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Helmet Use Among Motorcyclists Who Died in Crashes and Economic Cost Savings Associated With State Motorcycle Helmet Laws — United States, 2008–2010

In 2010, the 4,502 motorcyclists (operators and passengers) killed in motorcycle crashes made up 14% of all road traffic deaths, yet motorcycles accounted for <1% of all vehicle miles traveled (*1,2*). Helmet use consistently has been shown to reduce motorcycle crash–related injuries and deaths, and the most effective strategy to increase helmet use is enactment of universal helmet laws (*3*). Universal helmet laws require all motorcyclists to wear helmets whenever they ride. To examine the association between states' motorcycle helmet laws and helmet use or nonuse among fatally injured motorcyclists, CDC analyzed 2008–2010 National Highway Traffic Safety Administration (NHTSA) data from the Fatality Analysis Reporting System (FARS), a census of fatal traffic crashes in the United States (*1*). Additionally, economic cost data from NHTSA were obtained to compare the costs saved as a result of helmet use, by type of state motorcycle helmet law. The findings indicated that, on average, 12% of fatally injured motorcyclists were not wearing helmets in states with universal helmet laws, compared with 64% in partial helmet law states (laws that only required specific groups, usually young riders, to wear helmets) and 79% in states without a helmet law. Additionally, in 2010, economic costs saved from helmet use by society in states with a universal helmet law were, on average, $725 per registered motorcycle, nearly four times greater than in states without such a law ($198).

Motorcyclist death data for operators and passengers were obtained from FARS. To be included in FARS, a crash must result in the death of at least one person (occupant of a vehicle or a nonmotorist) within 30 days of the crash. Percentages of fatally injured motorcyclists who were not wearing a helmet were calculated as a proportion of all motorcyclist fatalities by state for 2008–2010. Percentages were suppressed for states with fewer than 10 fatalities involving motorcyclists who were not wearing helmets.

Information on economic costs saved from helmet use (e.g., medical and productivity costs saved) was obtained from NHTSA (NHTSA, unpublished data, 2012). The methods used to estimate 2010 costs were first used to calculate 2008 cost estimates.* For 2010, the number of fatally injured motorcyclists who wore helmets was derived from FARS, and estimates of the number of helmeted motorcyclists who were injured were obtained from NHTSA's General Estimates System, a nationally representative sample of nonfatal traffic crashes.† These values were divided by 1 minus the corresponding effectiveness estimate for preventing motorcycle crash fatalities and injuries§ (*4*) to obtain estimates of the

*Additional information available at http://www-nrd.nhtsa.dot.gov/pubs/811433.pdf, and at http://www-nrd.nhtsa.dot.gov/pubs/809861.pdf.
†Additional information available at http://www.nhtsa.gov/Data/National+Automotive+Sampling+System+(NASS)/NASS+General+Estimates+System.
§37% for preventing fatal injuries to riders and 41% for passengers, 13% for preventing serious injuries to riders and passengers, and 8% for preventing minor injuries to riders and passengers.

INSIDE

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potential number of motorcycle crash fatalities and injuries expected if helmeted riders had not been wearing a helmet. The numbers of fatalities and injuries involving helmeted motorcyclists were then subtracted from the expected numbers of motorcycle crash fatalities and injuries to estimate the numbers of motorcyclist lives saved and serious and minor injuries prevented. Corresponding cost calculations from NHTSA¶ were then applied to these estimates, and the resulting costs were adjusted to year 2010 dollars. Costs saved were estimated to be $1,212,800 per fatality, $171,753 per serious injury, and $7,523 per minor injury (in year 2010 dollars) (NHTSA, unpublished data, 2012). Costs saved included injury-related costs (e.g., medical and emergency services costs, and household and work productivity losses) and excluded costs (e.g., property damage and travel delay). For this report, costs saved were standardized by state by dividing the total costs saved in each state by the number of registered motorcycles in that state in 2010** to determine costs saved per registered motorcycle.

During 2008–2010, a total of 14,283 motorcyclists were killed in crashes, among whom 6,057 (42%) were not wearing a helmet. In the 20 states with a universal helmet law, 739 (12%) fatally injured motorcyclists were not wearing a helmet, compared with 4,814 motorcyclists (64%) in the 27 states with partial helmet laws and 504 (79%) motorcyclists in the three states without a helmet law (Figure 1).

By preventing motorcyclist deaths and protecting against injuries, helmet use also translated to economic costs saved. In 2010, approximately $3 billion in costs were saved as a result of helmet use in the United States; however, another $1.4 billion could have been saved if all motorcyclists had worn helmets (NHTSA, unpublished data, 2012). Total costs saved from helmet use ranged from $394 million in California to $2.6 million in New Mexico. Economic costs saved from helmet use per registered motorcycle ranged from $1,627 in North Carolina to $48 in New Mexico, with a median of $286 (Figure 2). Nearly all (23 of the 25) states with costs saved per registered motorcycle below the median had either a partial helmet law or no helmet law. Costs saved in states with a universal helmet law were, on average, nearly four times greater per registered motorcycle than in states without such a law ($725 versus $198).

¶ Additional information available at http://www.nhtsa.gov/DOT/NHTSA/Communication%20&%20Consumer%20Information/Articles/Associated%20Files/EconomicImpact2000.pdf.

