

PEER-REVIEWED ARTICLE

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Photo by: Richard Stone

Online Purveyors of Raw Meat, Poultry, and Seafood Products: Delivery Policies and Available Consumer Food Safety Information

ABSTRACT

Hundreds of companies market perishable meats, poultry, game, and seafood (finfish and shellfish) directly to consumers online, with delivery via carriers such as FedEx® and UPS®. While these products are shipped in containers with gel-packs or dry ice, the packages are transported, stored, and delivered by use of the same methods as those used for non-perishable items, potentially exposing them to extreme temperatures. Except when signatures are required for delivery, packages may be left outside a customer's home (*signature release*), where they may be subjected to temperature abuse. The Web sites of 427 online purveyors of perishable meat, poultry, game and seafood were analyzed regarding the company's delivery policies and the food safety information they provide. Only 20 (5%) companies indicate that they require customer signatures upon delivery. More than half (58%) provide no food safety information on their Web sites, and only 30% provide safe cooking information (9% mention safe cooking temperatures), 24% discuss safe storage, 23% list handling information, and 16% provide information

about safe thawing. Moreover, the available food safety information is often difficult to locate and is sometimes inaccurate. The common delivery practice of signature release, potential resulting temperature abuse, and lack of food safety information on purveyors' Web sites may pose health risks to consumers.

INTRODUCTION

Selling perishable meats, poultry, and seafood products online is a large and growing business (2, 8). About one in ten Americans report having purchased or received perishable meat, poultry, or seafood from an online vendor that was delivered by a common carrier such as UPS® or FedEx® in the past year (6).

While virtually every kind of fresh meat, poultry, game, fish, shellfish, and seafood product is available for purchase from online purveyors, very little research has examined the factors that may influence the safe delivery, handling, storage, cooking, or consumption of these foods. Therefore, the purpose of this research is twofold: (1) to analyze the delivery policies of online

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purveyors of raw meats, poultry, and seafood products, and (2) to characterize the food safety information provided on the Web sites of these online purveyors.

Delivery policies

The production, processing and packaging of fresh meats, poultry, and seafood products requires that a Hazard Analysis Critical Control Points (HACCP) plan be in place to safeguard against temperature abuse while the food is in the custody of the purveyor (12, 21). However, the perishable nature of these products and a lack of control over the cold chain once the product leaves the purveyor pose real challenges to their safe shipment from producers to retail customers by use of parcel delivery services.

After leaving the custody of the company that packs them, the individual parcels containing perishable foods are treated no differently from any other package handled by FedEx® and UPS® (the two major carriers used). Unlike bulk shipments of perishable products that are typically delivered to retailers using refrigerated railcars and trucks, where an unbroken cold chain can be assured, individual parcels shipped directly to consumers are typically loaded, stored, transported, and delivered using loading docks, warehouses, trucks, cargo planes, and delivery vans without controlled temperatures (3). As a result, FedEx® (4) warns those shipping perishable goods: “Lows can reach -60°F (-51°C) in carrier vehicles and open dock areas during the winter in northern climates; highs can reach 140°F (60°C) in closed, parked carrier vehicles during the summer in southern climates.” Similarly, UPS® (15) informs its shipping customers: “Temperature extremes globally can range from -80°F to +160°F and can dramatically affect the performance characteristics of packaging material,” thereby affecting the integrity of these perishable products.

Both FedEx® and UPS® make it clear that it is the shipper’s responsibility to ensure that their packages are appropriately packed and contain enough refrigerants to ensure that their perishable goods reach their customers safely. In their respective terms of service, both FedEx® and UPS® also disclaim responsibility for perishable goods that become spoiled or damaged during the delivery process. FedEx® (5) emphasizes the importance of proper packaging of the perishable items by the vendor: “We are not liable for perishable articles unless packaged for a minimum transit time of at least 12 hours greater than our delivery commitment time for the shipment . . . Your failure to use proper packaging releases us from any liability for spoiled perishables that we would otherwise assume.” FedEx® (4) provides advice concerning how to properly package perishables in a separate fact sheet. The UPS® terms of service Section 3.13 (Perishable Commodities) goes further, categorically stating that all perishable items are the responsibility of the shipper (17), and will not accept any liability for damage to perishable items while they are being transported, even when the packages are delayed in transit.

