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Original Article

Food-borne diseases knowledge, attitude, and practices of women living in East Azerbaijan, Iran

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Abstract

Introduction: Food-borne-related illnesses are important worldwide, as they are responsible for considerable morbidity, mortality, and economic costs.

Methods: This cross-sectional study was conducted on 384 women in Tabriz, East Azerbaijan, Iran, who were chosen through stratified random sampling method, using a validated and reliable questionnaire prepared by the researchers. The aim of the present study was to examine the knowledge, attitude, and behaviors related to food-borne diseases among women in Tabriz who had the main responsibility for food preparation at home.

Results: Women had a good level of knowledge, attitude, and practice on most important factors related to food poisoning. There was a significant relationship between women's attitude and practice, and their knowledge.

Conclusion: Our results showed a good level of information of the women in Tabriz about protection against food-borne diseases; however, some practices were threats to food safety. There is a need for further education and information on the disadvantages of eating raw or semi-processed foods.

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Introduction

Food-borne-related illnesses are important worldwide, as they are responsible for considerable morbidity, mortality, and economic costs.[1,2] The consumption of water and food contaminated with potential food-borne pathogens such as bacteria, viruses, parasites, and toxins accounts for more than 250 different food-borne diseases.[3] Symptoms of food-borne diseases include vomiting, nausea, and diarrhea, which typically last for 2 to 3 days in most individuals. Further intense complications can also occur because of food-borne diseases in certain patients. These intense complications may include hospitalization due to sepsis, hemolytic uremic syndrome (HUS), stillbirth, and death.[4] Annually, almost 48 million or 1 in 6 persons in the United States fall patient, 128000 are hospitalized, and 3000 die from food-borne diseases;[5] so, food safety and hygiene knowledge and practices are of very importance in the prevention of these diseases.

Food-borne diseases happen as a result of consumption of the food contaminated with microorganisms or their toxins. The contamination occurs because of unhygienic handling practices, preservation methods such

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as inadequate cooking or improper cooling and food storage, cross-contamination from food contact surfaces and raw and cooked foods or from persons sheltering the microorganisms in their nose and on their skin, and poor personal hygiene such as hand washing;[6,7] therefore, consumers' food handling and preparation behaviors are important means to decrease food-borne diseases. Unhygienic practices during food preparation provide the conditions that allow the multiplication of disease caused by microorganisms.[8,9] International studies have appraised that a considerable proportion of food-borne diseases occur in practices in the kitchen of a home.[10,11] Fortunately, many of these food-borne diseases are preventable with safe food-handling behaviors exercised during every level of food preparation and storage.[12] For example, primary research proposed that avoiding preparation of food in very advent of cooking, temperature control, and preventing cross-contamination from other foods and utensils could all reduce food-borne diseases.[13,14] Over the past few years, most of the work has been centered on control of hazards in the production section, but not an equal attempt was dedicated to improving the food safety education to the consumers. Given that it is currently impossible for food producers to ensure a pathogen-free food supply, the food preparation at home is an acute link in the chain to prevent food-borne diseases;[15] hence, domestic food preparation can negate most of the attempt of prime and secondary food producers to provide safe food. A study on food safety-related knowledge and practices of mothers in Hyderabad, India, showed that above 60% of stored cooked food was left over at room temperature. While above 90% of mothers washed their hands before nourishing children, eating, and cooking food, high incidence of food-borne illnesses was reported in the families (21%) and community (12%).[16]

