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Author(s): Jessica Galen
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JESSICA GALEN

Cheesemongers Over Fearmongers: Toward Data Driven Cheese Recommendations for Pregnant Women

abstract | *A core area of food safety concern for expecting mothers is contamination by Listeria monocytogenes, a harmful pathogen that can cause fetal demise. The FDA lists certain types of cheese among the foods that are more likely to carry Listeria, yet the recommendations on safe cheese consumption lack scientific justification and are confusing to pregnant women. Emphasizing these potential dangers leads to unjustifiable fear of cheese consumption during pregnancy, a concern for pregnant women across the socioeconomic spectrum that can and should be addressed by public health authorities. Cheese serves as a case study to assess the challenges of translating scientific research into policy and practical consumption guidelines for a vulnerable population. This article scrutinizes the recommendations to elucidate their semantic and scientific shortcomings and also provides a framework for authorities to develop a new set of recommendations that gives pregnant women a clear path for making safe and delicious cheese selections.*

keywords | *cheese, women, pregnancy, FDA, food safety*

INTRODUCTION: A CHEESEMONGER'S STORY

I managed a cut-to-order cheese shop, Lucy's Whey, in New York City from 2013 to 2014. I reveled in helping customers find the perfect cheese to fit their preferences and needs: the most buttery cheese, or the stinkiest cheese, or a cheese that would remind them of a recent vacation to Italy.

Many pregnant customers also came in asking for cheese that was safe for them. Most told me that they had been instructed to stay away from some combination of soft cheeses and raw cheeses (also called unpasteurized cheeses), but were not sure of the details of the warnings. They often arrived armed with what they thought was a good sense of how to safely indulge, but over the course of a purchase convinced themselves that the counter was full of threats to their babies. Their primary concern was *Listeria monocytogenes* (hereafter referred to as *Listeria*), contamination, which has been linked to cheeses and can cause harm to fetuses or even miscarriages. In order to better assist these customers, I investigated the recommendations on my own, but found that even my background in cheese did not help to translate this advice into a real-world setting. My pregnant customers felt hamstrung in pursuing what was most likely a safe and healthy taste preference, because recommendations from the Food and Drug Administration (FDA) had caused them fear and insecurity.

I became pregnant just as my tenure at Lucy's Whey was coming to an end and was personally confronted with the same guidance. Digging deeper into the cheese consumption recommendations only muddled their message and rationale further. This article scrutinizes the recommendations in order to elucidate their semantic and scientific shortcomings. It also provides a framework for authorities to develop a new set of recommendations that give pregnant women a clear path for making safe and delicious cheese selections. Cheese provides a case study to assess the challenges of translating scientific research into policy and practical consumption guidelines for a vulnerable population. Global differences in "do not eat while pregnant" lists—pregnant women eat raw cheese and drink wine in Europe, and eat sushi in Japan, at levels that the American public health apparatus would deem harmful—reveal that authoritative knowledge in this context is hardly infallible.[1]

In this article, I begin with an explanation of the risks to pregnant women of contracting listeriosis and a brief review of *Listeria* outbreaks that have been linked to cheese. These sections contextualize the risks and the justification for warnings about cheese. I then investigate the range of guidance available to pregnant women on safe cheese consumption, exposing the internal inconsistencies as well as the insufficient detail and scientific basis of these recommendations. Finally, I provide a road map for the FDA to overhaul its recommendations for pregnant cheese consumers, including a template for a new set of recommendations that would provide the clarity and nuance that pregnant women seek.

Although I began these investigations with customers in a privileged setting—an artisanal cheese shop where cheeses commonly sold for $30 or more per pound—I argue that the

public health investment to refine and better communicate these recommendations would benefit women across the cultural and socioeconomic spectrum. *Listeria* outbreaks in the industrial food system could inspire pregnant women to seek local and foods perceived to be ethical and safe foods at an even greater rate than they already do,[2] and the FDA must adapt to meet these shifting preferences.

