

streamline

Seeing Patients Cradle to Grave on the U.S. Mexico Border: A Profile in Commitment

Jillian Hopewell, MPA, MA

Adrian Billings will tell anyone who asks that he loves what he does. Dr. Billings is a family physician practicing in one of the most underserved areas of the United States. He was born and raised in Del Rio, Texas, located on the US-Mexico border. The region's unique mix of language and culture has always felt comfortable to him and from the time he entered college he knew that he wanted to become a doctor and return to the Texas-Mexico border to practice.

Growing up, Dr. Billings had two important role models. When he was in high school he worked for a dedicated solo-practice veterinarian. In this role, Adrian would assist the veterinarian with house calls for animals in their care. The dedication and care demonstrated in this practice were important examples of how to run a medical practice as well as a veterinary practice. Dr. Billings' second role model was with his family physician, Dr. Garcia, who cared for many of the people in Del Rio. "My family doctor delivered me," Dr. Billings remembers, "and took care of me all through school including college when I'd come back home. After my freshman year in college I came back and was trained as an anesthesiology technician at the local small hospital in Del Rio. I was able to scrub in on surgeries and assist with patient care. One of my fondest memories is helping deliver babies with Dr. Garcia. I was 19 at the time and I reminded him, 'you know what happened 19 years ago? You delivered me!' I knew then that I wanted to be a family doctor who took care of everybody cradle to grave."

OPPORTUNITIES ABOUND

That dream was delayed when Dr. Billings was not accepted into medical school out of college. He decided to take a different path and entered into a University of Texas Medical Branch PhD program in Experimental Pathology. After graduation he went to work



Adrian Billings, MD

at the Centers for Disease Control and Prevention (CDC) in the Special Pathogens Branch of the Division of Viral and Rickettsial Diseases. Although it was interesting work, he never lost the drive to attend medical school.

He redoubled his efforts to apply to medical school and was accepted at the University of Texas Medical Branch at Galveston, Texas. While he was working at the CDC a colleague encouraged him to apply to the National Health Service Corps (NHSC) for support during his medical education. Dr. Billings eagerly accepted the financial support in exchange for a commitment to work at least four years in a medically underserved area. He began his residency at John Peter Smith Hospital in Fort Worth, Texas and served as chief resident in 2005-2006. Because his intention was to return to an underserved area of the Texas-Mexico border where there were few practicing OB/GYNs, he decided to take an additional year of training as an OB/GYN Fellow.

Once he finished his residency, he began looking for a place to practice. Since the Del Rio area did not meet the NHSC criteria of an underserved region to qualify for the scholarship repayment, he chose Alpine, TX which is relatively close to Del Rio and, where medical care was desperately needed.

For four years Dr. Billings ran a solo private practice in Alpine. He managed his practice with a strong commitment to the local community and functioned essentially as a community health center (CHC) without the benefits of the resources and services that are afforded to CHCs. When Dr. Billings arrived there had been no full time family physician providing care. He was one of only two doctors in a 6,000-square-mile area that delivered babies. In those first years of practice Dr. Billings delivered 40-70 babies each year. To meet the needs of some of the most debilitated patients, Dr. Billings also made house calls for those who could not make it in to the office. As a solo practice physician he was on call 24 hours a day seven days a week for six years.

PRESIDIO COUNTY HEALTH SERVICES

The practice hardships meant that Dr. Billings was unable to recruit a physician partner. At the same time he wanted to expand care to a greater area which included the town of Presidio right on the US/Mexico border. He decided that the best option would be to merge his practice with Presidio County Health Services, a Health Resources and Services Administration (HRSA) Health Center Program grantee.

He became a part of the Presidio County Health Services and saw immediate benefits for his patients. All of Dr. Billings' private patients were transferred over and now benefit from the community health center's resources and services. Since all of his patients continue to see Dr. Billings there are few adjustments from the patient perspective. With the support of the overall health center structure, Dr. Billings has been able to recruit a partner who helps to shoulder the patient care load. He is now covered under the health center's malpractice coverage

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which greatly reduces his vulnerability to lawsuits and the costs associated with insurance coverage. Dr. Billings enjoys the support of a HRSA grant that allows the center to provide more enabling and wrap-around services. He is also happy to be able to focus on patients more and worry less about the business side of running a practice.

The region of Texas where Dr. Billings practices is home to both migrants who travel part of the year to work in agriculture in the northern states as well as agricultural workers employed seasonally in the Texas border region. The Health Center that Dr. Billings joined, Presidio County Health Services, is one of the 169 health centers across the country that receives funding specifically to provide services to migrant and seasonal agricultural workers. Dr. Billings says that he "feels blessed to be able to take care of this population."

Dr. Billings is also very positive about his experiences with the HRSA-mandated quality control measures and the data collection system that facilitates the reporting process. From Dr. Billings' perspective the clinical performance measures and the Uniform Data System provide important quality assurance/improvement screening and peer review processes. He remarks that in a private practice it can be difficult to devote as much attention as is ideal to the outcomes of care. The clinical quality process at the health center provides a snapshot that gives a much better understanding of how the practice is achieving better health care.

Presidio County is in one of the poorest regions of the United States. Dr. Billings' biggest concern is the overall lack of access to care for many people in the region. He hopes that some of this lack of access will be ameliorated by the Affordable Care Act.

As is true in many isolated areas of the U.S., lack of access to care is especially challenging when a patient needs specialty care. In Dr. Billings practice the greatest need for specialty care is in the areas of child psychology and psychiatry, cardiology, gastroenterology, orthopedics, and ear/nose/throat. The nearest specialists are located more than 200 miles north in Odessa or west in El Paso, or nearly 6 hours away in Lubbock. To get some of his sickest patients into care Dr. Billings has become skilled at negotiating with specialists to see patients who lack insurance or have other challenging circumstances. He is also working to leverage additional resources such as telemedicine to provide on-site specialty care.

Inevitably Dr. Billings has had to take on more specialty care himself than he would if he were working in a higher resource area because he is the first point of access for most patients. He says that he has seen almost anything and everything.



Dr. Billings with the first baby he delivered after joining Presidio County Health Services, Inc. in April 2013.

One example he remembers vividly was several years ago when a young pregnant woman came into the emergency room with vaginal bleeding and abdominal pain. It became quickly apparent that she had an ectopic pregnancy which had already ruptured. The woman's blood pressure was critically low and she needed emergency surgery. She was too unstable to transfer the long distance to a major medical center. Dr. Billings sat with her and told her what needed to happen. He was very upfront about the fact that he was not as experienced in this procedure as he would have hoped; it had been 5 years since he had even assisted in this type of surgery. He knew however that he either needed to perform this surgery or she would die. In the end he was able to successfully operate and helped to save her life. "I certainly felt that I had someone working through my hands during this surgery." This woman is still one of his patients. While this case was extreme, Dr. Billings says that he still gets nervous in these situations. "Even today just delivering any baby is a miracle, a new experience, I still get nervous. I just hope that my training has been good enough when I am backed into a corner."

