Agricultural Health Training for Rural America

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EXECUTIVE SUMMARY

Purpose of the Report: Comprehensive information on the extent to which health care professionals receive training in agricultural health is not available. This study locates agricultural health programs and courses and describes collaborations that exist between clinicians and agriculture-related agencies. Information from the study may be used to improve rural training programs for health care professionals providing primary care to agriculture workers.

Methods: We conducted a systematic literature review for published papers and a search of Internet sites on topics related to agricultural health training and education. All training programs in agricultural health were evaluated for appropriateness for inclusion in a database of training programs, using criteria determined for this project and delineated in this report. Working with the AgriSafe Network consortium, we identified key informants from the agricultural health and primary care fields to participate in interviews to answer questions related to existing collaborations between clinicians and agriculture related agencies.

Results: We found 61 programs offered onsite or online originating from 15 states in the US. We found that areas in need of improvement include (1) provision of additional continuing education for practicing physicians, registered nurses (RNs), physician assistants (PAs), and nurse practitioners (NPs); (2) provision of time and funding for primary care providers for continuing education in agricultural health related topics, (3) evaluation of methods to adjust the health care delivery model to the needs of the agriculture community, and (4) enhancement of linkages and coordination of activities between health care professionals and public agencies in occupational and agricultural domains.

Policy Implications: Results support the need for improved and increased availability of continuing training education specializing in agricultural health. Policy options from this study could include:

1. A potential need exists for increased training and education opportunities for primary care and specialty providers, particularly those who serve rural agriculture communities. An understanding of the unique culture, as well as illnesses, injuries, symptoms that farm

workers may exhibit is essential to provision of high quality care to this population. Training programs can be developed online, allowing improved access by the rural primary care clinician population, who are less likely to be able to leave their practices to attend onsite programming. Online programs can also enhance knowledge of other providers regardless of their practice location, who may receive agricultural workers on a referral basis, and must understand the unique needs of this population.

2. Mechanisms can be developed to increase the awareness of existing resources and tools, such as those available from the Agri-Safe Network and the Migrant Clinicians Network as well as other continuing education opportunities, so that rural primary care providers may gain a better understanding of agricultural medicine/health issues.

3. Integration of occupation-specific information related to agricultural health can be included in electronic medical records in rural primary care settings in agriculture communities.

4. Methods to incentivize continuing education to increase agriculture health knowledge for primary care providers in rural agriculture communities can be considered.

5. Strengthening partnerships between agriculture related agencies and associations concerned with rural health can help to increase the focus on agricultural health education in rural primary care.

FINAL REPORT
AGRICULTURAL HEALTH TRAINING FOR RURAL AMERICA

INTRODUCTION

Agricultural workers and their families face numerous threats to health and safety. These threats include accident and injury caused by machinery; exposure to pesticides, herbicides, allergens, and dust; stress from long work hours and economic uncertainty; noise pollution; long-term sun exposure; and others. In short, agriculture is one of the most hazardous occupations. Agricultural workers display elevated rates of traumatic death, disabling injury, suicide, and acute and chronic illness.[1-3] In 2002 agriculture had an occupational death rate of 21 per 100,000, which was second only to that of mining.[4] In addition, due to the family structure of farming, lack of regulation, and economic barriers to hiring extra laborers, health risks associated with agricultural work impact many children and seniors, in addition to those between 18-65 years of age.[1-4]

Although literature on recent traumatic injury rates and causes among agricultural workers is scarce, a 2000 publication noted an injury rate per year for farmers of 10%, a high number relative to other occupations.[5] Injuries in agriculture are linked primarily with animals and machinery, particularly tractors.[5] Musculoskeletal disorders, which can result in lost work time, disability, and increased production costs, are the most common injury reported.[5] Furthermore, animals pose an additional threat in that they can carry and transmit ringworm, E. coli 0157, tuberculosis, brucellosis and enzootic infections to workers.[6]

Herbicides, fungicides, insecticides, and other chemicals, as well as organic dust, pollen, and fungi produce a high incidence of respiratory disorders such as asthma, organic toxic dust syndrome, and bronchitis among agricultural workers.[1-3,7,8] In addition, pesticide exposure has been linked with many other serious health conditions, including Parkinson's disease[9] Alzheimer's disease,[10] some forms of cancer, [11] and retinal degeneration.[13] Agricultural workers overall display higher rates of some types of cancer such as non-Hodgkins lymphoma, soft-tissue sarcomas, and melanoma.[14,15] Pesticides can also cause contact dermatitis, one of the most common skin diseases among agricultural workers.[16] Prevalence of skin diseases in general is higher in agriculture than in other industries.[11,16] In fact, agricultural workers have the highest incidence of skin disorders of all industrial sectors with an annual incidence four to six times higher than the annual incidence for all private industry.[12] Because extended exposure to hot environments is common in agricultural work, agriculture also possesses a 20% greater rate of hyperthermia than other vocations.[17] In many common agricultural settings noise levels often exceed the Occupational Safety and Health Administration (OSHA) permissible exposure limits, resulting in high incidence of hearing loss among agricultural workers; noise-induced hearing loss affects 55% to 72% of the farming population.[11] Finally, farmers face a unique spectrum of job-specific stressors related to physical environment, farming family structure, and economic hardship, and although studies vary in their assessment of the prevalence of mental illnesses in this group, research has indicated that farmers have suicide rates higher than the general population.[18]

The degree of diversity, severity, and prevalence of health problems associated with agricultural work necessitate the training of health care professionals working in rural areas to address these health problems. Training focusing on how to identify and treat such disorders and educate patients about prevention will enhance primary care services for agriculture workers. However, a survey of primary care physicians revealed scant knowledge of the health

risks associated with agriculture.[19] Rural areas (in which agricultural work is most common) are already currently experiencing shortages of health care professionals.[20] U.S. farm workers display low rates of health care utilization.[21] In addition, research suggests that nursing students and faculty display increased interest in agricultural topics when exposed to them in the classroom.[22] It thus seems likely that agricultural health components in the curriculum of health care practitioners promote not only preparedness to serve agricultural workers, but also engagement with this population. Nonetheless, although information has been collected on agricultural health in graduate and undergraduate nursing curricula for schools in the most rural states (revealing absent or scant material in most schools),[22] no comprehensive study has yet been conducted on the extent to which a broad spectrum of health care providers receive training in this area and the extent to which training is available.

In this study, we collected information to answer the following questions. **1.** Are continuing medical education (CME) and continuing education (CE) opportunities in agricultural health available for physicians, RNs, PAs, or NPs practicing in rural settings? **2.** Do RN, PA, NP, MD, and DO training programs specializing in rural health care offer required or elective courses, or other educational programs such as seminars or guest speakers, on agricultural health topics? **3.** To the extent that questions 1 and 2 are answered affirmatively, what are the characteristics of these educational opportunities: content areas, program type (elective, required, seminar, CME, etc.), geographic distribution, participation levels, and student/clinician population (RN, PA, NP, MD, DO)? **4.** What collaborations exist between clinicians and agriculture-related agencies (e.g., the Department of Agriculture and NIOSH) for delivery of agricultural health services?