Another study was conducted on the evaluation of food hygiene awareness, attitudes, and practices on food in Turkey. The study showed that food handlers in Turkish food businesses had lack of knowledge about the basic food hygiene (critical hot/cold temperature for ready-to-eat foods, acceptable refrigerator temperature limits, and cross-contamination). Hence, there was an immediate need for education and increasing the knowledge and awareness among food handlers regarding safe food handling practices.[17] Abdul-Mutalib et al. conducted a study on the knowledge, attitude, and practices regarding food hygiene and sanitation of food handlers in Malaysia. The results showed that considering the people with the necessary knowledge on food hygiene, there was a significant relationship between the components of knowledge, attitude, and performance, as well as the level of education and attitude.[18] Haji Mohammadi et al. carried out a study on knowledge, attitude, and practices of women in Shiraz, Iran, about food-borne diseases. Their results demonstrated that women had moderate to good level of knowledge, attitude, and practices about food-borne diseases.[19] Askarian et al. conducted a study on meat processing plants in Fars Province, Iran, and reported that the respondents had an acceptable level of knowledge, excellent attitude, and poor practices towards food hygiene measures.[20] Talaei et al.[21] conducted an investigation on knowledge, attitude, and practice of people in Isfahan, Iran, about the foodborne outbreak and found that the knowledge led to attitude and the attitude led to practice. Also, it is essential for people to start training to improve their knowledge, attitude, and practice and learn about factors influencing foodborne outbreaks. In another study by Cheraghi et al.[22] on the knowledge, attitude, and practice regarding water and foodborne outbreak in Yazd Province, Iran, it was shown that the total mean scores of knowledge and practice were highest among housekeepers (since the majority of housekeepers were women), and with the increase in the score of knowledge about food and water outbreak, the score of practice increased slightly.

Many other studies assessing various types of consumer groups identified the food preparation in the family home as the main source of food poisoning. These studies uncovered a lack of food safety knowledge and the need to promote food safety behaviors for particular aim groups.[20,23,24] Accordingly, increased awareness of individuals had a very effective role in improving nutritional status. Since women have a very important role in the process of cooking and preparing food at home, raising their awareness on the health practices and careful preparation of food can be effective in reducing the illnesses or food poisoning. Therefore, an important purpose was to educate them about preparation of food using a system of good nutritional practices that emphasized dangerous food handling techniques and the microbiological reasons of food-borne diseases. Receiving data on food safety knowledge and practices is necessary for the advent of impressive health education programs in an attempt to reduce the dangers associated with improper food handling at home. There are a number of studies have identified the necessity for continued efforts towards educating consumers on the dangers of inappropriate food handling. However, in relation to the results of literature review, thus far, there has been no research on the evaluation of knowledge, attitude, and practices towards food-borne diseases among inhabitant women in Tabriz City, Iran, and also the important role of women in preventing food-borne diseases. Therefore, the objective of this study was to evaluate the knowledge, attitude, and practices about food safety and food-borne diseases among women in Tabriz.

Methods

This cross-sectional study was conducted among 384 women in Tabriz who were chosen through stratified random sampling method, which was calculated by the following equation:

$$n = \frac{Z^2 p(1-p)}{d^2}$$

Where n is estimated sample size, Z is critical value (1.96), P = 0.5, and d = 0.05.

A reliable questionnaire designed by the researchers was used for data collection. The first part of the questionnaire included demographic information of the participating women namely, their age, level of education, number of children, and having passed courses related to health and food safety, food poisoning, and economic situation. The second part of the questionnaire dealt with the knowledge of the respondents about an emphasis on personal hygiene, microbiological food hazards, and specific food-borne diseases. Fifteen questions were provided and participants answered the questions using a three-point rating scale (true, false, and no idea). The third section of the questionnaire included the questions related to attitude. In the attitude part, there were 15 close-ended questions about food safety. Each question was provided with three possible answers (true, false, and no idea). Practices of women were diagnosed with their self-reported hygienic behaviors in the last part of the questionnaire. In this part, 20 questions were designed with the two-point rating scale (yes, no).

Descriptive statistics (mean, frequency, percentage) and statistical tests such as Pearson's correlation coefficient and Student's t-test were conducted using SPSS software (version 16, SPSS Inc., Chicago, IL, USA). A significance level of 0.05 was considered for the statistical tests.

Results

Analyzable questionnaires were filled out by 384 women in Tabriz. Demographic characteristics of study participants are listed in table 1. Most respondents were 30-49 years old, had an associate degree, and were married. Further, it was found that 56.7% of respondents had attended training classes and 43.3% had never participated in any training class related to food safety.

