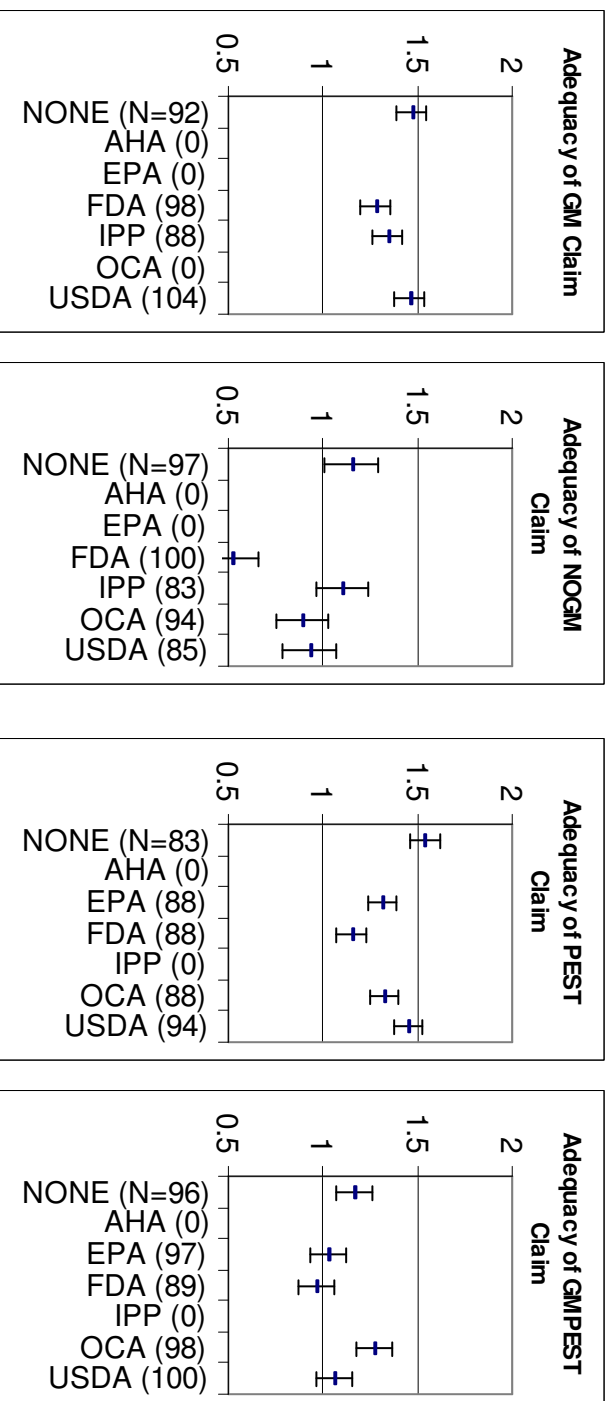


Figure 5. Effect of Claim on Perceived Health Problems for Three Certifying Authorities.