METHODS

Geographic Coverage

This study was national in scope. Data on available training activities were collected for all regions and states of the U.S. Locations of types of training activities (e.g., program types, student/clinician population, etc.) are identified by state and results are applicable to the continuum from places adjacent to urban areas to places in frontier areas. In addition, online education activities, accessible to a broad population were collected and presented.

Identifying Continuing Educational Opportunities

The first step in the description of agricultural health continuing education opportunities for rural care providers was an exhaustive web and literature search, as well as key informant contacts. Literature searches of PubMed, CINAHL, Cochran Library, ScienceDirect, MEDLINE, POPLINE, and TOXNET were performed. As anticipated, less traditional, or “grey,” literature formed much of the basis for this study and these sources included websites for continuing education programs, proceedings from professional conferences, curriculum documents from schools which offer rural primary care programs, and professional organization meeting minutes. Thus, Google and Google Scholar searches were included for grey literature. Defining programs that focused on rural primary care was difficult, as no central list exists at any professional or accrediting organization that classifies programs in this way. Therefore, we used search terms for rural primary care training programs, and then searched for those sites for agricultural health content. We also used search terms for agricultural health training, and identified those programs that included rural populations. In some cases, we included training programs that did not focus particularly on rural primary care, if the agricultural health education program was targeted at primary care providers.

One reviewer initially screened all search results for possible inclusion as source materials for description of agricultural health continuing education opportunities. The initial screening used very broad criteria to ensure that all potentially relevant items found during the

search were included. A second research team member reviewed all the potentially relevant hits found during the search using initial study inclusion/exclusion including:

1. English language, program offered in the U.S. or by a U.S. entity.
2. CE or CME opportunity is directed to one of the primary care disciplines included in this review (RN, NP, PA, MD, and DO).

Due to the unique and exploratory nature of this study, additional inclusion/exclusion criteria emerged once searches were complete. Significant criteria alterations for inclusion of documents now include the following:

1. The study captures data on continuing education opportunities available from 2009 to the present only.
2. The study captures both undergraduate and graduate academic curricula, as well as professional education programs.
3. The study revealed many data options but it was decided that the focus remain on the original target inclusions of content areas, program type, location, objective, and target audience.
4. The study does not capture data on education and training targeted to agricultural students or professionals, unless the training program was also accessible to health care providers.

Analyzing Agricultural Health Programs and Curricula

We examined RN, NP, PA, MD, and DO training programs to describe required or elective courses, or other educational programs such as seminars or guest speakers, on agricultural health topics. We performed an exhaustive web search for formal degree and certificate level training programs specializing in rural health care. To the extent available, we accessed curriculum documents via web searches to analyze all required, elective and other educational opportunities included in the curriculum as related to agricultural health. For those identified formal degree or certificate level training programs that do not allow access to their curriculum documents via the web, we contacted program directors to request copies of their program curricula for inclusion in this study. Our data extraction and reporting includes the development of a grid of program name, target audience, program length and type (degree or certificate), and agricultural health content (including topic and length). Simple descriptive statistics were used to analyze these data, including number of degree and certificate programs that offer agricultural health content, and location of programs.

Identifying and Describing Clinician and Agency Collaboration

In order to describe existing collaborations between clinicians and agriculture-related agencies for delivery of agricultural health services, we conducted key informant interviews beginning with key informants provided by the Agri-Safe Network, and those from the NIOSH Agricultural Centers. Doing so enabled us to ascertain the existence and extent of collaborations between their agencies and clinicians for the delivery of agricultural health services. These interviews were exploratory in nature, and collaboration examples that were provided ranged from regular meetings, to informal networks such as online forums or newsletters, to formal relationships such as co-participation in projects to enhance care in agricultural communities. When collaborations existed, we used snowball sampling techniques, gaining access from these interviews to other key informants, including other agriculture agencies or clinicians. We continued the interview process until we exhausted all possible sources of information. Interviews included the following:

1. Existing collaboration between clinicians and agriculture related agencies.
2. Purpose of collaboration.
3. Extent of collaboration (time since initiation, type of contact, etc).

4. Perceived benefits of collaboration.
5. Barriers to collaboration.
6. Plans for future collaboration.
7. Gaps in collaboration and perceived impact of these gaps.

Briefly, our method for accessing this population was:

1. Department Heads/Directors from selected agencies were emailed an introductory letter from the research team to explain the study and request participation in a telephone research interview by a member of their agency. An electronic Interview Contact Form was attached in the email for follow-up. Research interview dates were scheduled.
2. An email confirmation was sent to the interviewee with scheduled interview date, time and the toll-free telephone number for call-in.
3. The research interview was conducted by an experienced research team member using a prepared script.
4. Given our previous experience, we anticipated that interviews would range in length from approximately 30-40 minutes depending upon feedback provided. Interviews scheduled but missed by the interviewee were rescheduled at the interviewee's convenience.
5. If no response to the request for interview was received, a follow-up correspondence was initiated within 7 days. A second or third contact was made via email or telephone if there was still no communication. In the event that potential interviewees were still non-responsive, we attempted to obtain department head contacts to substitute for those agency contacts who did not respond to our request for interview. We used the same technique for contacting and arranging interviews for key informants located in the snowball sampling process.

Once interviews were completed, we analyzed qualitative data descriptively. Below we report the collaborations discovered, and describe their purpose, extent, benefits, barriers, future plans and gaps, analyzing common themes that emerged.

RESULTS

A state by state analysis of agricultural health training programs was undertaken. **Table 1** demonstrates the available programs by state identified during our search and meeting the search criteria described earlier. The state, sponsor, and link to the website for available programs are included in the table. Fifteen states offer a variety of agricultural health related programs or courses, some onsite, and some offered online. In addition, some programs are offered completely online and therefore are not attached to a state in the tables and maps below. A full spreadsheet which includes additional data including targeted provider type, type of credit for attendance (CE or college/university credit), program objectives and other interesting details about programs is found on the Center's website at http://publichealth.hsc.wvu.edu/wvrhrc/projects/2012/agmedicine/.