Although perishable meats, poultry, game, and seafood are usually packed in containers with gel-packs, or dry ice, the bottom line is that packages containing them are transported, stored, and delivered using the same methods as those used for non-perishable items. Unless they are properly packed and contain sufficient refrigerants, this practice poses the risk of temperature abuse resulting in an increase of pathogenic bacterial growth and thus raises the likelihood of consumers being exposed to foodborne pathogens.

This potential food safety issue may be exacerbated by the common practice among purveyors of waiving the requirement that customers sign for a package upon delivery. This policy, referred to as *signature release*, *shipper release*, or *driver release*, means the parcel with perishable items may be left outside an exterior door. Some purveyors suggest alerting the intended recipient of the shipment that they should be at home to receive it or to ensure that a neighbor is available to accept the package. However, this is not always practical. In fact, in nearly half (47%) of married couples in America, both spouses are employed outside the home, which means that often no one is at home during the work day to receive packages (11). Packages of perishable meat, poultry, game, and seafood products are also very popular gifts. Unfortunately, the intended recipients of this largesse may not find it particularly convenient to stay at home to receive it or even be aware that a gift has been sent to them. As a result, packages containing perishable products can spend considerable time in outdoor locations before the recipient retrieves them, thereby potentially subjecting the contents to temperature abuse.

While the practice of signature release may pose increased food safety risks, from a customer’s viewpoint, not having to be home to sign for a package may be an attractive feature of ordering perishables online. Especially when the expected time of delivery is uncertain, waiting at home for a package to be delivered is inconvenient and inefficient, and doing so may result in lost productivity and income. In a 2011 survey of more than 1,000 American adults, more than 50% of the participants reported using a sick day or a vacation day to wait for a delivery or service, and 25% reported that they had lost wages because of it (9).

For the parcel delivery company, *signature release* is beneficial because it exempts the carrier from having to carry out multiple delivery attempts, which would be necessary if a signature were required. As a result, signature release may reduce overall shipping costs.

A second delivery attempt would also likely entail having the undelivered package remain on a delivery truck without appropriate temperature controls while the remainder of the packages on the route are delivered, then stored in an unrefrigerated warehouse overnight, and then put on a truck for delivery the next day. Therefore, waiving the need for a signature may also decrease the total amount of time that a package remains in transit, potentially reducing the likelihood that the refrigerants

inside the package will lose their ability to effectively cool the perishable contents.

Purveyors may benefit from signature release in another way. Some purveyors (e.g., allfreshseafood.com; always-freshfish.com; freshfromtheboat.com; thegreatgourmet.com) stipulate on their Web sites that *signature release* signifies customer acceptance of the order (i.e., it is equivalent to a signature). By agreeing to signature release of their package, the customer is responsible for full payment for their order, while the carrier is absolved from liability for loss or damage to the products once they have been delivered (16, 17).

A preliminary examination of purveyors' Web sites suggests that signature release is a common practice; however, its extent is undocumented. Therefore, the first part of this study was designed to document the stated delivery policies of online purveyors of perishable meats, poultry, game, and seafood products.

Food safety information

It is vital that food safety guidelines be adhered to when handling, storing, thawing, and cooking perishable products. Both the USDA Food Safety and Inspection Service (19, 20, 22, 23) and the FDA (13) emphasize that perishable foods should not be held at temperatures between 40°F and 140°F for longer than two hours. At these temperatures pathogenic bacteria can grow rapidly, but because they may not affect the taste, smell, or appearance of a food, their presence may not be detected by consumers (18). In addition, the USDA (19, 20, 22) urges consumers: to keep perishable items refrigerated or frozen, to thaw them either in the refrigerator or in the microwave oven and consume them immediately, to avoid cross-contamination, and to cook the products thoroughly. This includes cooking steaks to a safe minimum internal temperature of 140°F, ground beef to 160°F, and whole chicken to 165°F to destroy harmful bacteria, such as *Salmonella*, *Staphylococcus aureus*, *Campylobacter*, *Listeria monocytogenes*, and *Escherichia coli* (*E. coli*).