The current orientation toward pasteurized and processed cheese reflects the public health apparatus' uneasiness with raw and small-scale cheese production.[3] Additionally, the recommendations frequently single out raw "Mexican-style cheeses"—such as queso fresco, queso blanco, and panela[4]—as high risk. The result is an apparent indictment of cheeses with Latin American origins over European-style cheeses without sufficient contextualization. "Soft" cheeses with French or Italian roots can be equally as dangerous; the issue at hand is unsafe production practices, not an intrinsic characteristic of the cheese style. Hispanic women are more likely than other women to contract listeriosis when there is an outbreak traced to a "Mexican-style" cheese,[5] but the recommendations fail to clarify the sociocultural rationale for this warning: protecting higher-risk women.

METHODOLOGY Building on my personal experiences working in the artisanal cheese field and as a pregnant woman living in New York City, I use an interdisciplinary approach to examine cheese consumption recommendations for pregnant women. I include an analysis of resources for pregnant women on safe cheeses, as well as *Listeria* outbreak data and publications from official government sources. To further contextualize these food safety recommendations, I discuss the cultural role of pregnant women in the US, examining how non-experts deploy authoritative knowledge in order to govern pregnant women's bodies, health, and consumption. My conversations with customers at Lucy's Whey, as well as a survey of 207 women's understanding of the "rules" on safe cheese consumption during pregnancy, round out this interdisciplinary inquiry. I distributed the survey, conducted between March 15 and April 5, 2015, through my personal networks, as well as to a community of mothers called "Private Awesome Mommy Group" on Facebook.

I was inspired by the work of two scholars who investigate the production, dissemination, and consumption of authoritative knowledge on, and cultural assumptions about, "risky foods" for pregnant women, and the scientific basis—or lack thereof—of such knowledge. In *Expecting Better: Why the Conventional Pregnancy Wisdom is Wrong—and What you* Really *Need to Know*, economist Emily Oster stress tests the studies underlying many of the items on American obstetricians' "do not eat or drink" lists for pregnant patients. She finds that many of the deeply held assumptions woven into these lists are based on threadbare data.[6] Heather Paxson's *The Life of Cheese: Crafting Food and Value in America*, and particularly her development of the concept of "microbiopolitics," exposes the role of a Pasteurian ideal in shaping Americans' sense of what makes food safe and how we conceive of risky food-related behavior.[7] Each of these works sheds light on the chasm between the FDA's recommendations, which implicitly demand public adherence due to their source, and the true nature of safe eating during pregnancy, which in many cases has not been studied rigorously enough to justify current warnings. In this article, cheese is a case study to examine the gap between the public health establishment's claims about how to be a "best possible" pregnant woman through food choice and the lack of scientific justification for many of those claims.

PREGNANCY, FOOD SAFETY & LISTERIA Pregnant women face daily challenges to make safe dietary choices and avoid any potential harm to their offspring, yet are often unequipped with sufficient information to do so. Advice about what to eat, what to avoid, and what to moderate during pregnancy abounds. However, much of this advice is based on incomplete or inadequate data, due to the ethical challenges of conducting high-quality studies on pregnant women.[8] Women are therefore compelled to heed guidance that does not meet the standard of other medical or public health initiatives and that is justified by a "better safe than sorry" explanation. Why should pregnant women ever make a choice to indulge taste preferences if there is even a small risk of harm to their baby?

Pregnancy is an iconic example of surveillance medicine, which assumes that healthy people are subject to risks and must constantly seek out and mitigate those risks.[9] This emphasis on identifying and warning against risk frames pregnancy as a fraught, hazardous time in the life of the mother.[10] She must be vigilant against a never-ending barrage of harms waiting around the corner to damage her baby.[11] In the endeavor to produce a "'best possible' child,"[12] norms of daily life—including eating according to taste preferences—are also suspended during this period. This emphasis on risk and risk avoidance creates a harmful paradigm for the mother. She is framed as the omnipotent power influencing the growing life inside her, yet feels overwhelmed in the face of contradictory advice about how

to provide the safest possible environment for her child.[13] The burdens of good decision making borne by pregnant women are compounded because the recommendations provided by the FDA and other sources of authoritative knowledge are not solidly based in reputable science.