Table 1: Available Agricultural Health training programs by state

State	Title	Sponsoring Organization	URL
AL	Rural Medical Scholars Program	University of Alabama	1
AL	Masters of Science in Agricultural Safety and Health	University of Alabama	2
IA	Agricultural Medicine: Occupational and Environmental Health for Rural Health Professionals- The Core	University of Iowa- Iowa's Center for Agricultural Safety and Health	3
IA	Agricultural Medicine: Occupational and Environmental Health for Rural Health Professionals - The Core Course	University of Iowa - Iowa's Center for Agricultural Safety and Health	4
IA	Graduate Certificate in Agricultural Health and Safety	University of Iowa College of Public Health	5
IA	11th Annual Midwest Rural and Agricultural Safety and Health Conference	Iowa's Center for Agricultural Safety & Health and the Great Plains Center for Agricultural Health, in coordination with the University of Iowa College of Nursing	6
IL	Rural Medicine Education Program	University of Illinois	7
IL	Nurse 431: Rural Health	Western Illinois University	8
KS	Agromedicine Collaboration between the University of Kansas Medical College, Kansas State University Research and Extension, and Kansas State University Veterinary Medicine	University of Kansas, Kansas State University	9
KY	Graduate Certificate in Public Health	University of Kentucky	10
KY	Agricultural Health Nursing	University of Kentucky College of Public Health	11
MD	Workshops & Seminars	Maryland Agromedicine Program; Pesticide Education and Assessment Program; University of Maryland	12
NC	Agricultural Medicine: Occupational and Environmental Health for Rural Health Professionals: The Core Course	East Carolina University; North Carolina Agromedicine Institute; AgriSafe Network of North Carolina; Iowa's Center of Agricultural Safety and Health	13
NC	Agricultural Medicine: Occupational and Environmental Health for Rural Health Professionals: The Core Course	East Carolina University; Agrisafe Network of North Carolina	14
NC	Agricultural Medicine: Occupational and Environmental Health for Rural Health Professionals	East Carolina University	15, 16
NC	NCMS: Mandatory Pesticide Illness Reporting	AHEConnect;North Carolina Area Health Education Center Program; North Carolina Medical Society	17
NC	Pesticide Related Illness and Health Issues	AHEConnect; North Carolina Area Health Education Center Program; Brody School of Medicine (East Carolina University), North Carolina Agromedicine Institute; N.C. Department of Agricultural and Consumer Services	18
NC	Fundamentals of Agromedicine	East Carolina Masters in Public Health Program	19, 20, 21

State	Title	Sponsoring Organization	URL
ND	Occupational & Environmental Health for Rural Health Professionals: Anticipation, Recognition, Treatment and Prevention Core Course	The University of North Dakota Center for Rural Health; Lake Region State College Dakota Center for Technology Optimized Agriculture; The University of Iowa College of Public Health, Great Plains Center for Agricultural Health, Iowa Center for Agricultural Safety & Health	22
NE	Agricultural Medicine: Occupational and Environmental Health for Rural Health Professionals - The Core Course	University of Nebraska Medical Center	23
NE	Agricultural Medicine: Occupational and Environmental Health for Rural Health Professionals - The Core Course	University of Nebraska Medical Center; Agrisafe	24
PA	Pulmonary Medicine Block Guest lecture on Environmental Medicine	Penn State College of Medicine	25
TX	South Texas Environmental Education and Research Program (STEER)* See home page for a variety of dates & locations for program	University of Texas Health Science Center	26
UT	Occupational Safety and Health	University of Utah	27
VT	Agricultural Medicine: Occupational and Environmental Health for Rural Health Professionals	This training is provided by the Vermont AgriSafe program and coordinated by University of Vermont (UVM) Extension, the Vermont Farm Health Task Force and the Vermont Department of Health's Office of Rural Health and Primary Care	28
VT	Agricultural Health and Occupational Safety Training	Vermont Farm Health Task Force, Vermont Office of Rural and Primary Care, University of Vermont Extension, University of Vermont College of Medicine, AgriSafe Network	29
WA	WRITE program	University of Washington	30
WA	Rural/ Underserved Opportunities Training Program	University of Washington Medicine	31
WA	Conj 515- The Rural Health Class	University of Washington School of Medicine; Department of Family Medicine	32
WI	Agricultural Medicine: The Core Course. Occupational and Environmental Health for Rural Health Professionals	Marshfield Clinic Research Foundation; Agrisafe Network	33, 34, 35
WI	Occupational and Environmental Health for Rural Health Professionals.	Agrisafe Network at the University of Wisconsin	36
	MCN 001: Adolescent Farmworkers at Risk	Migrant Clinician Network	37
	The Clinicians Role in Addressing Occupational Health Risks of Adolescent Migrant Farmworkers	Migrant Clinician Network	38
	The Nuts and Bolts of Cholinesterase Monitoring for Farmers, Ranchers, and Agricultural Workers	Migrant Clinician Network	39
	Care for Immigrant/Temporary (H2A) Workers	Migrant Clinician Network	40
	Emergency Preparedness and Management: Reaching Farmworkers through Migrant Health Centers	Migrant Clinician Network	41
	Bringing Health care Justice to the Front Line: Integrating	Migrant Clinician Network	42

	Environmental Health into Nursing Practice		

State	Title	Sponsoring Organization	URL
	Demystifying Workers Compensation Law for Clinicians	Migrant Clinician Network	43
	Patient Centered Medical Home: Adaptations for Farmworkers and Other Migrant Populations	Migrant Clinician Network	44
	Grasshoppers, Dust, and Salsa- An Old Toxin in a New Setting: A Fresh Look at Lead Poisoning in Migrant Populations	Migrant Clinician Network	45
	Understanding Voucher Model Programs: Best Practices in Creating Access for Farmworkers	Migrant Clinician Network	46
	Disaster Relief Available to Farmworkers and the Role Migrant Health Centers Can Play in Securing Them	Migrant Clinician Network	47
	Recognition and Management of Pesticide Poisoning	Migrant Clinician Network	48
	Update in Agricultural Infectious Diseases	Migrant Clinician Network	49
	Environmental/Occupational Health for the Primary Care Provider	Migrant Clinician Network	50
	Healthcare Issues For Migrant Women	Migrant Clinician Network	51
	Pesticides and Farmworkers	Migrant Clinician Network	52

Reference Number	Full URL
1	http://cchs.ua.edu/
2	http://www.ches.ua.edu/pub/files/ms-agr-safety-hlth-special.pdf
3	http://www.public-health.uiowa.edu/icash/education/agmedtraining.html
4	http://www.public-health.uiowa.edu/icash/education/2011-IA-Ag%20Medicine-Training-brochure.pdf
5	http://cph.uiowa.edu/oeh/programs/certificate/ash_curriculum.html
6	http://cph.uiowa.edu/icash/events/MRASH/2012/index.html
7	http://www.ncrhp.uic.edu/
8	http://www.wiu.edu/cas/nursing/pre-licensure/courses.php
9	http://www.vet.k-state.edu/links/agromed/agromedicine.htm
10	http://www.mc.uky.edu/scahip/programs.html
11	http://www.uky.edu/publichealth/
12	http://www.pesticide.umd.edu/agromed/index.html
13	http://www.public-health.uiowa.edu/icash/education/NC_agmed_brochure_2012.pdf
14	http://www.ecu.edu/cs-dhs/agromedicine/upload/AgriSafe-4th-Qtr-2010.pdf
15	http://www.agrability.ext.vt.edu/Papers/AgrAbility_VA_FINAL_Report_2006-10.pdf
16	http://www.ecu.edu/cs-dhs/dph/upload/Oct-1-2009-minutes-1.pdf
17	http://www.aheconnect.com/newahec/cdetail.asp?courseid=ncms3
18	http://www.aheconnect.com/newahec/cdetail.asp?courseid=Pesticide
19	http://www.ecu.edu/cs-acad/grcat1011/coursesMPH.cfm
20	http://www.ecu.edu/cs-dhs/agromedicine/
21	http://www.ecu.edu/cs-acad/grcat/coursesMPH.cfm
22	http://ruralhealth.und.edu/topics/workforce/pdf/agrisafe_agenda.pdf
23	http://webmedia.unmc.edu/cce/JHusted/agrimed_booklet2.pdf
24	http://cmetracker.net/UNMC/Files/Brochures/11067.pdf
25	http://www.pennstatehershey.org/web/college/home
26	http://steer.uthscsa.edu * see home page for a variety of dates and locations for program
27	http://ehs.utah.edu/
28	http://www.uvm.edu/extension/agriculture/pdfs/agmedicine_training2011.pdf
29	http://www.uvm.edu/extension/eventpdfs/agrisafetrainingfeb10.pdf
30	http://depts.washington.edu/write/index.html
31	http://www.uwmedicine.org/Pages/default.aspx
32	https://depts.washington.edu/fammed/education/courses/conj515
33	http://www.public-health.uiowa.edu/icash/education/agmedtraining.html