The content, design, and appearance of Web sites marketing perishable food products vary considerably. Some purveyors display the mere minimum regarding product information, pricing, and shipping on their Web sites, while others include detailed product and nutrition information, and preparation and cooking videos, as well as providing an overall easy navigation experience. Regardless of the online purveyors' marketing expertise or the Web sites' level of sophistication, food safety information concerning how to safely handle, store, thaw, and cook the perishable products they sell should be an essential part of Web site content to prevent potential foodborne illness among customers.

Yet there is no requirement that online purveyors display food safety information on their Web sites, and the extent to

which food safety information is incorporated into the Web sites of online purveyors of perishable meat, poultry and seafood is undocumented. Therefore, the second part of this study was designed to examine this question.

MATERIALS AND METHODS

Online purveyors were identified using *Google* searches including combinations of the terms online, delivery, meat, poultry, game, fish, shellfish, and seafood, as well as specific products in these categories, such as beef, ground beef, bison, buffalo, chicken, deer, venison, duck, goose, lamb, pork, turkey, fish, crab, clam, oyster, and lobster (7). The search terms initially yielded 516 Web sites. Companies were selected for further analysis if they were based in the United States, sold one or more uncooked perishable meat, poultry, game, or seafood products directly to consumers, were currently accepting orders, and shipped to consumers by use of a common carrier such as FedEx®, UPS®, or the US Postal Service (USPS®). Based on these criteria, 89 Web sites were excluded, leading to a sampling frame of 427 online vendor Web sites.

We examined whether purveyors specifically require customers to sign for the packages upon delivery or whether the signature requirement had been waived (i.e., whether a *signature release* policy was in place). Additionally, the Web sites were coded as to whether they provided information regarding safe handling, storing, thawing, and cooking (including temperature guidelines) of the perishable products they sold. The location of this food safety information on the Web sites was also recorded. As a measure of accessibility, the number of mouse clicks it took to find information related to food safety was used as a proxy for the number of levels that the consumer must navigate within a Web site to locate this essential information. Although food safety information might be available on multiple pages within one website, a conservative measure (i.e., where food safety information appeared for the *first* time) was chosen. All coding was conducted by two coders, who checked each Web site independently. Discrepancies in coding were corrected through consensus of the two coders.

RESULTS AND DISCUSSION

Delivery policies

We identified the Web sites of 427 online purveyors of fresh uncooked meats, poultry, game, and seafood (finfish and shellfish) who use common carriers, such as FedEx® and UPS® to ship directly to U.S. consumers. The types of foods offered on the Web sites are shown in *Table 1*, which shows that meat and seafood account for approximately one-third and one-fourth of the food items, respectively.

Forty-three percent of the Web sites surveyed offered seafood only; 14% offered meat only (beef, pork, lamb,

TABLE 1. Types of foods offered on Web sites

Types of Foods Offered on Web Sites	n	%
Meat	385	30
Seafood	278	22
Poultry	172	14
Game	141	11
Sausages	126	10
Jerky	63	5
Other	58	5
Deli meats	48	4
	1271	

Meat (beef, pork, lamb, goat)
 Seafood (finfish, shellfish, smoked fish)
 Poultry (chicken, turkey)
 Game (game birds [e.g., duck], game meat [e.g., bison])
 Sausages (meats, game, poultry)
 Other (e.g., yak, foie gras, lox)

or goat, excluding sausages). Eight percent of the purveyors sold all of the following: seafood, meat, poultry, and game.

Of 427 purveyor Web sites, only 20 (5%) indicated that they specifically require a signature at the point of delivery and will not deliver the package if no one is present to accept it. In contrast, 114 (27%) of the purveyors explicitly state that their packages are shipped *signature release*, meaning that no signature is required upon delivery, and packages will be left at an exterior door. The remainder (68%) provided no information on their Web sites concerning a signature requirement.

Orders were placed with a sample of 30 of the online purveyors randomly selected from among those that did not include delivery information on their Web sites. None of the 30 required a signature upon delivery. We hypothesize, therefore, that if purveyors do not specifically state on their Web sites that they require a signature, the likelihood is that the products will be shipped and delivered *signature release*.