** Additional information available at http://www.fhwa.dot.gov/policyinformation/statistics/2010/mv1.cfm.

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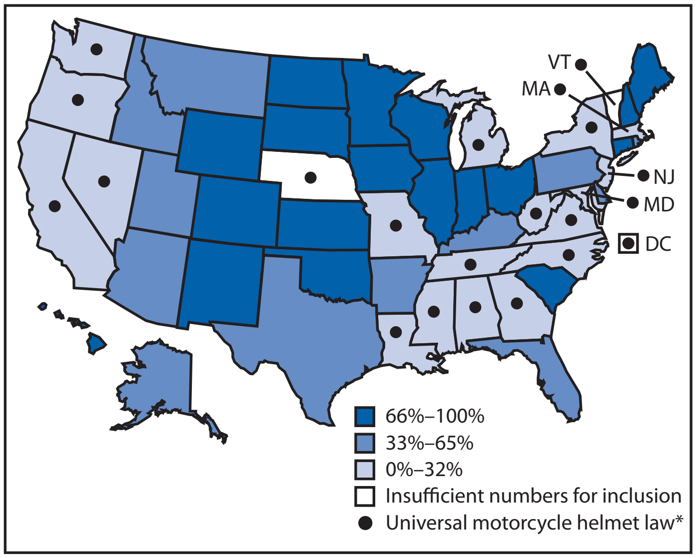
FIGURE 1. Percentage of motorcyclist fatalities in which riders were not wearing helmets, by state — United States, 2008–2010



* All other states had partial helmet laws, with the exception of Iowa, Illinois, and New Hampshire, which had no helmet laws. Michigan changed to a partial helmet law in April 2012; however, this analysis reflects the situation during 2008–2010, when a universal helmet law was in effect.

What is already known on this topic?

In 2010, motorcycle crashes made up 14% of all road traffic deaths, yet motorcycles accounted for <1% of all vehicle miles traveled. Helmet use prevents an estimated 37% of fatalities among motorcycle operators and 41% of fatalities among passengers.

What is added by this report?

Compared with motorcyclists in states with a universal helmet law during 2008–2010, fatally injured motorcyclists in states with a partial helmet law were more than five times as likely not to have been wearing a helmet, and fatally injured motorcyclists in states with no helmet law were more than six times as likely not to have been wearing a helmet. Economic costs saved in states with a universal helmet law were, on average, $725 per registered motorcycle, nearly four times greater than in states without such a law ($198). Although approximately $3 billion in economic costs were saved as a result of helmet use in the United States in 2010, another $1.4 billion could have been saved if all motorcyclists had worn helmets.

What are the implications for public health practice?

Helmet use by motorcyclists is proven to save lives, decrease the severity of crash injuries, and reduce costs. Universal helmet laws are demonstrated to be the most effective way to increase helmet use.