34	http://www.marshfieldclinic.org/eduprofessionals/?page=confevents
35	http://www.marshfieldclinic.org/patients/
36	http://www.fammed.wisc.edu/
37	http://courses.migrantclinician.org/course/view.php?id=3&username=guest
38	http://courses.migrantclinician.org/course/view.php?id=22&username=guest
39	http://www.migrantclinician.org/nutsandboltsresources#
40	http://cne.memberclicks.net/index.php?option=com_mc&view=mc&mcid=72&eventId=259680
41	http://cne.memberclicks.net/index.php?option=com_mc&view=mc&mcid=72&eventId=218106
42	http://cne.memberclicks.net/index.php?option=com_mc&view=mc&mcid=72&eventId=298517
43	http://cne.memberclicks.net/index.php?option=com_mc&view=mc&mcid=72&eventId=298517
44-51	http://www.cdnetwork.org/NewCDN/index.aspx
52	http://www.migrantclinician.org/toolsource/resource/pesticides-and-farmworkers-webinar.html

Additional analyses demonstrate the type of training programs available by state and county, as well as the providers targeted by these training programs. **Figure 1** demonstrates the type of program (onsite or online) by state. *This analysis should be interpreted with caution, as many programs are available online, and thus are theoretically available to providers across the country.* We noted no states that limited enrollment in online programs to providers from particular states.

Figures 2-5 demonstrate the availability of training programs by provider type by state. It is important to note that some programs may overlap the providers targeted for training, especially those offering continuing education. For a full view of programs targeted to particular provider groups, please see the detailed table of available programs on our website at http://publichealth.hsc.wvu.edu/wvrhrc/projects/2012/agmedicine/