FAMILY MEDICINE RESIDENCY PROGRAM

In addition to providing quality care to the people in Presidio County, Dr. Billings is committed to improving the overall health care system in the region. To this end, five years ago Dr. Billings started talking to Texas Tech University Health Sciences Center-Permian Basin about establishing a formal rural family medicine residency program in the Big Bend region of Texas that includes Alpine, Marfa, and Presidio. The idea has come to fruition; the first resident has

been accepted after a competitive process and will begin the residency program later this year. Dr. Billings has also hosted over 60 medical students and more than 12 residents who have come through and spent time learning about frontier practice on the Texas-Mexico border. Dr. Billings says that he initially started to host students and residents when he was in private practice and feeling professionally isolated and lonely. He quickly realized that he became a better physician by helping to teach these medical trainees.

A couple of years ago Dr. Billings was elected as a Young Physician delegate to the American Medical Association on behalf of the American Academy of Family Physicians. He and his wife attended a reception in Chicago, with many of the other young physician delegates. He was the only family physician and the only person practicing in a rural area. The group was curious about what he did as a rural doctor. One person in particular didn't understand how it was that he could work in such an isolated area and deliver babies at all times of the night or day. She wondered what it did to his family. Dr. Billings' wife elbowed him in the ribs and said, "I'll answer this one. My husband works hard and has to work nights and weekends often. He is a great father to our children when he is there and when he's not able to be with us our children are learning about service through him. It is not always about you or about what you want, it's about helping others when they are in need. We are a team." Dr. Billings acknowledges that his efforts would not be possible without the support of his family and office staff. "I still feel that I am called to do what I am doing and that I am doing the work that I was put on this earth to do. Hopefully I am making a difference."

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What Happened to My Mobile Patient? – An Assessment of Health Network Outcomes Reporting

Nancy Gannon

Migrant Clinicians Network (MCN) began Health Network (HN) as proof of the concept that a patient navigation program could work successfully with patients on the move to provide continuity of care for a range of health conditions. Health Network first began with assisting client with tuberculosis (TB), then later added clients with diabetes, cancer, and pregnancy. For the past 18 years, HN has directed patients to clinics in more than 70 countries and hundreds of communities inside the United States, eliminating mobility as an obstacle to clinical care for both infectious and chronic diseases, and other health concerns.

Recently MCN undertook an evaluation to improve HN's responsiveness to clinics and strengthen disease management outcome reporting. Once a clinic enrolls a patient, HN staff maintains ongoing communication with the patient, schedules appointments, transfers records, searches for transportation resources, facilitates clinic visits, and provides a toll-free number to request medical record updates. However, MCN sent case completion reports only when a health center requested outcome information.

In January 2013, MCN began sending clinics case completion reporting forms for each patient who completed treatment or whose case was closed. A HN completion form includes: patient's health condition or concern, date enrolled and case closed, care outcome, and the country or clinic reporting completion. For TB patients, completion reporting forms also contain the initial and final TB classification, smear and culture results, and other testing. MCN's goal is to give clinics and health centers precise documentation regarding the outcomes of the mobile patients they enrolled with HN.

In the summer of 2013, MCN undertook an assessment of how useful health centers found the completion forms in order to determine the effectiveness of HN's outcome reporting. With this information HN would modify its communications with a clinic, to ensure that the program remains relevant and useful for the clinics involved.

The assessment identified key personnel at 10 different sites that had enrolled patients in HN since the beginning of the year. MCN began with a phone interview to the clinic. The interview included six questions that pertained to the content in each form that was sent to the clinical site (see Questions below). Each question addressed the effectiveness of a specific aspect of the comple-



Photo courtesy of Blue Ridge Community Health Center

tion reports. Phone interviews allowed for clear and thorough communication pertaining to the assessment. The interviews were conducted with the HN enrollment point person at each clinic. The questions were:

- Do you find it beneficial to receive completion forms for patients who have completed treatment and been lost to follow up?
- How do you use the information on the completion forms? Do the forms assist you with reporting outcomes?
- What type of information/data point is useful for determining outcome for a patient?
- Would you like more information about the patient's treatment outcome or the clinic or health center where the patient completed treatment? If so, what?
- Would you like to continue receiving completion forms from MCN?
- Are there any other comments/suggestions you have about patient completion forms?

The overall response to the assessment was very positive, with all 10 sites agreeing that completion forms were beneficial. A health department contact noted, "[completion forms] are very effective and efficient." In response to a question about the type of information most useful for determining the outcome for a patient, a coordinator from a migrant health program on the east coast explained that "just knowing that there was an attempt with the client if they were lost to follow up" was helpful. Several other sites agreed about the value of knowing that patients they enrolled with HN were followed up by an HN case manager.

The sites also acknowledged the usefulness of outcome reports in creating their own closing reports on their patients. Five of the sites expressed their appreciation for knowing the treatment start and end dates, as well as the reason why the patient started or stopped treatment. Half of the sites interviewed offered suggestions for the completion forms, such as including new contact information for the patient and all of the health centers from which the patient received care while enrolled in HN.

The information compiled through this assessment of outcome reporting's utility has not only improved HN's communication with clinics, but also confirms that HN can serve as an effective tool for providing care outcomes for mobile patients under the Patient Centered Medical Home framework. Health Center Programs face a particular challenge trying to report outcome data for mobile patients. In some cases, a migrant health center will treat a patient, and that patient may not return to their health center. Outcome reporting allows sites to document whether the patient was treated elsewhere or lost to follow up.

HN, through its global patient navigation, provides crucial linkage for patients who do not reside in a permanent location. A coordinator from a Migrant Health Program noted, "We are so appreciative of this service. It is great to be able to send [patients] out into the world and trust that MCN will catch them whenever they can."

To learn more about enrolling mobile patients in Health Network please contact Ricardo Garay at rgaray@migrantclinician.org; tel: 512-579-4508.

Female Crew Leaders of Migrant Agricultural Workers

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Clinicians are always looking for ways to improve the health and well-being of the people they serve. Nurses working in migrant and seasonal agricultural worker (MSAW) camps in northeastern Ohio have recognized one such opportunity, that of working with women who lead MSAW crews.

On Midwestern farms, such as in Ohio, growers are contracted by large food processing corporations to raise tomatoes, lettuces, peppers, corn and radishes. Crew leaders on the farms in northeastern Ohio confer with growers to obtain suitable contracts for their crews. Crew leaders usually receive a post card in the mail from the grower in January. The growing season's start date and the number of workers the crew leader must bring to the area are written on this card. Crew leaders recruit, hire train and supervise their own workers to cultivate, harvest, process, and package various crops. Some crew leaders have the power to fire workers. The crew leader often builds the crew through family and friendship networks. By recruiting familiar people, the crew leader improves the chances that the crew members will work well together. Crew leaders may furnish transportation from their winter residences in the southern United States to the farms in Ohio. They may consult with employers to ensure available and suitable housing for families and single individuals. In addition, they may manage the payroll and also keep production records. Crew leaders drive a grower's or personal vehicle to transport workers and equipment. Growers provide farm implements, but crew leaders provide access to and training with the equipment. Crew leaders may be additionally responsible to help team members navigate the educational and medical systems in the area. In many cases, without crew leader assistance, workers would have difficulty locating churches, grocery stores, pharmacies, schools, and other necessary services.