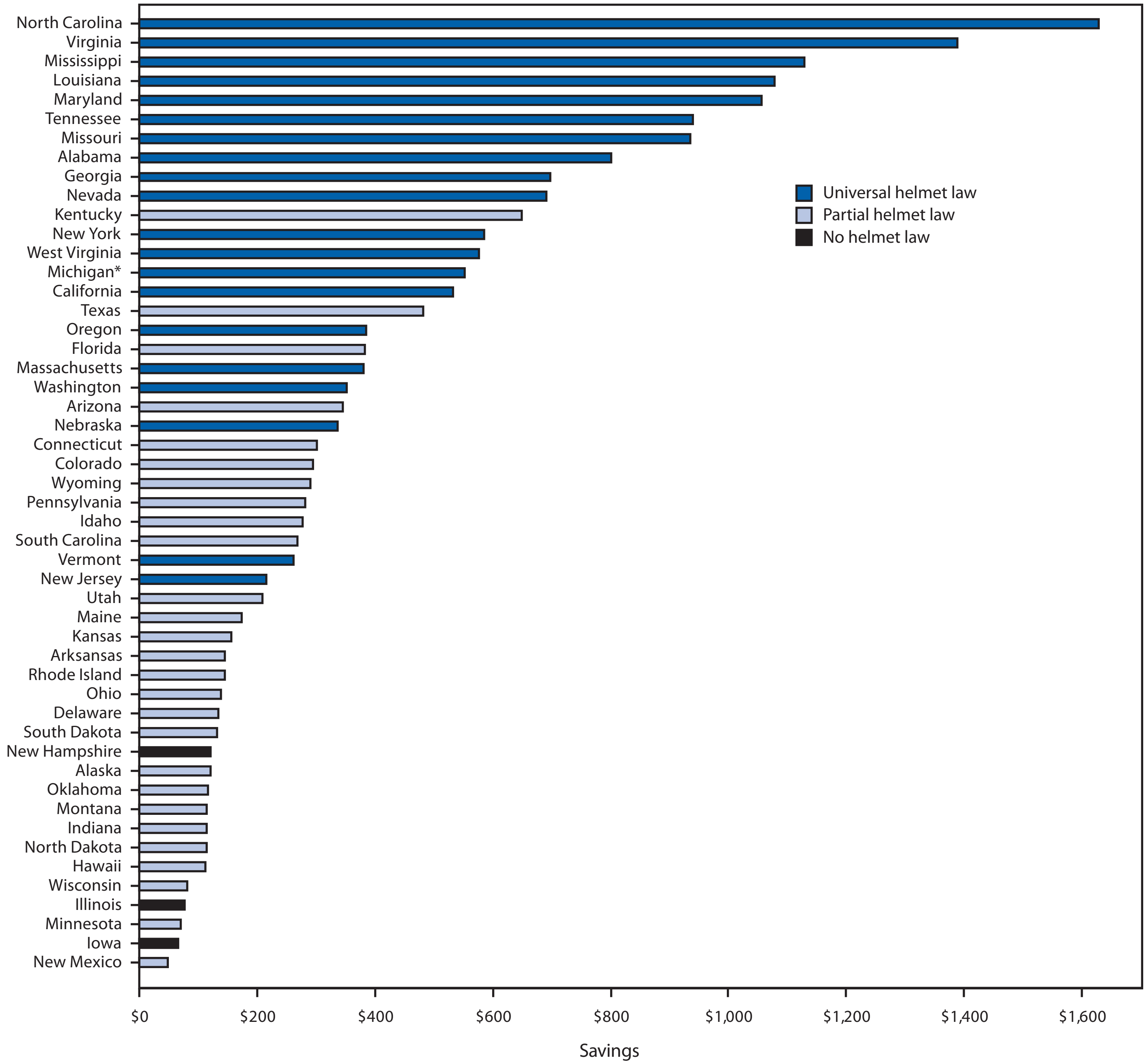
Editorial Note

The findings in this report indicate that fatally injured motorcycle riders were less likely to wear helmets in states that do not have universal helmet laws. During 2008–2010, fatally injured motorcyclists in states with a partial helmet law were more than five times as likely not to have been wearing a helmet as those in states with a universal helmet law (64% versus 12%). Fatally injured motorcyclists in states with no helmet law were more than six times as likely not to have been wearing a helmet as those in states with a universal helmet law (79% versus 12%). In addition, the economic costs saved by helmet use are substantial. The savings in states with a universal helmet law were, on average, $725 per registered motorcycle, nearly four times greater than in states without such a law ($198).

As of April 2012, 19 states and the District of Columbia had universal helmet laws, 28 states had partial helmet laws, and three states had no helmet law (*5*). Motorcycle helmet legislation in the United States has been marked by change, with cycles of helmet law enactments followed by periods of helmet law repeals (Figure 3) (*5*). In the mid-1970s, 47 states and the District of Columbia had universal helmet laws, prompted in part by a 1967 federal requirement that states have such laws or lose a portion of their federal highway funds. In 1976, however, Congress removed penalties for not having a universal helmet law and states began to change or repeal their laws. By 1980, 20 states had changed their universal helmet laws to partial helmet laws and eight states had repealed their laws altogether (*5*). In 1991, Congress reintroduced financial penalties for states without universal helmet laws; California and Maryland responded by passing universal helmet laws. In 1995, federal sanctions against states without universal helmet laws again were lifted, and New Hampshire's helmet law immediately was repealed. During 1997–2003, Arkansas, Texas, Kentucky, Louisiana, Florida, and Pennsylvania followed by changing their helmet laws from universal helmet laws to partial helmet laws (*5*). In 2004, Louisiana reinstated its universal helmet law. Since then, state legislatures have continued to debate helmet laws, and bills to change or repeal universal helmet laws routinely are introduced. In 2011, such bills were introduced in 10 of the 20 universal helmet law states, and in April 2012, Michigan changed its universal helmet law to a partial helmet law (*5,6*).

Research has shown that when a state repeals its helmet law or opts for less restrictive requirements, helmet use decreases and motorcycle-related deaths, injuries, and costs increase. In 2000, for example, Florida changed its universal helmet law to a partial helmet law that covered only riders aged <21 years and those with <$10,000 in medical insurance coverage. During the 2 years after the law was changed, the motorcyclist death rate per 10,000 registered motorcycles in Florida increased by 21%, deaths among motorcycle riders aged <21 years nearly tripled, and hospital admissions of motorcyclists with injuries