A core area of food safety concern for expecting mothers is avoiding *Listeria*, a potentially deadly pathogen that can cause fetal demise and has been in the news repeatedly as the source of deadly outbreaks in recent years. *Listeria*[14] can be found in meat, poultry, seafood, dairy, and produce, and thrives even under refrigeration, unlike most foodborne pathogens.[15] Pregnant women are particularly vulnerable to *Listeria*,[16] and contracting listeriosis can lead to premature labor, fetal infection, or even miscarriage.[17,18] In 2004, the Centers for Disease Control and Prevention (CDC) created a nationwide *Listeria* initiative to track cases of confirmed listeriosis, which leads to about 250 deaths per year in the US,[19] about one quarter of the 1,000 annual deaths attributed to foodborne illness.[20] Pregnant women made up 17 percent of 762 reported listeriosis cases between 2004-2009 and were found to contract listeriosis 13-100 times more frequently than did the general population, although this disproportionate incidence may be partially explained by pregnant women having the illness recognized and diagnosed at a higher rate than the general population.[21]

Because of cheese's known association with *Listeria*, the FDA's and others' pregnancy eating guides encourage pregnant women to avoid certain cheeses, as well as a number of other foods. While cheese is a relatively small source of foodborne illness given the vast amounts consumed,[22] every "do not eat" list created by the FDA and others includes at least some types of cheese.[23] The FDA's list also includes other dairy, deli meats and hot dogs, refrigerated pâtés and meat spreads, and refrigerated smoked seafood.[24] *Listeria* is not limited to these foods, however, and official warnings about risks to pregnant women appear remarkably inadequate given a recent wave of *Listeria* recalls and outbreaks:

- Kellogg recalled approximately 10,000 cases of Eggo Waffles in September 2016 because of potential *Listeria* contamination.[25]
- At least 456 frozen vegetable products were recalled in March-July 2016 because of a multistate outbreak of listeriosis from vegetables traced to CRF Frozen Foods, including at least 10 products at Trader Joe's.[26]
- Sabra, a popular hummus brand, recalled 30,000 cases of product after samples were found to carry *Listeria* in April 2015.[27]
- Blue Bell Ice Cream, whose products have been linked to eight illnesses, including three deaths, from *Listeria* since 2011 has recalled all of its products as of April 20, 2015.[28]
- Amy's Kitchen recalled nearly 74,000 cases of organic frozen meals due to *Listeria* contamination on organic spinach in March 2015.[29]
- An additional recall of organic spinach involved four nationally distributed brands in March 2015.[30]
- Frozen ravioli made with organic spinach was also recalled in March 2015.[31]
- Jeni's Splendid Ice Creams, an artisanal ice cream producer in Columbus, OH, recalled all of its frozen products in April 2015 due to detection of *Listeria* in a number of pints and its production kitchen.[32]

As these outbreaks demonstrate, *Listeria* can come from many food sources. None of the foods above appear on the FDA's lists of risky foods for pregnant women, yet cheese, which has been responsible for a minority of outbreaks, is continually highlighted on these lists. The FDA should rethink its communications to pregnant women about avoiding *Listeria*, starting with a scientifically sound approach to cheese recommendations.

CHEESE'S DOCUMENTED LINKS TO LISTERIA OUTBREAKS A number of historical outbreaks have been traced to cheese.[33] In a CDC review of 24 confirmed *Listeria* outbreaks from 1998-2008, five were traced to cheese. Unpasteurized "Mexican-style" cheese was responsible for three of the outbreaks. Such cheese is illegal to sell because the FDA requires all unpasteurized cheese to be aged for sixty days, and these fresh cheeses are consumed in a much shorter time frame.[34] Two additional outbreaks were traced to pasteurized cheese, one "Mexican-style" and the other made from "pasteurized sheep's milk."[35] Another CDC review of 1,651 reported listeriosis cases from 2009-2011[36] found that 14 percent of cases were associated with pregnant women, and 64 percent of the affected women experienced preterm labor. In this review, six out of twelve outbreaks, but just 23 percent of cases, were found to have origins in cheese. Five of the six traced the outbreak to soft cheese that was labeled as pasteurized. An additional outbreak in 2013 was linked to consumption of pasteurized soft cheeses.[37] In 2009, an outbreak linked to a Mexican-style cheese production facility was traced to post-production contamination of properly pasteurized cheese.[38]