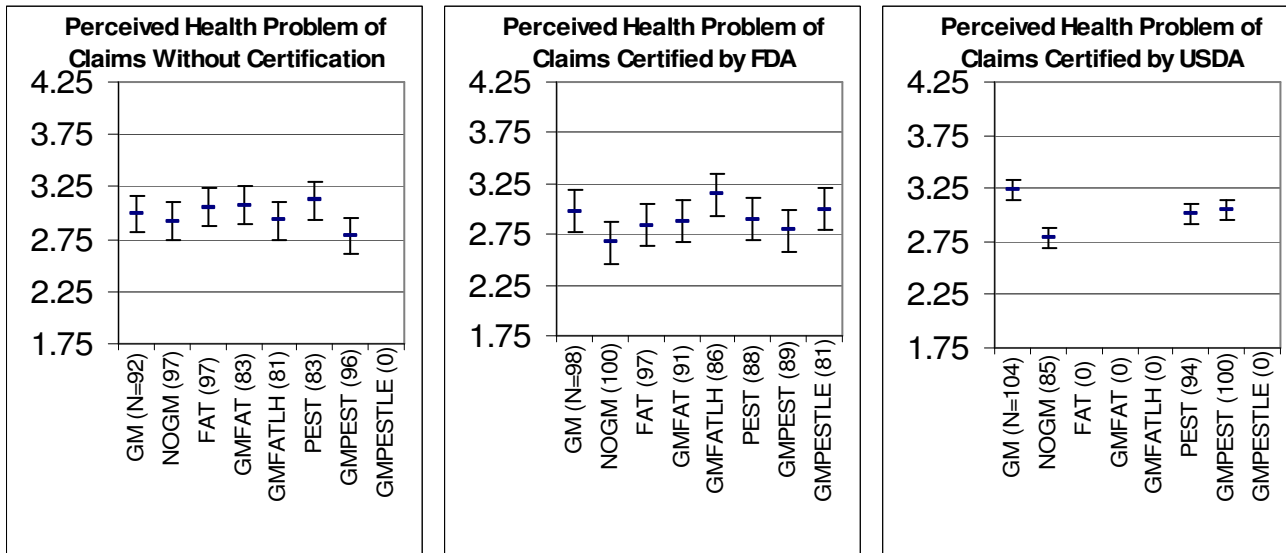


Figure 6. Effect of Certifying Authority on Perceived Health Problems for Four Different Claims.

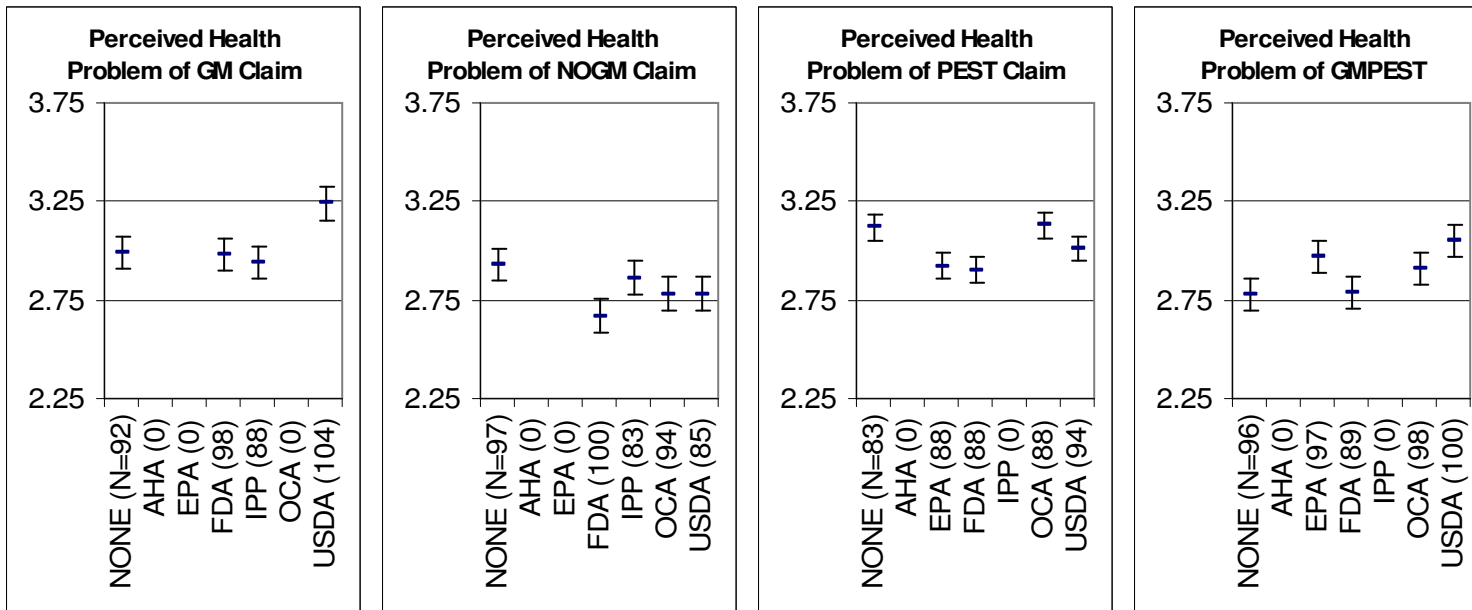


Figure 7. Effect of Claim on Perceived Environmental Effects for Three Certifying Authorities.

