

World No Tobacco Day — May 31, 2015

Each year, the tobacco epidemic kills an estimated 6 million persons worldwide, including about 600,000 who die because of secondhand smoke exposure. If current trends continue, this number is expected to reach 8 million deaths annually by 2030 (1).

Sponsored by the World Health Organization (WHO) and observed on May 31 each year, World No Tobacco Day highlights the health risks associated with tobacco use and encourages effective actions to reduce tobacco consumption. This year, WHO calls for international collaboration to stop the illicit trade of tobacco products (2).

Illicit tobacco trade is characterized by tax avoidance and tax evasion, such as bootlegging, counterfeiting, and smuggling. This practice undermines tobacco use prevention and control by increasing the accessibility and affordability of tobacco products and can reduce government tax revenue (3). An estimated one in 10 cigarettes consumed worldwide and 8%–21% of those consumed in the United States are illicit (2,4). Governments can adopt a range of measures to reduce illicit tobacco trade, as described by the WHO *Protocol to Eliminate Illicit Trade in Tobacco Products* (3).

References

1. Eriksen M, Mackay J, Schluger N, Gomeshtapeh F, Drope J. The tobacco atlas. Fifth ed. Brighton, UK: American Cancer Society; 2015. Available at <http://www.tobaccoatlas.org>.
2. World Health Organization. World No Tobacco Day: 31 May 2015. Geneva, Switzerland: World Health Organization; 2015.
3. World Health Organization. Protocol to eliminate illicit trade in tobacco products. WHO Framework Convention on Tobacco Control. Geneva, Switzerland: World Health Organization; 2013.
4. National Academy of Sciences. Understanding the U.S. illicit tobacco market: characteristics, policy context, and lessons from international experiences. Washington, DC: National Academies Press. In press 2015.

Use of Tobacco Tax Stamps to Prevent and Reduce Illicit Tobacco Trade — United States, 2014

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Tobacco use is the leading cause of preventable disease and death in the United States (1). Increasing the unit price on tobacco products is the most effective tobacco prevention and control measure (2). Illicit tobacco trade (illicit trade) undermines high tobacco prices by providing tobacco users with cheaper-priced alternatives (3). In the United States, illicit trade primarily occurs when cigarettes are bought from states, jurisdictions, and federal reservation land with lower or no excise taxes, and sold in jurisdictions with higher taxes. Applying tax stamps to tobacco products, which provides documentation that taxes have been paid, is an important tool to combat illicit trade. Comprehensive tax stamping policy, which includes using digital, encrypted (“high-tech”) stamps, applying stamps to all tobacco products, and working with tribes on stamping agreements, can further prevent and reduce

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illicit trade (4,5). This report describes state laws governing tax stamps on cigarettes, little cigars (cigarette-sized cigars), roll-your-own tobacco (RYOT), and tribal tobacco sales across the United States as of January 1, 2014, and assesses the extent of comprehensive tobacco tax stamping in the United States. Forty-four states (including the District of Columbia [DC]) applied traditional paper (“low-tech”) tax stamps to cigarettes, whereas four authorized more effective high-tech stamps. Six states explicitly required stamps on other tobacco products (i.e., tobacco products other than cigarettes), and in approximately one third of states with tribal lands, tribes required tax stamping to address illicit purchases by nonmembers. No U.S. state had a comprehensive approach to tobacco tax stamping. Enhancing tobacco tax stamping across the country might further prevent and reduce illicit trade in the United States.

The Tobacconomics Program* examined state statutes and regulations and, for tribal tobacco sales, relevant agency opinions and case law, under a cooperative agreement funded by the National Cancer Institute as part of its State and Community Tobacco Control Initiative, 2011–2015. State laws were compiled through primary legal research using the Westlaw and Lexis-Nexis commercial legal research services. Where possible, state law data were verified against publicly available secondary sources, including CDC’s State Tobacco

*Tobacconomics Program, Health Policy Center, Institute for Health Research and Policy, University of Illinois at Chicago. Additional information available at <http://www.tobacconomics.org>.

Activities Tracking and Evaluation system,[†] which provides current and historical state-level data on tobacco use prevention and control, including cigarette stamping. Clarification of codified law was sought through state or federal case law, Attorneys General opinions, and notices or rulings from states’ departments of revenue. Excluded from the tribal sales research were state laws that made general reference to tobacco sales without explicit reference to tribes or application to tribal sales by case law, Attorneys General opinions, or departments of revenue notices; also excluded were tribal codes, tax agreements, or compacts not codified by the state (i.e., individual tribe-specific codes and policies).

As of January 1, 2014, a total of 48 states (including DC) applied cigarette tax stamps. Only four of these authorized the use of high-tech stamps. Three of these four states (California, Massachusetts, and Michigan) have implemented their use; New Jersey has not (Table). Of the 17 states that taxed little cigars at an amount equivalent to cigarettes, which makes them subject to stamping, only five of these states’ laws explicitly required stamps on little cigars. Of the five states that taxed RYOT as cigarettes, which makes them subject to stamping, only two explicitly required stamps on RYOT (Table, Figure 1).

Although Native American tribes within the United States are protected by sovereign immunity and states do not have legal authority over tribes within their borders, agreements,

[†] Information available at http://www.cdc.gov/tobacco/data_statistics/state_data/state_system/index.htm.

