Hispanic Farmworker Interpretations of Green Tobacco Sickness

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ABSTRACT: *This paper describes the explanatory model of green tobacco sickness (GTS) held by migrant and seasonal farmworkers in North Carolina and compares it with a research-based biobehavioral model. GTS is a form of acute nicotine poisoning that affects individuals who work in wet tobacco fields. It is characterized by nausea, vomiting, headache, and dizziness. There are no standard diagnostic criteria for GTS; clinicians must diagnose it based on a combination of symptoms and exposure risk. GTS resembles pesticide poisoning, but treatment is quite different. Many farmworkers in tobacco today are Spanish-speaking immigrants from Mexico with limited experience in tobacco work. In-depth interviews about GTS were conducted with 23 Hispanic farmworkers in central North Carolina to explore their understanding of the problem. Workers generally attributed the symptoms to other aspects of working in tobacco, such as pesticides or heat, rather than nicotine. They cited many of the same risk factors identified in the biobehavioral model, such as wet work conditions and inexperience with tobacco work. Prevention and treatment include a combination of exposure avoidance and common medications. The symptoms of most importance to farmworkers were insomnia and anorexia, both of which impaired the ability to work. This jeopardized their income, as well as their work security. If health care providers understand the explanatory model held by farmworkers, they will be more effective at diagnosing and treating GTS and be better prepared to teach patients how to prevent future episodes.*

Green tobacco sickness (GTS), or acute nicotine poisoning, is an occupational illness that affects individuals who work in tobacco fields. It occurs when wet tobacco leaves come in contact with the skin during agricultural activities. Nicotine in the moisture on the leaves is absorbed through the skin (D'Alessandro et al., 2001), leading to nicotine poisoning and causing a variety of physical symptoms. The most common combination of symptoms is either headache or dizziness accompanied by nausea or vomiting. GTS is self-limiting, usually resolving within a day or two after onset. However, a severe case can cause dehydration, resulting in the need for emergency medical care and loss of work time. GTS can pose a serious economic hardship for workers and their families, as well as for the growers who rely on them. GTS is not considered life-threatening, but it is unpleasant and incapacitating, and the possible long-term consequences are not known at this time (Quandt et al., 2000).

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Over the past decade, U.S. tobacco production has changed from small family-held farms to large consolidated operations worked by migrant and seasonal farmworkers. Many of these workers are new to tobacco work and thus are not familiar with this particular occupational illness (Quandt et al., 2000). Complicating the situation further, nearly all of these new workers are from Mexico or other Latin American countries and speak little English. Growers who do not speak Spanish find it difficult to inform their workers about the condition and its prevention. Workers who do not speak English have difficulty describing their symptoms and seeking treatment.

There are no standard diagnostic criteria for GTS, nor does it have an International Classification of Diseases code (World Health Organization, 1997). Unless a health care practitioner has worked in a tobacco-growing area, it is unlikely that he or she will have heard of it before being presented with a case. The individual symptoms are nonspecific and therefore easy to confuse with other common farmworking illnesses, such as heat stress and pesticide exposure. It is the constellation of symptoms, combined with the potential for exposure (i.e., recent tobacco work) that is indicative of GTS. Proper diagnosis can be problematic, but it is necessary because the appropriate treatment for each of these conditions is quite different.

The purpose of this paper is to describe the explanatory model of GTS held by migrant and seasonal farmworkers in North Carolina and to compare it with a research-based biobehavioral model. If health care providers understand the explanatory model held by farmworkers, they will be more effective at diagnosing and treating GTS and be better prepared to teach patients how to prevent future episodes.

Literature Review

GTS was first noted in the medical literature in the early 1970s (Weizenecker & Deal, 1970; Gehlbach et al., 1974), but it has been known and experienced by generations of tobacco growers and workers. The majority of occurrences described in the literature occurred in the United States, mostly in the Southeast. Case studies of one or a few individuals who developed GTS and were treated in a clinical setting are reported from North Carolina (Ives, 1983; Swinker, 2000); Kentucky (Hipke, 1993); and Tennessee (Edmonson, 1996; Cantrell, 1999). The problem has also been described and studied in India (Ghosh et al., 1980); Japan (Misumi et al., 1983); and Italy (D'Alessandro et al., 2001).