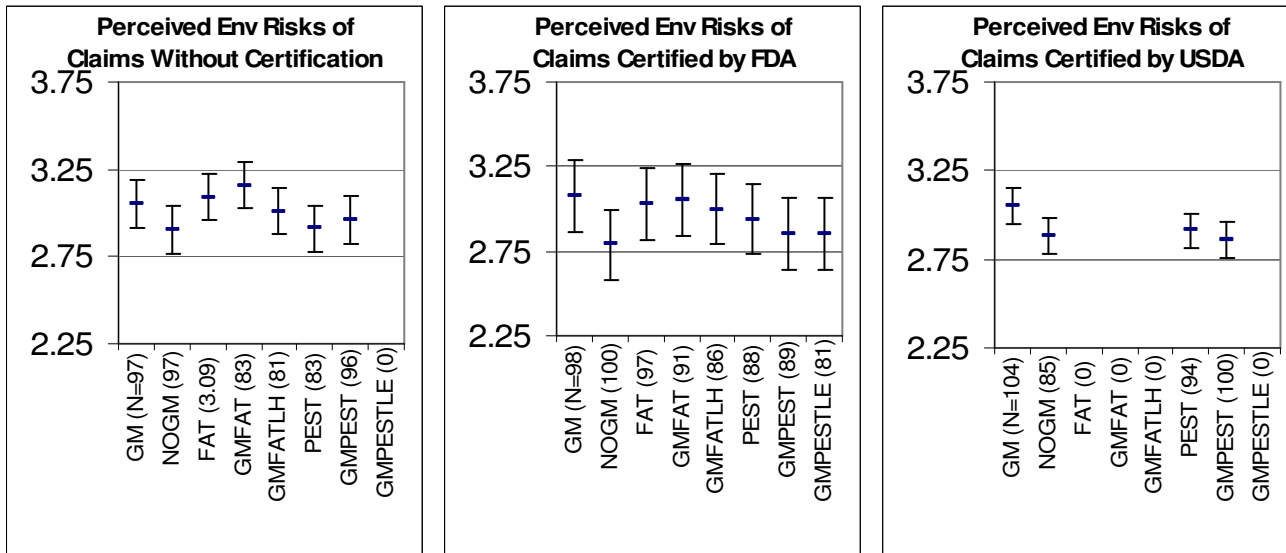


Figure 8. Effect of Certifying Authority on Perceived Environmental Effects for Four Different Claims.