A minority of purveyor Web sites (14%) advise customers to make sure that the intended recipient is at home to receive the perishable shipment, to arrange for a neighbor to accept the package and promptly refrigerate

its contents, or to have it sent to a business address, while the overwhelming majority (81%) do not make such recommendations. Instead, many purveyors simply add a disclaimer on their Web sites that they will not be responsible for the contents of the packages once delivered, including problems due to theft, spoilage, and weather conditions. Indeed, 51 of the purveyors (12%) specifically remind their customers that they will not be liable if no one is home to receive the delivery on the requested day, or if the package is left unattended, lost or stolen, or spoiled because of weather.

Online purveyors shipping perishables via *signature release* offer various arguments in support of this policy. Companies emphasize time and convenience as reasons to waive the signature requirement, e.g., “We do not require a signature for delivery. This avoids the need to wait for your package to arrive and delays for an additional delivery attempt the following day” (willapa-oysters.com) and “. . . This means that if you are at work during the day, you can expect your package to be waiting for you on your doorstep” (ilovecrabs.com). Other online purveyors stress the perishable nature of their products and the benefits of signature release in avoiding potential spoilage: “This ensures that FedEx® does not “hold”

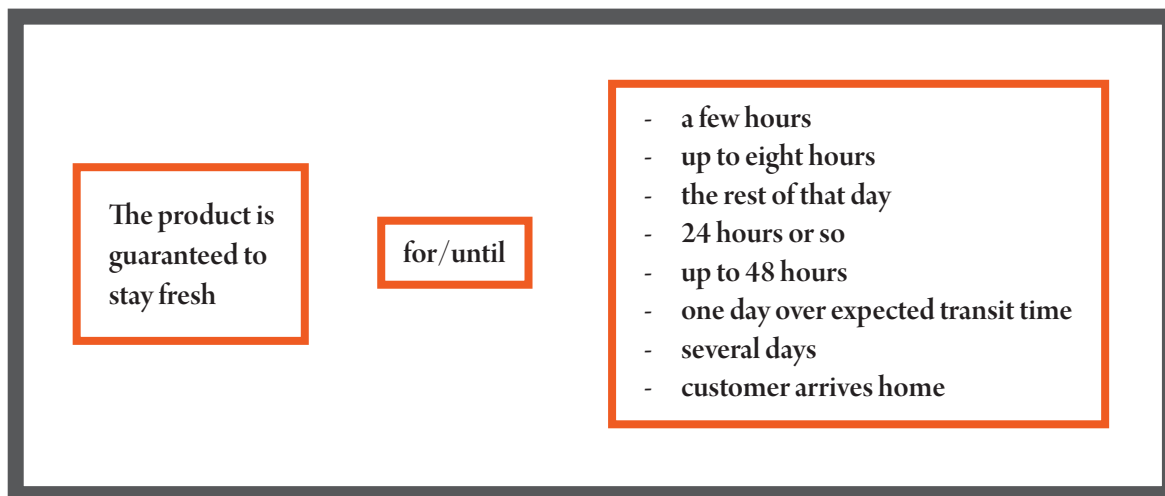


Figure 1. Examples of time frames for guaranteed freshness

your perishable meat products” (meyernaturalangus.com); “due to our products being perishable and for the convenience of our customers there is no signature required when receiving your order” (beststonecrabs.com). Interestingly, the same argument is used by companies requiring a signature, e.g., “You will need to sign for your order and ensure someone is available for accepting your package due to the products being perishable” (athomasmeats.com).

It is important to note that signature release is not an option in all circumstances. A signature is required upon delivery for orders exceeding a value of \$500 for packages shipped by FedEx® (5) or \$999 for packages shipped by UPS® (16, 17). In addition, packages for recipients living in residences that are part of gated communities, condos, or apartment buildings will not be left at the door, and require a signature.

Because the perishable nature of their products, some online purveyors do urge their customers to make arrangements for the package either “to be left in a cool, dry spot away from the sun” (e.g., catchapieceofmaine.com), or “to ship to a business address where someone is guaranteed to be present to accept the package” (e.g., peterluger.com), or “to send a gift certificate instead” (e.g., shoplegalseafoods.com).