Female Hispanic Crew Leaders

Approximately 400 Hispanic farm workers and families return each spring to the same rural location in northeastern Ohio. A majority of the migrants travel as large extended families. These migrant farm laborers work for five growers. The largest grower employs nearly 300 workers, the next largest hires about 45. The other growers employ just five to 10 MSAWs at a time. The camps where the crews live surround the growers' fields.



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Traditionally, MSAW crews are led by men, however in this part of Ohio, women lead several MSAW crews. These female Hispanic crew leaders (FCL) step beyond the gendered norms of their Hispanic-American families and in doing so, impact the lives of their crews and families in numerous ways. Their influence in the fields, in their camps, at the medical clinic, and in the community was observed over the course of several seasons.

Leadership Narratives

The lead author (LW) conducted face-to-face, individual interviews with four Hispanic women to learn about their role as crew leader, and how they use that role to improve the health of their communities. Both authors analyzed the data. Each woman was assigned a pseudonym to protect her privacy. When the interviews took place Carlota and Olivia had been crew leaders for nine years and Elena and Sofia for four years. All four women were able to speak both English and Spanish fluently. All the women had grown up in migrant farm worker families and were US residents. They were all in their 30s, ranging from 31 to 38 years of age. Three were married and one was single. All four women had children; one woman also had grandchildren. Two women were leaders of all male crews; two were leaders of mixed gender crews. The leadership qualities these women exhibited were attractive to the nurses at the migrant camp clinic; the FCLs were able to encour-

age health seeking-behaviors and treatment compliance by their crews because they were relational, assertive, and nurturing in and out of the fields.

Relational leadership. The FCLs knew their crew members well, which was not always the case with male crew leaders. The women built strong relationships with their crews. Carlota said, *"I get along pretty good with everybody and they get along pretty good with me. And every time I do something for them they always say, 'If we were working on another crew for a man as a crew leader, I don't think we could ask for this or for that.'"* Elena described how her leadership style was different from that of her male counterparts. She said, *"If there is a problem, I ask them what it is. I talk to them and we work it out. We make a group decision and then fix it. [Men] don't worry about everyone working in peace. They wouldn't have some of the problems if they just didn't order people to do stuff."*

Assertive leadership. The FCLs were confident and could be assertive when necessary. Olivia exhibited this when dismissing a fieldworker. She said, *"Last year there was this guy that used to work with us but we told him 'not this year' because he did not drink his medicine; because he came out positive for TB and he didn't want any treatment."* Sofia showed her authority with a man on her crew. *"[My grower] gives me the authority to [send people home]. The past week, one of them came in drunk on Monday. And I told*

him, 'Are you drunk?' And he said, 'No'. And I told him, 'Yes you are. You know what? Take a day off. Go home.' And since that, none of them had a drink." Elena described a change she made on her crew with their physical and mental health in mind. "In the beginning, every job was supposed to rotate every three hours. I started having everyone rotate every hour. That way you didn't get as tired, because some jobs are just harder. And on the easier jobs you didn't get as bored. Everyone liked this and it made it better for all of us."

Nurturing leadership. The involvement of FCLs in the crew members' lives did not stop in the field, the wash house or the packing house. Workers knew they could seek their FCL's advice when ill. Sofia said, "They look for me when they need medicine or something. They will come to me and say, 'Sofia, my stomach hurts. [Or] I have a pain in my ear.' So when they need directions they come to me. Olivia elaborated, "Every guy that is in my crew, I try to take care of them. They tell me, 'I don't feel good', I tell them, 'There's a doctor at the clinic here. Go to it.'" A FCL even drove crew members and their families to the local clinic when necessary. If she had to get back to the field the FCL would leave her cell number so the clinic staff could call her to come get the patient after treatment.

FCLs and the Clinic

The farm workers in the locale have access to a free healthcare clinic centrally located to the five growers' camps. Holistic care is offered based on an assessment and interpretation of the MSAWs' health beliefs and practices as well as their cultural and linguistic needs.³ The clinic was operated by a team of volunteer doctors and nurses. The services offered included physical assessments and treatment of illnesses, as well as health promotion activities like immunizations, well child exams and gynecologic exams. Several local physicians

and nurses from the area donated their time with the support of their institutions and universities. Medical, nursing and pharmacology students as well as medical residents also had volunteered as part of their training. Spanish interpreters were available. The clinic was open both day and evening hours. Because FCLs took a personal interest in the needs of the migrant families, the quality of services rendered at the clinic had improved significantly over the past few years. One example was an event held soon after the MSAW crews arrived in the spring.

Clinic Partners. Each year, usually in early June, the clinic staff holds a Welcome Day, a prime example of holistic and collaborative care. The FCLs work with the clinic staff to guide the migrant families through processes that address educational, medical, spiritual and social needs. A major priority during the day is the screening and registration of children for the federal Migrant Head Start program. In addition, people from the local public school district and an after-school program register children for summer school activities. Dental, hearing and vision screenings are available along with opportunities to receive physical exams. At the same time, religious organizations announce programs that are available for children and adults. Finally, the staff describes weekly social activities offered after work to the MSAWs and their families. Throughout the day, FCLs serve as a go-between for staff and MSAWs and their families. They translate announcements into Spanish and help parents complete clinic and school forms. They communicate MSAWs' questions to the staff.

Recommendations to Health Care Workers

Because of their positions of authority, leadership, and respect, FCLs open doors for health care professionals to work more closely with people in the migrant social network.

Hispanic FCLs are women of influence. In their traditional culture, Hispanic women are responsible for the health and welfare of their spouses, children, and extended families. Since an FCL views her crew as extended family (and often it is), she plays a significant role in the health and well-being of the crew. Health care workers can cultivate relationships with crew leaders who can in turn influence the way MSAWs prioritize curative care and preventative health.

Workers hate to miss work for fear that their pay will be reduced or they will lose their jobs.² Job responsibilities are perceived as more important than personal health.¹ Vigilant crew leaders may be able to decrease lost work time by timely attention to the workers' health and in turn increase the crew's productivity. Clinic staff should affirm FCLs who take time to drive sick crew members to the clinic or require their crew members to comply with medication regimes.

