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Fatal Injuries Among Young Workers in Kentucky, 2005-2014

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FATAL INJURIES AMONG YOUNG WORKERS IN KENTUCKY, 2005-2014

CAPSTONE PROJECT PAPER

This paper is submitted as a portion of the requirements to complete a degree of Master of Public Health with a concentration in Environmental Health from the University of Kentucky

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Abstract

Background: *Young workers have been more vulnerable to fatal and nonfatal work injuries. To gain a comprehensive understanding of the injuries that led to fatalities in younger workers, the goal of this study was to compare characteristics of young worker fatal injuries in those aged 16-24 to all workers aged 25 and older in Kentucky using a descriptive analysis.*

Methods: *A retrospective analysis of fatalities among workers under the age of 25 compared to workers aged 25 and older was performed over a ten-year period from 2005-2014 using Kentucky Fatality Assessment and Control Evaluation (FACE) program data.*

Results: *From 2005-2014, there were 61 young worker fatalities for the 16-24 age group (Table 1). For the same time period, there were 930 fatalities aged 25 and above. The majority of young workers who died on the job worked in the construction (21%), professional and business services (20%), and the natural resources and mining (18%) industries (Tables 2 and 3). Falls, struck bys, and suicides occurred more frequently, and at equivalent percentages in young worker fatalities (18% each) compared to older worker fatalities (Table 4). Occupational fatality rates declined in both worker groups over the study period and displayed similar trends (Figure 1). The overall occupational fatality rate for young workers was 2.28 per 100,000 workers, and for older workers, the overall occupational fatality rate was 5.71 per 100,000.*

Conclusions: *Despite the decline in young worker fatality rates over the recent years, young worker occupational fatalities are still occurring yearly. Employers should assess hazards daily. Engineering controls and processes, could be implemented to reduce falls and struck by incidents. Employers should ensure that their workers are properly equipped to perform the job task at hand as well as knowledgeable about the potential hazards they could be exposed to.*

Introduction

Historically, young workers have been more vulnerable to fatal and nonfatal work injuries. The first child labor laws were implemented in the United States in 1836 to protect young workers in the work environment from hazardous jobs.[1,2] The child labor laws were updated over several years and President Franklin D. Roosevelt enacted the Fair Labor Standards Act in 1938.[3] In 1941, the Supreme Court upheld the act.[3] The Fair Labor Standards Act limited the number of hours that individuals under the age of 18 years spent working.[3] Regulations differ by age and are more stringent for younger worker 16 years of age and under compared to 17- and 18- year olds.[2] These laws and regulations apply to all states, and some states have adopted even stricter standards that apply to young workers.

The Occupational Safety and Health Administration (OSHA) has implemented standards to help employers understand their responsibility to their young worker populations. For example, the employer must implement a mentoring or buddy system for new young workers, and they must have an adult or experienced worker available to answer all questions pertaining to the required job tasks.[4] The employers must ensure that young workers receive safety training to recognize hazards and are competent in safe work practices.[4] Young workers have the right to work in a safe environment, ask questions if there is something that isn't understood, and to have the correct personal protection gear to perform the required job tasks.[4]

Young workers, 16-24 years old, typically suffer the highest injury rates compared to all other worker groups.[5] While a typical work day for a young worker involves a great deal of physical strength, young workers may engage in job activities

multiple times a day that put them at increased risk for occupational injuries that could potentially lead to fatalities. Studies have shown that the majority of young worker fatalities can be attributed to transportation, construction, and mining work tasks.[6] This vulnerable population is in need of continued worker safety guidance and training from their employers to ensure their safety while at work. Child labor laws, like the Fair Labor Standards Act, do not apply to those workers who are aged 18-24. Workers aged 18-24 are typically inexperienced and may be just as vulnerable to fatal injuries as those workers under the age of 18.