Several purveyors posted statements on their Web sites regarding the guaranteed freshness of their products upon delivery and beyond. However, there is considerable variability in the length of time that online purveyors promise that their perishable products will remain “fresh” or “frozen” in their packages after delivery. Interestingly, these claims are independent of whether the items are shipped fresh or frozen. Examples are displayed in Fig. 1.

In addition to the variability in the time frame claimed for product freshness, purveyors also use an array of terminology to describe what they guarantee. Products are variously guaranteed to stay “fresh,” “ok,” “to last,” to remain “frozen,” “sufficiently frozen,” and to “withstand temperatures in transit” — terms that are rather vague and imprecise.

Food safety information

More than half (58%) of the purveyors offer no information related to the safe handling, storage, thawing, or cooking of their raw products. Examination of the 180 Web sites that do provide some food safety information reveals that the majority of the information (72%) focuses on cooking/preparation methods for their products; 58% refers to best product storage methods; and 54% gives instructions concerning how to best handle the food items. Thirty-eight percent (n = 68) of the information provided refers to thawing advice, and only 22% (n = 40) of the food safety information catalogued mentions safe internal cooking temperatures.

In addition, one quarter (25%) of the 180 Web sites that list food safety instructions provided information about only one food safety component (i.e., cooking, storage, handling, thawing, or temperature guidance), and about one third (34%) addressed two of the five food safety areas. Only nine (5%) of the Web sites provided information about all five food safety components.

The results in Table 2 demonstrate that even when present on the Web sites, food safety information is not typically displayed on a purveyor’s homepage. Instead, among the 180 Web sites that offer any food safety information, it takes a mean of 1.7 (SD = 0.8) clicks to access information relevant to food safety.

TABLE 2. Number of mouse clicks to obtain food safety information

Number of Mouse Clicks	n	%
One	90	50
Two	67	37
Three	16	9
Four	4	2
Five	1	1
Six	1	1
Total	179*	

n = 427

*For one Web site the number of clicks could not be determined.

The food safety information that does appear on the Web sites is often not made obvious. Of the 180 Web sites that contain food safety information, most (22%) list food safety instructions under a Frequently Asked Questions (FAQ) tab on their main page. Thus, to find food safety information, consumers would need to know to read through the FAQ section. For the remainder of the Web sites (n = 141), where to find food safety information may be even less clear to consumers (*Table 3*).

Searching for food safety information on the Web sites may also be difficult. Of the 427 purveyors whose Web sites were analyzed, only four (1%) explicitly use the term “food safety.” Three of those refer to what the customer can do to safely handle, store, and cook the perishable food items. One company lists a “Food Safety Commitment” link on their Web site discussing “proper safe handling instructions”; another purveyor provides extensive “Food Safety Information” on its Web site including “Freezing and Food Safety”; a third Web site includes a “Food Safety” link that explains how to handle live shellfish; and the fourth addresses its own sanitation and monitoring policies on the “Food Safety” tab of its Web site. The remaining Web sites use a variety of terms under which the reader can find information concerning how to safely handle, store, thaw, and cook their products, including tabs labeled “Cooking Tips,” “Customer Service,” “Shipping,” “Recipes,” “Seafood Facts,” “About Us,” “How To . . .,” and others.

Twelve terms were used only once and are not individually listed in *Table 3*. For those 12 Web sites, food safety information was found under tabs and links, such as a grilling video, a different homepage, “Care of Your Product,”

“Contact Us,” “Crawfish Storage,” “Health & Nutrition,” “Market,” “Prepare,” “Read Our Safe Thawing Instructions,” “They’ve Arrived,” “Tools & Resources,” and “Why Yak Meat” – terms which, with the exception of “Read Our Safe Thawing Instructions,” are not intuitively understood by a consumer when searching for food safety information. Thus, although the information might exist on the Web site, the terminology used is not conducive to eliciting a search response for “food safety” from customers.