Because these FCLs are bilingual, they are able to help their crew members navigate the healthcare system. FCLs explain medical findings and the importance of follow-up instructions. Invested with the dual authority of domestic and workplace leadership, FCLs are uniquely positioned to collaborate with health care professionals. This collaboration leads to better communication and comprehension between nurses and the migrant community which they serve. ■

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New Initiative Launched to Engage Community Research Partnerships

Jillian Hopewell, MPA, MA

On April 17th a new initiative launched in Washington State with the intent to spark collaboration and creativity and address gaps in research and education on the behavioral and physical health of Latinos throughout the region and nationally. The Latino Center for Health is an independent organization supported by the University of Washington School of Social Work and the Medical School. According to the Center's mission statement, "the Latino Center will create a rich environment for nurturing the next gen-

eration of leaders who will respond to the current and emerging health and behavioral health issues facing their communities. All efforts will be based on principles of social justice, human rights and inclusion." The intent of the center is to connect researchers that want to study health issues in the Latino community with community members and organizations that have an area of concern that would benefit from additional research. The Center also hopes to engage more fully in health policy discussions at the state and

national level. Currently the Center's principal areas of focus are:

- Physical Health
- Health Services Access and Utilization
- Behavioral Health
- Violence Prevention
- Occupational Health
- Binational Collaborations

For further information about the Latino Center for Health please visit: latinocenterforhealth.org

HIV in the Migrant and Seasonal Agricultural Worker Population: Oral conditions early indicators of infection

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Rural United States is home to the bulk of our country's agricultural industry. Farms both large and small are vital in the delivery of fruits, vegetables and grains to our dining room tables. Equally as vital to the farms across the country are migrant and seasonal agricultural workers (MSAW); though invisible to most of us, they are key players in cultivating and harvesting various crops in an efficient and timely manner.¹ Their mobility among other access barriers makes them a difficult to reach population.¹⁻³ Healthcare providers must be educated about and sensitive to the unique and complex needs of MSAWs for the delivery of optimal health services.

Accessing healthcare is difficult for the

population.²⁻¹⁰ Barriers include cost, language, transportation, healthcare clinic hours and knowledge of where to go for services. A study of migrant health centers across the country revealed that 52% of the clinics were not open in the evening and only 13.6% were open on Saturday or Sunday.¹¹ Leaving the fields early for a medical/dental appointment can mean missing several hours of pay which could translate to not providing even the basic necessities of life for the following week.² Those that have families are relied upon to either provide for daily needs, if accompanied by spouses and children, or to send money home to family members who remain in their country of origin. Absence from the fields could also be

cited as reason for termination, making most farmworkers very reluctant to miss work for healthcare appointments, providing they even know where to seek health services in the first place. These barriers and others result in healthcare that is sporadic at best for the majority of the population.

MSAWs and HIV Infection

Given MSAW's difficulty accessing care in many parts of the country, it is particularly important that all members of the health care team pay attention to signs of possible HIV infection so patients can get into care at an early stage of disease. Oral health providers can play an important role in this effort.



Figure 1. Acute pseudomembranous candidiasis in an HIV positive patient



Figure 2. Erythematous candidiasis in an HIV positive patient



Figure 3. Hairy Leukoplakia in an HIV positive patient



Figure 4. Aphthous ulcer (major) in an HIV positive patient

Figure 5. Kaposi's sarcoma in an HIV positive patient



(Photos by Mona VanKanegan, DDS)

In the early 1980's, when the United States was first learning about HIV/AIDS, the manifestation of oral lesions played a key role in identifying HIV+ individuals.¹⁵⁻¹⁸ Markers of immune dysregulation become evident in the oral cavity and are some of the first clinical signs of HIV infection.^{19,20} Oral candidiasis and hairy leukoplakia are two of the earliest opportunistic infections among HIV positive patients (see figures 1-3 available in online version).¹⁵⁻¹⁸ While relatively common among the very old and the very young, candidiasis is not a common condition affecting young, otherwise healthy individuals. Likewise, hairy leukoplakia is almost never encountered in those who are immunocompetent and were some of the early indicators of HIV infection in the beginning of the US epidemic. Additional oral lesions experienced later by HIV+ patients include herpes simplex lesions, aphthous ulcers (aphthous major), condyloma acuminatum, Kaposi's Sarcoma and squamous cell carcinoma (see figures 4-5, available in online version).^{20,21} In the general population, highly active antiretroviral therapy (HAART) has greatly reduced the prevalence of oral lesions as early manifestations of opportunistic infections in HIV infected individuals. Early diagnoses and initiation of HAART has resulted in a 30% reduction in HIV associated oral lesions.^{20,22,23} Because MSAWs are typically diagnosed later in the

course of the disease than the general population, oral lesions can still serve as an early indicator of HIV infection and a motive to encourage testing. Recognition of the early appearing lesions as well as those that follow later can alert the provider to the possibility of HIV infection and the need for appropriate referral and/or testing. Both medical and dental healthcare providers serving the population should be cognizant of increased HIV prevalence in the population, their delayed diagnoses and what to look for in these patients.

Education and intervention

It is imperative that HIV education and interventions for MSAWs be culturally appropriate for best efficacy and compliance.^{12,24} *Promotores de salud* or community health workers have shown to be very effective in reaching the population with health messages.^{2,13,25} The National Center for Farmworker Health (NCFH) recently produced an HIV prevention toolkit for unaccompanied farmworker men.²⁶ The complexities surrounding the population call for a combination of educational methods in delivering HIV education messages and preventive interventions.

Best Promising Practices

The entire healthcare team can play a role in

the delivery of HIV intervention. For vulnerable populations, Health Center Programs and other health care sites could consider making HIV testing available by both medical and dental providers in an interdisciplinary approach to care. Health Center Program Grantees present a perfect opportunity for provider collaboration in diagnosis and treatment of HIV infected MSAWs as these health centers have a better change of co-located medical and dental services in the same facility than most health care sites. Community based organizations have been found to be more effective in reaching these at risk groups because of their greater number of bilingual staff, outreach programs, and culturally sensitive approaches to service delivery.¹⁴ Healthcare providers should be knowledgeable about the issues MSAWs face, and the idiosyncrasies associated with providing them with comprehensive, culturally appropriate health services.

Prompt diagnosis and services for those infected with HIV is imperative for positive long term outcomes as well as for general public health implications. Identification of oral lesions can be the first clinical signs of HIV infection in MSAWs; therefore, collaboration among all members of the health care team is necessary for the adequate delivery of health services to this difficult to reach population. ■

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Cancer Prevention & Survivorship

360 trained clinicians/promotores  **42,609** community members reached with education

Worker and Environmental Health

168,470 pesticide education comic books distributed to **163** organizations



97% of organizations distributing comic books said they are a **useful tool** to educate farmworkers and their families about pesticide exposure risk and prevention.