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TABLE. States with laws requiring tax stamps on cigarettes, little cigars (LC), roll-your-own tobacco (RYOT), and tribal tobacco — United States, January 1, 2014

State (and District of Columbia)	Cigarettes		LC and RYOT		Tribal stamping	
	Stamp required	Encrypted tax stamp	LC and/or RYOT taxed as a cigarette*	LC and/or RYOT explicitly stamped	On-reservation tobacco sales require stamps on some or all products	Type of stamp(s) required
Alabama	Yes					
Alaska	Yes				—†	
Arizona	Yes				Yes (all [§])	SE, GT, O [¶]
Arkansas	Yes		RYOT			
California	Yes	Yes	LC			
Colorado	Yes					
Connecticut	Yes					
Delaware	Yes					
District of Columbia	Yes		LC			
Florida	Yes				Yes (all [§])	Silent**
Georgia	Yes					
Hawaii	Yes		LC			
Idaho	Yes				Yes (some ^{††})	SE
Illinois	Yes		LC	LC		
Indiana	Yes					
Iowa	Yes		LC	LC	Prohibited ^{§§}	
Kansas	Yes					
Kentucky	Yes					
Louisiana	Yes					
Maine	Yes					
Maryland	Yes					
Massachusetts	Yes	Yes	LC	LC		
Michigan	Yes	Yes			—†	
Minnesota	Yes		LC		Yes (some ^{††}) ^{¶¶***}	SE, TA
Mississippi	Yes					
Missouri	Yes					
Montana	Yes		LC		Yes (some ^{††}) ^{***}	SE
Nebraska	Yes				Yes (all [§])	SE, ST
Nevada	Yes				Yes (all [§])	SE, GT
New Hampshire	Yes		LC, RYOT			
New Jersey	Yes	Yes ^{†††}				
New Mexico	Yes		LC, RYOT		Yes (all [§])	SE, GT ^{§§§}
New York	Yes		LC		Yes (all [§])	SE
North Carolina	No					
North Dakota	No				—†	

See table footnotes on page 544.

such as ones to regulate tobacco sales, may be negotiated. Thirty-four states have federal reservation land within their borders. Of these, 20 regulated tribal tobacco sales as of January 1, 2014, 13 of which explicitly addressed stamping of products sold on-reservation (Table, Figure 2). Of those 13, nine required stamps on all cigarettes or tobacco products sold on-reservation, and four only required stamps on products sold to nonmembers of the tribe or on all products sold by tribes without tax agreements with the state.

Discussion

This report indicates that although the majority of states required low-tech cigarette tax stamps as of January 1, 2014, few were using high-tech stamps, applying stamps to other tobacco products, or working with tribes on stamping agreements. Depending on analytical approaches and definitions of illicit trade, it is estimated that 8%–21% of cigarettes

consumed in the United States are purchased illicitly (4). These illicit purchases undermine tobacco control efforts (2), might contribute to health disparities (4), and reduce local and state revenues by billions of dollars annually (4). Lack of comprehensive tax stamping could thwart U.S. efforts to reduce illicit trade and complicate law enforcement.

Three states (North Carolina, North Dakota, and South Carolina) did not require any stamps, making tax collection more difficult and potentially facilitating illicit trade. The majority of states use low-tech stamps on cigarettes, which are easier to counterfeit (6). These conventional stamps do not take advantage of overt and covert security features and encrypted information regarding manufacturing, distribution, and retail destination (4) that is contained in high-tech stamps. A recent study of littered cigarette packs in New York City found that approximately 60% of packs examined lacked the appropriate tax stamp (7), which was more prevalent in

TABLE. (Continued) States with laws requiring tax stamps on cigarettes, little cigars (LC), roll-your-own tobacco (RYOT), and tribal tobacco — United States, January 1, 2014

State (and District of Columbia)	Cigarettes		LC and RYOT		Tribal stamping	
	Stamp required	Encrypted tax stamp	LC and/or RYOT taxed as a cigarette*	LC and/or RYOT explicitly stamped	On-reservation tobacco sales require stamps on some or all products	Type of stamp(s) required
Ohio	Yes					
Oklahoma	Yes				Yes (all [§])	SE, GT, TA
Oregon	Yes				— [†]	
Pennsylvania	Yes		LC			
Rhode Island	Yes		LC	LC		
South Carolina	No		LC			
South Dakota	Yes				— [†]	
Tennessee	Yes					
Texas	Yes					
Utah	Yes		LC		Yes (some ^{††}) ^{¶¶}	SE
Vermont	Yes		LC, RYOT	LC, RYOT		
Virginia	Yes					
Washington	Yes		LC, RYOT	RYOT	Yes (all [§])	SE, ST, TA
West Virginia	Yes					
Wisconsin	Yes				Yes (all [§])	SE, GT
Wyoming	Yes				Prohibited ^{§§}	
Totals	48	4	18	6	13	—

Source: Tobacconomics Program, Health Policy Center, Institute for Health Research and Policy, University of Illinois at Chicago. Additional information available at <http://www.tobacconomics.org>.

Abbreviations: SE = state excise stamp; GT = general tribal stamp (used by all tribes); O = other; TA = tribal agreement stamp (used by all tribes with tribal agreement); ST = specific tribal stamp (specific to certain tribe).

* In these states, LC and/or RYOT are taxed as cigarettes and, therefore, with the exception of LC in South Carolina (where cigarettes are not stamped), might be subject to cigarette stamping requirements.

† State regulates tribal tobacco sales but is silent on the stamping issue.

§ State laws explicitly state that all cigarettes or tobacco products sold on-reservation require stamps.

¶ Tax-free reservation stamp.