The responses of women to the items on knowledge of food-borne diseases are presented in table 2. According to the

responses, more than 73.0% of participants had good knowledge (answered correctly) on each of five expressions out of 15. These are: question number 1) ''Food poisoning occurs by pathogenic microorganisms" (86.7%), question number 3) ''Drinking raw milk increases the risky food poisoning" (86.7%), question number 4) ''Eating raw eggs greatly increases the risk of food poisoning" (88.2%), question number 5) ''Eating raw and half-cooked meat greatly increases the risk of food poisoning" (96.7%), and question number 13) ''Keeping food at refrigerator temperature will slow down the microbial growth and multiplication, thereby preventing food spoilage and food poisoning" (90.0%). On the other hand, about 50% of the women had little knowledge (answered incorrectly) on three expressions related to food-borne diseases. These are: question number 11) ''Raw white cheese produced from raw milk (not heated) has a risk of food poisoning" (45.0%), question number 12) ''Pasteurized milk can be drunk directly with no food poisoning" (46.7%), and question number 15) ''There is no risk of food poisoning from eating left-over cooked food kept in the refrigerator for 2-3 days" (60.0%).

Table 1. Demographic characteristics of participants (n = 384)

Variable		Value
Age (year) [n (%)]	20-29	78 (20.0)
	30-39	153 (40.0)
	40-49	153 (40.0)
	50-59	0 (0)
	60-70	0 (0)
Education [n (%)]	< diploma	90 (23.3)
	Associate degree	128 (33.4)
	Undergraduate	115 (30.0)
	> Master	51 (13.3)
Marital status [n (%)]	Single	78 (20.0)
	Married	306 (80.0)
Number of children [n (%)]	0	104 (26.7)
	1-2	166 (43.3)
	3	104 (26.7)
	> 3	10 (3.3)
Passing courses related to health and food safety [n (%)]	Yes	218 (56.7)
	No	166 (43.3)
Food poisoning [n (%)]	Yes	205 (53.3)
	No	179 (46.7)
Economic situation [n (%)]	Low	78 (20.0)
	Middle	166 (43.3)
	High	140 (36.7)

Table 2. Response of women living in Tabriz City, Iran, to knowledge part of questionnaire on food poisoning

Question statement	True [n (%)]	False [n (%)]	No idea [n (%)]
Food poisoning occurs by pathogenic microorganisms.	333 (86.7)	0 (0)	51 (13.3)
Some toxins produced by the microorganisms and causing food poisoning are resistant to heating temperature of food.	282 (73.3)	51 (13.3)	51 (13.3)
Drinking raw milk increases the risky food poisoning.	333 (86.7)	12 (3.3)	39 (10.0)
Eating raw eggs greatly increases the risk of food poisoning.	339 (88.2)	39 (10.1)	6 (1.7)
Eating raw and half-cooked meat greatly increases the risk of food poisoning.	372 (96.7)	13 (3.3)	0 (0)
Eating raw and unwashed vegetable greatly increases the risk of food poisoning.	294 (76.7)	51 (13.3)	39 (10.0)
Eating unwashed and not pealed fruits greatly increases the risk of food poisoning.	282 (73.3)	63 (16.7)	39 (10.0)
Food handlers with unhygienic practice could be the source of microbial contamination of the food, which causes food poisoning.	321 (83.3)	63 (16.7)	0 (0)
Well-cooked food is free form microbes, which cause food poisoning.	180 (46.7)	165 (43.3)	39 (10.0)
Eating uncovered leftover cooked foods, kept at room temperature for 12 to 24 hours, is at the risk to cause food poisoning.	307 (80.0)	26 (6.7)	51 (13.3)
Raw white cheese produced from raw milk (not heated) has a risk of food poisoning.	210 (55.0)	96 (25.0)	78 (20.0)
The consumption of pasteurized milk drunk directly can cause a food poisoning.	205 (53.3)	101 (36.7)	39 (10.0)
Keeping food at refrigerator temperature will slow down the microbial growth and multiplication, thus prevents food spoilage and food poisoning.	345 (90.0)	39 (10.0)	0 (0)
Drinking surface water such as rivers, streams, and rainwater reservoirs without any treatment as boiling or chlorination is at high risk to cause food poisoning.	295 (76.7)	26 (6.7)	63 (16.7)
There is no risk of food poisoning from eating leftover cooked food kept in the refrigerator for 2-3 days.	156 (40.0)	138 (36.7)	90 (23.3)

Table 3. Response of women living in Tabriz City, Iran, to attitude part of questionnaire on food poisoning

