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## SPECIALTY SECTION

This article was submitted to  
Agro-Food Safety,  
a section of the journal  
Frontiers in Sustainable Food Systems

RECEIVED 11 November 2022

ACCEPTED 22 December 2022

PUBLISHED 27 January 2023

## CITATION

Leslie JF, Morris JB, Gurung JK,  
Harvey JJW, Ayalew A, Baker R and  
Zhang G (2023) Mycotoxin  
communications: Managing messages  
for different audiences.  
*Front. Sustain. Food Syst.* 6:1095256.  
doi: 10.3389/fsufs.2022.1095256

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# Mycotoxin communications: Managing messages for different audiences

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Mycotoxins, such as aflatoxins, fumonisins, trichothecenes, and zearalenone, are increasing in visibility as a public health threat through both acute and chronic exposure in food. USAID through its Feed the Future program has sponsored research in Nepal on mycotoxin contamination and the correlated high levels of stunting in children under age five. Communicating about mycotoxins is a complicated matter, as is communicating about any potentially serious economic or health threat that may be difficult to control. Two nominal group workshops in Nepal focused on identifying problems from multiple perspectives and developing potential communication strategies to mitigate the problem and potential concerns about it. Target audiences were identified along with their interests and effective channels to communicate with and within them. The first audience to work with is the government, as it must understand and value the problem and help generate confidence in potential regulatory and mitigation processes. Producers, educators and health professionals are the next audiences to address as they are the most closely involved with the problem. Consumer engagement is last, with a communication goal of sharing information to heighten awareness and minimize unwarranted public concern.

## KEYWORDS

aflatoxin, economic loss, government policy, Post-Harvest Loss, public health, risk communications

## Introduction

Mycotoxins, the most prominent of which is aflatoxin B<sub>1</sub>, are a well-known food safety problem worldwide (Bennett and Lee, 1979; Shephard, 2008; JECFA, 2011, 2018; Stoev, 2013; Eskola et al., 2020; Jallow et al., 2021). Regulation, monitoring and discarding contaminated material keep mycotoxin levels in foods available in developed countries at relatively low levels (Gallo et al., 2021; Park and Troxell, 2022), however in bad climatic years losses can be costly

(Mitchell et al., 2016). By contrast, mycotoxins are a persistent and larger-scale issue in less-developed countries, where such contamination is poorly controlled, if it is controlled at all. This contamination can be especially problematic for those who grow and store their own food, typically in tropical and sub-tropical rain-fed systems with insufficient inputs, or who purchase food at an unregulated local market (Chilaka et al., 2022). In some cases, population exposure can be nearly universal. For example, 94% of pregnant women in the Banke district in Nepal consumed aflatoxin-contaminated food in the 6 months preceding child birth (Andrews-Trevino et al., 2020), and was associated with small-for-gestational age infants (Andrews-Trevino et al., 2019).

The list of problems known to be associated with mycotoxin-contaminated human food and animal feed also has lengthened with time. Initial health concerns focused on cancer (Liu et al., 2012) and potentially death in humans, and in growth abnormalities, failure to gain weight or mature properly, and death in domesticated animals. More recently these concerns have expanded to include concerns about chronic exposure to sub-acute mycotoxin levels leading to developmental stunting and/or partial suppression of the immune system (Andrews-Trevino et al., 2019; Saha Turna and Wu, 2022). Drought and high temperatures during the growing season usually result in increased mycotoxin contamination (Cotty and Jaime-Garcia, 2007; Guo et al., 2008). Climate change and an increasingly globalized food supply chain mean that mycotoxin contamination problems will increase in terms of the size of the geographic areas where problems may occur as well as in terms of the number of animals and people exposed (Battilani et al., 2016; Harvey et al., 2016). As entries on sanitary and phytosanitary regulatory lists, mycotoxin contaminants can cause huge economic losses in producing countries if their crops are too highly contaminated to be exported to high value markets in developed countries.