** Law is silent on specific stamps required for tribal sales.

†† In certain instances (e.g., products sold to nonmembers or products sold to tribes without tax agreements), cigarettes or tobacco products sold on-reservation require stamps.

§§ Stamps explicitly prohibited on cigarettes or tobacco products sold on-reservation.

¶¶ Tax stamps required on products sold to nonmembers.

*** Tax stamps required on products sold to tribes without agreements.

††† Authorized by law but not currently implemented.

§§§ New Mexico has a general tribal tax-exempt stamp (for tribal members) and a tax credit stamp (for sales to nonmembers on reservation).

socioeconomically deprived areas, suggesting that illicit trade might exacerbate existing health disparities by facilitating access to cigarettes and making them more affordable to persons with lower incomes (7).

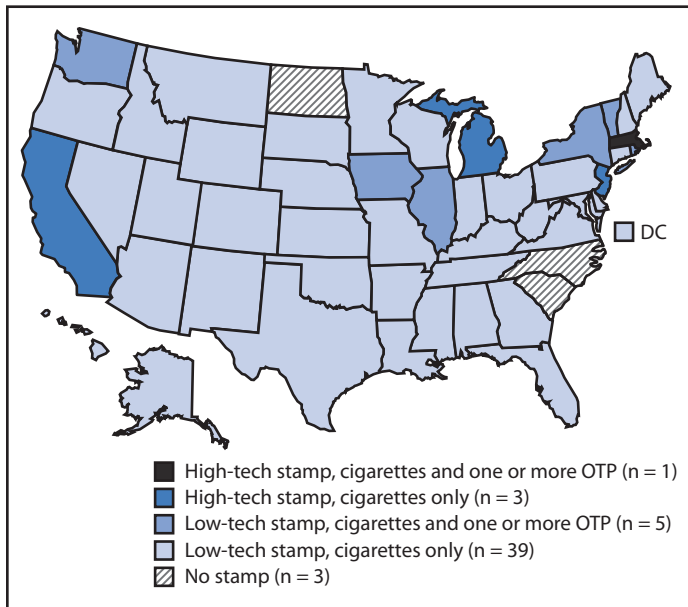
A few states are successfully employing high-tech stamps (4). Anti-counterfeit technology enables enforcement agents to immediately authenticate the stamp and to detect counterfeit stamps. A study in California showed that the additional tax revenues collected using the state's high-tech stamp could be as much as eight times higher than implementation and administrative costs (4).

Although most states applied at least low-tech stamps to cigarettes, only a few expressly stamped little cigars or RYOT. Requiring stamps on other tobacco products, especially cigarette analogues such as little cigars and RYOT, is an important aspect of preventing tax avoidance by minimizing opportunities and incentives for substitution (2). Without stamps, it

is difficult for inspectors to distinguish tobacco products on which tax has been paid from those coming from illicit markets.

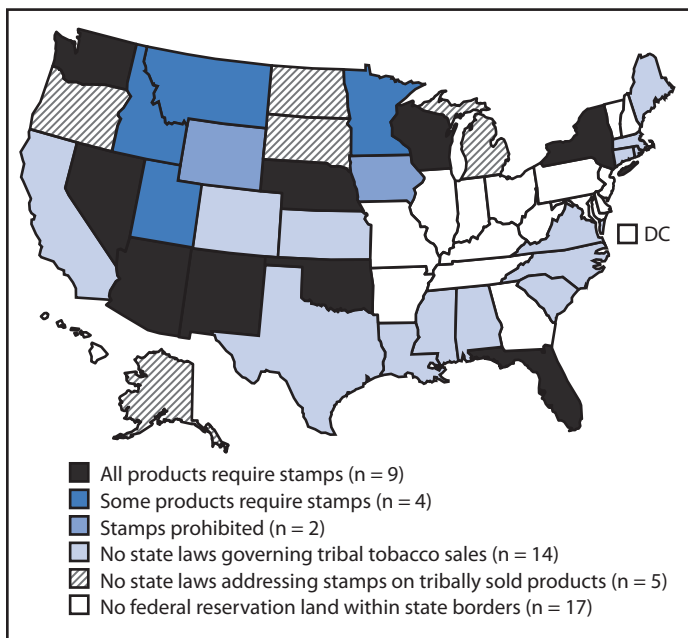
A critical facet of a comprehensive approach to tobacco stamping is the inclusion of all sources of tobacco in this practice, including sales by Native American tribes. Several states have entered into agreements with Native American tribes on general tobacco-related issues or have negotiated specific tax agreements with tribes to reduce the avoidance of tobacco excise taxes by nonmembers, including application of tax stamps to products sold on-reservation. Although tribal members who purchase tobacco on-reservation are exempt from state taxation, nonmembers purchasing on-reservation are not exempt from state taxation; these illegal purchases by nonmembers are a significant source of illicit trade because of challenges in collecting taxes on sales to nonmembers (8). Agreements requiring stamp application or a state's decision to apply stamps strategically within the distribution chain might alleviate concerns about tax losses from tribal sales, because it

FIGURE 1. Use and type of cigarette and other tobacco product (OTP) stamps, by state — United States, January 1, 2014



Source: Tobacconomics Program, Health Policy Center, Institute for Health Research and Policy, University of Illinois at Chicago. Additional information available at <http://www.tobacconomics.org>.

FIGURE 2. Laws governing use of tobacco stamps on tobacco products sold on tribal reservations, by state — United States, January 1, 2014



Source: Tobacconomics Program, Health Policy Center, Institute for Health Research and Policy, University of Illinois at Chicago. Additional information available at <http://www.tobacconomics.org>.