Figure 1: Type of program by state

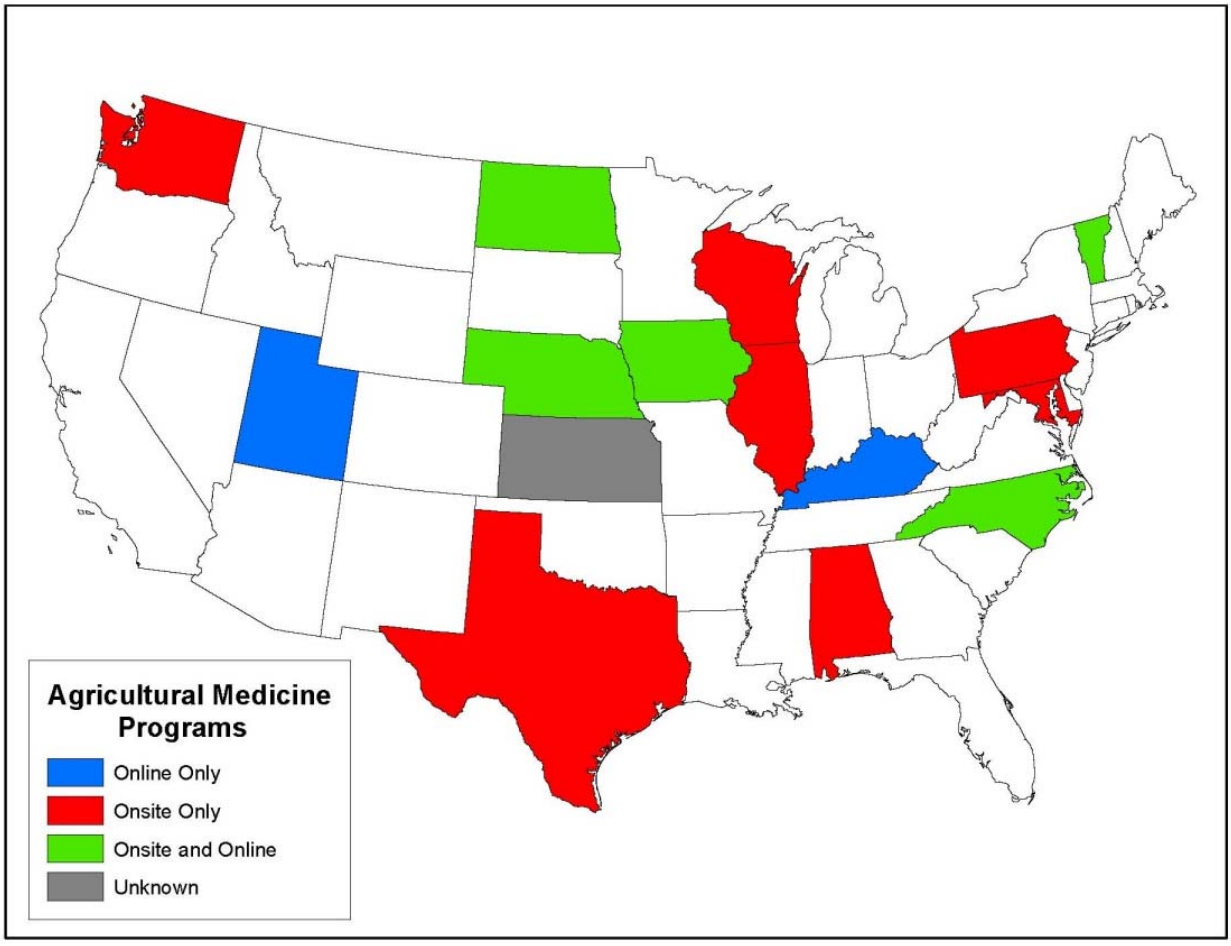


Figure 2: Available training programs for physicians by state

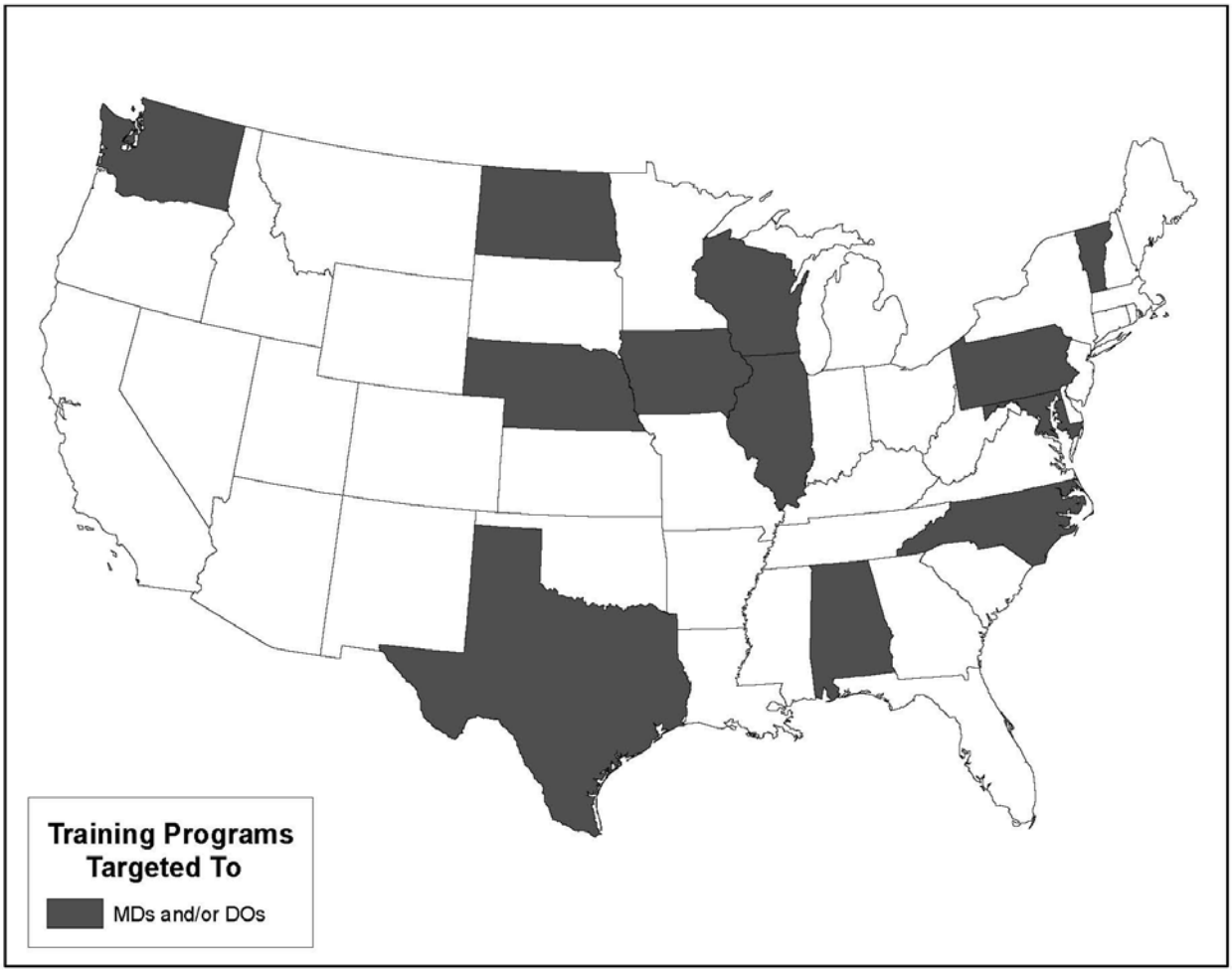


Figure 3: Available training programs for physician assistants by state

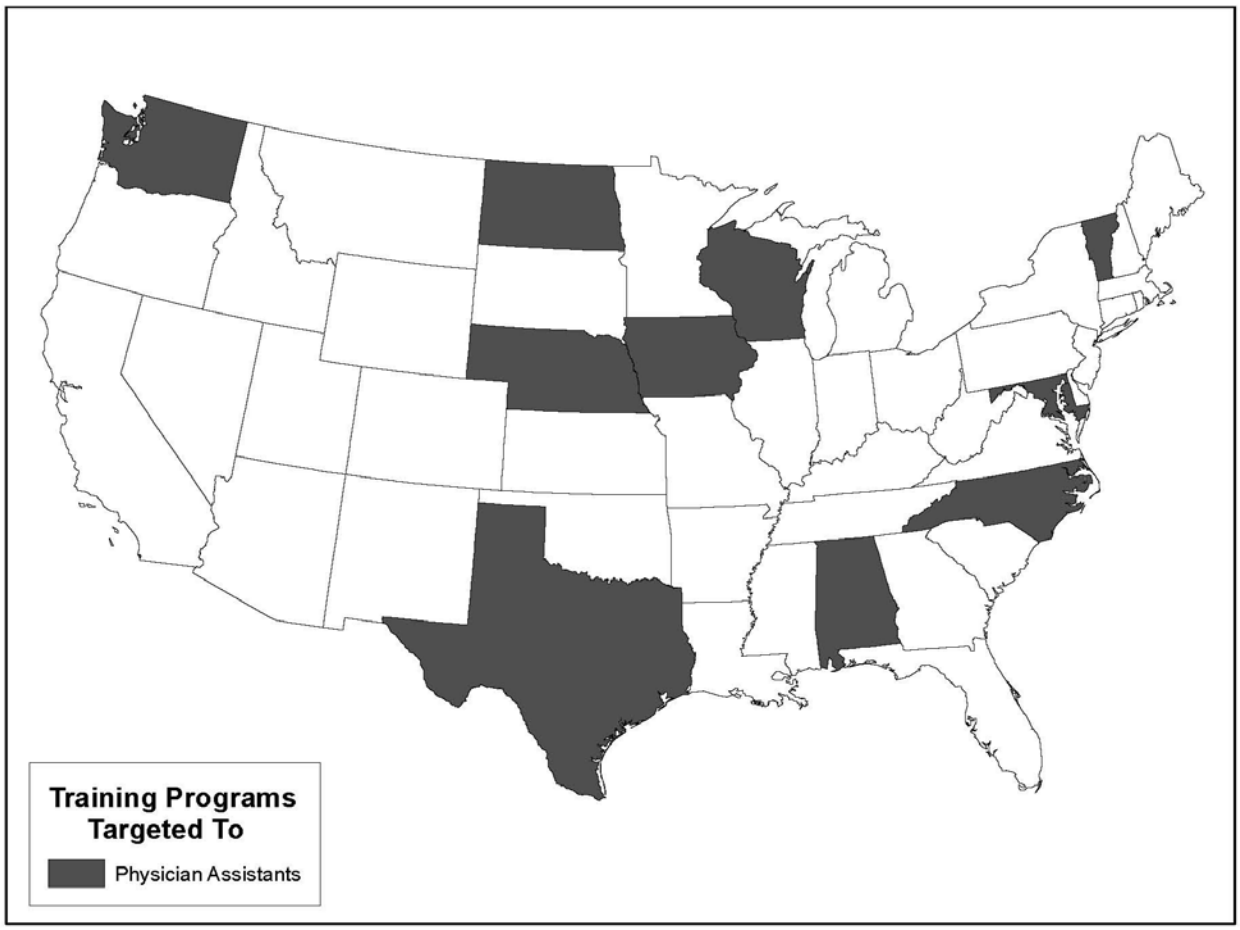


Figure 4: Available training programs for advanced practice registered nurses by state