These outbreaks are a matter of concern for pregnant women and their care providers, but outbreak data indicate that non-cheese foods, including many that are not on do-not-eat lists, should be of greater concern. A CDC report on foodborne illnesses concludes that between 2008-2012, 31 percent of *Listeria*-related illnesses were linked to dairy (of all kinds, not just cheese), while 50 percent were attributed to fruit,[39] which is not included on the FDA's or CDC's lists of foods to avoid in any form during pregnancy. The report still warns, though, that *Listeria* "outbreaks have been frequently linked to the Dairy category, specifically with the consumption of soft cheeses by pregnant women and persons with weakened immune systems," reflecting historical tendencies to emphasize the dangers of cheese.

"Targeted prevention" has sometimes been utilized to communicate with Hispanic women who might not be aware of the risks of eating unpasteurized "Mexican-style" cheeses during pregnancy.[40] For example, after an outbreak of listeriosis in North Carolina, public health officials used public service announcements to communicate with Hispanic populations about the risks of *Listeria* during pregnancy and its association with cheeses they might encounter.[41] *Listeria* outbreaks from "Mexican-style" cheeses made with unpasteurized milk have been traced to unregulated facilities that sold cheese illegally or to homemade cheeses, both of which tend to stay within Hispanic communities and therefore affect Hispanic women disproportionately.[42] Such cheeses do not satisfy the FDA's sixty day aging rule for raw cheeses and have been made in unregulated facilities that may not meet sanitation guidelines. The frequency of outbreaks linked to raw "Mexican-style" cheeses is a therefore a regulatory and communications challenge, and does not reflect an inherent risk of eating cheeses of Latin American origin over those of European origin.

Good production practices and sanitation prevent *Listeria*, from milking through the entire cheesemaking process. The pathogen is not more likely to be present in one style of cheese over another (e.g., "Mexican-style" as opposed to a French-style cheese) if sanitary practices are followed. Furthermore, pasteurization is not sufficient to guarantee protection from *Listeria*. *Listeria* can form "biofilms" that are resistant to cleaning and sanitizing, rendering pasteurization insufficient because the pathogen can infect a pasteurized cheese during the aging and packaging processes even in an otherwise clean facility.[43]

This review of recent *Listeria* outbreaks involving cheese indicates that the primary culprits are illegally sold, unpasteurized, "Mexican-style" cheeses and soft cheeses that were made from pasteurized milk, but nevertheless contaminated during or after production. Recommendations about safe cheese consumption should, at a minimum, be derived from this historical outbreak data, but that is quite often not the case.

AMBIGUOUS & CONFUSING: CURRENT CHEESE RECOMMENDATIONS FOR PREGNANT WOMEN

Pregnant women concerned about making safe cheese choices during pregnancy must reckon with a range of advice that is often confusing and ambiguous. The following advice is readily available:

- FDA's "Food Safety for Moms-To-Be": "Don't eat: Soft cheeses like Feta, Brie, and Camembert, 'blue-veined cheeses,' or 'queso blanco,' 'queso fresco,' or Panela—unless they're made with pasteurized milk. Make sure the label says, 'made with pasteurized milk.'"[44]
- FDA's "The Dangers of Raw Milk": "If you are pregnant, consuming raw milk—or foods made from raw milk, such as Mexican-style cheese like Queso Blanco or Queso Fresco—can harm your baby even if you don't feel sick."[45]
- Centers for Disease Control's (CDC) "Listeriosis (Listeria) and Pregnancy": "Do not eat soft cheeses such as feta, Brie, and Camembert, blue-veined cheeses, or Mexican-style cheeses such as queso blanco, queso fresco, and Panela, unless they have labels that clearly state they are made from pasteurized milk. It is safe to eat hard cheeses, semi-soft cheeses such as mozzarella, pasteurized processed cheese slices and spreads, cream cheese, and cottage cheese […] Do not drink raw (unpasteurized) milk or eat foods that contain unpasteurized milk."[46]
- American College of Obstetricians and Gynecologists (ACOG) "Frequently Asked Questions": "Unpasteurized milk and cheese—These foods can cause a disease called listeriosis. Avoid cheeses that are made with raw milk (such as some feta, queso fresco, and bleu cheeses)."[47]
- What to Expect When You're Expecting, the "pregnancy bible" that is "read by more than 90% of pregnant women who read a pregnancy book":[48] "To protect yourself and your baby from hazardous bacterial infections, such as listeria, make sure all the milk you drink is pasteurized, and all the cheeses and other dairy products you eat are made from pasteurized milk ('raw milk' cheeses are not)."[49]