Question statement	True [n (%)]	False [n (%)]	No idea [n (%)]
Raw milk is healthier and more nutritious than pasteurized or boiled milk.	0 (0)	384 (100)	0 (0)
There is no risk for disease form drinking raw sheep or cow milk right after milking.	13 (3.3)	371 (96.7)	0 (0)
There is no risk for disease form drinking raw camel milk right after milking.	26 (6.7)	295 (76.7)	63 (16.7)
Raw eggs are healthier and more nutritious than cooked ones.	13 (3.3)	255 (66.7)	116 (30.0)
There is no danger of disease form eating raw eggs.	26 (6.7)	358 (93.3)	0 (0)
There is no danger of disease form eating raw meat of young animals.	0 (0)	384 (100)	0 (0)
Wiping fruits and vegetables makes them safe to be eaten.	192 (50.0)	192 (50.0)	0 (0)
There is no danger of disease from eating cooked food kept at room temperature for one day if covered.	13 (10.0)	358 (86.7)	13 (3.3)
There is no danger of disease from eating unwashed vegetables and herbs picked up directly form that plant.	0 (0)	384 (100)	0 (0)
Baby feces are free from pathogenic microbes if he/she is not sick.	0 (0)	294 (76.7)	90 (23.3)
Rainwater collected in reservoir is safe to drink without any process (such as chlorination and heating).	0 (0)	384 (100)	0 (0)
Food handlers without clinical symptoms can contaminate food with pathogenic microbes, which cause food poisoning	255 (66.7)	51 (13.3)	78 (20.0)
Washing hands with soap and water before eating food is necessary to prevent food poisoning.	371 (96.7)	13 (3.3)	0 (0)
Thoroughly washing of vegetables and fruits by tap water is necessary to prevent food poisoning.	384 (100)	0 (0)	0 (0)
Washing hands with water and soap before preparing food is necessary to prevent food poisoning.	384 (100)	0 (0)	0 (0)

The responses of women to the attitude-related part of the questionnaire on food-borne diseases are presented in table 3. Over 90.0% of the women had a great positive attitude (answered correctly) towards each of nine expressions out of 15. These are question number 1) ‘‘Raw milk is healthier and more nutritious than pasteurized or boiled milk” (100%), question number 2) ‘‘There is no risk of disease incidence from drinking raw sheep or cow milk right after milking” (96.7%), question number 5) ‘‘There is no danger of disease from eating raw eggs” (93.3%), question number 6) ‘‘There is no danger of disease from eating raw meat of young animals” (100%), question number 9) ‘‘There is no danger of disease from eating unwashed vegetables and herbs picked up directly from the plant” (100%), question number 11)‘‘Rain water collected in the reservoir is safe to drink without any process (such as chlorination and heating)” (100%), question number 13) ‘‘Washing hands with soap and water prior to eating food is necessary to prevent food poisoning” (96.7%), question number 14) ‘‘Washing the vegetables and fruits by tap water is necessary to prevent food poisoning” (100%), and question number 15) ‘‘Washing hands with soap and water before preparing food is necessary to prevent food poisoning” (100%). On the other hand, women answered mistakenly to three negative expressions related to food-borne diseases. These are: question number 4) ‘‘Raw eggs are healthier and more nutritious than cooked ones” (33.3%), question number 7) ‘‘Wiping fruits and vegetables makes them safe to be eaten” (50.0%), and question number 10) ‘‘Baby feces is free from pathogenic microbes if he/she is not sick” (23.3%).

The responses of participants to practice-related part of the questionnaire on food poisoning are presented in table 4. Over 88.0% of the women had good hygienic practice (answered correctly) in response to fifteen questions out of 20. Only several questions had high unhygienic practice responses (answered incorrectly). These are question number 11) ‘‘Do you eat a soft boiled egg?” which 26.7% answered “yes”, question number 16) ‘‘Do you consume raw

Table 4. Response of women living in Tabriz City, Iran, to practice part of questionnaire on food poisoning