What is already known on this topic?

Increasing the unit price on tobacco products is the most effective tobacco prevention and control intervention, especially among price-sensitive populations, such as youth. Illicit tobacco trade can undermine the effectiveness of high tobacco prices by providing tobacco users with cheaper priced alternatives. Tobacco tax stamping is intended to further support efforts to prevent and reduce illicit trade.

What is added by this report?

A comprehensive tax stamping approach includes the use of digital, encrypted (“high-tech”) stamps, the application of stamps to all tobacco products, including little cigars and roll-your-own tobacco; and working with Native American tribes on stamping agreements. As of January 1, 2014, most states used traditional paper (“low-tech”) stamps that are easy to counterfeit, and many did not explicitly require stamps on cigarette-equivalent products such as little cigars and roll-your-own tobacco. Approximately two thirds of states with federal reservation land did not have codified agreements that permit tobacco stamping of tribally sold products.

What are the implications for public health practice?

Illicit trade undermines tobacco control efforts and might contribute to health disparities. Comprehensive tax stamping policies could enhance U.S. efforts to reduce illicit trade, thereby increasing revenues as well as protecting public health and reducing smoking by stopping illegal cigarette sales.

encourages prepayment of taxes, and might aid in enforcement of excise tax payment by establishing clear procedures and tax rates for products sold on federal reservation land.

The findings in this report are subject to at least three limitations. First, the cigarette, little cigar, and RYOT data were limited to codified statutory and administrative law and do not include Attorneys General opinions, case law, or departments of revenue-issued notices, rulings, or decisions. For example, California’s statutes or regulations do not explicitly call for little cigar stamping. However, per a notice issued by California’s Board of Equalization (excluded from this report’s primary legal research), all little cigars must be stamped.[§] Second, this report did not include information on states that maintain general tobacco sales laws that are not explicitly enforced with tribal entities, and it was not possible to determine whether the states that regulate tribal tobacco sales, but do not explicitly address stamping do, in fact, include stamps in their noncodified agreements or compacts. In addition, a tribe’s own laws might dictate tribal tax rates or enforcement mechanisms not captured in this report. Finally, this report only reviewed the laws pertaining to the use of tax stamps on tobacco products; however, tax stamping on its own is not sufficient to deter illicit

[§] Information available at <http://www.boe.ca.gov>.

trade. Enforcement is also necessary (5,6). Other policy interventions, such as licensing, implementing a track-and-trace system, and the harmonization of tax codes, also contribute to reductions in illicit trade (3).

A comprehensive approach to tobacco tax stamping could be an important tool in reducing illicit trade and revenue loss in the United States. Applying tax stamps to all tobacco products, and for those states with federal reservation land within their borders, working with tribes to negotiate mutually beneficial agreements, including the use of stamps on tobacco products sold on reservation land, could have an important impact on reducing illicit trade and further reduce smoking and associated health care costs as well as recoup lost revenues from illicit trade (4). Additionally, introducing high-tech tax stamps with new technologies including encryption, holograms, and scannable barcodes in all states could further reduce counterfeiting and improve supply-chain monitoring and enforcement (4).

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References

1. US Department of Health and Human Services. The health consequences of smoking—50 years of progress: a report of the Surgeon General. Atlanta, GA: US Department of Health and Human Services, CDC; 2014. Available at <http://www.surgeongeneral.gov/library/reports/50-years-of-progress/full-report.pdf>.
2. Chaloupka FJ, Yurekli A, Fong GT. Reviews: tobacco taxes as a tobacco control strategy. *Tob Control* 2012;21:172–80.
3. Joossens L, Raw M. From cigarette smuggling to illicit tobacco trade. *Tob Control* 2012;21:230–4.
4. National Academy of Sciences. Understanding the U.S. illicit tobacco market: characteristics, policy context, and lessons from international experiences. Washington, DC: National Academies Press. In press 2015.
5. World Health Organization. Framework Convention on Tobacco Control: protocol to eliminate illicit trade in tobacco products. Geneva, Switzerland: World Health Organization; 2013. Available at http://apps.who.int/iris/bitstream/10665/80873/1/9789241505246_eng.pdf.
6. Allen E. The illicit trade in tobacco products and how to tackle it. *World Customs Journal* 2012;6:121–9.
7. Kurti MK, Von Lampe K, Thomkins DE. The illegal cigarette market in a socioeconomically deprived inner-city area: the case of the South Bronx. *Tob Control* 2013;22:138–40.
8. Alderman J. Strategies to combat illicit trade. Available at http://www.publichealthlawcenter.org/sites/default/files/resources/tclc-syn-smuggling-2012_0.pdf.

Approaches for Controlling Illicit Tobacco Trade — Nine Countries and the European Union

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An estimated 11.6% of the world cigarette market is illicit, representing more than 650 billion cigarettes a year and \$40.5 billion in lost revenue (1). Illicit tobacco trade refers to any practice related to distributing, selling, or buying tobacco products that is prohibited by law, including tax evasion (sale of tobacco products without payment of applicable taxes), counterfeiting, disguising the origin of products, and smuggling (2). Illicit trade undermines tobacco prevention and control initiatives by increasing the accessibility and affordability of tobacco products, and reduces government tax revenue streams (2). The World Health Organization (WHO) *Protocol to Eliminate Illicit Trade in Tobacco Products*, signed by 54 countries, provides tools for addressing illicit trade through a package of regulatory and governing principles (2). As of May 2015, only eight countries had ratified or acceded to the illicit trade protocol, with an additional 32 needed for it to become international law (i.e., legally binding) (3). Data from multiple international sources were analyzed to evaluate the 10 most commonly used approaches for addressing illicit trade and to summarize differences in implementation across select countries and the European Union (EU). Although the WHO illicit trade protocol defines shared global standards for addressing illicit trade, countries are guided by their own legal and enforcement frameworks, leading to a diversity of approaches employed across countries. Continued adoption of the methods outlined in the WHO illicit trade protocol might improve the global capacity to reduce illicit trade in tobacco products.

