A Clinic-Based, Case-Control Comparison of Green Tobacco Sickness Among Minority Farmworkers: Clues for Prevention

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ABSTRACT

Background. Green tobacco sickness (GTS) is a highly prevalent occupational illness among tobacco workers. Working in wet tobacco is a major risk factor for GTS. Little is known about preventing GTS. This analysis examines possible GTS preventive measures.

Methods. Data were collected from 36 patients with GTS and 40 controls who presented at clinics in eastern North Carolina in 1999 and 2000. Each participant completed an interview that included questions about their personal characteristics, work characteristics, and GTS risk factors.

Results. Participants were Mexican men. Those with GTS were much less likely to have worn rain suits while working in wet tobacco and more likely to be in the United States on a work contract.

Conclusions. Wearing a rain suit while working in wet tobacco can significantly reduce the risk of GTS among tobacco workers. Care must be taken that farmworkers do not have heat stress from wearing rain suits.

GREEN TOBACCO SICKNESS (GTS) is a highly prevalent occupational illness affecting workers who cultivate and harvest tobacco. An estimated 24% of workers have this illness each season, and workers experience almost 2 days of illness for every 100 days at risk.[1-3] Green tobacco sickness is nicotine poisoning that results from dermal absorption of nicotine when workers come into contact with the tobacco plant.[4] The common symptoms of GTS include nausea, vomiting, headache, and dizziness. Additional symptoms may include abdominal pain, abdominal cramps, and difficulty breathing.[5,6] Workers can become severely dehydrated. Earlier research showed that major GTS risk factors include working in wet tobacco, harvesting tobacco, and lack of experience in tobacco work.[1-3] Ghosh et al[7] found that gloves were effective in reducing nicotine absorption. No further studies have examined protective measures agricultural workers can take to prevent GTS. The aim of this analysis was to determine possible preventive measures for GTS through the comparison of clinic-based cases and controls.

MATERIALS AND METHODS

Data were collected at 2 clinics during 1999 and at 3 clinics during 2000, all in eastern North Carolina. Thirty-six individuals who met the diagnostic criteria for GTS and who presented at a participating clinic (the cases) were asked to participate in the study. The 40 controls included farmworkers presenting at the clinics who were not diagnosed with GTS, but who had worked in tobacco. Each participant completed an interview to collect information on personal characteristics, work char-

KEY POINTS

- Little is known about preventing green tobacco sickness.
- The odds of having green tobacco sickness were estimated to be 14 times higher for workers who did not wear rain suits than for workers who did.
- Wearing rain suits is a behavior within the control of farmworkers that will limit their risk of occupational exposure to nicotine and green tobacco sickness.

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TABLE 1. Relationship of Background, Work, and Prevention Characteristics to Green Tobacco Sickness

Characteristic	*Cases (n = 36) No. (%)*	*Controls (n = 40) No. (%)*	P *Value*
Age (years)			.904
18-24	11 (31)	14 (35)	
25-34	9 (25)	10 (25)	
≥35	16 (44)	16 (40)	
Body mass index			.687
<25	16 (44)	22 (55)	
25-29	10 (28)	10 (25)	
≥30	3 (8)	6 (15)	
Missing data	7 (20)	2 (5)	
Education (years)			.114
0-5	14 (39)	11 (27)	
6-8	16 (44)	15 (38)	
9-16	5 (14)	14 (35)	
Missing data	1 (3)	0	
Understand English			.740
None	13 (36)	13 (33)	
Some	23 (64)	27 (67)	
Years worked in tobacco			.956
First	17 (47)	18 (45)	
2-4	15 (42)	18 (45)	
≥5	4 (11)	4 (10)	
In United States on work contract			.096
Yes	28 (78)	24 (60)	
No	8 (22)	16 (40)	
Tobacco production task			.221
Prime	21 (58)	17 (42)	
Top	5 (14)	11 (28)	
Barn	7 (20)	5 (12)	
Other	3 (8)	7 (18)	
Tobacco use			.875
Yes	4 (11)	4 (10)	
No	32 (89)	36 (90)	
Four or more alcoholic drinks per day			.322
Yes	4 (11)	2 (5)	
No	31 (86)	37 (93)	
Missing data	1 (3)	1 (2)	
Work with no shirt			.369
Yes	33 (92)	34 (85)	
No	3 (2)	6 (15)	
Work in wet clothes			.034
<25% of the time	5 (14)	14 (35)	
≥25% of the time	31 (86)	26 (65)	
Work in wet tobacco at least 25% of the time			.001
No	4 (11)	17 (43)	
Yes, wore rain suit	8 (22)	13 (32)	
Yes, did not wear rain suit	24 (67)	10 (25)	

acteristics, and preventive actions taken. Weight and height were measured.