The need to effectively communicate about mycotoxin contamination and the risks associated with these toxins has been recognized for some time (Bandyopadhyay et al., 2008; Leslie and Morris, 2019). Researchers often quantify the problem, but little is done to sensitize consumers, producers, traders, health professionals or government officers about the results and the potential for ensuing health and financial difficulties. To meet this challenge, in 2021, the Food Safety Coalition (FSC; [gfsc.mars.com](http://gfsc.mars.com)) was formed. The FSC included parties from academia, industry, non-governmental and inter-governmental organizations, who met to align on common goals and identify specific actions to drive innovation in food safety at pace—specifically, optimal methods of progressing data and knowledge sharing on aflatoxin (and other mycotoxins) risk management. This report represents findings from Workstream 4: Training and Education which builds off a recently completed USAID project in Nepal.

The Nepalese project identified mycotoxin contamination issues in maize, peanuts and chilies as potential threats to both humans and domesticated animals (Harvey, 2022). To mitigate these problems, a proactive and holistic approach is required to improve the impact of education and communication about mycotoxin contamination. Through a two-day workshop (Leslie et al., 2022a), potential remedies and communication channels have been identified. In this report we consider these results and develop a general model for communicating about mycotoxins with various audiences within a country, e.g., consumers, farmers, traders, educators, health professionals, regulators and policy makers, who have distinct but overlapping interests in the resulting food safety and food security issues.

## Methodology

The Feed the Future Innovation Lab for Reduction of Post-Harvest Loss (PHLIL) ran a workshop focused on the future of mycotoxin problems in Nepal at Dhulikhel, Nepal in August 2019. This workshop had 110 participants and lasted for 3 days during which time the participants addressed 34 questions related to potential actions to be taken regarding mycotoxin contamination in Nepal with Nominal Group discussions (Delbecq et al., 1975). This conference and others that preceded it (Leslie et al., 2008, 2018, 2020, 2021) identified communications as an essential follow-up activity to help reduce health and economic risks associated with mycotoxin contamination in human food and animal feed. Initially, these results were used to develop a communications model (Leslie and Morris, 2019) that focused on different participants in a value chain for a particular commodity. The present conference changed that focus to more general audiences that are not all necessarily associated with a particular commodity's value chain, but would still have interest in mycotoxin contamination of food and feed: (i) Consumers, (ii) Producers, Traders & Distributors, (iii) Health Professionals, (iv) Educators, Trainers and Researchers, and (v) Policy Makers and Regulators. From the Dhulikhel conference, several broad areas of interest/concern were identified: (i) health, (ii) economics, (iii) post-harvest issues, and (iv) testing, reporting and regulation (Leslie et al., 2022b). Different audiences have interests limited only to them as well as interests that are shared with one or more of the other four audiences.

The present conference was a hybrid one. The majority of participants were together in a conference room at the Himalaya Hotel in Kathmandu, Nepal (Leslie et al., 2022a). Other participants were located in China, India, Thailand, the United Kingdom, and the United States and participated through a video conference arrangement. All participants received a summary of responses to questions from the Dhulikhel conference that had been sorted into one of the 20 possible combinations of topic and audience (Leslie et al.,

2022c). Participants were divided into five nominal groups (named for convenience for the trees Cherry, Elm, Oak, Pine and Teak).

On the first day, each group was tasked with considering the question, “Identify key issues regarding mycotoxins of relevance to **audience**” for each of the five possible audiences. Most groups provided responses for four of the five possible audiences. Discussion rules were similar to those used for previous Nominal Group discussions (Delbecq et al., 1975; Leslie et al., 2018, 2020, 2021; Leslie, 2022a,c) and resulted in lists with around 40 composite responses for each audience (Leslie et al., 2022d). These results are discussed below by audience.

## Day 2

Results from the first day of discussions (Leslie et al., 2022d) were compiled and shared with participants for discussions on Day 2. Again, the results (Leslie, 2022b) are of potential topics, as were the results from the Dhulikhel conference distributed on Day 1 (Leslie et al., 2022c), but now target audiences were associated with potential topics of interest.

An effective communications strategy requires more than just the identification of topics of interest. It requires a vehicle for the delivery of the message and a “trusted source” to provide the information. Barriers to communications surrounding science-based issues often arise around an inability to get scientists, communicators and government agencies to coordinate, and for groups to “translate” their knowledge and concerns into activities and messages that are both factually correct and readily understood by other groups. Once a trusted source is identified, often an academic researcher or government ministry, the proper information channels and methods can be applied to reach the target audience.