Information concerning what customers should do if the products they receive are spoiled, damaged, or otherwise unsafe to consume was also lacking. Half of the vendors (n = 215) do not list any information regarding refunds for spoiled, damaged, or unsatisfactory products, while 42% (n = 179) of the companies indicate that they will issue a refund for damaged or spoiled food products deemed unsatisfactory by customers. In contrast, 8% (n = 33) of the purveyors indicate that will not provide refunds, including disclaimers on their Web sites such as “Due to conditions beyond our control, once the package leaves our facility it is the responsibility of the customer to take the necessary steps to insure the quality of the product within,” or “All sales are final,” or referring specifically to the perishable nature of their products, “Perishable food cannot be returned,” or “Due to the nature of the products, perishable items, such as meat, poultry, and dairy are not eligible for refund.”

In addition to failing to provide useful food safety information, some purveyors provided inaccurate information. In particular, several (n = 19 [4%]) stated that their perishable food is safe to consume as long as it is

TABLE 3. Wording of tabs or links leading to food safety information

Wording of Tabs or Links	n	%
Frequently Asked Questions/FAQ/Questions	40	22
Cooking tips/guide/manual	24	13
On individual product page	22	12
Customer service/support	13	7
Shipping (policy)	10	6
Recipes	7	4
Seafood facts	7	4
About (us/food)	6	3
How to...	6	3
Food Safety (information/commitment)	4	2
Place an order/order info	3	2
Resources	3	2
Serving suggestions/tips	3	2
Ask the butcher	2	1
Buy (wild ocean) seafood	2	1
Food	2	1
Grilling	2	1
Handling	2	1
(Re-)Heating instructions	2	1
Help	2	1
Online store	2	1
Quicklinks/quick tips	2	1
Policy & procedures	2	1

n = 180

Reported here is where food safety information appeared on the Web site for the first time. Twelve terms were used only once and are reported in the text.

“cool to the touch” upon arrival. For example, one purveyor in Alameda, California, posts on its Web site that products “may be thawed upon arrival, but are safe to use and can be refrozen if they are cool to the touch.” Another company in Reno, Nevada, refers to the USDA in attesting, “Yes, it is safe to eat the meat as long as it is cool to the touch, according to USDA standards.” However, the USDA does *not* make such a recommendation. On its food safety fact sheet on ground beef, in response to the question, “What’s the best way to handle raw ground beef when shopping?” the USDA (22) posits “At the store, [to] choose a package that feels cold and is not torn.” In addition, it advises that to “keep bacterial levels low, store ground beef at 40°F (4.4°C) or below and use within 2 days, or freeze.”

Unfortunately, touch is a poor indicator of whether a product is being held at a safe temperature. Products may feel “cool” and be well above 40°F. Moreover, some food pathogens, such as *L. monocytogenes*, can multiply at temperatures as low as 4°C (1). As a result, the product might still feel cool, yet harbor pathogenic bacteria that make it unsafe for consumption. In fact, the USDA (24) specifically instructs customers to check the temperature of food items immediately upon delivery using a food thermometer, and not to consume the product if its temperature is above 40 degrees. Therefore, purveyors’ “cool to the touch” advice to its customers is not safe, and might pose a potentially serious health risk, especially to consumers whose health might be compromised, such as the elderly, young children, or pregnant women.

CONCLUSIONS/RECOMMENDATIONS

Purchasing perishable products online may pose a food safety risk because of the nature of the prevailing shipping methods. After leaving the purveyors’ facilities, these packages containing refrigerated or frozen foods are generally treated no differently than any other non-perishable packages handled by FedEx® or UPS®. Unless they are appropriately packaged and contain sufficient refrigerants, exposure to extreme temperatures during transit and delivery may lead to temperature abuse of the perishable contents, contributing to the proliferation of food pathogens affecting the safety of the perishable items.

The prevalent *signature release* delivery policy of online purveyors of raw meat and seafood products may further expose these products to extreme temperatures for extended periods. Yet, requiring signatures may not be the answer. When a signature is required but not obtained at the first delivery attempt, the amount of time the package of perishables spends in transit without appropriate external temperature controls significantly increases. This also presents the risk of temperature abuse resulting in the growth of pathogenic bacteria.

The risk to consumers is further exacerbated by the lack of food safety information on the purveyors’ Web sites.