There are no formal diagnostic criteria for GTS. A GTS case was defined as an individual who presented with nausea or vomiting, and headache or dizziness, and who had worked in tobacco that day or the previous day, was not pregnant, not exposed to pesticides, and did not have a fever. Inclusion criteria for controls were individuals who presented at the clinic and had worked in tobacco that or the previous day, and did not meet the criteria for GTS diagnosis. The research was reviewed and approved by the institutional review boards of Wake Forest University School of Medicine, the University of North Carolina at Chapel Hill, and the Centers for Disease Control and Prevention. Informed consent was obtained from each participant before data were collected.

All participants were Mexican males. Independent variables (Table 1) included personal characteristics (age, body mass index [BMI], education, ability to understand English), work characteristics (years worked in tobacco, whether in the United States on a work contract, tobacco production task), and preventive actions (use tobacco, consume 4 or more alcoholic drinks per day, work with no shirt, work in wet clothes, work in wet tobacco, wear a rain suit). A variable created to address correlation among potential covariates com-

TABLE 2. Logistic Regression Results in the Analysis of Green Tobacco Sickness Among Mexican Male Farmworkers in Eastern North Carolina

Characteristic	*Odds Ratio (95% CI)*
Worked in wet tobacco at least 25% of the time*	
Yes, wore a rain suit	2.599 (0.618-10.924)
Yes, did not wear a rain suit	14.559 (3.455-61.360)
Had a work contract	4.204 (1.218-14.507)

*Reference response was "no."
CI = Confidence interval.

bined the dichotomous variables "work in wet tobacco" and "wear a rain suit." This new variable, "work in wet tobacco at least 25% of the time," had the values: (1) No (did not work in wet tobacco); (2) Yes (work in wet tobacco at least 25% of the time), and wore a rain suit; and (3) Yes, and did not wear a rain suit. Pearson chi-square tests were applied to variables to assess their bivariate relationships with GTS. Variables with $P < .15$ in the bivariate analysis were candidates for inclusion in a logistic regression model to estimate the extent to which they were independently associated with the odds of having GTS (ie, the odds of being a case versus a control).

RESULTS

Study participants were relatively young men with little education and limited ability to understand English (Table 1). Many were in their first year of tobacco work. Cases and controls differed significantly on 2 variables, with one other being of borderline significance ($P < .15$). Significantly more cases than controls worked in wet tobacco at least 25% of time, and more cases than controls did not wear rain suits while working in wet tobacco (overall $P < .001$). More cases than controls worked in wet clothes at least 25% of the time. Finally, more cases than controls tended to be in the United States on a work contract.

In multivariable logistic regression analysis (Table 2), the odds of workers who wore a rain suit in wet tobacco having GTS were 2.60 times higher than those who worked in drier conditions; however, these groups did not differ significantly (95% confidence interval [CI], 0.62-10.92; $P = .19$). The odds of those who worked in wet conditions and did not wear a rain suit having GTS were 14.56 times higher than than those who worked in drier conditions (95% CI, 3.45-61.36; $P < .001$). Those who worked in wet conditions without a rain suit had odds 5.60 times higher of having GTS than those who did wear a rain suit (95% CI, 1.56-20.15; $P = .008$). Finally, workers who were in the United States on a work contract were 4.20 times more likely to have GTS than those who were not (95% CI, 1.22-14.51; $P = .023$).

DISCUSSION

Earlier analyses of a cohort of similar workers in the same region found that working in wet clothing, along with priming tobacco and lack of tobacco work experience, is a major risk factor for GTS.[1-3] This analysis shows that wearing a rain suit, which is one method that can reduce the amount of time workers spend in wet clothing, differentiates between workers who present at a clinic with and without GTS.

Farmworkers harvest tobacco in the morning, often the coolest time of the day, when tobacco is wet from dew. There are few preventive measures that farmworkers can take to reduce their risk of GTS. In earlier reports,[1-3] we argued that changing out of wet clothes when the tobacco dries is one measure farmworkers can take to reduce their risk of GTS. The results of this analysis suggest that wearing rain suits while working in wet tobacco can also significantly reduce the risk of GTS. When they wear rain suits, farmworkers should be advised to drink water and wear the rain suits only when the tobacco is wet so that they do not increase their risk of heat stress.

This analysis also found that farmworkers who had a work contract had 4 times greater odds of presenting with GTS than those who did not. Controlling for other variables did not explain this association. Although farmworkers on work contracts were less likely to understand English ($P = .007$) and less likely to drink 4 or more alcoholic drinks ($P = .050$), neither of these variables was a confounder for the association between work contract and GTS. This association is difficult to interpret. It could indicate that those with a work contract have a more difficult work situation, and therefore are more like to experience an occupational illness; however it could also indicate that the employers of workers with work contracts are more likely to take their employees to a clinic when they are ill with GTS.

This analysis has some limitations. The sample is small and taken from just a few clinics in eastern North Carolina, limiting the generalizability of the results. The lack of a precise diagnostic test for GTS means we cannot be cer-

tain of the actual illness of the cases. Even with these limitations, this study identifies another action within the control of farmworkers, use of rain suits, that will limit their risk of occupational exposure to nicotine.

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The formulation of a problem is often more essential than its solution, which may be merely a matter of mathematical or experimental skill.

Albert Einstein