A variety of cross-sectional or retrospective research projects have been undertaken to describe the characteristics and determine the cause of GTS. A survey conducted in a health center in Florida (Weizenecker & Deal, 1970) was the first to systematically describe the condition and propose possible causes. Several studies have been undertaken to define the problem further by determining incidence rates, risk factors, and protective variables (Gehlbach et al., 1974, 1975; Ghosh et al., 1979, 1980; Centers for Disease Control and Prevention [CDC], 1993; Ballard et al., 1995; Quandt et al., 2000). Estimates of incidence among tobacco workers range from 1% in Kentucky (CDC, 1993) to over 88% in India (Ghosh et al., 1980). Researchers also have documented clusters of cases occurring within geographical regions or family groups in North Carolina (Gehlbach et al., 1974) and Kentucky (McKnight et al., 1994; McKnight, Dawson et al., 1996; McKnight, Kryscio et al., 1996a, 1996b). Two studies have investigated preventive measures, such as gloves (Ghosh et al., 1987) and rain suits (Gehlbach et al., 1979). These measures were found to be effective but problematic to implement because of the hot and humid working conditions generally associated with tobacco work. In most of the studies, smoking was found to have a protective effect.

The first prospective surveillance study of GTS was conducted by Arcury and colleagues with North Carolina farmworkers in 1999 (Arcury, Quandt, & Preisser, 2001; Arcury, Quandt, Preisser, & Norton, 2001; Quandt et al., 2001). This study, in which data on symptoms and risk factors were documented for a cohort of 182 workers over a 10-week period, found that one in four workers suffered GTS at least once during the season. Workers were sick with GTS approximately 2 days of every 100 days worked in tobacco. That nicotine is the underlying cause of GTS was supported by salivary cotinine levels collected from the same workers, which increased dramatically over the season, even after controlling for smoking (Quandt et al., 2001; Arcury, Quandt, & Preisser, 2001; Arcury, Quandt, Preisser, & Norton, 2001). Risk factors found to be statistically significant for the development of GTS included lack of work experience in tobacco, working in wet clothes, working later in the season, priming (harvesting tobacco), and not smoking.

Biobehavioral Model of GTS

Arcury, Quandt, and Preisser (2001) and Quandt et al. (2000) have developed an empirically based biobehavioral model of GTS that integrates recent data from epidemiology as well as physiology and pharmacokinetics (Benowitz et al., 1987, 1992, 1997). Nicotine is a water-soluble alkaloid that is present on the surface of wet tobacco leaves, which is then transferred to workers' skin during certain agricultural activities. According to this model, GTS results from the effect of nicotine that is absorbed through the skin and enters the bloodstream (D'Alessandro et al., 2001). The nicotine in the bloodstream can either stimulate or desensitize various nervous system receptors, resulting in symptoms that include nausea, vomiting, and changes in blood pressure and heart rate. Direct effects on the brain include generalized stimulation and tremor (Hardman et al., 1996). Mean elimination half-life of plasma levels is about 4 hours after exposure has ceased (Keller-Stanislawski et al., 1993). Transdermal absorption tends to increase with skin moisture, skin damage, and low body mass index (BMI; Wester & Maibach, 1983; Benowitz et al., 1987; Meuling et al., 1997). It is also increased by variables that regulate vasodilation, such as temperature, humidity, and alcohol consumption (Quandt et al., 2000).

The behavioral aspects of GTS are related to control of dermal exposure and transdermal absorption. Workers who work in wet conditions or with large areas of skin exposed (e.g., wearing short-sleeved shirts) are at greater risk for exposure. The skin on certain areas of the body, such as the face, back, and axilla, more readily absorbs nicotine than other body sites (Feldmann & Maibach, 1967). However, absorption through the skin decreases in individuals with other sources of nicotine (smoking, chewing). All of these factors operate in combination to affect an individual's plasma nicotine level, which, when high enough, can lead to GTS. The amount of exposure, and therefore risk, is also dependent upon the type of work being done. Removing the flowers, or "topping," and harvesting the leaves, or priming, involve the most direct contact with the leaves and are the activities most likely to precipitate GTS. However, the longer one has worked in all activities of tobacco, the less susceptible one becomes, perhaps because of learned avoidance or because more susceptible workers switch to other work (Arcury, Quandt, Preisser, & Norton, 2001).

