



# Center for Worker Health

Wake Forest School of Medicine

## POLICY BRIEF

### Cotinine Levels for North Carolina Farmworkers

#### Summary

Nicotine is an alkaloid present in tobacco plants. Cotinine is a biomarker of nicotine dose; it is a byproduct of nicotine that is produced when the body metabolizes nicotine. Nicotine has known and suspected health effects for people. The most immediate health effect for farmworkers and farmers who work in tobacco is nicotine poisoning, often called green tobacco sickness, or GTS. Although work in tobacco is the generally accepted cause of high nicotine levels among tobacco workers, some industry critics remain skeptical. This analysis compares urinary cotinine levels in Latino farmworkers to Latino non-farmworkers who live in North Carolina. The results document that farmworkers have substantially higher cotinine levels than non-farmworkers. These differences remain when smoking status is considered; farmworkers who have never smoked have much higher cotinine levels than do non-farmworkers who have smoked. Procedures (e.g., not working in wet tobacco, wearing a rain suit, changing from wet clothes) to reduce nicotine exposure are widely known. The results of this analysis show the need to require the implementation of these procedures. These results suggest the need to examine the long-term effects of occupational nicotine exposure.

#### Why does it matter?

Nicotine is an alkaloid that is present in tobacco plants. Nicotine can enter a person through the consumption of tobacco products (e.g., smoking or chewing tobacco). Nicotine can also enter a person when they come into contact with environmental or “second hand” tobacco smoke. Finally, it can be absorbed through the skin when a person comes into contact with a tobacco plant or water on a tobacco plant. Cotinine is an easily measured nicotine metabolite that is a biomarker of nicotine dose.

The immediate health effects of nicotine absorbed through the skin of farmworkers and farmers who work in tobacco are referred to as green tobacco sickness or GTS. GTS is an occupational disease that results from nicotine poisoning and that has the symptoms of dizziness, headache, nausea, vomiting, loss of appetite, and inability to sleep. It is dangerous because it can lead to dehydration and weakness among tobacco workers who engage in strenuous work in hot and humid conditions. The long-term health effects of nicotine absorbed through the skin have not been studied.

Procedures to reduce or prevent nicotine exposure are widely known and simple. These procedures include not working in wet tobacco, or wearing a rain suit (or other water resistant clothing) and changing out of wet clothing after working in wet tobacco. Also, GTS is self-limiting, the symptoms and effects of nicotine poisoning will subside if an individual does not work in tobacco for a few days. Unfortunately, farmworkers often do not have the resources to take preventive actions, or to not work for a few days. Greater information about the size of the nicotine dose experienced by farmworkers is needed to support further occupational safety policy for these vulnerable workers.

Although work in tobacco is the generally accepted cause of high nicotine levels among those working in tobacco, some industry critics remain skeptical. These critics dispute any negative health effects of nicotine, the need to use procedures that reduce nicotine exposure, or the occupational cause of GTS. This analysis compares urinary cotinine levels in Latino



#### Research for this policy brief is

**reported in:** Arcury TA, Laurienti PJ, Talton JW, Chen H, Howard TD, Summers P, Quandt SA. Urinary cotinine levels among Latino tobacco farmworkers in North Carolina compared to Latinos not employed in agriculture. *Nicotine and Tobacco Research*. 2015 Sep 16. [Epub ahead of print]

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farmworkers to Latino non-farmworkers who live in North Carolina to document the occupational causes of high nicotine levels experienced by farmworkers in North Carolina.

## What did the researchers do?

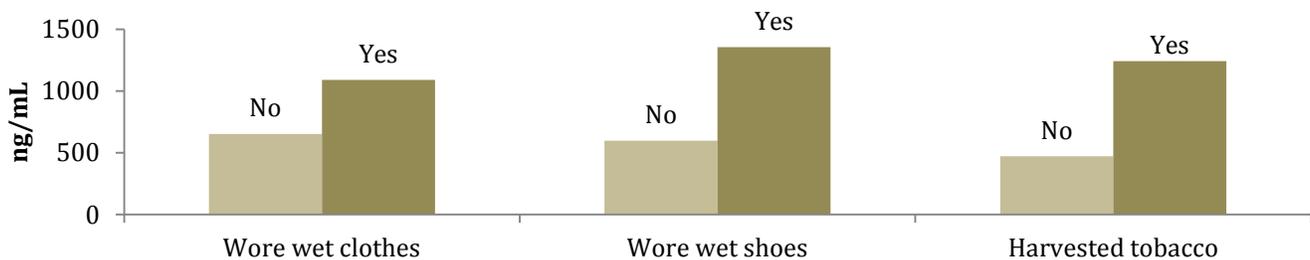
In 2012 and 2013, the researchers conducted interviews and collected urine samples from Latino farmworkers working in three eastern North Carolina counties (Harnett, Johnston, and Sampson), and from Latino immigrant non-farmworkers working in a Piedmont North Carolina county (Forsyth). From the larger study of 235 farmworkers and 212 non-farmworkers, specific individuals were selected to participate in sub-studies of brain anatomy (using magnetic resonance imaging, MRI) and of balance. The sub-study participants were selected on the basis of their potential pesticide exposure, and without reference to their tobacco exposure at work or tobacco consumption. Urine samples (which were originally collected to measure pesticide metabolites) for 63 different farmworkers, 62 in 2012 and 56 in 2013; and 44 different non-farmworkers, 44 in 2012 and 34 in 2013 were analyzed for cotinine levels. Salimetrics, LLC, a laboratory in State College, Pennsylvania, reported values of cotinine in ng/mL of urine (nanograms per milliliter).

## What did the researchers find?

### *Cotinine Levels: Farmworkers and Non-Farmworkers Compared*

- Farmworkers had much higher cotinine levels than did non-farmworkers.
  - Among farmworkers, the average (geometric mean) levels of cotinine were
    - 1,808.2 ng/mL of urine in 2012
    - 396.0 ng/mL of urine in 2013
  - Among non-farmworkers, the average (geometric mean) levels of cotinine were
    - 4.7 ng/mL of urine in 2012
    - 9.0 ng/mL of urine in 2013
- Even in 2013, when the average cotinine level for farmworkers was lower (396.0 ng/mL), the average farmworker level was still 44 times higher than the average non-farmworker level (9.0 ng/mL).
- The high levels of cotinine for farmworkers compared to non-farmworkers remained even when cigarette smoking was considered.
  - The average level of cotinine for farmworkers who never smoked was 541.3 ng/mL of urine.
  - The average level of cotinine for non-farmworkers who have smoked was 199.4 ng/mL of urine.

### *Correlates of Cotinine Levels among Farmworkers*



Cotinine levels were higher among farmworkers who worked in wet clothes, worked in wet shoes, or harvested tobacco in the three days before providing the urine sample.

## Recommendations

- Policy: Although procedures to reduce nicotine exposure among tobacco workers have been documented for over a decade, no changes in work practices or in policies to protect workers have been implemented. These include,
  - Limiting work in wet tobacco,
  - Providing workers with water resistant clothing, and
  - Providing workers with work uniforms so they can change out of wet clothing.
- Health
  - The long-term health effects of occupational nicotine exposure must be examined.
  - Nicotine exposure must be put in the context of other toxicants to which workers are exposed, including pesticides and heat.