Fostered **2 new** 13 total

Environmental & Occupational Health Centers of Excellence

Clinician Education

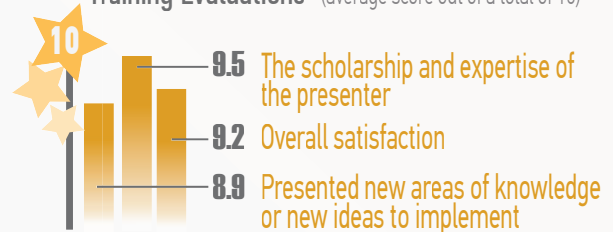
1,516 clinicians trained



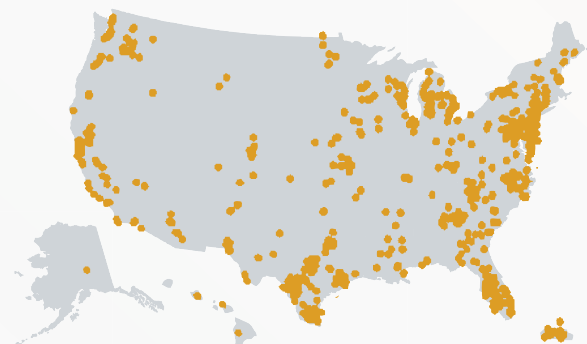
equivalent to

4 clinicians trained **every day**

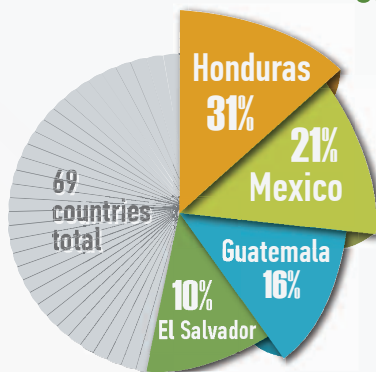
Training Evaluations (average score out of a total of 10)



24,648 technical assistance encounters



Continuity of Care for Mobile Patients



Health Network Patients' Country of Origin

68% increase over 2012
4,286 medical records transferred

100% of clinics that enrolled patients in Health Network received **completion reports** on the patients they enrolled.



83% of **1,347** Active TB patients (national & transnational mobile cases) completed treatment (2005 – 2013)

MCN Makes a Difference in 2013

The following stories illustrate just some of the important services and engagement MCN provided during the year...

A Partnership to Engage Men in Ending Intimate Partner Violence

Enlace Comunitario is a social justice organization led by Latina immigrants in central New Mexico that provides direct services to Spanish-speaking female victims of domestic violence and advocates for the rights of Latino immigrants and their children. In 2013 *Enlace Comunitario* decided to initiate a new program to work specifically with men. Without prior experience designing and developing a male-specific curriculum, *Enlace* looked to MCN for help. "If it wasn't for your organization, we would be stuck trying to develop something; [*Hombres Unidos*] really helped us get the ball rolling in our community," said Virginia Perez-Ortega, Director of Prevention. To date *Enlace Comunitario* has trained 150 men in their community using MCN's *Hombres Unidos* curriculum. Ms. Perez-Ortega says,

"When I look at the work MCN has done, it feels that we are supported and that we are not alone. It is especially important knowing that this work has actual research tied to it with tools that help our communities. It feels really, really good to know that we have this support."

Working together, MCN and *Enlace Comunitario* will be using newly designed materials, resources, and strategies to expand this critical program in the years to come.

MCN Supports Clinicians in Training to Pursue Careers Serving the Underserved

Dayna Fondell shared her experience working with MCN during her graduate nursing program:

"I came to MCN in January 2014 for my final semester internship in my Master of Science in Public Health Nursing. Not only has the semester allowed me to work on specific projects within my interests, but it also provided me with the general opportunity to gain a deeper understanding of the clinical and public health needs of migrant populations. My work with MCN is already impacting my perspective as a nurse at an FQHC (federally qualified health center) in Austin, TX.

Now I am able to better identify mobile patients, and am currently advocating for more tailored services for these patients, such as Health Network and other programs I have learned about through MCN. Throughout my Masters I have focused on studying interdisciplinary care in a range of settings.

This internship has convinced me that healthcare for migrants and the mobile poor is the setting with the most glaring need for interdisciplinary care. I feel so privileged to have gotten to learn about even a small fraction of all the different programs and professions that are advocating for these patients. Whether through paid or volunteer work I know I want to stay involved with migrant/mobile patients, as well as supporting the wide range of people that work to advocate for their health."

MCN Provides Global Care Coordination Services

MCN's **TBNet** (a component of *Health Network*) was contacted by the Centers for Disease Control and Prevention's Division of Global Migration and Quarantine to enroll a patient that had come to the United States as part of a performance group. The patient was diagnosed positive for TB, had initiated treatment and needed to find a clinic in Uganda to continue treatment.

After enrolling the patient, TBNet staff contacted the National Tuberculosis Program of Uganda to coordinate care. Staff sent a patient clinical summary and a copy of all medical records. The country coordinator referred TBNet to the International Hospital Kampala as a point of contact for the patient.

Once the patient arrived in Uganda, **TBNet** followed the case using a combination of e-mails and phone calls to both the patient and the physician to ensure proper continuity of care. The patient reported feeling progressively better and the physician was able to confirm that the patient finished treatment several months after arriving back in Uganda. Personnel at the hospital performed follow-up testing to confirm the closure of the case. The patient was clearly relieved to have been able to finish treatment in her own country. All of these outcomes were reported to the Division of Global Migration and Quarantine Office, and demonstrate **TBNet's** effective global patient navigation.

[The material presented in this portion of *Streamline* is supported by the Environmental Protection Agency, Office of Pesticide Programs, Cooperative Agreement # x8-83487601]

Best Practices in Identification of Migrant and Seasonal Farmworkers: MCN and Blue Ridge Community Health Services Partner to Improve Quality of Care

Kerry Brennan

Why should clinicians need to know about their patients' occupation? How can the identification of migrant and seasonal agricultural worker patients make a difference in the exam room? Migrant Clinicians Network's (MCN) Environmental and Occupational Health (EOH) program partners with health centers to address these questions and help improve the quality of care.

Beginning in 2012, Blue Ridge Community Health Services partnered with MCN to become an Environmental Occupational Health Center of Excellence. MCN offered onsite continuing education, technical assistance and resources to help clinicians improve the recognition and management of work-related and environmental health conditions. A key part of this effort is the identification of patient occupation as many health center patients are employed in high risk jobs such as agriculture and construction. Knowing the occupation can impact the differential diagnosis. For instance, being aware that their patients work in agriculture may help clinicians better recognize symptoms and potentially prevent a work-related condition such as a pesticide exposure.

MCN provided Blue Ridge staff with a bilingual tool called *Identifying Migrant and Seasonal Farmworkers* (available at http://www.migrantclinician.org/files/IDMigrantSeasonalFarmwrks-final_0.pdf). This tool is being used by the front office staff to more accurately identify farmworkers and their families. Once identified, the information is passed on to the provider for use during the clinical encounter. The goal is to ensure that occupation is not used solely for administrative and reporting purposes, but also is used for clinical care. Blue Ridge's Patient Centered Medical Home (PCMH) activities augment the identification process. The identified farmworker patients are noted during provider team huddles at the beginning of the day. During patient encounters, clinicians also identify and document any farmworkers not identified during intake. These patients are discussed during end-of-day

Updated Pesticide Tools

MCN's Pesticide Clinical Guidelines and Pesticide Exposure Assessment Form assist in the recognition and management of acute pesticide exposures in primary care settings.