Study Design

Conceptual Framework. This project was conducted using the explanatory models of illness framework developed by Kleinman (1980). Explanatory models are the knowledge and ideas that people use to make sense of a health-related condition or sickness and to choose and evaluate treatment options. The content of the explanatory model of a given condition or sickness will vary from person to person; often it is only partly articulated and inconsistent or even self-contradictory. Explanatory models held by different individuals share common features to the extent that individuals share a common cultural and social orientation (Rubel & Hass, 1996). Components of an explanatory model for a specific condition or illness include its (a) name; (b) etiology; (c) onset, course, and symptoms; (d) pathophysiology and other resulting problems; and (e) treatment and prevention. These aspects of people's explanatory models predispose them to different health behaviors. Unlike biomedical models of illness, explanatory models also incorporate the significance of the condition with respect to other areas of the patient's and his or her family's lives. These can include the patient's ability to fulfill his or her role within the community or the family, such as producing income or caretaking. These effects can be more important to the patient than the causes, symptoms, and treatments that are the focus of more biomedically oriented models (Kleinman, 1980).

Data Collection. In order to understand the explanatory models of GTS held by farmworkers, data were collected using in-depth semistructured interviews. The interviews were conducted to elicit discussions of the five aspects of illness described above during the 2000 tobacco growing season in several central North Carolina counties. Inclusion criteria included currently working in tobacco and familiarity with sickness resembling GTS. Participants were recruited with the assistance of the North Carolina Farmworkers' Project, an advocacy and service organization that has compiled information on farmworker camps in the area. Assistance in locating additional sites was obtained from area clinics and migrant health programs. Using this information, four bilingual interviewers located and recruited individuals willing to participate. Informed consent was obtained according to a protocol approved by the Wake Forest University School of Medicine Institutional Review Board. Interviews were conducted in the language of the participant's choice,

Table 1. Categories of Explanatory Models and Corresponding Interview Questions.

Categories	Explanatory Model Interview Questions
Name	What do you call the condition that develops after working in the field?
Etiology	What do you think causes it?
Onset, course, symptoms	Why do you think it starts when it does? How severe is it? How long does it take to get over it? What does a worker with this illness experience?
Pathophysiology and resulting problems	What does it do to a worker? Are there any lasting effects? What are the chief problems having this illness causes? Does everybody who works in tobacco get it? Why or why not?
Treatment and prevention	What can you do to treat it? What can a health care provider do to treat this illness? What can be done to prevent it?

which was Spanish in all cases. A total of 23 interviews were completed during July and August 2000 with 21 Hispanic men and two Hispanic women. The final sample of 23 farmworkers was selected from 13 separate sites.

An English-language interview guide was developed based on the explanatory models framework and then translated into Spanish. Questions addressed the details of the participant's explanatory model, such as what he or she believes causes GTS, what happens when a person has it, what problems it causes, and what can be done to treat or prevent it (Table 1). Background information was also collected, including tobacco work experience and smoking behavior (factors that influence the likelihood, course, and severity of an episode). Interviews lasted from 20 minutes to over an hour depending on the individual's experience with GTS. Participants received a T-shirt in appreciation of their time.

All interviews were tape-recorded and transcribed verbatim. Interviews were translated by a professional translation service and edited for accuracy by the original interviewer. The transcripts were processed using the Ethnograph v5.0 (Seidel, 1998), a computer program for text-based data analysis. A coding scheme was developed based on the categories of the explanatory models conceptual framework. Each transcript was coded by members of the research team in order to identify overarching themes, patterns, and issues that arose in the narratives (Luborsky, 1994). All interviews were coded by one member of the team and reviewed by a second to ensure consistency. All segments of text for each code were summarized to achieve an overall understanding of each component of the farmworker model of GTS. In addition, each separate transcript was summarized as a case study that could be compared and contrasted within the group. The final product of this variable-based and case-based analysis is an explanatory model of GTS that represents the range of farmworker beliefs and knowledge about the condition.