A few studies have been conducted to analyze injuries among workers under the age of 18 years in the United States. A study in 1994 investigated occupational injury deaths among young people in the United States using Occupational Safety and Health Administration data between the years of 1984 and 1987.[7] This study found that of the 104 documented deaths, 30% involved industrial vehicles and equipment, 17% were electrocutions, and 11% were from falls in the workplace; this study focused on 16 and 17 year olds only.[7]

A similar study, conducted in 1999, investigated worker injuries under the age of 18, and found that between the years 1992-1997 there were 67 fatalities. The number of fatalities accounted for only 1% of the total injuries recorded over the study period.[3] A more recent study published in 2007 estimated workers, 16 to 17 year of age, to be approximately 69% of the workforce in 2000.[8] This study reported that among 17-year-olds and younger, the average number of fatalities was 68, between 1992 and 2000.[8] This confirms previous reported findings that young worker fatality numbers have remained consistent over recent years.[9] A 2010 study examined young workers, aged 15-24 years

old that represented 14% of the US labor force at that time.[6] The report covered a 10-year period and found that 5,719 young workers died from occupational injuries, averaging 572 per year, and calculated a fatality rate of 3.6 deaths per 100,000 workers; there was a 14% decline in fatality rates over this 10-year period.[6]

To gain a comprehensive understanding of the injuries that led to fatalities in younger workers, the goal of this study was to compare characteristics of young worker fatal injuries in those aged 16-24 to all workers aged 25 and older in Kentucky using a descriptive analysis. The results of this study can be used to target worker safety interventions to reduce fatalities among young worker populations. The study objectives were to (1) characterize young worker fatalities in those aged 16-24 compared to worker fatalities in those aged 25 and up by demographics, industry type, occupation, incident, and class of worker; (2) characterize multiple jobs holders, self employment, and subcontractor status; and (3) calculate fatality rates, for years 2005-2014 to compare fatality rates between young workers and workers 25 and older.

Materials and Methods

A retrospective analysis of fatalities among workers under the age of 25 compared to workers aged 25 and older was performed over a ten-year period from 2005-2014 using Kentucky Fatality Assessment and Control Evaluation (FACE) program data. The FACE program conducts surveillance of all fatal occupational injuries within Kentucky boundaries.[10] A work-related fatality is considered a case in the FACE database if the injury occurred in Kentucky and if the person was performing work tasks at the time of the fatal injury.[10] The FACE dataset is compiled from multiple sources including death certificates, Occupational Safety and Health Administration reports, Collision Reporting

Analysis for Safer Highways reports, coroner reports and interviews, news media reports, Mining Safety and Health Administration reports and others.[10] This study was conducted at the Kentucky Injury Prevention and Research Center (KIPRC), a joint entity between the University of Kentucky, College of Public Health and the Kentucky Department for Public Health. The University of Kentucky Institutional Review Board approved this study.

FACE data was used in this study for all analyses. This study examined age, sex, race, class of worker, type of industry and occupation, type of incident, class of worker, whether or not the worker held multiple jobs at time of death, and if they were employed by a subcontractor. A descriptive analysis was performed on all variables. Frequencies tabulated for demographic data included sex, race, and age. All analysis performed utilized SPSS version 22.0.[11] Selection criteria for this study included all occupational fatalities where the fatal worker injury occurred in Kentucky. The study did not include Kentucky resident worker fatalities where the fatal work injury occurred outside Kentucky.

North American Industry Classification System (NAICS) codes were used to identify and classify industry type for each worker.[12] NAICS is the standard for classifying business establishments. Frequencies were calculated and bivariate chi-square analysis tests were performed to compare young worker fatalities 16-24 years of age to workers aged 25 and over. Low frequency numbers were categorized as "other industries" and included military, public administration, and government industries. Occupation data were coded and classified using the Standard Occupational Classification system (SOC).[13] Frequencies for "other occupations" included computer

and financial operations; architecture and engineering; life, physical, and social science; community and social service; legal; education; training and library; arts; design; entertainment; sports; media; healthcare practitioners; technical and healthcare support; protective service; food preparation and service related; personal care and service; sales; office and administrative. Incident type, class of worker, self-employment, multiple job holders, and subcontractor employment status were coded by the FACE program.

Fatality rates were calculated for each year and plotted to compare young worker fatalities to all worker fatalities among those aged 25 and older. The United States Census Bureau data was used to obtain denominator numbers to calculate fatality rates.[14] The numerator was provided from the FACE database. The fatality rates were calculated each year per 100,000 workers. A trend analysis was performed in Microsoft Excel to determine the change in rates over the study period. Fisher's test was performed due to the small cell sizes.