Question statement	Yes [n (%)]	No [n (%)]
Do you wash fresh fruits and vegetables in top water before eating?	345 (90)	39 (10.0)
Do you wash your hands with water and soap before eating your meal?	321 (83.3)	63 (16.7)
Do you wash your hands with water and soap before preparing and preparing food?	384 (100)	0 (0)
Do you wash your hands with soap and water after clearing or touching raw vegetables?	358 (93.3)	26 (6.7)
Do you wash your hands with soap and water after using the toilet?	358 (93.3)	26 (6.7)
Do you wash your hands after contact with the animals?	358 (93.3)	26 (6.7)
Do you consume fresh fruits and vegetables without washing?	51 (13.3)	333 (86.7)
Do you just wipe fresh fruits and vegetables before you eat them?	13 (3.3)	371 (96.7)
Do you pick up vegetables and plants when you are travel eat them without washing?	13 (3.3)	371 (96.7)
Do you consume raw eggs?	0 (0)	384 (100)
Do you eat half-cooked eggs (honey)?	103 (26.7)	281 (73.3)
Do you consume raw meat?	13 (3.3)	371 (96.7)
Do you consume half-cooked meat?	13 (3.3)	371 (96.7)
Do you drink raw cow or goat milk (not heated)?	26 (6.7)	358 (93.3)
Do you drink raw camel milk (not heated)?	0 (0)	384 (100)
Do you consume raw white cheese made from raw un-pasteurized milk?	154 (40.0)	230 (60.0)
Do you eat cooked food that has remained at room temperature for over 6 hours without reheating?	76 (20.0)	308 (80.0)
Do you serve at the restaurant or cafeteria, which looks not clean?	0 (0)	384 (100)
Do you use rainwater or river that is collected and stored without any treatment (such as chlorination and heating) in reservoirs?	26 (6.7)	358 (93.3)
Do you eat food (such as meat, rice and soup) by hand form a large bowl shared for several people?	0 (0)	384 (100)

white cheese made from raw un-pasteurized milk?" which 40.0% answered "yes", and question number 17) ''Do you eat cooked food that has remained at room temperature for over 6 hours without reheating?" which 20.0% answered "yes".

Discussion

Knowledge of food-borne pathogens can play a positive role in decreasing food-borne diseases and can possibly be a useful approach in advocating safe food preparation practices. In general, the results in the field of knowledge revealed good information of women in Tabriz on the most important factors related to food poisoning. They did not have the necessary knowledge in a few factors. For example, 45% of the women lacked the knowledge that eating raw cheese prepared from un-pasteurized milk is highly risky for food poisoning; this reflects the urgent need for training in this field. Moreover, 26% of women lacked the knowledge that some bacterial toxins are highly resistant to thermal processing of food. This case reflects the potential practice of insufficient temperature for reheating food. Likewise, 60% of women were misinformed or had inadequate knowledge about the consumption of foods stored in the refrigerator after 2 to 3 days; according to their opinion, it was not possible to use these foods. Similar results were also found by Haji Mohammadi et al.[19] A few women in Tabriz reported that they did not know apparently that even healthy persons could contaminate foods. The women had a favorable attitude to food-borne diseases. In terms of consuming raw milk, raw eggs, raw meat, and fresh vegetables, an optimal attitude was observed, but in the case of child feces, 23.3% of opinions were incorrect. The negative attitude that mothers did not wash their hands after changing diapers of the babies might lead to a great danger;[25,26] also there was the possibility of transmitting microbes to the foods of both adults and infants while breastfeeding or baby feeding. In the field of hand washing before eating and before food preparation, the attitude was quite correct and well ventilated. In this regard, 50% had an unfavorable attitude to simply wiping