The pesticide guidelines were adapted from guidelines by Dr. Dennis H. Penzell, a former medical director of a health center with experience in large-scale pesticide exposure incidents.

The Acute Pesticide Exposure Form was adapted from the data collection on an acute pesticide exposed patient tool developed by Matthew C. Keifer, MD, MPH, Director of the National Farm Medicine Center, appearing in the

EPA's Recognition and Management of Pesticide Exposures, 6th Edition, EPA 2013.

These resources were developed with guidance from MCN's Environmental and Occupational Health Advisory Committee – a panel of healthcare professionals and researchers with expertise in pesticides and migrant health. To download these tools visit: <http://www.migrantclinician.org/toolsource/tool-box/pesticide-clinical-guidelines.html>

huddles to assess any gaps in the identification process. The huddles and strengthened identification process help Blue Ridge to improve quality of care for their farmworker patients by better equipping clinicians to identify the unique healthcare needs, including work-related conditions, of their migrant patients.

In reference to the MCN sponsored program, Shannon Dowler, MD, the Chief Medical Officer at Blue Ridge Community Health Center, says "In the fast pace of the clinic, it can be easy to bypass a thorough social history, when in fact that may be the key to making an accurate diagnosis and treatment plan. Simple reminders incorporated in the workflow make it easier to cap-

ture this type of critical information!"

MCN has developed this program to improve care in the primary care setting, supported through a cooperative agreement with the US Environmental Protection Agency (EPA), Office of Pesticide Programs as part of the National Strategies for Healthcare Providers: Pesticide Initiative. To date, MCN has partnered with fourteen health centers to establish Centers of Excellence in Environmental and Occupational Health. To learn more about this program, contact Amy K. Liebman, MPA, MA, Director of Environmental and Occupational Health by email aliebman@migrantclinician.org or by phone, 512.579.4535.

An estimate of the U.S. government's undercount of nonfatal occupational injuries and illnesses in agriculture

J. Paul Leigh PhD, Juan Du PhD, Stephen A. McCurdy MD, MPH

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Introduction

The federal government's undercount of nonfatal occupational injuries and illnesses for all industries combined has received considerable research and popular press attention.¹⁻³ A U.S. General Accounting Office report addressed undercounting and suggested remedies for all industries combined.⁴ This study extends previous research by focusing on agriculture, an industry that merits special attention for several reasons. First, although estimates vary, agriculture employs roughly 2-4 million people and includes the highest share of self-employed persons in any industry.^{5,6} Second, agriculture is among the most hazardous industries, especially for the self-employed.^{7,9} Third, agriculture employs many undocumented workers; for example, the most recent analysis from the National Agricultural Workers Survey (NAWS) estimated 53% of all hired crop workers were undocumented.¹⁰ Contentious debate surrounds whether undocumented workers should be granted citizenship and the impact this may have on workers' subsequent use of Medicaid and workers' compensation.^{11,12} Fourth, many farm workers are migrants; the NAWS estimated 42% of crop workers annually traveled 75+ miles to obtain jobs.¹⁰ Fifth, and most importantly, agriculture poses the greatest challenge of any industry for generating estimates of undercounting because of the seasonal nature of employment and predominance of small, family-run operations.¹³

We measured the injury and illness undercount as the difference between estimates from the Bureau of Labor Statistics (BLS)'s Survey of Occupational Injuries and Illnesses (SOII) and our own estimates. Unlike the SOII, we accounted for the self-employed and workers on small farms as well as willful and negligent underreporting by both employees and employers. We believe our estimates are conservative, in part because

we use the same criteria as the BLS to qualify a case as an occupational injury or illness. We do not include, for example, estimates of job-related cancers, chronic obstructive pulmonary disease, and circulatory disease that far exceed those recognized by the SOII.^{14,15} The undercount has institutional and behavioral causes. Institutional causes pertain to deliberate reasons for excluding persons. Two of these institutional causes are the exclusions of self-employed farmers on all farms and workers on farms with less than 11 employees from the SOII. A third institutional cause is the government's undercount of employment of farm workers in virtually all government data sets. This employment undercount is widely recognized owing to the fluid and part-time nature of farm work.⁷ BLS readily acknowledges the employment undercount and estimates its magnitude in supplements to the Quarterly Census of Employment and Wages (QCEW).¹⁶ There are two behavioral causes: negligence (e.g., employer inadvertently fails to record qualifying injuries in the OSHA log) and willful underreporting (e.g., employer purposefully fails to record qualifying injuries or employees do not notify employers for lack of knowledge regarding reportable injuries or fear of reprisal).^{1,2} Despite the undercount, the SOII is widely cited by researchers and journalists, in part, because it has been providing the only annual national estimates of nonfatal workplace injuries and illnesses for 40 years. There are three additional data sets with relevant information, but none as comprehensive as the SOII. The National Health Interview Survey provides information on injuries, but not illnesses nor estimates within industries. The Census of Fatal Occupational Injuries provides information within agriculture but only for injury fatalities. The NAWS contains data on injuries but only for crop, not animal farms.

Discussion

Our approach estimated the undercount of nonfatal occupational injuries and illnesses on crop and animal farms using data from the SOII, QCEW, CPS, and assumptions from the literature. Whereas the SOII estimated 32,100 cases in 2011, we estimated

143,436, indicating that SOII missed 77.6%. A sensitivity analysis suggested the percent missed by SOII ranged from 61.5% to 88.3%. The reasons for this undercount are straightforward and, for the most part, readily acknowledged by BLS. We refer to these as institutional causes of the undercount. First, the SOII explicitly excludes farms with less than 11 employees, all self-employed farmers, and family members. Second, SOII, QCEW, and CPS acknowledge data-gathering problems from agriculture due to the transient nature of the work and the extent of employment accounted for by undocumented workers. These institutional causes account for nearly one-half of the undercount. Third, there is considerable evidence that workers and employers in all industries underreport cases due to willfulness and negligence.^{1,13,17-20} This third cause, which we label behavioral, accounts for a little over one-half of the undercount. The QCEW is not the only data set with information on agricultural employment; the CPS and the Census of Agriculture also generate estimates. We preferred the QCEW because it serves as the basis for estimates in the SOII. It is nevertheless useful to compare employment estimates. The QCEW estimates 532,245 and 230,610 employees for crop and animal farms, respectively, in 2011. In the CPS for 2011, for private sector employees, these numbers were 626,000 for crop farms and 447,000 for animal. Carroll²¹ recently analyzed Census of Agriculture data from 2007 and estimated 1,358,020 farm workers on crop farms and 434,953 on animal farms. But none of these estimates are for FTEs, and agriculture is well known for transient and part-time work. Thus, each of these data sets, including the QCEW, have deficiencies.²² The CPS and Census of Agriculture data suggest an employment undercount by the QCEW. Accordingly, our estimates accounted for an estimated 14.29% employment undercount by the QCEW. Also, and more importantly, we only used ratios from the QCEW to adjust numbers of injury and illness cases from the SOII, and these ratios are similar for all three data sets (QCEW, CPS, and Census of Agriculture). In addition, if the QCEW under-

■ An estimate of the U.S. government's undercount continued from page 11

count bias is the same for farms with fewer than and more than 11 employees, then these ratios were appropriate.