Results

All the farmworker participants were born in Mexico. They ranged in age from 22 to 62, with the majority being in their 20s to mid-30s. Most respondents were married (n = 20). Spanish was the first language of all but two participants, for whom Tarasco (an indigenous language of southern Mexico) was their first language. About half of the farmworkers indicated that they understood English "none" or "very little." Half of the farmworkers had completed 6 years of schooling or less; nine had completed 12 years or more. Few of the farmworkers (n = 7) were smokers. Just over half of the farmworkers (n = 14) were in the country under H2-A work contracts. (The H2-A program is a special visa program that permits foreign workers to enter the country to work only for a specific farmer and requires them to return to their home country at the end of the contract period.) Only two indicated this was their first year working in tobacco. The number of years of tobacco experience ranged from less than 1 to 20 years; this was the second or third year for half of the workers.

Farmworker Model of GTS. Although the farmworkers in this study were in agreement about the overall explanatory model of GTS, they held some differing beliefs about specific details of the five components.

Name. Although the farmworkers in the study had heard of GTS, none actually had a specific name for it, either in Spanish or English. It was simply known as

"the sickness one gets from working in tobacco." Some learned of it when they first started in tobacco, either from coworkers or clinic outreach workers. A few had heard of it before coming to the United States, generally from friends with previous experience. Roughly half of the farmworkers indicated that they personally had experienced it at some time.

Etiology. The most common explanation given for GTS was that it was caused by the chemicals that were applied to the plants. The plant absorbed the chemicals, such as pesticides and growth regulators, and the workers came in contact with them while working the crop. The chemicals entered the body by being inhaled, swallowed along with sweat and water from the plants, or absorbed through the skin. A few believed the skin was the route into the body. Sweating while working in the hot sun opened the pores, increasing the rate of absorption. A few felt that the problem was the chemicals produced by the plants themselves, in addition to those that were applied: ". . . they apply a lot of things [to the tobacco], a lot of chemicals, and that's what hurts us. The tobacco also has others. It has a substance that also harms people" (Farmworker 24 [FW24]; 23 farmworkers were interviewed, but some were assigned identification numbers higher than 23 for other purposes). It was not clear whether the participants were referring to nicotine or some other plant product. Some workers believed that the smell of the tobacco, rather than the tobacco itself, caused GTS: ". . . the smell of the tobacco, it upsets the stomach. It makes you want to throw up" (FW20).

Other causes offered included becoming overheated from working in the sun, particularly in the stooping position required while harvesting leaves, or priming. The worker did not get enough air when leaning over to pull the bottom-most leaves. Several workers observed that they were not used to this type of work from Mexico, and the hard work in the hot sun caused dehydration, which also contributed to GTS. A few workers did identify nicotine as the cause: ". . . the pores open, the nicotine from the tobacco gets in through them. The body gets saturated . . . with nicotine" (FW17). Others blamed it on the sticky juice, or "gum," from the tobacco leaves. However, at least one worker was quite sure that GTS was *not* caused by the tobacco itself: ". . . the tobacco, it's not." Interviewer: "It isn't the tobacco?" Worker: "No, no. It's the heat. It's the [chemical] spray that we drink" (FW18).

Onset, Course, and Symptoms. Farmworkers varied considerably in their beliefs regarding the duration and severity of an episode of GTS. The most common causes of onset cited were heat and the smell of the tobacco, which was consistent with the beliefs about etiology: "When we smell the odor of the gum, just a little bit, it affects us very much" (FW25). Symptoms developed slowly, starting in the morning, and lasted from a few hours to an entire season. This broad range resulted from a difference in the definition of "an episode" of GTS. Some workers viewed each new occurrence of symptoms as a separate episode, regardless of how often it recurred during the season. Others considered an "episode" to be from the first time the symptoms occurred to when they stopped recurring later in the season. Most thought that the symptoms ceased because the worker learned to prevent GTS or gave up the work entirely. Most workers indicated it lasted 3 to 4 days.