The results of this study suggest that customers may have difficulties finding food safety information on the vendor Web sites and thus lack relevant information on how to safely handle, store, store, or cook the products. Worse yet, some purveyors provide inaccurate advice to consumers, instructing them that perishable products that “feel cool to the touch” are safe to cook and consume.

Vendor and carrier policies disclaiming responsibility for the delivery of spoiled, damaged, or unsafe perishable goods, and the lack of clear recourse for consumers when they receive unsafe products, may also be especially problematic. Faced with the option of discarding potentially unsafe but very expensive perishable items, some consumers may simply decide to consume the products rather than “waste them.”

Consistent with the 2011 FDA Food Safety Modernization Act (FSMA), which shifts the focus of federal regulators from responding to contamination to preventing it (10, 14), online purveyors of perishable meats, poultry, and seafood products should be required to clearly post food safety information (e.g., how to best handle and store their perishable products upon delivery, how to safely thaw them, and how to properly cook them, ideally with temperature guidelines) on their Web sites to reduce the risk of foodborne illness.

Food safety information should be easy to find on these Web sites, and ideally should be displayed either on the home page (first page) or in conjunction with the individual food products, as handling and storage methods, as well as cooking preparations and cooking times (including recommended cooking temperatures) differ depending on the type of perishable item. Adopting more consistent terminology for food safety information among online purveyors of perishables food products would prove equally useful for customers, who would know exactly what to look for instead of having to blindly search for food safety information only to accidentally find it under the “Serving Suggestions” or “Tools & Resources” tabs.

Reasonable return or reimbursement policies are also necessary when perishable products are spoiled, damaged, or made unsafe during the delivery process. These also need to be clearly stated on the purveyor Web sites.

In conclusion, there is a theoretical risk of temperature abuse and consequently of consumer exposure to pathogens and foodborne illness when consumers eat perishable products such as raw meats, poultry, and seafood purchased online. However, additional research is needed to assess whether online purchases of these items do in fact present a food safety issue. Future studies need to explore potential temperature abuse in these shipments and whether there is a difference in product temperatures upon arrival under the conditions of a signature being required versus “signature release.” Further research needs to analyze the prevalence of microbial pathogens in these products and assess additional

variables, such as packaging materials and types of coolants used in the shipment of perishable products. These are just some queries in the realm of direct-to-consumer online purchases of meats, poultry, game and seafood products future research should explore to make this growing business form as safe as possible for consumers.