Data on approaches for addressing illicit trade were obtained from a combination of sources from individual countries, including literature searches, reports by international agencies and nongovernmental organizations, industry documents, online data sources by agencies that oversee enforcement, and interviews with in-country experts.* The following 10 most commonly identified approaches were evaluated: 1) licensing, 2) product markers, 3) national recordkeeping, 4) track-and-trace systems, 5) enforcement, 6) export tax, 7) tax harmonization, 8) agreements with tobacco industry, 9) promotion of public awareness, and 10) coordination among agencies. The status of these approaches was assessed in nine countries (Brazil,

Canada, Hungary, Italy, Malaysia, Romania, Spain, Turkey, and the United Kingdom [UK]), and EU. These countries were selected based on data availability and participation in the WHO Framework Convention on Tobacco Control (FCTC). EU is described separately from its member states because current approaches used by individual member states may differ from the central EU action plan. Approaches were assessed as of January 2015.

The most common anti-illicit-trade measures were licensing and enforcement (Table 1), which were present in all countries reviewed in this report (Table 2). A total of nine countries employed product markers, most commonly in the form of tax stamps (Table 2). Although requirements for product markers are not included in the centralized EU Tobacco Products Directive, EU member states have incorporated those on an individual basis. Systems for national recordkeeping and agency coordination were established in all countries except Malaysia. Track-and-trace systems, as outlined in the WHO illicit trade protocol, were in effect in Brazil and Turkey, and, in a limited version, in Canada and Hungary; EU and its member states operate a separate system for monitoring the movement of excise goods across their borders. Tax harmonization was employed within EU. Agreements with the tobacco industry were in place in most countries, except for Brazil and Malaysia. Public awareness programs were not widely employed, and export taxes were applied in Brazil and Canada only. While all examined countries were parties to the WHO FCTC, most have not yet ratified or acceded to (i.e., made legally binding) the WHO illicit trade protocol, and only one has thus far acquired accession status (Table 2) (3).

Discussion

Approaches to address illicit tobacco trade vary across countries. In the sample of countries in this report, the most commonly used approaches included licensing, markers, national recordkeeping, and enforcement, while other measures such as track-and-trace systems and export taxes were not universally employed. Research suggests that the revenue gains from eliminating illicit tobacco trade globally would exceed \$31 billion, and might help prevent more than 160,000 tobacco-related deaths per year from 2030 onwards (1). Accordingly, continued adoption of the provisions outlined in the WHO illicit trade protocol

*Additional information on sources by country is available at <http://tobacconomics.org>.

TABLE 1. Definitions of common approaches to address illicit tobacco trade

Approach	Definition
Licensing	Official authorization for engaging in any activity within the tobacco supply chain, from tobacco growing to product manufacturing to product transportation, retail, and export
Markers	Counterfeit-resistant, affixed images on product packaging, most commonly in the form of tax stamps, which indicate date and location of manufacture and the intended retail market
National recordkeeping	Collection of data on the tax liability of tobacco products within country borders or while transiting through individual countries
Track-and-trace	Systems incorporating both markers and national recordkeeping structures to enable tracking of tobacco products throughout the supply chain; tracing the movement of products by transferring tracking data into a global information-sharing database
Enforcement	Commitment to detect and prosecute illicit trade activity
Export tax	Applying a cigarette export tax to reduce the motivation for illegal re-import of exported products
Tax harmonization	Equalizing tax rates across neighboring jurisdictions to lower cigarette price differences across borders
Agreements with industry	Obtaining industry cooperation in improving the security of the supply chain
Public awareness	Disseminating information about the risks associated with illicit tobacco trade; motivating support for enforcement activities
Agency coordination	Coordination between agencies within and across borders to support intelligence gathering, joint customs operations, and sharing of best practices

TABLE 2. Implementation of common approaches to address illicit tobacco trade and year of ratification of WHO Framework Convention for Tobacco Control (FCTC) and signing/accession of WHO FCTC Protocol to Eliminate Illicit Trade in Tobacco Products, by nine countries and the European Union (EU)

Approach	Brazil	Canada	EU	Hungary	Italy	Malaysia	Romania	Spain	Turkey	UK
Licensing	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Markers	yes	yes		yes	yes	yes	yes	yes	yes	yes
National recordkeeping	yes	yes	yes	yes	yes		yes	yes	yes	yes
Track-and-trace	yes	yes		yes					yes	
Enforcement	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Export tax	yes	yes								
Tax harmonization			yes	yes	yes		yes	yes		yes
Agreements with industry		yes	yes	yes	yes		yes	yes	yes	yes
Public awareness		yes	yes			yes				yes
Agency coordination	yes	yes	yes	yes	yes		yes	yes	yes	yes
Year ratified WHO FCTC	2005	2004	2005	2004	2008	2005	2006	2005	2004	2004
Year signed/year of accession* WHO illicit trade protocol			2013					2013/2014	2013	2013

Abbreviations: UK = United Kingdom; WHO FCTC = World Health Organization Framework Convention for Tobacco Control.