The Day 2 deliberations culminated in groups being asked to identify combinations of characters, instead of just individual topics, as was done on Day 1. For each audience, groups were asked to identify three issues of relevance for that audience. Once topics were identified, then groups were asked to identify up to five combinations of (i) Trusted source, (ii) Information channel, and (iii) Method/Tactic.

## Results

### Day 1

#### Consumers (based on 41 responses)

Four groups responded, but there were no responses common to all four. Four topics were common to three groups: knowledge of the problem, impacts on family health, worries about food safety and security, and concerns about economic losses, which probably are associated with a lack of awareness.

Two topics were common to two groups, and these topics also focused on food safety. The remaining 34 responses were unique to a single group and 28 of these responses were found on at least one participant’s top five list.

Quality of life and economic issues are mentioned as such only once each. Family health issues were weighted heavily in the responses related to this issue, with most concern focused on specific issues associated with mycotoxicoses, although general stress and psychological impacts were mentioned.

The most mentioned topic for consumers had to do with the availability and affordability of safe food. Malnutrition and fear of not being able to afford safe food were mentioned in multiple contexts. One question was, “How can a consumer determine if food is safe?” Storing food to keep it safe after purchase was the most heavily weighted response received. Disposal methods available for contaminated material at the household level were another prominent topic.

Who to trust, who to blame, and gaining compensation for the purchase of bad food were a third major topic area. How can the government (or others) help ensure a safe food supply for consumers? What role does the private sector have? Does open trade with India have a role in contamination problems (dumping unsafe food in Nepal)? Proper regulation by a government body was requested. Mycotoxin contamination was identified as a potential topic on which the government and consumer activists could cooperate with a goal of providing safer food for everyone.

#### Producers, traders and distributors (based on 38 responses)

Four groups responded, with all indicating that increasing basic knowledge of mycotoxins was an important objective. There were three responses common to all three groups and they all focused on product quality and improved storage practices and facilities. An additional 11 responses were common to two groups. Of the remaining 23 unique-to-a-group responses, 16 were included in at least one participant’s top five list. In general there was more consensus among the groups for the relevant issues for this audience than there was for any other audience.

The top issue identified for this audience was the need for more people in the audience to be aware of the problem and to understand why it was an issue. A closely related concern was whether the human resource capacity within the audience was sufficient to meet the potentially increased demands that mycotoxin concerns would place on those individuals, and whether additional regulatory burdens might result in a loss of good will, especially toward potential regulators and government officials.

This audience encompasses those along the value chain from the field to the consumer. Suggestions were made for pre-harvest/on-farm activities such as following GAP (Good Agricultural Practices), planting quality seeds, and using

moisture meters to assess grain dryness. Once out of the field, the questions of drying and storage become the central issues. Where the grain is stored greatly affects the answer to this question. Technology for large scale drying and storage is different than for village or household level drying and storage processes. From storage, grain may be processed and sold. Keeping this portion of the value chain efficient and timely while following GMP (Good Manufacturing Practices) were the main messages.

Wellbeing, both health and financial, were concerns for those along this portion of the value chain. Do those who work along this portion of the value chain have an elevated risk of mycotoxin-related health issues? Financially, what are the risks from lower product quality? How should potential losses be managed if crops are contaminated? Government and trade organizations can be particularly important here through the development of safety regulations for both workers and the final products they produce and ultimately consume. Ensuring sufficient testing capacity is available to screen materials is important as well. If trade organizations prioritized mycotoxin-free food, it would expand the availability of such products, encourage greater access to testing, and help ensure government standards were reasonable.

### Health professionals (based on 45 responses)

Four groups responded, but there were no responses common to all four. Two topics were common to three groups: Lack of knowledge of the impact of mycotoxins on health, and poor coordination between health and agriculture sectors to manage the problem. An additional 10 responses were shared by two groups, with the remaining 33 responses unique to a single group. Twenty-four of the 33 single-group responses were found on at least one participant's top five list.