It is difficult to parse what is and is not safe based on this range of guidance. At least among public health authorities, the basic consensus seems to be: only eat soft cheese if it is pasteurized; all other cheese is fine. Yet both the FDA and CDC undercut this basic premise by recommending that pregnant women avoid all raw cheeses and/or all food made from raw milk (presumably including cheese). These contradictory statements are sometimes made within the same publication.

Further questions about definitions come swiftly when deployed in a real-world cheese shop or grocery store. Where is the line between soft and hard? Raw cheese may be sold legally in the US only after aging for sixty days, so only pasteurized Feta and Brie (both consumed before sixty days of aging) are legally sold here. Why is raw Feta on the list—what stores are selling raw Feta? Is young cheddar "soft" because it is not the hardest available version of the cheese? Is any raw cheese, including very hard cheeses like Parmigiano Reggiano (always raw), safe? What does the CDC mean by saying "mozzarella" is safe—does that apply to both fresh and aged mozzarella? If fresh mozzarella is safe, why are Feta or Brie unsafe, if the issue is softness? If *What to Expect* says no raw cheese at all, and the FDA implies that raw cheese might be fine as long as it is not soft, but the term "soft" is so vague, should pregnant women just avoid all raw cheese just in case? If soft cheese is risky, why is it safe to eat cream cheese and other soft processed cheeses?

While working at Lucy's Whey, I observed women struggling to implement these recommendations. Often, out of fear that they might harm their baby, they would move to an extreme interpretation, choosing a cheese that unambiguously met all of the guidance: hard and pasteurized. My observations at the cheese counter were validated on a larger scale through the survey I conducted: "Eating Choices During Pregnancy."[50] The survey asked women who had been or planned to be pregnant how they made or expected to make decisions about what cheeses to eat during pregnancy. The responses confirm that there is a wide range of interpretation about the risks of eating different kinds of cheese during pregnancy. Open-ended answers indicated that there is no clear-cut consensus on what the "rules" are, ranging from "no soft cheese" to "no raw cheese" to "no soft raw cheese" to "avoid soft cheeses because they are raw." In addition, many respondents were under the impression, based on the recommendations, that pasteurization eliminated all *Listeria* risks. Finally, many of the women surveyed, like customers at Lucy's Whey, avoided cheese during pregnancy if they were not precisely sure how the cheese in front of them fit into the "rules."

The lack of clarity in the recommendations is compounded by the fact that outbreak data do not support their basic premises. At the heart of this confusion is the inference that pasteurized cheese is safe and raw cheese is not, yet the truth is more complex. As discussed, most recent cheese-related outbreaks of *Listeria* were traced to unregulated "Mexican-style" cheeses, made with raw milk outside of the food safety infrastructure,[51] and to soft cheeses made with pasteurized milk that were contaminated after pasteurization. The recommendations only address one of these risk factors explicitly: eating soft cheese made with raw milk, which is rarely a factor in cheese selection because the examples given (Brie, Feta, "Mexican-style" cheeses) cannot legally be sold in the US as unpasteurized cheese. Women who shop or live in Hispanic communities may encounter raw "Mexican-style" cheese, but this environmental risk and the rationale for the warning is not explained. Soft pasteurized cheese, the other chief source of recent *Listeria* outbreaks, is explicitly listed as a safe option on these lists—an untenable position given the outbreak data.