Our findings can be compared with others in the literature. Leigh et al.¹³ found that for all industries combined, the SOII missed between 33% and 69% of cases with the preferred estimate being 45%. Findings in other studies and those summarized in Leigh et al.¹³ suggest undercounting percents from 11% to 75%.^{1,17-20} Our higher estimates for agriculture are consistent with the unique SOII exclusions and the inherent undercounts of employment in agriculture. Using SOII fatality data in 1990 and Census of Fatal Occupational Injuries fatality data in 1992, Leigh et al.²³ estimate that SOII missed 79% of cases in agriculture in the 1990s.

Most studies suggest that the smaller the firm, the higher the injury rate, but these studies are predominately outside agriculture and frequently from other countries.²⁴⁻²⁶ Data from the SOII, however, suggest that the smaller the establishment size, the smaller the injury rate.²⁷ Our sensitivity analysis allowed for both lower and higher rates in scenario #1. We assumed that farmers and family members experienced the same rate of injury and illness (cases-per-number-employed) as employees on farms with more than 11 employees. This might be an underestimate for farmers because self-employed persons may take more risks than employees; the fatality rate for the self-employed is considerably higher than for employees both on and off farms.²⁸ It may be an underestimate for family members as

the farmer may not let family members be exposed to as much risk or take as many chances as either the farmer him or herself or a paid employee. For these reasons, we chose alternative assumptions in the sensitivity analysis.

Limitations of our study include undercounting assumptions that were not addressed in the sensitivity analysis. The first was the assumption that the QCEW missed 14.29% of employment in agriculture. This 14.29% technically applied to the broad agricultural division crops, animals, logging, fishing, hunting, and support services combined but we assumed it applied to crop and animal farms. Crops and animals comprised approximately 70% of total

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Pesticide Exposure and Depression among Male Private Pesticide Applicators in the Agricultural Health Study

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Introduction

Exposure to pesticides, particularly organophosphate insecticides (OPs), may be positively associated with depression.^{3,4,5,16,18,20,21,27,28} However, only a few of these studies were longitudinal,^{3,4,18,21} an important consideration because many people with depression will recover and some may relapse.¹⁰ The largest longitudinal study previously conducted (651 Colorado farmers and their spouses) assessed depression annually for three years using the Center for Epidemiological Studies-Depression Scale (CES-D) and found that individuals who reported past pesticide poisoning at baseline were twice as likely to be depressed during follow-up as those who did not.⁴ That study, however, did not evaluate associations with chronic exposure in the absence of poisoning or to specific pesticides.

The Agricultural Health Study (AHS) is a prospective cohort study including 52,394 licensed private pesticide applicators (mostly farmers), designed to assess associations between agricultural exposures and health endpoints.² We previously found a higher prevalence of depression among male applicators who reported past pesticide poisoning or use of pesticides from several different classes.⁴ That study, however, used a cross-sectional design and did not examine specific pesticides. The aim of the current study is to assess associations between pesticide use and depression among male pesticide applicators in the AHS.

Discussion

We found positive associations between use of some pesticides and depression among male private pesticide applicators in the AHS. Depression was positively associated in each case group with ever-use of two pesticide classes, fumigants and organochlorine insecticides, as well as with ever-use of seven individual pesticides: the fumigants aluminum phosphide and ethylene dibromide; the phenoxy herbicide 2,4,5-T; the organochlorine insecticide dieldrin; and the OPs diazinon, malathion, and parathion. Positive relations

between depression and cumulative days of use were evident, although non-monotonic, in each case group for the fumigants ethylene dibromide and methyl bromide; the fungicide captan; and the organochlorine insecticide lindane. Positive associations between depression and acute, high-intensity pesticide exposures, such as pesticide poisoning or high pesticide exposure events, were reported previously in a longitudinal study of 651 Colorado farmers and their spouses⁴ and cross-sectional studies of 208 Costa Rican banana plantation workers²⁸ and 17,585 male private pesticide applicators⁴ and 29,074 wives in the AHS.⁵ In our study, depression was positively associated with physician-diagnosed pesticide poisoning and high pesticide exposure events among PRE-E and PRE-B cases, but not among POST cases.

Previous studies have observed positive associations between depression and exposure to any pesticides or to some pesticide classes, particularly OPs: a follow-up study in Brazil that compared 25 agricultural workers assessed after three months of OP exposure to themselves assessed again after three months of no OP exposure,²¹ a three-month follow-up study in Poland that compared 26 OP-exposed greenhouse workers to 25 unexposed canteen, kitchen, and administrative workers,³ a three-year follow-up study of 257 farm operators in Iowa that compared those exposed to pesticides to those who were not,¹⁸ a cross-sectional study in England that compared 127 current and retired sheep dippers exposed to OPs to 78 unexposed current and retired police officers,¹⁶ and a cross-sectional study of 17,585 male private pesticide applicators in the AHS that separately compared those exposed to any pesticide or to seven pesticide classes (carbamates, fumigants, fungicides, herbicides, insecticides, organochlorine insecticides, OPs) to those who were not.⁴ A study of 567 agricultural workers in France that evaluated exposure to any pesticide, three pesticide classes, or 13 herbicide families, using no exposure to the pesticide class/family in question as the reference, reported positive associations between depression and exposure to herbicides in general and dinitrophenol herbicides, but not exposure to any pesticide, fungicides, insecticides, or the other 12 herbicide families.²⁷ In contrast, a cross-sectional survey of 9,844 sheep dippers in England and

Wales that used no exposure to any pesticides as the common reference found no association between depression and use of sheep dip (usually diazinon or other OPs), other insecticides, herbicides, fungicides, or wood preservatives.²³ In our study, depression was positively associated with cumulative days of use of any pesticide among PRE-E and PRE-B cases, ever-use of the pesticides classes fumigants and organochlorine insecticides in each case group, and ever-use of several other pesticide classes, including OPs, in at least one case group. Results appeared to be independent of pesticide poisoning because we observed similar results when we excluded applicators who reported physician-diagnosed pesticide poisoning (data not shown).

Only one previous study evaluated the association between depression and a specific pesticide, finding a cross-sectional association between parathion exposure and CES-D scores indicative of clinical depression among 115 adults in Jackson County, Mississippi.²⁰ We found that ever-use or trend versions of cumulative lifetime days of use of several individual pesticides, including parathion, were positively associated with depression.