* Accession is an act by which a state signifies its agreement to be legally bound by the terms of a particular treaty.

and its accession could improve the global capacity to reduce illicit trade in tobacco products and enhance public health.

The WHO illicit trade protocol contains three main elements for addressing illicit trade: 1) controlling the supply chain of tobacco products through track-and-trace systems (Articles 6–13); 2) addressing unlawful conduct and criminal offenses through enforcement means such as seizure and disposal of confiscated products (Articles 14–19); and 3) promoting international cooperation through information sharing, mutual administrative and legal assistance, and extradition (Articles 20–31) (2). The WHO illicit trade protocol emphasizes the importance of national track-and-trace systems, and recommends collection of data on supply-chain movements

into a global information sharing database, which would facilitate the coordination of international response (4). Although establishing track-and-trace systems has been identified as a central approach for limiting illicit trade, its implementation is not yet widespread. Some countries may not have the resources to support a fully functioning track-and-trace system, or they may have alternative structures already in place. For example, EU has implemented a substitute computerized system, the Excise Movement and Control System, which differs from the standard track-and-trace model by collecting only limited information in excisable goods, not monitoring duty-paid products, and relaxing the requirement for product markers. Some countries and EU employ agreements with

tobacco companies to limit tax evasion, but evidence suggests that the industry-operated monitoring system is subject to limited transparency and insufficient tracing capabilities (5). Turkey is among the countries that have recently implemented track-and-trace systems with noted success; the size of the illicit market has been controlled despite ongoing increases in tobacco taxes in the country (6,7).

The context for illicit tobacco trade globally varies by country. For example, while cross-border smuggling is a primary concern for many countries, the U.S. tobacco market is primarily affected by illicit domestic movement of goods from low-tax to high-tax jurisdictions (8). International experience with tax harmonization across jurisdictions, such as that employed in EU, can provide an example of potential strategies for reducing the size of the domestic illicit market in the United States. Because higher cigarette prices are a primary method for reducing tobacco use (9), an effort to reconcile tax differences across jurisdictions at a shared higher level might help limit tobacco use as well as illicit trade incentives in the United States and other countries.

This report is subject to several limitations. First, it provides a brief summary from a limited number of countries; thus, experiences and approaches from other countries might vary. Second, only the reported presence or absence of an approach was assessed, and differences across countries in the strength of implementation or enforcement were not identified.

Tobacco use is the leading preventable cause of death and disability around the globe, contributing to six million deaths per year (10). Illicit trade in tobacco products undermines global tobacco prevention and control interventions. This report illustrates the diversity of approaches for limiting illicit tobacco trade in a number of countries and EU. These findings underscore the importance of continued adoption of the provisions outlined in the WHO illicit trade protocol to improve the global capacity to reduce illicit trade in tobacco products. Once legally binding (ratified by at least 40 countries), the WHO illicit trade protocol will facilitate international cooperation, a core provision to counteract illicit trade. Further, continued monitoring of the implementation of the WHO illicit trade protocol could counteract the negative economic, societal, and health effects of illicit tobacco trade. Understanding differences across countries in the implementation of the WHO FCTC *Protocol to Eliminate Illicit Trade in Tobacco Products* is important for assessing country-specific needs in implementing this protocol and for identifying best practices that address illicit tobacco trade and reduce tobacco-related disease and death globally.

What is already known on this topic?

Illicit trade in tobacco undermines tobacco control efforts. The WHO Framework Convention on Tobacco Control (FCTC) *Protocol to Eliminate Illicit Trade in Tobacco Products* provides tools for addressing illicit tobacco trade through a package of regulatory and governing principles, and requires FCTC signatories to institute global track-and-trace systems and a global information sharing focal point.

What is added by this report?

There is diversity in the adoption of anti-illicit-trade measures by countries, demonstrating cross-country similarities and differences in main approaches to the standards outlined in the WHO FCTC *Protocol to Eliminate Illicit Trade in Tobacco Products*.

What are the implications for public health practice?

Continued adoption of the methods outlined in the WHO *Protocol to Eliminate Illicit Trade in Tobacco Products* can improve the global capacity to reduce illicit trade in tobacco products and enhance public health. Understanding differences across countries in the status of implementation of the WHO protocol is important for assessing country-specific needs in implementing it, and for identifying best practices in addressing illicit trade.

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References

1. Joossens L, Merriman D, Ross H, Raw M. The impact of eliminating the global illicit cigarette trade on health and revenue. *Addiction*; 2010. Available at <http://onlinelibrary.wiley.com/doi/10.1111/j.1360-0443.2010.03018.x/epdf>.
2. World Health Organization. Protocol to eliminate illicit trade in tobacco products. Geneva, Switzerland: FCTC—WHO Framework Convention on Tobacco Control; 2013. Available at <http://www.who.int/fctc/protocol/en/>.
3. United Nations. Protocol to eliminate illicit trade in tobacco products, Seoul, 12 November 2012. New York, NY: United Nations Treaty Collection; 2015. Available at https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no=IX-4-a&chapter=9&lang=en.
4. World Health Organization. Combating the illicit trade in tobacco products from a European perspective. Geneva, Switzerland: FCTC—WHO Framework Convention on Tobacco Control; 2014. Regional Studies Series Paper R/3. Available at http://www.who.int/fctc/publications/Regional_studies_paper_3_illicit_trade.pdf?ua=1.