As the recommendations broadly approve pasteurized soft cheeses and warn against raw cheeses of various types, they lend an air of suspicion to all raw cheese. This innuendo is unjustified, suggesting that even styles such as aged Parmigiano Reggiano, which is always raw yet does not provide a viable environment for *Listeria* growth, should be avoided. Pasteurization is not the panacea for soft cheese safety that these recommendations imply it is. In fact, pasteurization may even make certain cheeses more vulnerable to *Listeria* contamination because of the pathogen's ubiquity and the inability of a microbiologically "dead" cheese to fend off *Listeria* infection,[52] as we see in the outbreak reports of pasteurized cheese that was contaminated post-production.

Public health authorities have not methodically translated evidence of different cheese styles' vulnerability to *Listeria* contamination into actionable recommendations. Cheeses behave distinctly as they age, becoming more or less friendly to pathogenic growth depending on acidity development, salt content, and evolution of moisture levels;[53] the "soft vs. hard" dichotomy is inadequate to capture these factors. Even the sixty day aging requirement for unpasteurized cheese does not address the specific risk of *Listeria* contamination or any link between pasteurization, cheese age, and safeguarding against *Listeria*. The requirement is based on a single study conducted in 1949, which demonstrated that *Salmonella* could not survive sixty days in one style of cheddar;[54] it does

not address *Listeria* survival. This regulation is furthermore a blunt instrument that does not account for the behavior of different cheeses during the aging process. Camembert, for example, becomes friendlier to *Listeria* growth as it ages because its acidity falls over time in a high-moisture environment, whereas cheddar's acidity increases and moisture decreases as it ages, making it less hospitable to *Listeria*. Aging a raw Camembert-style cheese for sixty days would therefore make it more dangerous to consume than it would have been earlier in the aging process, when such cheeses are typically consumed.[55]

The internal contradictions woven throughout the recommendations, and their dubious scientific basis, creates confusion and doubt. These ambiguities must be addressed so that women understand the risks associated with different kinds of cheese they find, not a hypothetical raw Brie they will never encounter. Public health entities could offer a more nuanced takeaway than "raw vs. pasteurized" and "soft vs. hard," which are insufficient guideposts in an increasingly diverse cheese landscape.

A PROPOSED FRAMEWORK TO IMPROVE CHEESE RECOMMENDATIONS FOR PREGNANT WOMEN

Robust data to inform the FDA's recommendations are not out of reach, and could yield a more effective set of communications to pregnant women. The FDA has demonstrated its capacity to produce and disseminate nuanced authoritative knowledge about the risks and benefits of certain foods to vulnerable populations, but has not yet invested in such knowledge production for cheese.

The first step to improve the recommendations is to generate a data set of pathogenic risks for different cheese styles. Such data could be gathered without a risky randomized control trial involving pregnant women. The study should examine common styles of cheese for the characteristics that influence whether or not a cheese is likely to form a hospitable environment for *Listeria*, including water content, aging length and conditions, acidity, and pasteurization. This study should include at least the following categories of cheese:

- fresh unripened (e.g., Feta, queso fresco, fresh mozzarella);
- soft ripened (e.g., Brie, Camembert);
- washed rind (e.g., Taleggio, Epoisses);
- Alpine style (e.g., Gruyère, Comte, Swiss);
- cheddar and natural rind style;
- Gouda style;
- Grana and similar styles (e.g., Parmigiano Reggiano, Pecorino Romano); and
- blue (e.g., Roquefort, Stilton).

Each of these categories contains a limitless variety of cheeses, but such a framework would help public health authorities and consumers form a common language about cheese styles and the potential risks associated with them. The study could review a set of cheeses in the above categories, infected with *Listeria* both before and during production, and assess whether *Listeria* is able to survive typical production practices, including pasteurization. Data from this study could form the basis of new recommendations that actually account for *Listeria* survival under typical circumstances, rather than the extremes of unregulated production.

Next, the FDA should review the existing outbreak data and use it to inform updated recommendations. This review, like the brief version included in this article, would likely point to unregulated (e.g., raw "Mexican-style" cheeses) or soft cheeses contaminated after pasteurization as the primary culprits of *Listeria* outbreaks, conclusions that are not visible in the current recommendations. Based on the review in this article, soft cheeses that are likely to permit *Listeria* growth should be considered higher risk for pregnant women, even if they are pasteurized. Bringing together the epidemiological analysis of *Listeria*'s survival within different cheese production pathways, as well as outbreak data from *Listeria*-infected cheese, will provide the FDA a sound basis for developing a nuanced and clear set of recommendations.