In general, farmworkers did not consider the condition to be severe, although they varied as to the severity of the individual symptoms. Some reported suffering primarily from dizziness or tiredness, whereas others reported nonstop vomiting. Overall, it was agreed that one would eventually recover and be able to return to work, although some individuals would never develop a tolerance. For the most part, workers did not believe that GTS had any long-term effects, although some were not sure. The few who felt there were long-term effects were concerned about cancer and sterility.

Many workers compared the experience of GTS to being drunk: ". . . everything is spinning . . . I have the sensation of being drunk, but I'm sober and that affects [me] very much" (FW18). Nearly all identified vomiting or nausea as a primary distressing symptom of GTS; however, the most salient symptoms were insomnia and anorexia. Additional symptoms included dizziness, headache, weakness, shakiness, and mental confusion. A few workers described skin rashes and itching, swelling of the hands, and visual disturbances.

Pathophysiology and Resulting Problems. Farmworkers noted that individuals vary in susceptibility by virtue of being inherently "stronger" or "weaker" than others. Individuals with poor nutrition or who drink alcohol were more susceptible because they had "weak" systems. Also, new or inexperienced farmworkers were more susceptible to GTS than those with more time in tobacco. Workers believed that it was also possible that some workers were allergic to tobacco. Smokers were thought to be less susceptible because they already had the nicotine in their bodies and were therefore less affected by the nicotine absorbed from the plants.

The most significant problem caused by GTS, even more than the physical symptoms, was the economic hardship caused by missing work or even having to return to Mexico. Even when workers were able to continue, they worked more slowly because they were weak from not eating, tired from not sleeping, or drowsy from having taken medication. This reduced their income even though they were working since tobacco workers are paid based on production, rather than on hours worked.

Treatment and Prevention. The most common treatment option mentioned was medication, generally motion sickness pills such as Dramamine. Workers expected to receive this treatment whether they went to a clinic or were assisted by their employer or foreman. Occasionally workers needed to go to the emergency room. Milk and lemon could be used as both a treatment and prevention.

Although GTS could be prevented by medications, the suggested preventive measure was to avoid exposure by wearing protective clothing. Workers suggested wearing long-sleeved shirts and long pants, and washing these clothes separately from other laundry. Gloves and rain suits were helpful but were uncomfortable and could impede work. It was more realistic to try to change out of wet clothes during the day. A few workers remarked that the only real option for preventing GTS was not to work in tobacco.

Case Studies. The following three case studies illustrate the range of explanatory models held by the farmworkers who participated in this study. The first worker does not consider GTS to be a serious problem, whereas the second does. The third offers a comparatively well-developed model of the course of GTS. All three workers have experienced GTS at least once.

Case 1. FW01 believes that the chemicals put on the tobacco, along with the strong smell of the tobacco and the heat, cause the vomiting. All of these are intensified when the worker bends over to pick the leaves closest to the ground. He experienced a mild case of GTS on his first day priming tobacco, complaining of a couple of hours of vomiting and dizziness that were not too severe if he rested and took the motion sickness pills provided by his boss. However, he says other workers experience bumps and swelling of the hands, as well as much more severe vomiting. Some people are more susceptible to GTS than others; new workers tend to get sick, as well as workers who grew up in the cities of Mexico and have little field experience. For prevention, some workers take analgesics (e.g., Tylenol) to prevent fatigue but do not take motion sickness pills. Overall, he does not perceive GTS as a very serious health problem for tobacco workers; it occurs often in new workers, but does not last long or cause prolonged or long-term problems.