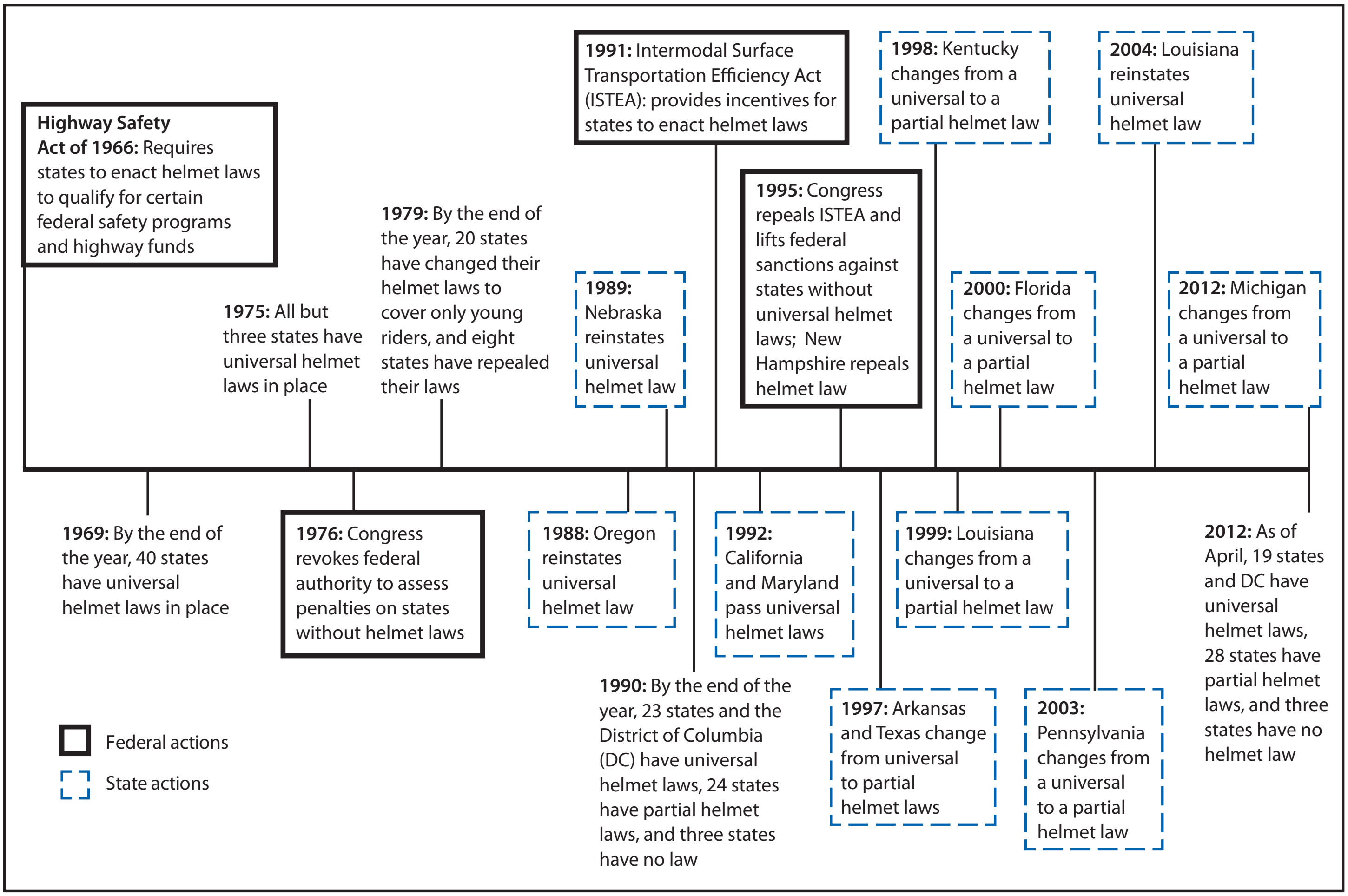
FIGURE 2. Estimated economic costs saved as a result of motorcycle helmet use, per registered motorcycle, by state — National Highway Traffic Administration, United States, 2010



* Michigan changed to a partial helmet law in April 2012; however, this analysis reflects the situation during 2010, when a universal helmet law was in effect.

to the head, brain, and skull increased by 82% (*7*). In addition, gross costs charged to hospital-admitted motorcyclists with head, brain, or skull injuries in Florida more than doubled, from $21 million to $50 million (*7*). Studies that have examined nonfatal injury outcomes among motorcyclists who wore helmets and those who did not have found that hospitalized riders who had not worn helmets incurred higher health-care costs (*8,9*). Riders who do not wear helmets are more likely to suffer traumatic brain injuries, and median hospital charges for those with traumatic brain injuries are 13 times higher than for those without such injuries (*8*). Riders who do not wear helmets also are less likely to have health insurance, and therefore are more likely to require publicly funded health care (*9*).

FIGURE 3. Motorcycle helmet legislation timeline — United States, 1966–2012



The findings in this report are subject to at least three limitations. First, the NHTSA cost estimates are based on year 2000 estimates, converted to year 2010 dollars; however, these are the most recent and comprehensive motorcyclist injury cost estimates available. Second, costs estimates are derived from national data and do not reflect variation in costs across states. Cost estimates also do not include intangible costs, such as those for pain, suffering, and decreased quality of life, nor do they account for the costs associated with a universal helmet law or owning a helmet. Finally, helmet use was unknown and therefore estimated for 2.5% of motorcyclist fatalities; however, no meaningful differences resulted from inclusion of these estimates.

Helmet use is estimated to prevent 37% of fatalities among motorcycle operators and 41% of fatalities among passengers (*4*). NHTSA estimates that in 2010, helmet use saved the lives of 1,544 motorcyclists, and an additional 709 lives might have been saved if all motorcyclists had worn helmets (NHTSA, unpublished data, 2012). With motorcycle ownership at an all-time high (8.2 million registered motorcycles in 2010, compared with 4.3 million in 2000),[††] motorcycle-related deaths and their associated costs are expected to remain at high levels unless more effective protective measures are implemented (*10*). Helmets are proven to save lives and money, and universal helmet laws are the most effective way to increase helmet use (*3*).

[††] Data available at http://www.fhwa.dot.gov/ohim/hs00/pdf/mv1.pdf, and at http://www.fhwa.dot.gov/policyinformation/statistics/2010/mv1.cfm.