Results

From 2005-2014, there were 61 young worker fatalities for the 16-24 age group (Table 1). For the same time period, there were 930 fatalities aged 25 and above. A little over half of the young worker fatalities were in the age range 22-24 (53%). The largest percentages of the older worker fatalities were in the age range of 45-54 years (29%). The average age at death for young workers was 21.43; the average age at death for older workers was 49.03 years. Nearly all workers in both groups (young workers and older workers) were male (90% and 93%, respectively) and white (75% and 87%, respectively). There was a statistically significant difference between the two groups for race (p=0.009), but no statistically significant difference was found for sex (Fisher's p=0.444). A higher

percentage of young worker fatalities were among black workers compared to older black worker deaths.

The majority of young workers who died on the job worked in the construction (21%), professional and business services (20%), and the natural resources and mining (18%) industries (Tables 2 and 3). This differs from the older worker group where the majority of fatalities were in the trade, transportation, and utilities (25%) and natural resources and mining (25%) industries. There was a statistically significant difference between young worker fatality industries and older worker fatality industries (p=0.002).

Occupation results differed from industry results; both young worker and older worker fatalities occurred primarily in the transportation and material moving occupations (23% for young workers and 27% for older workers). Higher percentages of young worker fatalities occurred in the construction and extraction occupations, building and ground cleaning and maintenance, and military occupations compared to older worker fatalities in the same occupations respectively. There was a statistically significant difference between the two worker groups (p<0.001).

Falls, struck bys, and suicides occurred more frequently, and at equivalent percentages in young worker fatalities (18% each) compared to older worker fatalities (Table 4). For each industry there were specific incidents that were higher in frequency. The majority of falls occurred in the construction industry (9 young workers and 54 older workers). Struck bys were in the Natural Resources and Mining industry (5 young workers and 53 older workers), and the majority of suicides occurred in the "other" industry (3 young workers and 6 older workers). These results were consistent for both young workers and older workers (data not shown). Older worker fatalities were

primarily due to motor vehicle crashes (31%). There was a statistical significant significance for incident type between young and older workers (p=0.047).

Tables 5 and 6 described the class of worker, whether or not they held multiple jobs, if they were self-employed, and if a subcontractor employed them. The majority of young workers were working for a privately owned company when they suffered a fatal work injury (77%) compared to 60% of older worker fatalities (p=0.001*).* Also, more young workers were considered government employees (13% of young workers compared to 5% of older workers). Most older workers who died on the job, on the other hand, were business owners (2% young workers compared to 20% of older workers). Few younger workers were self-employed at the time of death compared to older workers (p<0.001). There was no difference between the two groups for subcontractor status, and multiple jobholder status.

Occupational fatality rates declined in both worker groups over the study period and displayed similar trends (Figure 1). The overall occupational fatality rate for young workers was 2.28 per 100,000 workers, and for older workers, the overall occupational fatality rate was 5.71 per 100,000. An important finding to note is the single increase in the 2011 rate; this increase may be a reflection of the small sample for that year. Ordinary least squares regression was used to compare the rate over the years between the young and the older workers. Log transformation of the rates was taken to smooth the data and to increase the stability of the rates. The result from the regression analysis showed that there was no interaction between the time and group variables supporting the observation that the trends for the two groups were similar. Both groups had significant

decreases in the log-transformed rates over the study period (p=0.0030) with rates for older workers being significantly higher than those for young workers (p<0.0001).

Discussion

Although many studies have been conducted on fatalities and injuries among young workers less than 18 years of age, this is the first known study to the authors' knowledge that compares young worker fatalities of those ages 16-24 to worker fatalities of those aged 25 and older. Occupational fatality rates for both young workers and older workers steadily declined over the study period. This study found an overall fatality rate for young workers to be 2.28 per 100,000 workers from 2005 to 2014.

The majority of worker fatalities for both groups were white males. These demographic results are similar to previous findings. [6] There was a statistical significance found for race. Studies report that fatal occupational injury rates for Black men in the United States are higher than fatal occupational injury for non-Black men.[15] This study found that 6% of young worker fatalities and 5% of older worker fatalities were Black in race, respectively. This could suggest a larger proportion of Black workers are entering the workforce at an earlier age or are in riskier jobs.