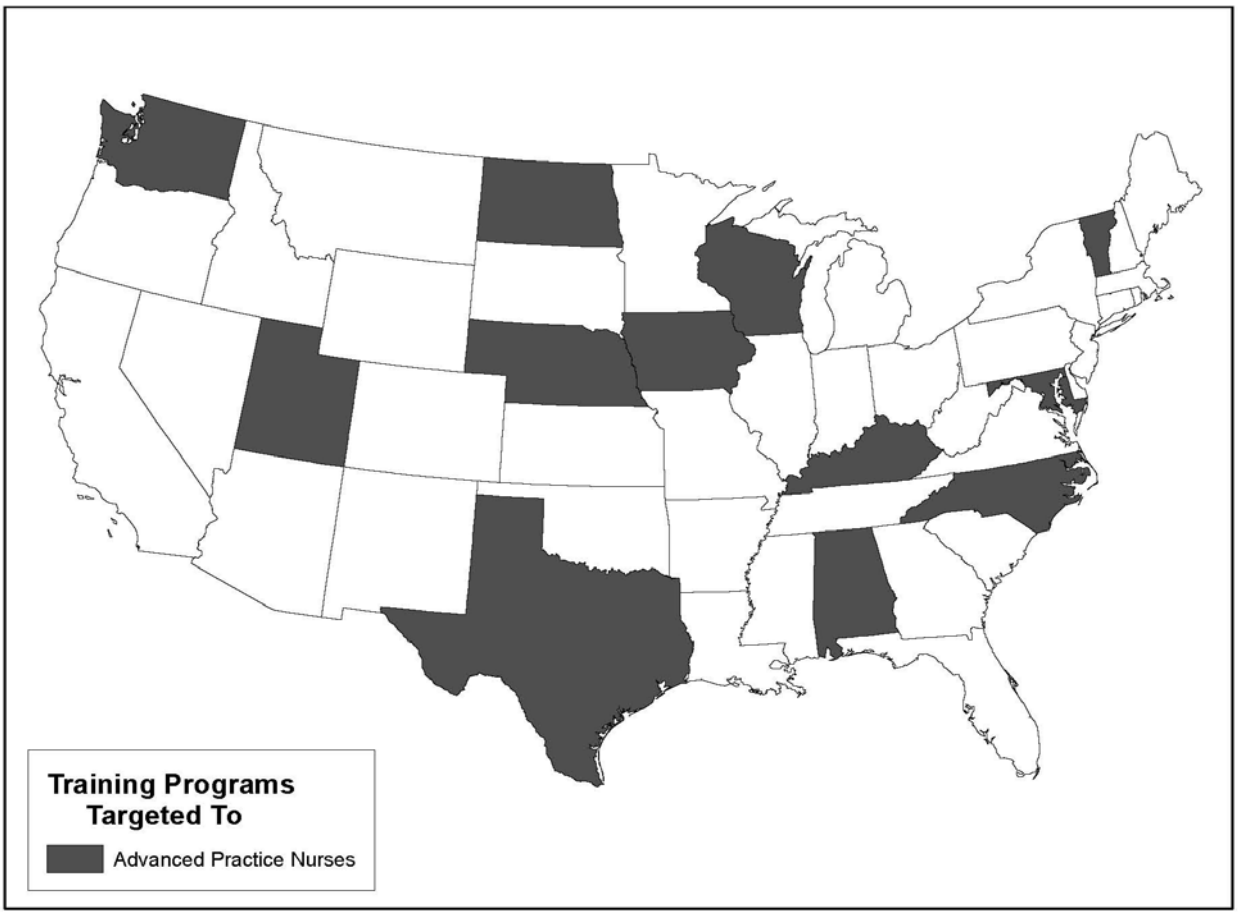
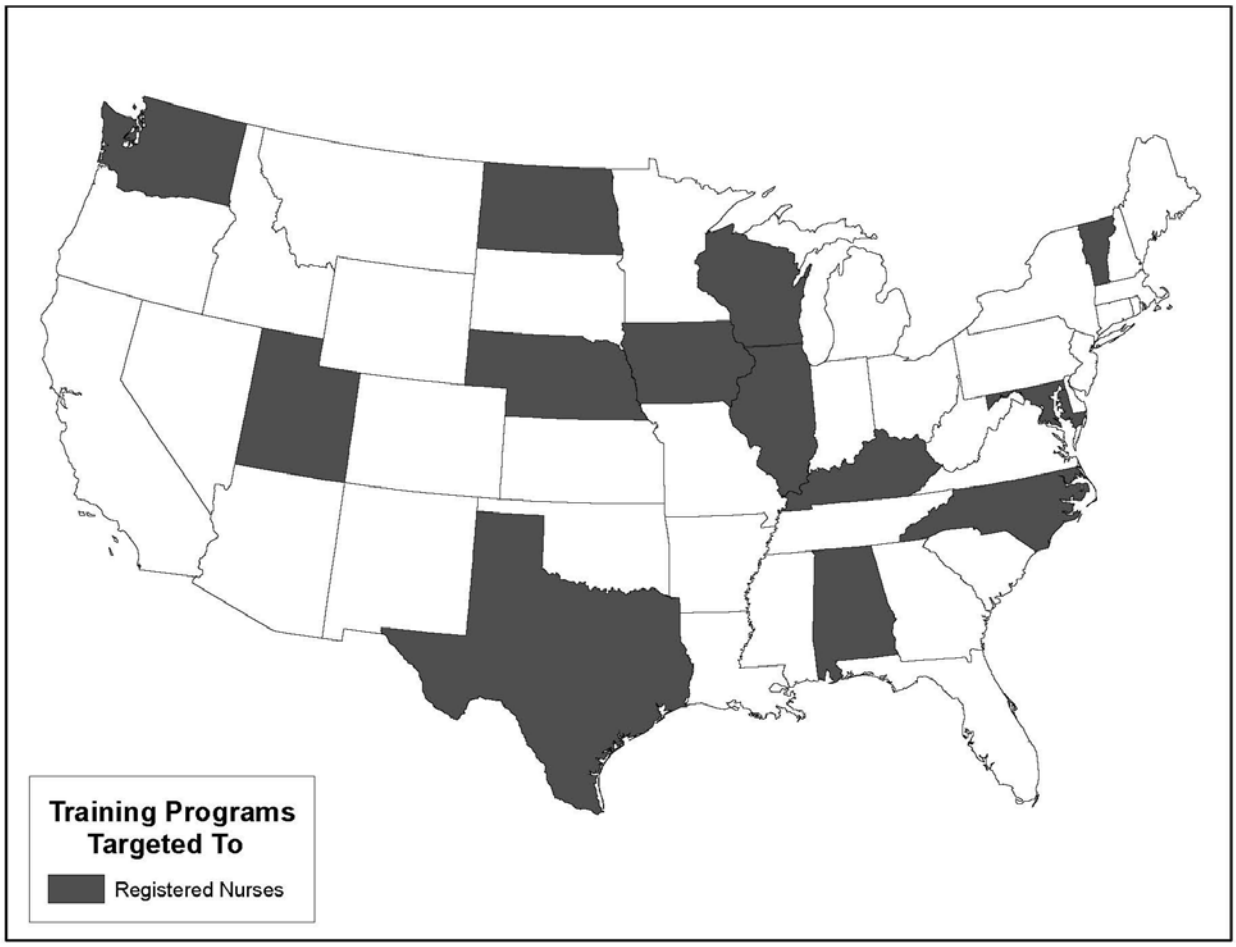