Acknowledgments

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Pneumoconiosis and Advanced Occupational Lung Disease Among Surface Coal Miners — 16 States, 2010–2011

Coal workers' pneumoconiosis (CWP) is a chronic occupational lung disease caused by long-term inhalation of dust, which triggers inflammation of the alveoli, eventually resulting in irreversible lung damage. CWP ranges in severity from simple to advanced; the most severe form is progressive massive fibrosis (PMF). Advanced CWP is debilitating and often fatal. To prevent CWP, the Coal Mine Health and Safety Act of 1969 established the current federal exposure limit for respirable dust in underground and surface coal mines. The Act also established a surveillance system for assessing prevalence of pneumoconiosis among underground coal miners, but this surveillance does not extend to surface coal miners. With enforcement of the exposure limit, the prevalence of CWP among underground coal miners declined from 11.2% during 1970–1974 to 2.0% during 1995–1999, before increasing unexpectedly in the last decade, particularly in Central Appalachia (*1,2*). Exposure to respirable dust is thought to be less in surface than underground coal miners. Although they comprise 48% of the coal mining workforce, surface coal miners have not been studied since 2002 (*3*,*4*). To assess the prevalence, severity, and geographic distribution of pneumoconiosis among current surface coal miners, CDC obtained chest radiographs of 2,328 miners during 2010–2011 through the Coal Workers' Health Surveillance Program of the National Institute for Occupational Safety and Health (NIOSH). Forty-six (2.0%) of 2,257 miners with ≥1 year of surface mining experience had CWP, including 37 who had never worked underground. Twelve (0.5%) had PMF, including nine who had never worked underground. A high proportion of the radiographs suggested silicosis, a disease caused by inhalation of crystalline silica. Surface coal mine operators should monitor worker exposures closely to ensure that both respirable dust and silica are below recommended levels to prevent CWP. Clinicians should be aware of the risk for advanced pneumoconiosis among surface coal miners, in addition to underground coal miners, to facilitate prompt disease identification and intervention.

During 2010–2011, the Coal Workers' Health Surveillance Program mobile surveillance unit traveled to 16 of the 17 states* with active surface coal mines to offer chest radiographs to miners. Site selection was based on accessibility and cooperation of surface coal mine operators, who are not required to offer chest radiographs to their employees. All participants provided written informed consent.

Work histories, including tenures in surface and underground coal mining, were collected from each miner. Radiographs were classified for changes consistent with CWP, according to the International Labour Office (ILO) International Classification of Radiographs of Pneumoconiosis (*5*). At least two NIOSH B Readers[†] who had no knowledge of miners' work history, performed the classifications (*5*). Identification of CWP required agreement between two readers that small pneumoconiotic opacities were present at an ILO profusion subcategory of ≥1/0 (range: 0/0–3/+). An ILO profusion subcategory of ≥2/1 was considered advanced pneumoconiosis. Identification of PMF required reader agreement on the presence of large (>1 cm) pneumoconiotic opacities (A, B, or C) (*5*). B Readers also recorded the presence of r-type radiographic opacities (rounded opacities, 4–10mm in diameter), which have been associated with inhalation of crystalline silica, a common exposure in mining (*6*). If the classifications of the presence or severity of pneumoconiosis by two B Readers were not in agreement, the radiograph was sent for classification to a third B Reader.

The crude prevalences of CWP, PMF, advanced pneumoconiosis, and r-type opacities among participating surface coal miners were calculated. Prevalences of diseases among miners from the three Central Appalachian states (Kentucky, Virginia, and West Virginia) were compared with prevalences among miners from the 13 other mining states; prevalence ratios were calculated using log binomial regression, adjusting for important confounders.

Radiographs from 2,328 surface coal miners (approximately 7% of active U.S. surface coal miners) were evaluated and classified. Among participants, 95% were men, and 83% were non-Hispanic whites. Of 2,257 (97%) miners who reported ≥1 year of surface mining tenure, 46 (2.0%) had CWP (Table), including 37 who reported no underground mining experience; 12 (0.5%) had CWP that had progressed to PMF (Table), including nine who had never worked underground. Among the 46 miners with CWP, 17 (37%) were classified as having

* Alabama, Arizona, Colorado, Illinois, Indiana, Kentucky, Maryland, Montana, New Mexico, North Dakota, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and Wyoming. Texas, which also has active surface coal mines, was not included in the survey.

† A "B Reader" is a physician certified by NIOSH as demonstrating proficiency in the use of ILO classification of radiographs of pneumoconiosis. B Readers must successfully complete a certification examination and be recertified every 4 years. Additional information available at http://www.cdc.gov/niosh/topics/chestradiography/breader.html.

TABLE. Prevalence of coal workers' pneumoconiosis (CWP) and progressive massive fibrosis (PMF) among surface coal miners, by region, age, CWP status, and total reported years of mining tenure — Coal Workers' Health Surveillance Program, 16 states, 2010–2011

		Age (yrs)		Total mining tenure (yrs)		Prevalence of disease			
						CWP		PMF	
Region/CWP status	No. tested	Median	Range	Median	Range	No.	(%)	No.	(%)
Surface coal miners	2,257	52	(18–82)	24	(1–58)	46	(2.0)	12	(0.5)
From Central Appalachia*	833	53	(22–78)	28†	(1–56)	31	(3.7)	10	(1.2)
From non–Central Appalachia§	1,424	52	(18–82)	20†	(1–58)	15	(1.1)	2	(0.1)
With CWP	46	56	(37–78)	33	(3–42)	—	—	—	—