Case 2. FW17 considers GTS to be an allergy to tobacco, but has heard it called "green tobacco fever" and "the green fever." The condition develops when the body becomes "saturated with nicotine" from contact with wet tobacco. He has experienced GTS with symptoms including insomnia, feeling hungover, headaches, lack of appetite, vomiting, nightmares, and muscle aches. The illness is very severe and the symptoms are often unbearable. Not everyone gets GTS the first time they work in tobacco, but most workers will develop it eventually. Long-term effects include impotence and cancer. Treatments for GTS include sleep aids, antinausea medicine (e.g., Pepto-Bismol), and pain medications. These do not always stop the symptoms and may cause drowsiness, which can interfere with work.

Case 3. FW25 believes that GTS is caused by the chemicals and tobacco gum that the workers ingest unintentionally. He states that the farmers routinely spray pesticides when workers are in the field. He has had GTS and describes its symptoms as nausea, loss of appetite, vomiting, fever, insomnia, fatigue, dizziness, and weakness. The illness lasted 3 or 4 days, and the symptoms mainly occurred at night. Some workers get the illness every year, which he believes will cause serious health problems in the future. GTS only attacks those with "weak" bodies, not strong people, or smokers who are resistant to the nicotine. For treatment, he takes Dramamine for dizziness and vomiting and headache powders (e.g., Goody's brand). He says that after working in tobacco all day, workers will suffer from vomiting and be unable to eat throughout the night. The next morning they try to work on an empty stomach, which causes them to become sick once again. This cycle continues during the entire work week until the weekend, when the workers have a chance to regain their strength and appetite.

Discussion

Comparison of the Biobehavioral and Farmworker Models of GTS. Some aspects of the farmworker model of GTS mirrored quite closely the biobehavioral model, whereas others were at considerable variance.

The areas of difference have implications for patient education.

Etiology. A minority of workers identified nicotine as the causative agent of GTS. Most attributed it to either the agricultural chemicals used on the crop, or to work-related factors, such as the heat or the smell of the tobacco. However, most did accurately identify at least some of the risk factors identified in the biobehavioral model, such as working in hot, wet conditions and lack of tobacco work experience. The fact that stooping and lack of air circulation while priming were cited as causes reflects the workers' experience of more incidents during that time of increased exposure to wet leaves.

Onset, Course, and Symptoms. The lack of consensus among workers as to the time of onset, severity, and duration of GTS is consistent with the empirical findings of a set of risk factors that vary by person. Each worker's experience with GTS depended on his own personal set of risk factors (e.g., BMI, smoking and drinking behavior, tobacco work experience). For example, a worker with more risk factors required less exposure and might develop GTS earlier in the day or suffer more intense symptoms than a worker with fewer risk factors. The explanatory models of these two workers reflects those different experiences. The length of time one was said to "have GTS" varied among workers because of differences in the definition of an episode. As described in case study 3, a reasonable justification for a 3- to 4-day course could be developed based on the workers' interpretation of the etiology and illness course. Most workers agreed that GTS was not a serious problem and that it eventually would resolve sufficiently for the worker to return to the field. Finally, workers shared the uncertainty over the possible long-term consequences with the biobehavioral model. Those who felt that it would cause cancer or sterility were probably reporting what they had learned during pesticide safety training (US-EPA, 1993).

In addition to the constellation of symptoms predicted by the biobehavioral model, workers also attributed such tobacco work–related problems as skin rashes and swelling of the hands to GTS. There is no clinical evidence that these are caused by the same mechanism as GTS; the fact that they tend to co-occur led some workers to consider them symptoms of the same condition. In fact, skin rashes could result from exposure to pesticides, growth inhibiters, or ripening agents, all chemicals used on tobacco plants.

Pathophysiology and Resulting Problems. Workers observed varying susceptibility to and experiences of GTS among their coworkers. Although they could not always explain the variation, their observations were consistent with the constellation of personal and environmental factors that modify risk as outlined in the biobehavioral model. Inexperienced workers, those with poor nutrition, and those who drink alcohol all had "weakened" systems and thus were at increased risk. Some people were considered inherently susceptible or were allergic to tobacco; this observation reflected factors not visible or obvious to coworkers, such as BMI. As noted above, some workers believed that smokers were less susceptible because of nicotine in their system despite the fact that these workers did not attribute GTS to nicotine.