Themes identified by the top two responses resonated through the list. Increasing communication between health, agricultural and veterinary practitioners would help provide the background information on mycotoxins that most health professionals currently lack. Adding information to medical training curricula and providing opportunities for continuing education on the topic are probably the most effective ways to overcome this problem. Some background knowledge can be provided through the development of materials based on results already known, mostly from outside Nepal. Other information will require additional research to obtain it from either a local (Nepalese) or a global setting. Formulation of specific suggested responses for patients also is needed. Materials that can be shared are important as is information on diagnosis/treatment options and on actions that could mitigate the effects of exposure. Hanging over patient issues are food security issues, as the quality of accessible food can play a major role in mycotoxin exposure. Knowing government policies on topics such as permissible contamination levels and assembly of

appropriate advisory groups to assess the urgency of the problem for public health could help determine the problem's priority and the efforts devoted to reducing it.

### Educators, trainers and researchers (based on 39 responses)

This audience is the only one addressed by all five groups. There were no responses common to all five groups. But there were two responses common to four groups, five responses common to three groups and eight responses common to two groups. Of the 24 responses to an individual group, 17 were on the top five list of at least one participant.

Development of human and laboratory capacity, and resources to be used in developing curricula and other materials for distribution were five of the seven top responses. Remediating these problems requires an adequate budget as well as long-term plans for addressing the needs. Resource materials need to be developed locally to ensure responsiveness to local needs. Standard materials that can be used for awareness training also are needed, since awareness is a critical problem across all of the audiences.

Additional research is suggested with international collaborators to help develop information about mycotoxins and mycotoxin contamination that can be distributed through channels appropriate for the information and the target audience. No specific areas of research are suggested, but the overall effort needs to be relatively broad, i.e., not limited to a single toxin, and the various pieces of research should be integrated with one another and with relevant international research efforts as well.

Outreach and educational materials could come in a number of forms. Adding age-appropriate information to standard school and university curricula provide a sustainable educational outreach that would relieve some of the current awareness problems over the long term. These materials and the communication channels through which they are presented need to be developed in local languages, and their production and content should be coordinated amongst researchers, teachers/trainers, extension, and communication specialists.

Multiple critical questions to be addressed were identified. Some questions, e.g., "What are mycotoxins?", will have a relatively constant answer, while others, e.g., "What are the impacts of mycotoxins on human health?", may have answers that evolve as research is completed both in Nepal and elsewhere. Questions regarding common contamination levels in Nepalese products and processes should have generally decreasing values. Questions about regulatory levels may be modified based on Nepalese diets rather than more generic global guidelines. In the end, the goal is to help people manage the health, financial and dietary implications of mycotoxin contamination in their daily lives.

Participants thought mycotoxins were not viewed as an important problem by multiple groups—educators, trainers, researchers and the media. Increasing awareness of the problem amongst all of the audiences discussed in the workshop is primarily the responsibility of the educators and trainers. This effort will require care and coordination to avoid panic while imparting a base level of knowledge that can then be built on as knowledge of the contamination problem increases and means to mitigate it are identified or developed.

### Policy makers and regulators (based on 41 responses)

Four groups responded, but there were no responses common to all four. Five responses were common to three groups and nine additional responses were common to two groups. The top four responses identified major themes running through the entire set of responses for this audience. In particular these responses were: (i) to ensure a budget sufficient for activity in this area, (ii) increasing awareness of the problem by members of the audience, (iii) enabling coordinated actions in response to the mycotoxin problem, and (iv) developing rules, regulations, policies and strategies to limit and manage mycotoxin contamination. Of the 27 responses that were unique to a single group, 20 were on the top five list of at least one participant.

Assuming an adequate budget, the question is, “What programs should it be spent on?” Collecting more information on mycotoxins through surveillance and Nepal-focused research are important for assessing food and feed quality and financial losses, and for developing local strategies to minimize losses. Capacity building to address mycotoxin-related issues is important in terms of infrastructure for drying, storage, transport, etc., research and testing laboratories, and increasing the sensitivity of trade groups to the problem. Human capacity building also is needed to ensure the other audiences are aware of the problem, its consequences and its solutions, and that there are a sufficient number of properly trained people available in country to meet mycotoxin management challenges.