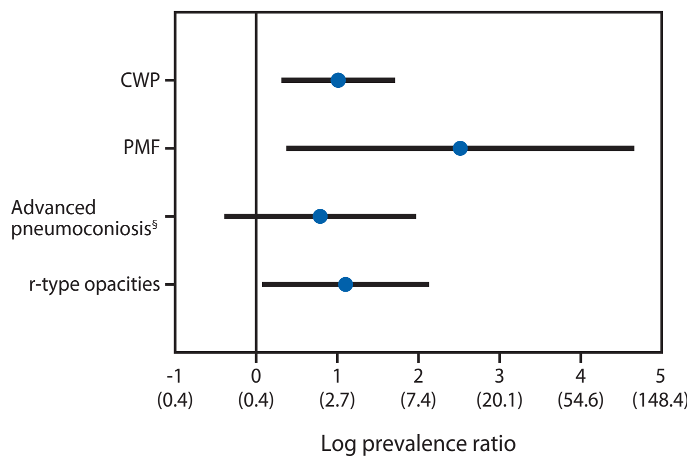
* Includes miners from Kentucky, Virginia, and West Virginia only.
† Median tenure for Central Appalachian and non–Central Appalachian surface coal miners is significantly different (p<0.001).
§ Includes miners from Alabama, Arizona, Colorado, Illinois, Indiana, Maryland, Montana, New Mexico, North Dakota, Ohio, Pennsylvania, Tennessee, and Wyoming.

advanced pneumoconiosis (≥2/1 ILO profusion category), and 17 (37%) were found to have r-type opacities (Table) (*6*).

Of the participating surface coal miners, 833 were from Central Appalachia, and 1,424 were from the other 13 states. Crude prevalences of CWP (31 miners [3.7%]) and PMF (10 [1.2%]) were higher among the Central Appalachian miners than the non–Central Appalachian miners (15 [1.1%] and two [0.1%], respectively) (Table). In addition, crude prevalences of advanced pneumoconiosis and r-type opacities were higher among the Central Appalachian miners (11 [1.3%] and 14 [1.7%], respectively) than the miners from the other 13 states (six [0.4%] and seven [0.5%], respectively)

The median total mining tenure differed significantly between Central Appalachian (28 years) and other surface miners (20 years) (Table). Adjustment for tenure was performed because the development and severity of CWP is directly related to both duration and concentration of dust exposure. After adjustment, results from a log-binomial regression among 2,102 miners for whom surface mining comprised ≥75% of their total mining tenure indicated that the prevalence of CWP was 2.7 times greater (95% confidence interval = 1.4–5.3) among Central Appalachian miners compared with the other miners (Figure). Tenure-adjusted prevalences of both PMF and r-type opacities also were significantly higher in Central Appalachian miners (Figure).

FIGURE. Prevalence ratios for coal workers' pneumoconiosis (CWP), progressive massive fibrosis (PMF), advanced pneumoconiosis, and r-type opacities, comparing Central Appalachian* and non–Central Appalachian† surface coal miners — Coal Workers' Health Surveillance Program, 16 states, 2010–2011



* Includes miners from Kentucky, Virginia, and West Virginia only.
† Median tenure for Central Appalachian and non–Central Appalachian surface coal miners is significantly different (p<0.001).
§ ≥2/1 International Labour Office small opacity profusion category.

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Editorial Note

This analysis indicates that some currently working surface coal miners with little or no underground mining experience suffer from severe preventable respiratory disease, even though surface miners are thought to work in conditions less dusty than the confined work spaces of underground miners. The specific appearance of the abnormalities (r-type opacities) observed on the miners' chest radiographs suggests that inhalation of respirable crystalline silica might be a key exposure. Dusts containing >5% respirable crystalline silica are more fibrogenic, and inhalation can lead to accelerated onset and greater severity of lung disease (*7,8*).

Surface coal miners in Central Appalachia had greater prevalence of both CWP and PMF compared with miners in other regions, independent of mining tenure, age, or underground working experience. Causes for these regional differences are unknown but might reflect differences in mining practices, safety culture, or geology. These findings suggest that current federal permissible dust exposure limits might be insufficient

What is already known on this topic?

Coal workers' pneumoconiosis (CWP) is a chronic lung disease caused by the inhalation of dust; advanced CWP is debilitating and can be fatal. In the past decade, the prevalence of CWP and progressive massive fibrosis (PMF), a severe form of CWP, have increased among underground coal miners, particularly in Central Appalachia. However, the most recent study of CWP and PMF prevalence among U.S. surface coal miners was completed in 2002, and current disease prevalence in this population is not known.

What is added by the report?

This study, the first assessment of CWP and PMF in surface coal miners since 2002, found that 46 (2.0%) of 2,257 miners working at surface coal mines during 2010–2011 had CWP, based on chest radiographs. Of those, 37 (80%) had no history of working underground. Twelve (26%) of the 46 had PMF, including nine (75%) who had never worked underground. The prevalences of CWP, PMF, and markers for severe occupational respiratory disease were greater in Central Appalachian miners, even after adjusting for mining tenure.

What are the implications for public health practice?

Clinicians and miners should be aware of the risk for CWP and PMF in surface coal miners as well as underground miners to facilitate prompt disease identification and preventive interventions. To prevent pneumoconiosis in surface miners, operations should use effective dust monitoring and control methods to reduce respiratory hazards and emphasize the risk for advanced pneumoconiosis in worker training. CDC's National Institute for Occupational Safety and Health recommends that surface coal miners be included in periodic health surveillance.

to protect against disease or are not being adequately controlled to prevent excess dust exposure.