Other studies have found that the greatest number of young worker fatalities were employed in agriculture industries.[16] This study found the greatest number of young worker fatalities occurred in the construction industry, specifically fatal falls. Some young workers fell installing roofing or stepped into a floor hole and fell 20 feet below fatally injuring themselves. Preventing falls requires a comprehensive approach. Construction companies should consider enhanced worker safety programs for workers performing roofing tasks. Requiring no slip footwear could prevent future falls. The Shoe

and Allied Trade Research Association (SATRA) produce guidelines for slip-resistant sole designs.[17] An engineering control to reduce these falls would include be to follow OSHA Standards and require personal fall protection. Education and training to use personal fall protection could be implemented in the hire training. Studies have proven to have a 14% decrease in their companies fall incidents by embodying these prevention strategies.[17]

The Bureau of Labor Statistics (BLS) found that in 2013 11% of fatal occupational injuries were caused by the worker being struck by an object or equipment.[18] This study found similar findings to the BLS; 18% of young workers were struck by an object or equipment. The majority of these incident types were in the Natural Resources and Mining Industry. This is consistent for older workers as well. The struck by incidents occurred while workers were operating trackers and were un-expectantly struck by a metal beam, or working on a front-end loader and became crushed by the pivoting machine. Studies have shown that the machine speed is the most vital variable in explaining why struck by incidents occurr.[19] Companies should consider enhanced safety training with an emphasis on low speed operation of machinery.[20] Other studies have shown that the most effective prevention strategy for reducing struck by incidents is communication and coordination between the workers.[20]

A higher percentage of suicides occurred among young workers, approximately 10%, which is consistent with another study, conducted in 2010 that examined young adults, mortality and employment. The authors found that about 13% of fatalities among the age group 18-24 were due to suicides.[5] The authors suggest that young worker suicide could be due to the stress and repetitive routines that are associated with young business

industry jobs that young workers may not be equipped to cope with. Other suggestions by authors are poor psychological well-being and/or unhealthy behavior choices that could assist in the decision of completing suicide.[5] These suicides were highest in the "other" industry category. The "other" industries include military, public administration, and government. Aspects of military service can increase the risk of Post Traumatic Stress Disorder (PTSD), depression, and alcohol abuse. These are known behavioral risk factors for increased suicides.[21] Suicides in this study are directly related to shootings. Suicides are the second most common cause of death in the United States military.[22] In 2009, the military adapted a recent Suicide Prevention model. This model focused on education and awareness programs, psychotherapy, and community based prevention programs.[21] A study conducted in 2003, implemented a community wide suicide prevention program in the US Navy. This study found a 33% risk reduction in completed suicides.[23] These programs could create safer workplaces by reducing access to weapons off the job.

There were several limitations to the present study. Regarding the FACE database, all resident deaths may not be accounted for since injuries that occurred outside Kentucky but their death happened in state would not be included in this database. This could lead to an underestimate of all analysis and fatality rates. There could be a large variability due to the small number of fatalities annually. These small numbers may indicate statistical significance when there is none.

Another limitation to this study is the United States Census data. Data was not complete for the year 2014. This could lead to an underestimate of the fatality rate for 2014 and the calculated overall fatality rates for both groups.

Impact on Public Health

Despite the decline in young worker fatality rates over the recent years, young worker occupational fatalities are still occurring yearly. This study identified young worker fatalities due to falls, suicides, and struck by incidents. These incidents primarily took place in the construction, military specific, and natural resources and mining industries. Employers should assess hazards daily. Engineering controls and processes, could be implemented to reduce falls and struck by incidents. Employers should ensure that their workers are properly equipped to perform the job task at hand as well as knowledgeable about the potential hazards they could be exposed to. Suicide prevention programs, like the military has implemented, could potentially benefit the young worker community in entirety. Employers should be aided by OSHA and education and training to provide the best possible guidance for these young workers.

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Tables and Figures

Table 1. Young Worker Fatalities vs. Older Worker Fatalities by Demographic Characteristics in Kentucky, 2005-2014.