Awareness of mycotoxin issues by policymakers and regulators needs to be increased so that mycotoxin contamination is a topic with which they have more than just passing familiarity and understanding. Including age-appropriate information on mycotoxin issues in school curricula is a sustainable way to begin building population-wide knowledge of this problem for the future.

Policy makers and regulators need to ensure that responses to mycotoxin contamination events are coordinated across ministries and that they receive up-to-date information from both domestic and international experts as policies and regulations are formulated. Ensuring food safety is the top goal and will require a combination of regulation, quarantine, testing, risk assessment, priority ranking, and labeling to build

confidence in the system. Current management structures may need to be modified to ensure collaborative management of the associated issues in a holistic and efficient manner from the farmer’s field to the consumer’s plate.

## Day 2

The participants’ responses (Leslie, 2022b) are instructive about the challenges faced in creating a communications infrastructure to coordinate messaging. Twelve major issues were identified for the consumer audience during the Day 1 discussions (Leslie et al., 2022d). The first issue was identified as “lack of knowledge of health implications of consuming mycotoxin contaminated food.” The groups identified five trusted sources to convey this information, four government agencies and a generic category of “consumer associations.” Ministries included Health and Population (MoHP), Agriculture and Livestock Development (MoALD), Education, Science and Technology (MoEST), and the Department of Food Technology and Quality Control (DFTQC). Subsequent issues added more trusted sources, including academic authorities, regional and local governments, plus other agencies. The potential for mixed or confusing messages resulting from the complex interconnected network of sources is obvious.

When asked to identify priorities for information channels, group results ranged from mass media outlets to more in-person interactions. The purpose of this exercise was to detect patterns and align the communications medium with the audience. Similarly, groups were asked to recommend methods and tactics specific to the trusted source and recommended channel. Integrated communications plans require layered media and tactical executions, with the recommendations provided by the Nepalese participants providing strategic guidance. The need was clearly identified for a neutral in-country coordinating agency to manage data, help coordinate external funding needs and advocate to policy makers.

Messaging strategy must account for three dominant findings. First, authority figures are very important for credibility with Nepalese groups, and many government agencies, were amongst the most trusted sources. Second, a general lack of awareness about mycotoxin issues was identified at all levels and within all audiences. Finally, people needed to have confidence and wanted assurance that the problems were being adequately addressed.

## Discussion

### Strategic communications approach

Based on results of the Nominal Group discussions, multiple activities must be aligned and occur in a specific order to create



an effective strategy. While the five distinct target audiences have some overlap and redundancy, three clear steps are foundational for establishing an operative communications plan. Although we did not subdivide audiences by sex, materials at least for producers and consumers will need to consider country-specific differences in gender in the home, farm and workplace (Ragasa, 2014; Bello-Bravo et al., 2022).

The communications plan depends on establishing clearly defined policies that directly affect the target audience(s). Having a trusted source requires accurate, verifiable data, and consistent rules for their interpretation. The first step is to convince policy makers/regulatory authorities of the need to broadly address the issue with accessible, understandable communications. With clearly defined regulations and testing protocols, educating individuals likely to serve as information resources will set the basis and tone for broader, more general communications. The goal is to assemble a range of trusted sources who can provide background information and answer questions prior to mass communications efforts. While some of these trusted sources will be subject matter experts, not all will be.

The next step is to equip trainers and educators with curricula, materials and resources to engage specific audiences through audience-specific channels and to identify critical points to convey to the general populace. Elements include both general awareness and technical information that has been modified to enhance understanding of potential issues. The third step is a widespread public awareness campaign in the form of public service announcements, social media, and placements with key media identified by the nominal group sessions (Leslie, 2022b).

## Step one: Convince and educate the government about the need to act on the issue

This step leads to the creation of formal policies, budgets, and plans at the national level. Once regulatory and testing policies are codified, the task becomes communicating the information. The Dhulikhel groups identified multiple ministries that could serve as trusted sources for different audiences. The exact ministries will vary by country. In Nepal, cited ministries and agencies included MoHP, MoALD, MoEST, DFTQC, the National Health Education and Communication Center (NHEICC), and the Nepal Health Resource Council (NHRC).