Figure 5: Available training programs for registered nurses by state



INTERVIEWS WITH KEY INFORMANTS

To analyze the collaboration between clinicians and the agriculture related agencies, we invited 25 individuals for inclusion in the key informant sample. We obtained consent from 9 individuals to participate in an interview to share their perspectives on collaborative relationships between the agriculture community and primary care providers. The intent of the interviews was to provide a snapshot of relationships across the country that could be used as examples and provide lessons to improve agricultural health services.

The interviewees were asked to provide their state and postal code to help determine representation of the key informants. Although the number participating was lower than we had anticipated, those who participated represented all four of the US census regions. The key informants were largely from the agricultural community (n=6) with the remainder participating from clinical occupations (n=3). The clinical disciplines represented included nursing, medicine, public health and social work with several reporting specialist training or certificates in occupational or environmental health. The amount of time key informants reported that they have been in their current positions ranged from 5 to 40 years.

The interviewees were asked several questions from a prepared script to assess the relationships that may exist between primary care providers and agriculture agency personnel in order to gain an understanding of the extent of existing collaboration. These questions were structured with choices for the respondent. They were also given the opportunity to provide specifics as needed. When asked about the frequency of interactions with either primary care providers or agricultural agency personnel about an agricultural health issue, the majority responded that daily or weekly interactions occur. Only one person indicated that they had quarterly interactions. The history of regular communications ranged from those that were long-term (beginning at least 20 years ago), to a few that are more recent and began within the last 5 years. The interviewees indicated that the reasons for collaboration included information sharing, exchanging of resources, and project-specific communication. The communication methods used were in-person, telephone, email communication, and listservs.

Interviewees were asked to rate the working relationship with either primary care providers (for agriculture representatives) or agricultural agency personnel (for clinicians) using a 4 point scale ranging from excellent to poor. Overall, the relationships were positive with 78% indicating their relationships were excellent and the remaining 22% indicating good.

BENEFITS OF COLLABORATIONS

All of the key informants reported similar benefits that result from collaborations between clinicians and agricultural agency personnel. The opportunity to provide better health care for people in agriculture occupations was a recurring theme. Improved health care services, education and improved competencies of providers were all noted as positive results from the ongoing relationships. Several interviewees specifically mentioned improved preventative care, as well as increased regular communication that does not typically occur between agriculture and clinical occupations.

EXAMPLES OF COLLABORATIVE MODELS

In an attempt to assess examples of how collaboration is working well, we asked informants about effective models of collaboration that they have seen in their area or other

areas of the country. Common themes in these programs include models that train and position primary health care providers to provide preventive and treatment services wherever agricultural workers are, and wherever access to providers is convenient to workers, as well as to provide agricultural health education in ways that are convenient for primary care providers. Several programs and initiatives were noted by informants as examples of effective collaboration and they are:

- the Agri-safe Network that helps provide provider training and certifications;
- the Migrant Clinicians Network education programs;
- a residency training model with rotations in migrant clinics and site visits to farms that provide direct experience on the hazards, risks, culture, and farm environment;
- the USDA AgriAbility program;
- agricultural health training programs through Area Health Education Centers (AHEC). The mission of the AHECs is to enhance access to high quality, culturally competent health care through community-based inter-professional/interdisciplinary training, continuing education, and health careers outreach activities. Since the goal of the AHEC program is to ultimately improve the distribution, diversity, and supply of the primary care health professions workforce who serve in rural and underserved health care delivery sites, this program could offer opportunities for expanded partnerships for agricultural health related education programs;
- a growing consortium of clinician training sites that provide education in agricultural screenings and farm safety;
- a university partnership between family medicine and occupational medicine programs to provide outreach and education activities.
- a practice model where providers at all levels travel to the farms to provide screenings and other services;
- an employee assistance program that provides mental health referrals within participating agricultural communities;
- a taskforce model that involves first responders, veterinarians, and other health care providers who regularly interact with the farming community;
- a program to develop guidelines for teenage agriculture workers;

AREAS THAT WOULD BENEFIT FROM COLLABORATION

We attempted to capture the informants' perspectives on areas that would benefit from collaboration. Overall, the training of primary care providers was mentioned as an area of need. Several specifically mentioned concern that professional education programs in medical or nursing schools provide very limited agricultural health instruction. A few shared their opinion that agricultural health training needs to go beyond continuing education training for clinicians; clinical students need an introduction in their undergraduate and graduate education so that they develop an interest in agricultural health. Inclusion of agricultural health content early in the educational process can help with capacity building, potentially increasing the number of future primary care providers who have an interest in agricultural health issues.

The structure of the health care delivery system and how service delivery beyond the typical 8-5 provider office hours was also mentioned as an area that would benefit from improved relationships. One agricultural agency interviewee pointed out farmers do not have time to leave the farm for medical services during the day and that "our medical model...needs a community-based approach to look at how to provide care to workers and families in non-traditional ways."

Several key informants noted that integrating questions about the patient's occupation and potential exposures as part of the clinical encounter would help the provider better treat the patient who works in the agricultural industry. One comment was about how policies could be developed to help facilitate this integration. With the push to electronic medical records, the suggestion was to make sure the patient's occupation and exposure history was part of that process. Collaboration between agriculture agencies and providers could serve to enhance the collection of assessment data specific to the health of farming families.

Finally, making sure the provider is aware and knowledgeable about the resources and tools that are available to increase understanding of agricultural health and medical challenges was noted as another potential solution. One person noted that these resources could also mean other professionals with agricultural expertise in their geographic area but at times providers are not aware of who to contact if they need additional information on agricultural health issues.

BARRIERS TO COLLABORATION

All of the subjects interviewed agreed that there were barriers to developing relationships or collaborations between primary care providers and agricultural agency personnel. Several individuals felt that the health care delivery system does not allow the time needed for the provider to obtain agriculture-specific training or give the primary care provider time to ask the types of questions needed to fully assess a patient when they present with agriculture-related health issues. The nature of the illnesses, injuries, and symptoms related to agriculture are different and interviewees felt that providers are not equipped with the training and background to correctly identify and treat these issues. Specific comments were that rural primary care providers are "overwhelmed" and "under enormous pressure to see more patients." Another mentioned time in a slightly different way and stressed the time it takes to develop trusted relationships with farmers so that they will seek health care services when needed.