The final step in updating the recommendations is to successfully communicate them to pregnant women themselves, as well as to the popular resources pregnant women often turn to for guidance. Although a more elaborate set of recommendations about cheese consumption may seem like a superfluous use of limited government resources, there is precedent for such nuanced recommendations. The FDA's information page about fish consumption for pregnant women and parents of young children lists more than thirty varieties of fish, their Omega-3 content, and their likely mercury load to help consumers make an informed choice about the relative risks and benefits of their fish selections.[56] The FDA could develop a similar table for styles of cheese with information about historical *Listeria* outbreaks and each cheese's likelihood of harboring *Listeria*. See Figure 1 below for an example of how the FDA could present such information.

To round out the effectiveness of its communications, the FDA should also reach out to pregnant women to understand the issues that they encounter when trying to select safe cheeses. A simple survey of pregnant American women could determine frequent questions that arise at

cheese counters, grocery stores, and restaurants, which the FDA could incorporate either into development of the table itself (by listing commonly mentioned cheeses) or as a supplementary "frequently asked questions" section. The question of where and how women encounter raw "Mexican-style" cheeses in their communities, for example, could be investigated so that the FDA and others might provide targeted support to help women avoid this risk.

Finally, the FDA should take steps to coordinate with popular pregnancy resources, such as *What to Expect When You're Expecting*, as well as professional organizations including the American College of Obstetricians and Gynecologists, to ensure that the resources pregnant women are most likely to reference are all speaking with one voice when it comes to cheese safety. In conjunction with a table like the one above, this set of communications would clearly articulate relevant risks and provide meaningful guidance on how to select the cheeses that are most likely to be safe without causing undue alarm and confusion.

CONCLUSION The FDA and other public health entities' recommendations for cheese consumption during pregnancy fall short in several regards. They are based on out-of-date science, do not correspond to historical outbreak data, fail to define what makes a cheese safe or unsafe, and create confusion through their ambiguity and internal contradictions. It is in the FDA's interest

CHEESE STYLES AND LISTERIOSIS RISKS FOR AT-RISK POPULATIONS

Cheese Style (Examples)*	Links to Listeria Outbreaks in Past 10 Years**	Listeria Risk - Pasteurized (1-5)***	Listeria Risk - Raw (1-5)****
Fresh, Unripened (Feta, Queso Fresco)			
Soft Ripened (Brie, Camembert)			
Grana Style (Parmigiano Reggiano, Pecorino Romano)			
Blue (Roquefort, Gorgonzola)			

Figure 1. Sample Framework: Cheese Consumption Recommendations for Pregnant Women

Note: When considering risks of cheese consumption, consumers should be aware that while statistical risks of contracting listeriosis are low, an infection can result in fetal demise and other significant effects. The risk therefore reflects the relative risks within the realm of encountering *Listeria*, not an overall risk to the general population; overall risk is very low.

* Outbreak reports that have linked cheeses in each style category to *Listeria* should be linked from the category headers.

** Number of times a cheese of this style has been linked to a documented *Listeria* outbreak in past ten years.

*** Based on FDA studies of cheeses of this style, is *Listeria* likely to survive when introduced at any point during the production process if the cheese is aged and consumed according to standard practices for that cheese style? Scale of 1 to 5: 1=very unlikely to harbor *Listeria* growth and 5=most likely to harbor *Listeria* growth.

**** Fresh and other young cheeses may not be legally available in an unpasteurized form. Higher-risk populations, including pregnant women and the elderly, should confirm pasteurization status of a cheese before considering how to assess its relative risk.

to address those shortcomings, as an improved set of recommendations would allow it to further its mission of protecting public health and shore up the agency's reputation for trustworthiness. The status of cheese as a well-known "risky" food for pregnant women, despite the uptick in *Listeria* outbreaks from non-cheese sources, illustrates the challenge of translating evolving food safety evidence into pragmatic recommendations for a vulnerable population. This is a challenge that the FDA can and should address by publishing clear, actionable recommendations that reflect the current understanding of where the greatest risks lie.