The findings in this report are subject to at least three limitations. First, this study used a sample based on accessibility and cooperation of mine operators and voluntary participation of miners. Whether any selection factors affected miner participation is unclear; therefore, prevalence of CWP might not be representative of all U.S. surface coal miners. Prevalence of CWP might be overestimated or underestimated, depending on whether miners with symptoms were more or less likely to volunteer for chest radiography. Second, age and mining tenure were self-reported, which could affect comparisons of tenure-adjusted disease prevalence. Finally, estimates of the prevalence of CWP and PMF included assessment of miners with underground mining experience, 155 (6.9%) of whom had ≥25% of their total mining tenure in underground mines. Therefore, morbidity in these surface miners cannot be attributed to their work as surface miners alone.

Surface coal miners and the clinicians caring for them should be aware of the risk for CWP and PMF, medical conditions traditionally associated with underground coal mining. Surface coal mine operators should inform workers of their risk for advanced pneumoconiosis and closely monitor exposures, ensuring that respirable dust and silica exposures are continuously below recommended levels to reduce the risk for pneumoconiosis.

To prevent pneumoconiosis among underground and surface coal miners, the Coal Mine Health and Safety Act established federal exposure limits for respirable silica and coal dust.[§] NIOSH has recommended changes to the manner in which respirable silica and coal dust are measured for compliance and enforcement purposes (*9,10*). Use of personal continuous dust monitoring devices is recommended to achieve a more accurate and representative assessment of workers' exposure, although these devices currently cannot distinguish between silica and coal dust (*10*). The NIOSH-recommended exposure limit for respirable silica is 50 $\mu g/m^3$, as a time-weighted average[¶] (*8*). Additionally, NIOSH recommends that surface coal miners be included in periodic health surveillance that is similar to that conducted for underground miners (*9,10*).

[§] Title 30, Code of Federal Regulations, Parts 70 and 71.
[¶] The average exposure over a 10-hour work day and limited to a 40-hour work week.

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Members of the Coal Workers' Health Surveillance Program mobile surveillance team and surface coal miner participants. Kristin J. Cummings, MD, Div of Respiratory Disease Studies, National Institute for Occupational Safety and Health; Derek Ehrhardt, MPH, Unice Oleander, Global Immunization Div, Center for Global Health, CDC.

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Notes from the Field

Salmonella Typhi Infections Associated with Contaminated Water — Zimbabwe, October 2011–May 2012

On October 25, 2011, a cluster of approximately 20 suspected cases of typhoid fever in residents of Dzivaresekwa, a high-density suburb of Harare, Zimbabwe, was reported to the City of Harare City Health Department. On November 22, a team from CDC-Atlanta, CDC-Kenya/Kenya Medical Research Institute, and the South Africa Field Epidemiology and Laboratory Training Program, was invited to assist with the investigation by providing epidemiologic and microbiologic support to better describe the outbreak and to evaluate response efforts.

As of May 2, 2012, a total of 4,185 suspected cases of typhoid fever had been identified in Harare. Suspected cases were defined as fever of ≥3 days duration and malaise, headache, vomiting, diarrhea, constipation, or cough in a person who lived in or had been in Harare since October 1, 2011. Confirmed cases (n = 52) met the suspected case definition and were confirmed by blood or stool culture. Median age of patients was 15 years (range: <1–95 years); 54% were female. Hospitalization was reported for 1,788 patients (43%); two deaths were reported. Suspected cases were reported predominantly in the high-density suburbs of Kuwadzana (1,957), Dzivaresekwa (1,012), and Marlborough (115). Of patients treated in Harare, 207 reported home addresses in other Zimbabwean provinces. Suspected cases of typhoid fever in Harare continue to decline as of May 2, 2012; however, with limited surveillance systems and laboratory capacity, national trends are unclear.

The investigative team, in collaboration with government officials, tested water samples from six public boreholes, seven shallow wells, and three municipal taps in Dzivaresekwa. Samples from two of six boreholes and all seven shallow wells yielded *Escherichia coli* (an indicator of fecal contamination); all municipal taps tested negative for *E. coli*.

Recommendations included promotion of household chlorination of water from all sources because chlorination of the municipal system might be unreliable. Public health partners targeted distribution of a 3-month supply of sodium dichloroisocyanurate water-purification tablets (i.e., enough tablets to treat a single 20-liter bucket for drinking water every day per household for 3 months) to all households in suburbs that were defined as being at high risk, and disseminated health education messages highlighting the importance of safe water collection, treatment, and storage, safe food preparation, and improved hygiene and sanitation practices. Efforts are under way to upgrade infrastructure (replacing old cast-iron pipes with new polyvinyl chloride pipes to prevent breakages), remediate existing boreholes by shock chlorination and drilling new ones, and establish local reservoir tanks.

Although this descriptive study does not prove that illness was associated with contaminated water, the association seems likely. Rural-to-urban migration has resulted in overcrowding in residential areas and has outpaced maintenance and expansion of water supply and sewerage infrastructure. Rationing of piped, treated water from municipal systems obliges residents to use unimproved water sources to meet their water needs, putting them at risk for enteric infections. Frequent sewer blockages compound this problem by further contaminating shallow wells used by residents for drinking water.