ADDITIONAL COLLABORATION SUGGESTIONS AND ISSUES

At the end of the interviews we provided the key informants the opportunity to share any other insights that we may not have covered with our scripted questions. One interviewee expressed that it "would really be great if there could be more of a presence and acceptance of agricultural medicine" within national organizations and associations that could result in increased funding and recognition of unmet needs in agriculture medicine. Another informant mentioned that agro-health is something that is not addressed by large corporations or industries such as the pharmaceutical industry, resulting in very little specific training and resources available for agricultural, environmental, and occupational health. One person also expressed concern that there are some areas of the country where the connections between agricultural industries and the health care system are not as strong as in other locations.

Finally, interviewees discussed at length unique cultural considerations for health care for those who work in agriculture occupations - how farmers are self-reliant, very prideful, live in close knit communities, do not seek help unless it is an emergency, especially for preventative health care, and often times suffer in silence. One shared stories of farmers who are injured and go right back to farm to continue working the same day as an example of the agriculture culture that primary care providers should understand as they interact and treat farmers and

their families. Understanding the unique needs of this population can be enhanced through collaboration between those who work directly with the agricultural community and those who provide care for the population.

STUDY LIMITATIONS

This study has several limitations. First, the search for agricultural health education programs, while exhaustive, is limited to what our Center was able to find on the Internet and via word of mouth of key informants and partners in a variety of networks interested in agricultural health. Information that is provided about the availability by state and county is therefore limited to only what we were able to access. While every attempt was made for over a year to gather information about existing programs, the list may not be complete. In addition, the number of key informants included in interviews from agriculture related agencies and especially from primary care providers who provide care in communities with high levels of agricultural industry was small. Using email and telephone messages, we contacted all potential informants several times but were unable to obtain their permission to participate in this project. Although we were able to interview a few providers, as with similar projects involving practicing clinicians, it was especially difficult to locate providers who were able and willing to set aside time for a brief interview. Therefore, interview results should be considered to be case studies, and thus can inform direction for future studies.

DISCUSSION

After an exhaustive search of over one year, we found only 61 programs offering agricultural health to students or practicing health care professionals nationwide. Furthermore, these programs were concentrated in only 15 states, some of which only offered on-site programs. Many of the programs were offered in urban settings or at academic campuses. Few truly rural- or remote-based continuing education programs were available to the rural health care community on agricultural health. Although there were a number of on-line training opportunities which would hypothetically be available to all providers, it is unclear how widely known or accessible these on-line programs are to potential target populations in rural areas. Our general conclusion is that opportunities exist to increase the capacity, presence, and utilization of agricultural health resources in rural areas.

We found that areas with opportunity for improvement include (1) provision of additional continuing education opportunities for practicing physicians, registered nurses (RNs), physician assistants (PAs), and nurse practitioners (NPs);(2) provision of time and funding for primary care providers for continuing education in agricultural health related topics, (3) evaluation of methods to adjust the health care delivery model to the needs of the agriculture community, and (4) enhancement of linkages and coordination of activities between health care professionals and public agencies in occupational and agricultural domains.

Up until this study, comprehensive information on the extent to which opportunities exist for health care professionals to receive training in agricultural health has not been available. This study documented that while few, there are some training programs for health care professionals that include agricultural health training and clinical rotations for their students. This study has documented that continuing education opportunities relevant to agricultural health are available, but these opportunities were sometimes difficult to locate. This raises concerns for the ability of busy rural primary care providers to locate and access these training programs. Provision of a summary of these courses and a link to the website for access will hopefully

provide a valuable resource for those interested in expanding knowledge related to agricultural health. It is important to note that while many programs are available online, there are still a number of programs that occur on-site, and concerns exist about the ability of primary care providers to take time from their clinical practices to gain the knowledge needed to provide high quality care to rural agriculture workers. Also, while our study focused primarily on those training programs with a rural focus, trainees in programs without a rural focus may also benefit from agricultural health programming in their curricula. As noted in our interviews, national organizations that focus on rural health could play a significant role in increasing the emphasis on continuing education about agricultural health issues.

The interviews conducted in this study with agriculture-related agencies and primary care providers seem to indicate a trend toward satisfactory collaboration between the two. However, there is a need for increased linkages to support emerging care models that could better serve rural farmers in their communities. Examples of emerging care models were provided by interviewees, and further study of these models may benefit future program planning.

A remaining question regarding agricultural health programs is whether the programs that are available are meeting the needs of primary care providers in agricultural health communities. It was beyond the scope of this study to evaluate learning needs, as compared to program objectives, and to analyze gaps. Future studies can undertake an analysis of learning needs and gaps in programming. In addition, this study does not tell us if the locations of current programs are actually in agriculture industry intensity areas of the US. Future studies could analyze the availability of these education programs as compared to the density of agricultural industry in different parts of the country.

POLICY IMPLICATIONS

Several policy directions have emerged from this study. These are:

1. A potential need exists for increased training and education opportunities for primary care and specialty providers, particularly those who serve rural agriculture communities. An understanding of the unique culture, as well as illnesses, injuries, symptoms that farm workers may exhibit is essential to provision of high quality care to this population. Training programs can be developed online, allowing improved access by the rural primary care clinician population, who are less likely to be able to leave their practices to attend onsite programming. Online programs can also enhance knowledge of other providers regardless of their practice location, who may receive agricultural workers on a referral basis, and must understand the unique needs of this population.

2. Mechanisms can be developed to increase the awareness of existing resources and tools, such as those available from the Agri-Safe Network and the Migrant Clinicians Network as well as other continuing education opportunities, so that rural primary care providers may gain a better understanding of agricultural medicine/health issues.

3. Integration of occupation-specific information related to agricultural health can be included in electronic medical records in rural primary care settings in agriculture communities.

4. Methods to incentivize continuing education to increase agriculture health knowledge for primary care providers in rural agriculture communities can be considered.

5. Strengthening partnerships between agriculture related agencies and associations concerned with rural health can help to increase the focus on agricultural health education in rural primary care.

CONCLUSIONS

Agricultural workers and their families face numerous threats to health and safety. These threats include accident and injury caused by machinery; exposure to pesticides, herbicides, allergens, and dust; stress from long work hours and economic uncertainty; noise pollution; long-term sun exposure; and others. In short, agriculture is one of the most hazardous occupations. The degree of diversity, severity, and prevalence of health problems associated with agricultural work necessitate the training of health care professionals working in rural areas to address these health problems. Availability of training focusing on how to identify and treat such disorders and educate patients about prevention will enhance primary care services for agriculture workers. While some training is available, future efforts at increasing availability and accessibility of agricultural health education for rural primary care providers is clearly warranted. Emerging models of care can be used as best practice models to improve care for rural farm workers. Strengthening linkages between agriculture related agencies and rural care organizations can further serve to improve the focus of agricultural health issues in rural primary care.

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Additional Information

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