Demographics	**Young workers n(%) N=61**	**Older workers n (%) N=930**	**Chi-Square *p* value**
Age		n=926	
16-18	6 (9.8)		
19-21	23 (37.7)		
22-24	32 (52.5)		
25-34		163 (17.5)	
35-44		189 (20.3)	
45-54		267 (28.7)	
55-64		187 (20.1)	
65-74		83 (8.9)	
75-84		37 (4.0)	
85-94		4 (0.4)	
Mean Age	21.43	49.03	
Race			*p*=0.009
White	46 (75.4)	808 (86.9)	
Black	4 (6.6)	47 (5.1)	
Asian of Pacific	1 (1.6)	1 (0.1)	
Other	2 (3.3)	23 (2.5)	
Unknown	8 (13.1)	51 (5.5)	
Sex			*p*=0.444
Male	56 (90.3)	863 (92.8)	
Female	6 (9.8)	67 (7.2)	

Table 2. Young Worker Fatalities vs. Older Worker Fatalities by Employment Industry in Kentucky, 2005-2014.

Industry	**Young workers n(%) N=61**	**Older workers n (%) n=893**	**Chi-Square *p* value**
Natural Resources and Mining	11 (18.0)	220 (24.6)	*p*=0.002
Construction	13 (21.3)	137 (15.3)	
Manufacturing	4 (6.6)	96 (10.8)	
Trade, Transportation, and Utilities	8 (13.1)	223 (25.0)	
Information	2 (3.3)	9 (1.0)	
Financial Activities	2 (3.3)	22 (2.5)	
Professional and Business Services	12 (19.7)	59 (6.6)	
Education and Health Services		30 (3.4)	
Leisure and Hospitality	1 (1.6)	23 (2.6)	
Other*	8 (13.1)	74 (8.3)	

*Other include military, public administration, and government industries.

Table 3. Young Worker Fatalities vs. Older Worker Fatalities by Employment Occupation in Kentucky, 2005-2014.

Occupation	**Young workers n(%) n=54**	**Older workers n (%) n=881**	**Chi-Square *p* value**
Management	3 (4.9)	155 (16.7)	$p<0.001$
Business and Financial	1 (1.6)	6 (0.6)	
Building and Ground Cleaning and Maintenance	10 (16.4)	50 (5.4)	
Farming, Fishing, and Forestry	2 (3.3)	59 (6.3)	
Construction and Extraction	13 (21.3)	155 (16.7)	
Installation, Maintenance, and Repair	4 (7.4)	70 (7.5)	
Transportation and Material Moving	14 (23.0)	251 (27.0)	
Military Specific	7 (11.5)	2 (0.2)	
Other*		133 (14.3)	
Unknown	7 (11.5)	49 (5.3)	

*Other occupation includes computer and financial operations; architecture and engineering; life, physical, and social science; community and social service; legal; education; training; and library; arts; design; entertainment; sports; and media; healthcare practitioners; technical and healthcare support; protective service; food preparation and service related; personal care and service; sales; office and administrative.

Table 4. Young Worker Fatalities vs. Older Worker Fatalities by Incident Type in Kentucky, 2005-2014.

Incident Type	Young workers n(%) N=61	Older workers n (%) n=929	Chi-Square *p* value
Fall	11 (18.0)	109 (11.7)	*p*=0.047
MVC	11 (18.0)	284 (30.6)	
Struck by	11 (18.0)	115 (12.4)	
Suicide	6 (9.8)	40 (4.3)	
Machine	5 (8.2)	123 (13.2)	
Other*	17 (27.9)	258 (27.8)	

*Other incident type includes homicide, explosion, drowning, poisoning, crushed by, overexertion, air/space transportation, suffocation, animal related, caught in, confined space, and unknown.