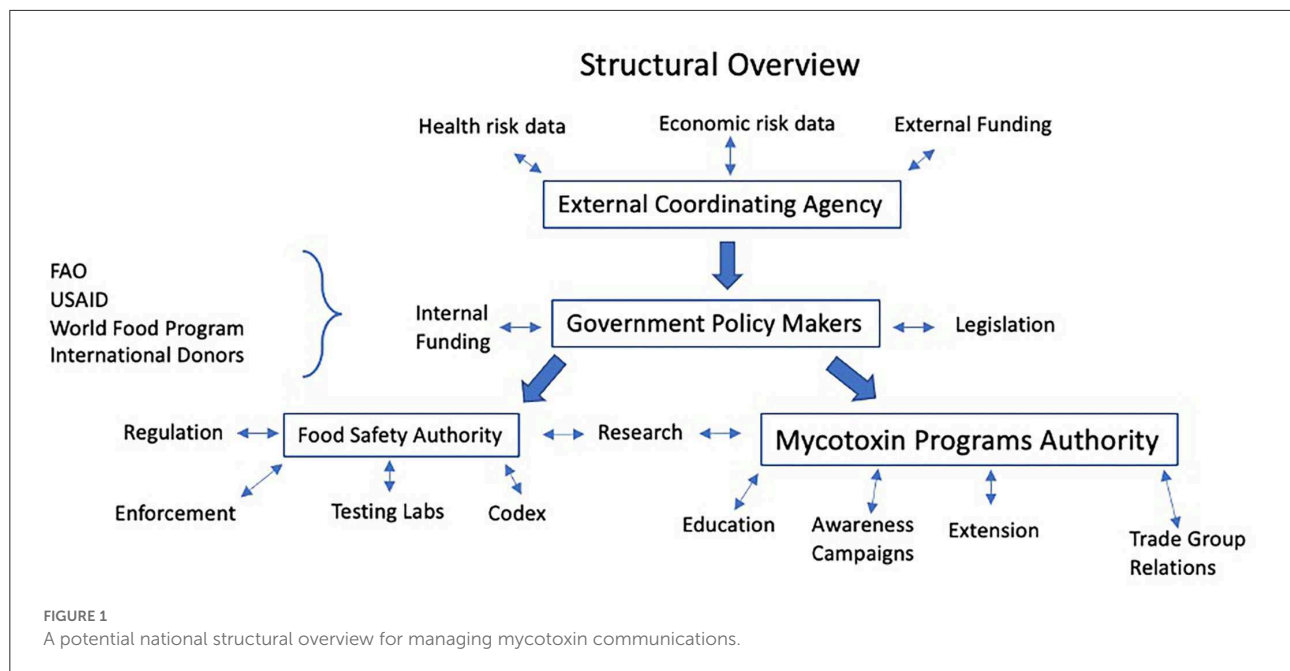
With multiple agencies and ministries involved within the government in addition to external partners, coordinating activities and messages is a major task, even in a country with highly centralized planning. It is critical that mycotoxins, especially aflatoxins, are viewed as a priority in light of the numerous critical needs faced by the government (e.g., social

systems, infrastructure, etc.). Additionally, the government agencies in collaboration with global agencies (e.g., FAO) and recognized key opinion leaders need to align on “What is safe food”? There is currently a range of safety interpretations that is causing confusion within the food industry as a whole. For example, established maximum limits for total aflatoxin allowed in peanuts ranges from 4 parts per billion in the European Community, to 20 ppb in the USA and China, to 30 ppb for export in India, and to 35 ppb in Malaysia (Meneely et al., 2022). These regulatory discrepancies sow confusion about what food is safe and add another level of complexity to be navigated by developing countries exporting agricultural products to developed countries (Gbashi et al., 2018). These regulations also generate a perverse dilemma for developing countries, who can only export their best quality food and must retain more contaminated food for local consumption, thereby lessening domestic food safety and security. Without further clarity and alignment, challenges to efforts to ensure and improve food security will only increase.