5. Joossens L, Gilmore AB. The transnational tobacco companies' strategy to promote Codentify, their inadequate tracking and tracing standard. *Tob Control*; 2013. Available at <http://tobaccocontrol.bmj.com/content/early/2013/04/26/tobaccocontrol-2012-050796.full>.
6. Tayyan U. Tobacco Banderol System application in Turkey. In: Presentation Data from the 10th Asian Pacific Conference on Tobacco or Health, August 18–21, 2013; Chiba, Japan. Available at http://www.apact.jp/presentation_data/pdf/PL3-4.pdf.
7. Euromonitor International. Passport tobacco. London: Euromonitor International; 2015.
8. Ross H. Controlling illicit tobacco trade: international experience. Chicago, IL: University of Illinois at Chicago, Health Policy Center, Institute for Health Research and Policy. *Tobacconomics*. In press 2015.
9. International Agency for Research on Cancer. Effectiveness of tax and price policies in tobacco control Lyon, France: World Health Organization, International Agency for Research on Cancer; 2011. IARC handbooks of cancer prevention: tobacco control, Vol. 14. Available at <http://www.iarc.fr/en/publications/pdfs-online/prev/handbook14/handbook14.pdf>.
10. US Department of Health and Human Services. The health consequences of smoking—50 years of progress: a report of the surgeon general. Atlanta, GA: US Department of Health and Human Services, CDC; 2014. Available at <http://www.surgeongeneral.gov/library/reports/50-years-of-progress/full-report.pdf>.

Occupational Fatalities During the Oil and Gas Boom — United States, 2003–2013

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During 2003–2013, the U.S. oil and gas extraction industry experienced unprecedented growth, doubling the size of its workforce and increasing the number of drilling rigs by 71% (1,2). To describe fatal events among oil and gas workers during this period, CDC analyzed data from the Bureau of Labor Statistics (BLS) Census of Fatal Occupational Injuries (CFOI), a comprehensive database of fatal work injuries (3). During 2003–2013, the number of work-related fatalities in the oil and gas extraction industry increased 27.6%, with a total of 1,189 deaths; however, the annual occupational fatality rate significantly decreased 36.3% ($p < 0.05$) during this 11-year period. Two-thirds of all worker fatalities were attributed to transportation incidents (479, [40.3%]) and contact with objects/equipment (308 [25.9%]). More than 50% of persons fatally injured were employed by companies that service wells (615 [51.7%]). It is important for employers to consider measures such as land transportation safety policies and engineering controls (e.g., automated technologies) that would address these leading causes of death and reduce workers' exposure to hazards (4–6).

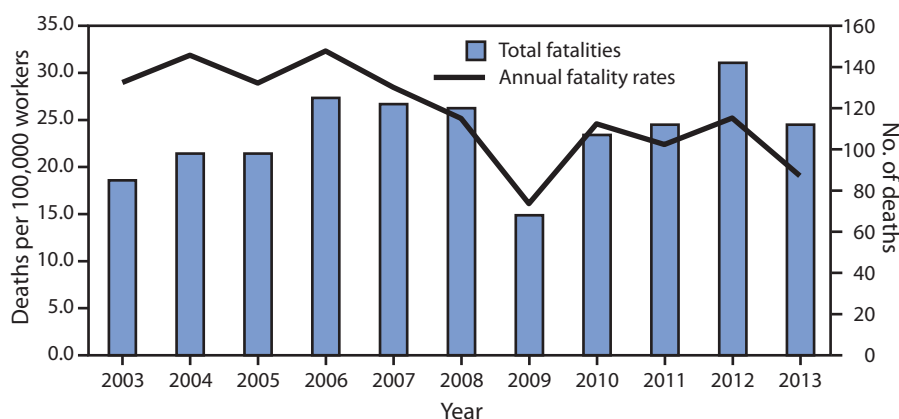
Publicly available data from CFOI were used to determine the number of fatal injuries to workers in the U.S. land-based and offshore oil and gas extraction industry during 2003–2013. CFOI collects information from multiple data sources to identify, verify, and describe fatal work injuries (3). According to CFOI, a fatal injury is considered work-related if 1) the event leading to the injury occurred while the employee was working and 2) the event is verified by at least two independent data sources.* The North American Industry Classification System (NAICS) was used to identify fatal events among the three types of companies in the oil and gas extraction industry: oil and gas operators that control and manage leased areas (NAICS 211), drilling contractors that drill the wells (NAICS 213111), and well-servicing companies that provide all other types of support operations that prepare a well for production and completion (NAICS 213112).

Annual occupational fatal injury rates were calculated using worker estimates from the

BLS Quarterly Census of Employment and Wages (1). Annual and overall fatality rates were also calculated by event type according to the Occupational Injury and Illness Classification System and by company type using NAICS. Negative binomial regression was used to estimate rates. The percent rate of change, incident rate ratio, and corresponding confidence intervals were calculated for the 11-year period, the five most frequent fatal events, and by company type. Each company and event type represents separate regression models.

During 2003–2013, 1,189 oil and gas extraction industry employees died while working, resulting in an average of 108 deaths per year and an annual average occupational fatality rate of 25.0 deaths per 100,000 workers. The highest fatality rate occurred in 2006 (32.4 deaths per 100,000 workers) with 125 fatalities (Figure). During this period all but 10 decedents were male, and the largest numbers of deaths were to workers aged 25–34 years (331 [27.8%]). Most were non-Hispanic whites (844 [71.0%]). Two-thirds of the fatalities were attributed to transportation incidents (479 [40.3%]) and contact with objects/equipment (308 [25.9%]). Incidents on land (as opposed to air or water) made up 86.2% of the transportation events. The remainder of the most frequent events were the result of fires or explosions (170, [14.3%]); exposure to harmful

FIGURE. Number* and rate† of fatal injuries among workers in the oil and gas extraction industry, by year — United States, 2003–2013[§]



Sources: U.S. Department of Labor, Bureau of Labor Statistics, Census of Fatal Occupational Injuries (2003–2013) and U.S. Department of Labor, Bureau of Labor Statistics, Quarterly Census of Employment and Wages (2003–2013).