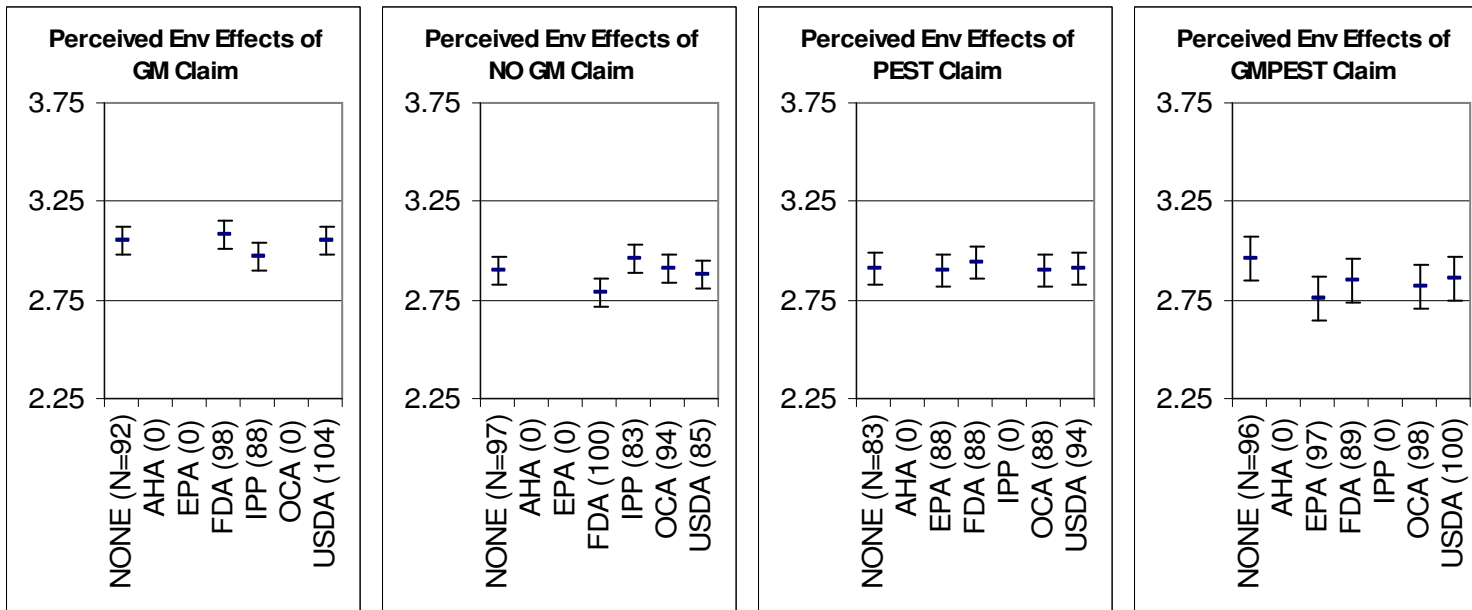


Figure 9. Effect of Claim on Purchase Intent for Three Certifying Agencies

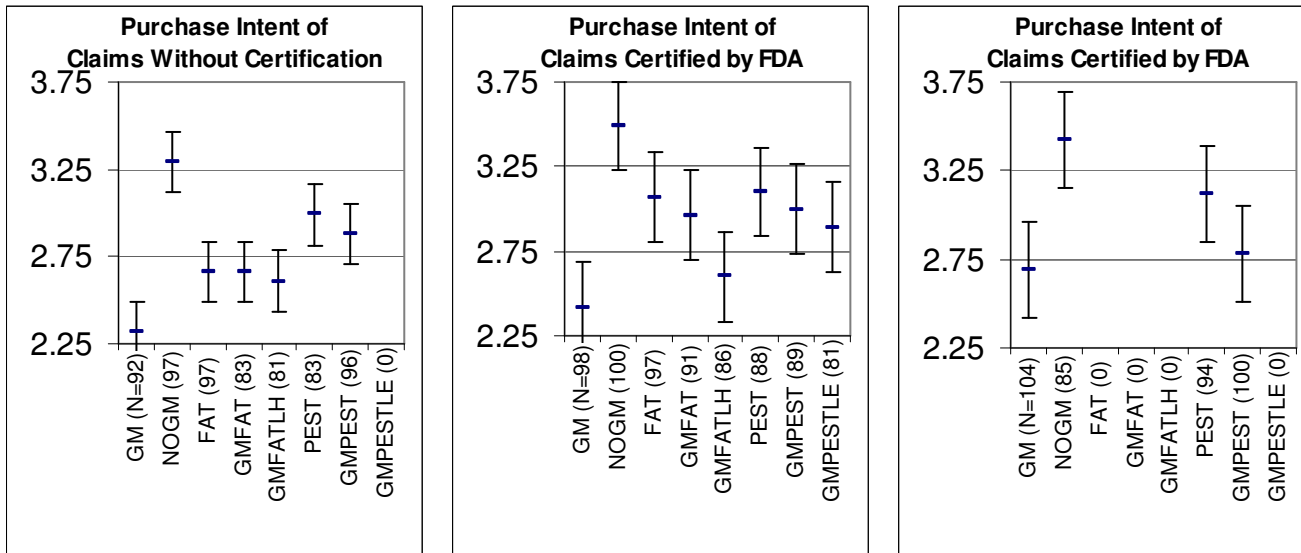


Figure 10. Effect of Certifying Authority on Purchase Intent for Four Different Claims.