Initially, the process might proceed most smoothly if an external coordinating group convenes the stakeholders and persuades government agencies to counter the all-but-inevitable bureaucratic turf issues (Figure 1). If external funding for the effort is provided, then this group could be responsible for disbursing it to develop programs in such a way as to best benefit the communications effort as a whole. As roles of agencies are defined, and a government-based mycotoxin programming authority established, then the role of this external group would be reduced, or perhaps even disappear completely. In Nepal, a group such as the Nepal Development Research Institute (NDRI) could fill this role. Initial communications to various regulators and policy makers should focus on three goals: (i) increasing awareness of the problem and the need for a solution, (ii) coordinating various levels and jurisdictions of policy makers for both efficiency and effectiveness, and (iii) enabling translation of regulatory and policy language into the common vernacular to support specific audience and public outreach efforts.

An organization such as NDRI can assist in acquiring external funds and coordinating with partners, but government policy makers must pass legislation that enables regulation and allocates significant internal funds. A central food safety authority, probably the one involved with Codex and other international safety issues, should be tasked with issuing and enforcing regulations, enabling routine testing, and overseeing research. A second government-based entity is needed to specifically address mycotoxin issues (Figure 1). The mycotoxin-specific authority lacks any regulatory or enforcement power and instead focuses on comprehensive educational and communications efforts, including coordinating with trade groups and the extension system.

In a broader geographic context and from over a decade of experience, the African Union Commission's Partnership for



Aflatoxin Control in Africa initiative has found that government involvement is critical for raising awareness and addressing mycotoxin contamination and associated problems (Ortega-Beltran and Bandyopadhyay, 2022). Governments in Africa, and in developing countries more broadly, have essential roles and a wide sphere of influence, whether in setting a research agenda, or developing communication campaigns, policies, regulations and more. Working closely with and through governments while engaging the private sector and other players, e.g., NGOs and external development sponsors, is important to underpin more effective communication and mycotoxin management broadly in most, if not all, developing countries.

## Step 2: Educate and train the key target audiences

Once government agencies are on board, the next step is to prioritize target audiences. In this second phase the critical audience is educators, trainers and researchers, who can then help develop curricula, and establish training programs and materials for the individual audiences. In Nepal, target-audience specific materials were identified as a need for health professionals and for producers and distributors. In this phase, specific audiences are educated as a key support group for the final phase, which is public and general awareness. Key messages are used to reconfigure technical information provided by researchers and regulatory bodies for implementation by other audiences. Health care professionals, for example, require education on the background mycotoxin issues, such as

prevalence, symptoms and health-related mitigation measures. Patient materials are needed to advise about potential dangers and provide best practices for food handling and storage. Specific communication channels identified for the health professional audience include training/educational programs and workshops targeted to subset audiences within the larger health professionals group. Ideally these programs would be sponsored by academic institutions, which were considered a trusted source.

Producers, traders and distributors have a well-established conduit for up-to-date information in countries that have traditional extension networks. These networks readily access rural consumers and producers through existing programs and relationships. The need to increase awareness of mycotoxins and education regarding best practices about mycotoxins are both amenable to implementation through the extension network. Identified trusted sources included MoALD, MoHP, academic researchers, and trade associations.

## Step 3: Educate the public through general awareness campaigns

Consensus from the Dhulikhel groups (Leslie et al., 2022b) supported the need for increased general awareness about mycotoxins and the ongoing threat they pose to the food supply among all target audiences. This third phase of the proposed communication strategy should launch when the prior two phases are complete, with policy/regulation and training/educational materials in place for health professionals

and the producer, trader and distributor audiences. Multiple communication tools have been assessed for effectiveness in terms of adoption of best practices and technologies aimed primarily at producers. Items assessed include traditional extension, animated videos, jingles, posters and pamphlets.

A new level of translation will be needed to effectively educate urban consumers who have little awareness or knowledge of the issues. Key questions to answer include (i) “What are mycotoxins?”, (ii) “Why should I care if they are in my food?”, (iii) “What are we doing about this problem?”, (iv) “What should we be doing about this problem?”, (v) “Who can we trust on this issue?”, and (vi) “Where can we find reliable information?” Having completed the first two phases of the communications plan will pave the way for this third phase as regulations, testing and training protocols, and educational processes and curricula will all be in place.