Throughout the literature on GTS, nausea and vomiting are widely referred to as the obvious symptoms from a diagnostic and treatment perspective. However, for workers, insomnia and anorexia were more significant because of their effect on ability to work and therefore on income. Although the other symptoms (dizziness, headache, etc.) will eventually resolve sufficiently for the sufferer to be able to return to work, insomnia and anorexia tend to compound over time and aggravate the problem. Furthermore, a worker can conceivably continue to work through those other symptoms in a way that is not possible with lack of sleep or food.

Treatment and Prevention. The use of antinausea medications, such as Dramamine, was consistent with symptoms resembling motion sickness; several workers even mentioned the work motion itself as a possible cause. The use of analgesics and sleep aids was also consistent with the usual symptoms. Workers were inconsistent on whether these medications also would prevent GTS if taken before entering the fields, and if so, which ones. A few workers mentioned going to a hospital emergency department, most likely because of severe dehydration. Other treatments included drinking milk or lemon juice, popular home remedies for a variety of ailments.

Workers applied their knowledge of pesticide safety to preventing GTS, namely wearing protective clothing, changing when clothes become saturated, and washing work clothes separately. Ideally, growers would provide some sort of lightweight, protective suit and gloves, or allow the workers time to change clothes at midday. A few workers developed creative alternatives, such as wearing plastic garbage bags around their midsections.

Implications. The comparison between the biobehavioral model and the farmworker model of GTS

highlights several points of correspondence and departure. In general, farmworkers understood the symptoms and prevention of the condition, but were mistaken about the mechanism (agricultural chemicals, rather than nicotine). Although pesticide poisoning has similar symptoms, treatment is quite different. On the other hand, measures for preventing pesticide exposure include those for avoiding nicotine exposure, so conflating the two problems actually promotes the appropriate behavior.

Despite being mistaken about the mechanism of GTS, workers were clearer on the most important exposure factors (e.g., wet plants, heat, and humidity). Many workers also identified the same behavioral factors as the biobehavioral model, such as smoking and drinking. Primary prevention education may be beneficial to clarify the actual causes of GTS and the appropriate preventive measures. For the most part, workers will need only to be encouraged to start or continue taking the preventive measures they have already identified. However, they should be reminded that smoking as a preventive measure is risky.

Awareness of the farmworkers' explanatory model of GTS can alert clinicians to the variety of complaints, such as pesticide poisoning, heat stress, or motion sickness, that workers might present with but that could signal GTS instead. GTS should be considered a possibility if the worker has been at risk (i.e., worked in wet tobacco during the previous 1 or 2 days). If the problem is indeed GTS, secondary prevention education is indicated to clarify the actual cause and reinforce appropriate prevention measures.

There are other compelling reasons why workers should be informed about the mechanism of GTS. If workers interpret every case of GTS as pesticide poisoning, they will be reluctant to work. This could undermine their relationships with employers. On the other hand, if every episode of headache and nausea is assumed to be GTS, workers could miss an episode of pesticide poisoning and delay treatment on the assumption that the symptoms will resolve on their own. Understanding the cause of GTS and its effects on the body will enable workers to take effective preventive measures and to respond appropriately when a case develops.

The vast majority of research on GTS in the United States has been conducted with farmers and family members. The intent has been to identify the cause of the problem and find ways to alleviate the most bothersome symptoms. Since the problem is self-limiting, simply resting and waiting it out is considered sufficient treatment (unless the worker is dehydrated). A farm family member who is especially susceptible can choose to switch to other work, or not to do farm work at all. For growers and their families, these can all be viable options. However, hired farmworkers do not have that luxury. If they cannot work, they will not get paid, and they risk losing their jobs. Those who entered the country under the H2-A program may not be eligible to return the following year. Tobacco work is comparatively lucrative for farmworkers from Mexico, and as long as there are tobacco farms, there will be a demand for hired labor to cultivate and harvest. Despite the fact that GTS is not life-threatening and perhaps is more distressing than it is a major health issue for workers, it constitutes a very real disability to those who experience it. Clinicians in tobacco-producing areas from Florida to Ontario should be aware of GTS and provide appropriate treatment and patient education.

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