In general, we observed fewer positive associations between pesticide use and depression among POST cases than among PRE-E or PRE-B cases. Reverse causation—where depression increases exposure, perhaps through careless handling of pesticides—is unlikely to explain the differences in associations among case groups because use of chemical resistant gloves was not inversely associated with depression after adjustment for age and state and because including use of chemical resistant gloves in models for the weights did not change results. Alternatively, differences among case-group-specific associations might be due to exposure being evaluated closer to first reported diagnosis of depression for PRE-E and PRE-B cases than for POST cases, which could be particularly important for pesticides, such as organochlorine insecticides, with marked secular trends in use. Using information on past instead of ongoing pesticide use could have obscured associations with POST depression. Differences among case-group-specific associations might be due to residual confounding from observed differences in per-

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■ Pesticide Exposure and Depression among Male Private Pesticide Applicators continued from page 13

sonal characteristics or in cumulative days of use of any pesticide among case groups; e.g., the average cumulative days of use of any pesticide reported by POST cases was 343 compared to 424 for PRE-E and 387 for PRE-B cases (Kruskal-Wallis $p = 0.02$). Finally, although we asked about ever diagnosis of depression at both enrollment and follow-up, some PRE-E depression cases were likely misclassified because they did not report a previous diagnosis at follow-up; i.e., they should have been classified as PRE-B cases. Possible reasons for this omission include recovering from depression before the follow-up interview (which was administered 12.1 years, on average, after enrollment) or, due to the sensitive nature of mental health conditions, being

less inclined to confirm a previous diagnosis of depression because the follow-up interview was conducted via telephone, whereas depression information was collected at enrollment via self-administered paper questionnaires. We cannot, however, confirm either of these possibilities. Despite this possible misclassification, we analyzed PRE-E depression as a separate case group because the number of applicators in this group was large ($n = 474$) and associations with pesticide use differed from those observed with PRE-B depression.

We used three strategies to account for exposure to multiple pesticides. First, we grouped individual pesticides into 10 pesticide classes (four functional, six chemical) because the pesticide that was most strongly correlated

with the pesticide of interest was often in the same class. We also conducted sensitivity analyses in which we additionally weighted for cumulative days of use of any pesticide or for the pesticide that was most strongly correlated with the pesticide of interest. Although neither strategy meaningfully changed our results (data not shown), we cannot rule out the possibility that associations between depression and use of individual pesticides were confounded by use of other pesticides.

We used inverse probability weighting to adjust for potential confounding and for potential biases from missing covariate data, missing farmer questionnaires, or drop out. One limitation of inverse probability weighting is that residual confounding, missing data bias,

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and/or selection bias could still occur. In addition, *c*-statistics for the drop out models, while not used to select variables for inclusion in our models for the weights, ranged from 0.60-0.61, which suggests drop out in the AHS is mostly random or our models did not predict drop out well. The former seems more likely because Montgomery et al.¹⁷ found that applicators who reported physician-diagnosed depression at enrollment were equally likely to drop out of the AHS before the first follow-up interview in 1998-2003 as applicators who did not report depression (OR = 0.92; 95% CI = 0.82, 1.02 after adjustment for age, state, education, and smoking).

Our information on pesticide use was self-reported and could be misclassified. Using data from orchardists in Washington State reported during the year of use as the gold standard, Engel et al.¹¹ found sensitivities for reporting ever-use of pesticides 25 years later were 1.00 for any pesticides, 0.87-1.00 for pesticides classes included in our study, and 0.80-0.94 for individual pesticides included in our study. A case-control study of cancer in Montreal, Canada, found the specificity of self-reported ever-exposure to pesticides or fertilizers was 0.95 when compared to expert assessment¹² questionnaire twice one year apart, percent exact agreement for ever-use of 10 individual pesticides ranged from 0.79-0.88.⁷ Another study found that < 1-5% of AHS applicators overestimated duration of use of 19 individual pesticides relative to the years the pesticide active ingredients were first registered for use with the U.S. Environmental Protection Agency.¹⁵ The effect of depression on recall of past pesticide use is unknown. Cancer cases and controls, however, were found to report pesticide use with similar accuracy in a validation study in Kansas⁷ and there is little evidence for differential recall in the self-reporting of occupational exposures among cases and controls of other diseases.²⁶

We also relied on self-reports of ever physi-



cian-diagnosed depression. Using information from a validation study conducted in a cohort of university graduates in Spain, the calculated sensitivity and specificity of self-reported ever physician-diagnosed depression was 0.85 and 0.68, respectively, when the Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, was used as the gold standard.²² In addition, associations we observed with pesticide poisoning and patient characteristics were similar to those reported in other studies, increasing confidence in the accuracy of our outcome. For example, depression was more common among applicators who were past smokers²⁴ or who visited a medical doctor in the past year or had poorer health.⁴ Therefore, the validity of self-reported ever physician-diagnosed depression in our study is likely good. Our cohort is imperfect for longitudinal analyses of pesticide exposure and depression because we collected information on depression at only two points in time on average 12.1 years apart, and we assessed ever physician-diagnosed depression rather than current depression. Thus, we were unable to utilize longitudinal or life course statistical methods.

Our study has several strengths including its large size. Its prospective nature provided the opportunity to identify POST cases of depression as well as PRE-E and PRE-B cases. We had detailed information on applicators' exposures, including general pesticide exposure, use of pesticide classes, and use of individual pesticides. We could control for many potential confounders and demonstrated the robustness of our results to additional potential confounders not included in the main models (data not shown). Finally, we used inverse probability weighting to adjust for potential biases from missing covariate data, missing farmer questionnaires, or drop out. Overall, the effect of missing data and drop outs on our results appeared to be small because results were similar when we used standard regression methods.

Conclusions

Our study supports a positive association between depression and occupational pesticide use among applicators. Furthermore, it suggests several specific pesticides that deserve further investigation in animal studies and other human populations. ■

employment in the broad agriculture division

■ An estimate of the U.S. government's undercount continued from page 12

in 2011.²⁹ The second was the assumption of the same 40% underreporting rate due to willfulness and negligence for both crop and animal production. In reality, these may differ just as we estimated the overall undercount to differ between crop (73.7%) and animal (81.9%) production. Finally, it is possible that other researchers may generate alternative estimates using a different methodology. But if that methodology involves using BLS estimates, each of the problems addressed in this article will have to be addressed by other researchers.

The substantial undercount of

employment and injuries has several baleful consequences for individuals and society. Most fundamentally, undercounting reduces our ability to identify and address agricultural health problems in a large population of workers. The burden falls most directly on undercounted workers, who may fail to benefit from protective governmental programs, such as unemployment insurance and workers' compensation. Although UI protects workers from economic risk associated with insecure employment, workers compensation mitigates health and

economic risks by providing care and a

measure of income replacement for workers injured on the job. Undercounting of employment and occupational health conditions affects society as a whole when the costs of injury and unemployment devolve to other social programs, such as Social Security, Medicare, Medicaid, or charity care. Finally, undercount limits our ability to identify areas in which preventive measures should be focused. ■



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