Each year, *Salmonella* Typhi causes an estimated 22 million cases of typhoid fever and 216,000 deaths worldwide (*1*). Humans are the only reservoir for *S.* Typhi, and infection occurs by the fecal-oral route, usually through ingestion of contaminated food or water. An estimated 884 million persons worldwide lack access to safe water, and nearly 2.5 billion persons do not have access to adequate sanitation (*2*). Incidence is highest in developing countries, particularly in areas with poor sanitation or without access to safe water. Recent evidence of the magnitude of epidemic and endemic typhoid fever in sub-Saharan African countries highlights the continued importance of typhoid fever prevention and control in Africa (*3*).

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Notes from the Field

Human *Salmonella* Infantis Infections Linked to Dry Dog Food — United States and Canada, 2012

CDC is collaborating with public health and agriculture officials in multiple states, the Public Health Agency of Canada, and the Food and Drug Administration (FDA) to investigate an outbreak of human *Salmonella* Infantis infections linked to direct or indirect contact with dry dog food. Multiple brands of dry dog food produced by Diamond Pet Foods at a single manufacturing facility in Gaston, South Carolina, have been linked to human illnesses (*1*).

On April 2, 2012, the Michigan Department of Agriculture and Rural Development detected *Salmonella* in an unopened bag of Diamond brand dry dog food collected during routine retail testing, resulting in a recall of a single product. Public health investigators used PulseNet, the national molecular subtyping network, to identify recent human infections with the same strain of *Salmonella* found in the dog food sample.

During February 1–May 31, 2012, a total of 22 cases (20 cases in 13 states, and two cases in Canada) of human infections with the outbreak strain were reported. The median patient age was 46.5 years (range: <1–82 years); 68% were female. Thirty-five percent (six of 17) were hospitalized. Epidemiologic investigations found that 83% (15 of 18) reported dog contact, and of the 11 patients who recalled types of dog food, eight reported brands produced by Diamond Pet Foods. The results of further product testing by multiple agencies and the provision of production codes by ill persons led to expansion of recalled products to include 17 brands, representing approximately 30,000 tons of dry dog and cat food produced at the implicated production facility. Pet illnesses associated with recalled products have been reported to FDA's pet food complaint system (*2*); as of May 31, 2012, the outbreak strain was isolated from one ill dog and one asymptomatic dog in Ohio, both of which had consumed recalled products.

This is the second documented outbreak of human salmonellosis linked to dry pet food in the United States (*3*). Persons should be aware that dry dog and cat food can be contaminated with *Salmonella* and should not be handled or stored in areas where human food is prepared or consumed. Washing hands is the most important step to prevent illness, especially right after handling pet food and treats or cleaning up after pets (*4*).

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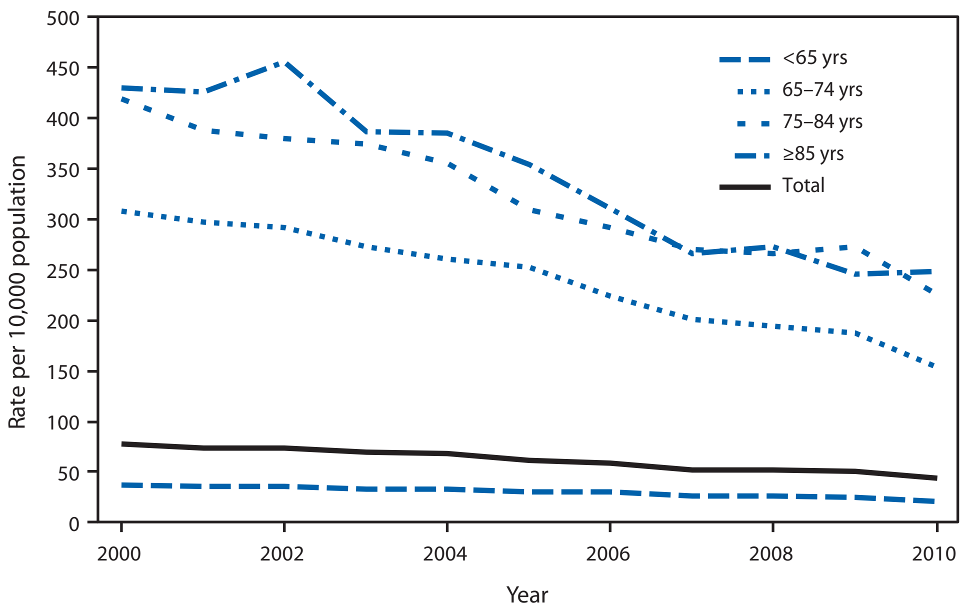
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Rate* of Hospitalization for Coronary Heart Disease, by Age Group — National Hospital Discharge Survey, United States, 2000–2010



* Per 10,000 population. Hospitalization for coronary heart disease is defined as a first-listed diagnosis on the medical record of 410–414 or 429.2, as coded according to the *International Classification of Diseases, Ninth Revision, Clinical Modification*. Rates were calculated using U.S. Census Bureau 2000–based postcensal civilian population estimates.

From 2000 to 2010, the rate of hospitalization for coronary heart disease declined by 43% for the total population. Rates declined by 42% for the youngest (<65 years) and oldest (≥85 years) age groups, by 50% for those aged 65–74 years, and 46% for those aged 75–84 years. Throughout the period, the rate of hospitalization for the <65 years age group was significantly lower than the rate for any other age group.

Sources: National Hospital Discharge Survey data (2000–2010). Available at http://www.cdc.gov/nchs/nhds.htm.

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