fruits and vegetables and making them safe for eating. In the field of practice, 91% of women believed that fruits and vegetables should be washed before they are consumed. About 26% of women preferred soft-boiled eggs. Although most of the women reported prevented consumption of raw or half-cooked foods, some of them reported that they did not know that eating raw or half-cooked foods could cause food poisoning. About 41% used raw white cheese prepared from non-pasteurized milk. In the study of Sharif and Al-Malki, it was reported that 50% of the Saudi college students consumed raw white cheese and raw eggs.[27] Leaving cooked food for many hours in the kitchen is a hazardous act, because food-poisoning microorganisms can grow and lead to food poisoning.[28] Most of our participants reported not leaving the cooked foods outside the refrigerator for long periods of time. Incomplete cooking of food and cross-contamination due to poor hand hygiene in food handling practices are responsible for many food-borne diseases. A meta-analysis done by Curtis and Cairncross on seven interposition studies indicated that washing hands with soap could decrease the risk of diarrheal diseases by 42%-47% and that hand washing might save a million lives;[29] in our study, 83% of women washed their hands before eating food. Generally, considering the answers to the knowledge and performance section questions, it can be concluded that there was a gap between food safety knowledge and practices and practices were better than knowledge in the partial food safety and some parameters. Actually, not only lack of food safety knowledge and practices, but also lack of critical knowledge may result in food-borne diseases. According to the results, there was a significant relationship between women's attitude and practice, and their knowledge. There was also a significant relationship between attitude and knowledge, and characteristics of education level, number of children, being afflicted with food poisoning, participation in training courses, and economic condition ($P < 0.05$). However, there was not any significant relationship between women's attitude and knowledge, and their age and marital situation ($P > 0.05$). The results showed that women with higher education had higher scores in knowledge and practice. Moreover, in this study, a statistically significant difference was found between attitude and behavior with the risk of food poisoning, indicating that the attitude of people, who suffer from food poisoning, about the causes of food poisoning has changed, and they are trying to improve their performance, so that they will not suffer from this illness. In general, we found that knowledge was dependent on the awareness about potentially precarious foods and substances, food safety-related behaviors, and demographics. Hence, increasing people's awareness of major food-borne pathogens is a potentially useful method to help promote safe food handling practices. Positive or negative, also both significant and insignificant knowledge-practice relationships may be ascribable to the reality that all available research is relying on self-reports instead of objectively-verifiable measures.

Conclusion

Hygiene is an essential part of healthy living. Not only selecting the right foods, but also cooking and consuming them in a hygienic way is equally important in preventing the infectious diseases. The importance of safe food handling is to educate everyone who handles kitchen about how they can help prevent contaminants from getting into the food. Today, more than ever, we are threatened by the possibility of food poisoning and lethal bacteria that have been proven extremely deadly. We need to make the persons aware of how to prevent these problems and learn how to combat them by taking as many precautious measures as possible. In general, it can be said that to hold worldwide food safety, all groups of consumers should be aware of essential principles of food safety assurance at home (good housekeeping practice), because food

safety begins and ends with daily practices of a consumer. The results showed a good level of information that women in Tabriz had about protection against food-borne diseases. However, there are food safety gaps between them and some practices that represent a risk to food safety (e.g., eating raw white cheese prepared from raw milk). Therefore, there is a need for further education and information on the disadvantages of eating raw or semi-processed foods, proper storage of food items prior to use, maintaining a clean environment when preparing the food, washing and disinfecting dishes, proper cooking and freezing temperatures, and making sure that all serving dishes are clean and free of bacteria that could lead to some types of contamination. According to these recommendations, it is possible to publish a guidebook or notification containing information about appropriate food preparation methods, avoiding cross-contamination, appropriate methods of washing fruits and vegetables, control and reduction of pathogens and related factors in food-borne diseases, and broadcasting educational programs on social media or creating a platform for awareness on social networks such as Telegram. Moreover, more training of the women referring to health centers on the symptoms of food-borne illnesses and food-borne pathogens may improve knowledge acquisition and develop good practice. It is recommended that future studies be conducted on the comparison of different societies in the field of knowledge, attitude, and practices in relation to food-borne diseases and also using food safety training programs for women and comparing the results of knowledge, attitude, and practice before and after the training program.

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Authors' Contribution

Ali Ehsani, Arezou Khezerlou, Mahmood Alizadeh-Sani, and Hajar Zolfaghari contributed to study concept and design. Data were acquired by Arezou Khezerlou, Mahmood Alizadeh-Sani, and Hajar Zolfaghari. Analysis and interpretation of data was performed by Ali Ehsani and Mahmood Alizadeh-Sani. Hajar Zolfaghari drafted the manuscript. Ali Ehsani and Arezou Khezerlou critically revised the manuscript for important intellectual content.

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Conflict of Interest

Authors have no conflict of interest.

Ethical Approval

This article does not contain any study on human participants or animals performed by any of the authors.

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