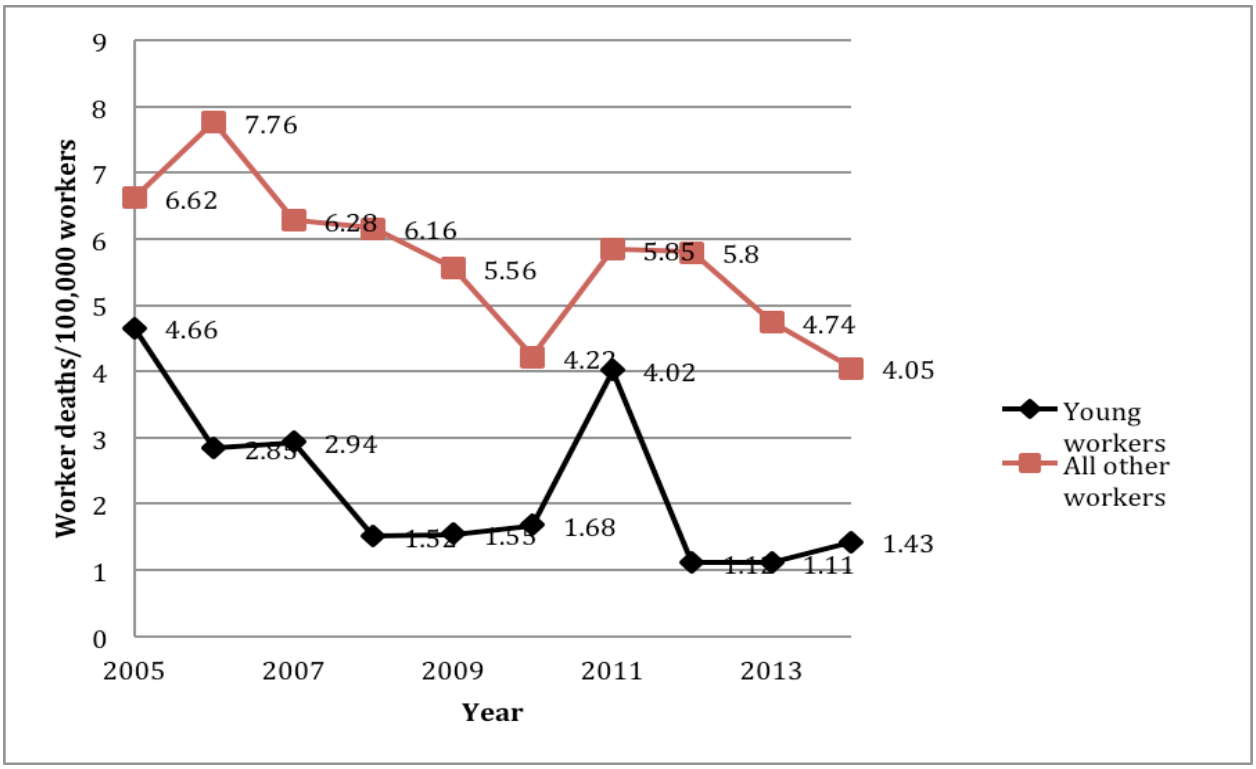
Table 5. Young Worker Fatalities vs. Older Worker Fatalities by Class of Worker in Kentucky, 2005-2014.

Class of Worker	**Young workers n(%) N=61**	**Older workers n (%) n=930**	**Chi-Square *p* value**
Privately owned company	47 (77.0)	556 (59.8)	*p*=0.001
Private, not-for-profit	1 (1.6)	11 (1.2)	
Government	8 (13.1)	48 (5.2)	
Business Owner	1 (1.6)	181 (19.5)	
Working without pay on family farm or business		2 (0.2)	
Unknown	4 (6.6)	132 (14.2)	

Table 6. Young Worker Fatalities vs. Older Worker Fatalities by Multiple Jobholder, Self-Employment, and Subcontractor Status in Kentucky, 2005-2014.

Job demographics	**Young workers n(%) N=61**	**Older workers n (%) n=930**	**Chi-Square *p* value**
Multiple Jobs			p=0.509
Yes	5 (8.2)	56 (6.0)	
No	23 (37.7)	416 (44.7)	
Unknown	33 (54.1)	458 (49.2)	
Self employed			p<0.001
Yes	2 (3.3)	209 (22.5)	
No	57 (93.4)	624 (67.1)	
Unknown	2 (3.3)	97 (10.4)	
Employed by a subcontractor			p=0.243
Yes	4 (6.6)	35 (3.8)	
No	27 (44.3)	503 (54.1)	
Unknown	30 (49.2)	392 (42.2)	

Figure 1. Fatality Rates for Young Worker vs. Older Workers in Kentucky, 2005-2014.



Biological Sketch

Allison Christian is originally from Ashland, KY. She received her Bachelor of Science degree in Human Nutrition, Food, and Exercise from Virginia Tech in 2011. She is currently a Master of Public Health (MPH) candidate in Environmental Health at the University of Kentucky and a NIOSH/CDC funded trainee through the Central Appalachian Regional Education and Research Center.

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