Trusted sources for this phase in Nepal were identified as government ministries and consumer associations. The myriad of agencies identified (MoALD, MoEST, DFTQC, MoHP and academic authorities, among others) reinforces the need for the mycotoxin authority, identified in the first phase to coordinate messages and serve as a gatekeeper for information. Too much information too quickly could easily alarm the general populace and lead to a shut-down type response, rather than a more positive response focused on constructive steps to mitigate identified risks. Ensuring consistent messaging requires common terms and definitions and coordinated efforts. Media channels identified by the Dhulikhel groups focused on public service announcements through traditional media outlets such as television, radio and newspapers. The utility of these channels for transmitting information was reinforced by the results from the Day 2 discussions at the present meeting (Leslie, 2022b). Websites, both domestic and international, with access to published work were frequently cited as trusted sources.

#### Step 4: Build support with key opinion leaders and industry to govern and nurture

Although not identified as an initial step in the process, it is imperative to involve industry and key opinion leaders to assist with the development, implementation and more importantly processes to monitor, govern and nurture the program(s). This process could involve consultation and sharing proven best practices and resources, as necessary. Industry is well placed to help build support, especially large global corporations that have access to information, proven science and applied programs to assess, monitor, educate, communicate and holistically manage

mycotoxin risks on a global scale. A small expert working group should define the kind of external support needed, who should be involved, and what the specific contributions would be.

In conclusion, communicating about mycotoxins is a complicated matter, as is communicating about any potentially serious economic or health threat that may be difficult to control (Morris, 2022). Identifying target audiences, defining their interests, and identifying effective channels to communicate with and within them is a critical first step to making risk communications about mycotoxins a priority amongst other areas requiring government resources. We think that the results from this workshop in Nepal mirror what would be found in many less-developed countries worldwide. The general framework of working first with the government, then with producers, educators and health professionals to ensure broad background acceptance amongst those most closely involved with the problem, and finally with consumers provides a stepwise strategy that should maximize the sharing of information while minimizing public concern. Industry and key opinion leaders will play a key role in assisting with the development, implementation and monitoring the impact of these initiatives. We anticipate this strategy will be modified on a country-by-country basis and look forward to the next steps in Nepal of identifying an external coordinating agency who can begin implementation of the communication program described here on a nationwide scale.

#### Data availability statement

The datasets presented in this study can be found in online repositories. The datasets from the Nominal Group Discussions for this study can be found in the Kansas State University Libraries K-Rex depository as: <https://krex.k-state.edu/dspace/handle/2097/42508> and <https://krex.k-state.edu/dspace/handle/2097/42507>. Relevant responses to nominal group discussion questions from the 2019 conference that formed the basis for the discussions at the current conference can be found at: <https://krex.k-state.edu/dspace/handle/2097/42504>.

#### Author contributions

JL: conceptualization, methodology, investigation, data curation, writing—original draft, writing—review and editing, and project administration. JM: conceptualization, methodology, investigation, writing—review and editing, visualization, and project administration. JG: conceptualization, investigation, and project administration. JH and GZ: conceptualization, investigation, writing—review and editing, project administration, and funding acquisition. AA: conceptualization and writing—review and editing. RB:



conceptualization, writing–review and editing, and funding acquisition. All authors contributed to the article and approved the submitted version.

## Funding

This work was funded in part by the Mars Global Food Safety Center, the Kansas Agricultural Experiment Station, and the USDA National Institute of Food and Agriculture Hatch Multi-state project KS1183A.

## Acknowledgments

We thank Justina Raggett, Bethany Wolf, Yueju Zhao, Chris Gilligan, Richard Stout, and Matt Castle for reviewing the manuscript and assisting in organizing the conference. Manuscript No. 23-071-J from the Kansas Agricultural Experiment Station, Manhattan.

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## Conflict of interest

GZ, RB, and JH are employees of or consultants for the Mars Global Food Safety Center, a major sponsor of the Food Safety Coalition.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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