Some might argue that such an investigation of cheese does not warrant an allocation of limited public health dollars—that cheese is an issue only for a privileged few, those women wealthy enough to find themselves in specialty cheese shops like Lucy's Whey. This is not merely an issue for wealthy women manifesting taste preferences through esoteric cheese choices. Cheese provides a healthy food option for pregnant women that should only be restricted where it has a demonstrated potential risk to the fetus or mother. Cheese provides protein and calcium, both of which contribute to healthy fetal growth,[57] and is a good protein option for vegetarian mothers-to-be. Lactose-intolerant women may also find that they can consume cheese as opposed to milk or yogurt.[58] Although cheese is often high in saturated fat, its benefits when consumed as part of a balanced diet, including deliciousness, arguably outweigh this shortcoming. In addition, there is precedent for reevaluating foods that have long been considered risky for pregnant women: a federal panel recently issued a recommendation that the FDA and Environmental Protection Agency reassess their warnings to pregnant women about tuna consumption, given that tuna's nutritional benefits to the mother and fetus appear to outweigh the risk of potential mercury poisoning.[59]

Current recommendations privilege industrially produced cheese by not providing a clear road map for risk avoidance based on cheese styles. The public health establishment should be looking to trends in eating across the country to inform research and its resulting recommendations. Artisanal cheese is but one example of a cultural realignment of American expectations of what makes food "good" in every sense—safe and healthy, but also grown and distributed in a transparent fashion that supports producers and the environment.[60] Grocery stores and other food shops have modified their offerings to meet this demand. Kroger supermarkets, the largest grocery chain in the country,[61] has partnered with the famous New York City cheese shop Murray's to brand its specialty cheese departments and train cheesemongers, bringing a more artisanal cheese selection to more than 140 Kroger locations to date.[62] Smaller, independent grocery chains around the country have also increasingly used cheese to differentiate themselves.[63]

While sales numbers on small-scale, local and artisanal products are elusive, organics sales can be used as a proxy for "value-led" and "ethical" food purchasing trends. Certified organic food was a $43 billion industry in 2015, with 75 percent household penetration and representation in 75 percent of supermarket categories. Millennials, particularly millennial parents, drive growth in this category.[64] Shifts away from conventional agriculture, and perhaps toward artisanal and local products, are here to stay. Despite the economic burden of buying organic and other foods perceived to be "safe" (e.g., local, fresh), mothers across the socioeconomic spectrum manifest their goal of raising an "organic child" through consumption and purchasing choices.[65] Feeling pressure to buy only the best food and keep children "safe" from industrial food,[66] mothers are likely to continue purchasing organic, local, and other ethically oriented food as often as possible. Highly publicized recalls of industrial food because of *Listeria* contamination reinforce pregnant women's questions about which foods are safe for them to eat and could further influence their consumption choices. FDA recommendations for cheese consumption during pregnancy should reflect these shifting cultural values and consumption choices, just as grocery chains have adjusted their offerings to meet demand. The FDA risks undermining their own authority by continuing to publish outdated, confusing recommendations. A further disintegration of trust in the agency, which is accountable for a wide range of food safety recommendations and regulations, could lead to increased public health risks for Americans.[67]

The benefits of improving cheese consumption recommendations for pregnant women would be well worth the effort it would take to develop them. With an unambiguous, data-driven set of recommendations, the FDA could clearly communicate the potential risks and benefits of a variety of styles of cheese, give pregnant women the information they need to select safe cheeses, and align recommendations with the shifting gustatory preferences and food politics of today's mothers-to-be. It is time for the FDA to provide pregnant women with information that will transform their interactions at the cheese counter from fear-laden and guilt-ridden to healthy, safe, and delicious.

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biography | *Jessica Galen is a graduate of New York University Food Studies Master's program and holds a BA from Harvard University. Her academic and professional focus is artisanal cheese. She was the general manager of Lucy's Whey, an artisanal cheese shop and wine bar in New York City, and has worked with cheesemakers and affineurs. She is a contributor to the Oxford Companion to Cheese.*