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REFERENCES

1. Eley, A. 1992. Food safety in the home. Current microbiological perspectives. *Nutr. and Food Sci.* 5:8–13.
2. eMarketer. 2013. Retail ecommerce set to keep a strong pace through 2017. Available at: <http://www.emarketer.com/Article/Retail-Ecommerce-Set-Keep-Strong-Pace-Through-2017/1009836>. Accessed 5 May 2014.
3. Estrada-Flores, S. 2006. Transportation of frozen foods, p. 227–242. In Sun, D. (ed), *Handbook of frozen food processing and packaging*. CRC Press, Boca Raton, FL.
4. Federal Express. 2010. Packaging pointers: Perishable shipments. Available at: http://www.themailcenteretc.com/pdf/Pointers_Perishable.pdf. Accessed 10 May 2013.
5. Federal Express. 2014. Service guide. Available at: http://images.fedex.com/us/services/pdf/Service_Guide_2014.pdf. Accessed 9 October 2014.
6. Godwin, S. L., R. W. Stone, A. Senger-Mersich, and W. K. Hallman (unpublished). Food safety information recalled by consumers who purchased and/or received raw meat, poultry, or seafood products from online purveyors. Tennessee State University.
7. Hallman, W. K. 2011. Listings of companies offering perishable meat and seafood products delivered by common carriers. Rutgers, The State University of New Jersey.
8. Lipschultz, D. 2003. The internet widens the butcher's reach. Available at: <http://www.nytimes.com/2003/02/23/business/yourmoney/23BD1G.html>. Accessed 17 February 2011.
9. Smith, R. A. 2012. The wait-time misery index. Available at: <http://online.wsj.com/news/articles/SB100014240529702045202045772516206549282022012>. Accessed 4 October 2013.
10. United States Government Printing Office. 2011. FDA Food Safety Modernization Act. Available at: <http://www.gpo.gov/fdsys/pkg/PLAW-111publ353/pdf/PLAW-111publ353.pdf>. Accessed 12 June 2014.
11. U.S. Bureau of Labor Statistics. 2014. Employment characteristics of families — 2013. Available at: <http://www.bls.gov/news.release/pdf/famee.pdf>. Accessed 9 May 2014.
12. U.S. Food and Drug Administration. 2011. Fish and fisheries products hazards and controls guidance (4th ed). Available at: <http://www.fda.gov/downloads/Food/GuidanceComplianceRegulatoryInformation/GuidanceDocuments/Seafood/UCM251970.pdf>. Accessed 23 May 2014.
13. U.S. Food and Drug Administration. 2013. Fresh and frozen seafood: Selecting and serving it safely. Available at: <http://www.fda.gov/food/resourcesforyou/consumers/ucm077331.htm>. Accessed 15 May 2014.
14. U.S. Food and Drug Administration. 2013. FDA strengthening our food safety foundation. Available at: <http://www.fda.gov/downloads/ForConsumers/ConsumerUpdates/UCM334128.pdf>. Accessed 12 June 2014.
15. United Parcel Service. 2005. Air freight packaging pointers. Available at: https://www.ups-scs.com/tools/packaging_pointers.pdf. Accessed 8 May 2013.
16. United Parcel Service. 2014. Shipper Release. Available at: http://www.ups.com/content/us/en/shipping/time/service/value_added/release.html. Accessed 13 May 2014.
17. United Parcel Service. 2014. UPS® Tariff/Terms and Conditions of Service — United States. Available at: http://www.ups.com/media/en/terms_service_us.pdf. Accessed 6 June 2014.
18. United States Department of Agriculture: Food Safety and Inspection Service. 2010. Refrigeration and Food Safety. Available at: http://www.fsis.usda.gov/wps/wcm/connect/934c2c81-2a3d-4d59-b6ce-c238fdd45582/Refrigeration_and_Food_Safety.pdf?MOD=AJPERES. Accessed 12 May 2013.
19. United States Department of Agriculture: Food Safety and Inspection Service. 2013. Beef from farm to table. Available at: http://www.fsis.usda.gov/wps/portal/fsis/topics/food-safety-education/get-answers/food-safety-fact-sheets/meat-preparation/beef-from-farm-to-table/ct_index. Accessed 16 May 2014.
20. United States Department of Agriculture: Food Safety and Inspection Service. 2013. Chicken from farm to table. Available at: http://www.fsis.usda.gov/wps/portal/fsis/topics/food-safety-education/get-answers/food-safety-fact-sheets/poultry-preparation/chicken-from-farm-to-table/ct_index. Accessed 16 May 2014.
21. United States Department of Agriculture: Food Safety and Inspection Service. 2013. FSIS Compliance Guideline. HACCP Systems Validation. Available at: http://www.fsis.usda.gov/wps/wcm/connect/a70bb780-e1ff-4a35-9a9a-3fb40c8fe584/HACCP_Systems_Validation.pdf?MOD=AJPERES. Accessed 6 June 2014.
22. United States Department of Agriculture: Food Safety and Inspection Service. 2013. Ground beef and food safety. Available from http://www.fsis.usda.gov/wps/portal/fsis/topics/food-safety-education/get-answers/food-safety-fact-sheets/meat-preparation/ground-beef-and-food-safety/ct_index. Accessed 16 May 2014.
23. United States Department of Agriculture: Food Safety and Inspection Service. 2013. Kitchen companion: Your safe food handbook. Available from http://www.fsis.usda.gov/wps/portal/fsis/topics/food-safety-education/get-answers/food-safety-fact-sheets/safe-food-handling/kitchen-companion-your-safe-food-handbook/ct_index. Accessed 3 May 2014.
24. United States Department of Agriculture: Food Safety and Inspection Service. 2013. Mail order food safety. Available from http://www.fsis.usda.gov/wps/portal/fsis/topics/food-safety-education/get-answers/food-safety-fact-sheets/safe-food-handling/mail-order-food-safety/ct_index. Accessed 10 June 2014.