* N = 1,189.

† Fatality rate calculated per 100,000 workers; significant decrease in fatality rate during 2003–2013 (negative binomial regression chi-square = 0.057; $p < 0.01$).

§ 2013 data are preliminary.

* Additional information is available at <http://www.bls.gov/iif/oshcfdef.htm>.

substances or environments (105 [8.8%]); or falls, slips, and trips (97 [8.2%]). The largest number of fatalities occurred among workers employed by well-servicing companies (615), followed by drilling contractors (378), and operators (196); but the highest fatality rate was among workers employed by drilling companies (44.6 per 100,000 workers), followed by well-servicing companies (27.9), and operators (11.6) (Table 1).

Although the oil and gas extraction industry's number of occupational fatalities increased 27.6% during the 11-year period, it did not increase as much as the number of workers, resulting in a significant decrease in the fatality rate of 36.3% (Table 2). The average annual decrease was 4% per year

(Table 1). Oil and gas operators experienced the largest decrease in the rate of fatal injuries, 8% per year ($p < 0.01$), followed by well-servicing companies (4% per year, $p < 0.05$). Among event types, contact with objects/equipment experienced the greatest decrease, 9% per year ($p < 0.001$); transportation events also showed a significant decrease, 3% per year ($p < 0.05$).

Discussion

Previous research found a positive correlation between the level of activity (number of active drilling rigs) and the occupational fatality rate in the U.S. oil and gas extraction industry (7). This report found that although the number of

TABLE 1. Trends* in worker fatality rates in the oil and gas extraction industry, by company type and event type, using an unadjusted model — United States, 2003–2013†

Company/event type	No.	(%)	Fatality rate [§]	% Rate change [¶]	IRR	(95% CI)	p-value
Total Fatalities	1,189		25.0	-36.3	0.956	(0.932–0.980)	0.000**
By company (NAICS code)							
Operators (211)	196	(16.5)	11.6	-58.2	0.917	(0.869–0.967)	0.001**
Drilling contractors (213111)	378	(31.8)	44.6	-27.2	0.969	(0.931–1.008)	0.118
Well-servicing companies (213112)	615	(51.7)	27.9	-33.4	0.960	(0.962–0.996)	0.028**
By event††							
Transportation	479	(40.3)	10.1	-28.1	0.968	(0.938–0.998)	0.040**
Contact with objects/equipment	308	(25.9)	6.5	-60.8	0.910	(0.879–0.944)	0.000**
Fires/explosions ^{§§}	170	(14.3)	3.6	-41.3	0.948	(0.884–1.017)	0.137
Exposure to harmful environments/substances ^{§§}	104	(8.7)	2.2	-42.6	0.946	(0.890–1.006)	0.076
Falls ^{§§}	97	(8.2)	2.0	+26.8	1.024	(0.960–1.093)	0.469

Sources: U.S. Department of Labor, Bureau of Labor Statistics, Census of Fatal Occupational Injuries (2003–2013) and U.S. Department of Labor, Bureau of Labor Statistics, Quarterly Census of Employment and Wages (2003–2013).

Abbreviations: CI = confidence interval; IRR = incident rate ratio; NAICS = North American Industry Classification System.

* Determined by negative binomial regression analyses.

† Data for 2013 are preliminary.

§ Annual average fatality rate per 100,000 workers.

¶ Using predicted values from negative binomial regressions over 11 years.

** Statistically significant at $p < 0.05$.

†† Break in Occupational Injury and Illness Classification System series in 2011.

§§ Contain one or more years during which the number of fatalities was <10.

TABLE 2. Annual fatality rates among workers in the oil and gas extraction industry, by company type and event type — United States, 2003–2013*†

Company/event type	Fatality rates (yr)											% Rate change [§]
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	
Total	29.0	31.9	29.0	32.4	28.5	25.2	16.1	24.6	22.4	24.5	19.1	-36.3
By company												
Operators	14.1	23.9	13.5	16.3	10.3	13.1	7.5	7.6	7.6	13.8	6.1	-58.2
Drilling contractors	50.5	52.3	51.0	45.1	49.7	32.4	42.8	63.1	47.0	42.2	25.7	-27.2
Well-servicing companies	34.7	30.4	32.3	39.2	33.0	30.9	14.0	23.8	24.0	27.3	25.6	-33.4
By event												
Transportation	10.6	14.7	10.1	11.2	11.7	10.3	6.4	9.4	10.2	11.0	7.5	-28.1
Contact with objects/equipment	8.9	9.5	8.0	10.1	9.4	6.3	5.0	4.8	5.2	4.3	4.3	-60.8
Fires/explosions	6.5	3.6	3.6	5.4	2.3	3.8	1.4 [¶]	5.8	2.4	4.1	2.2	-41.3
Exposure to harmful environments/substances	1.7 [¶]	1.6 [¶]	3.3	3.1	3.5	2.5	2.1 [¶]	2.3	1.8 [¶]	1.4 [¶]	1.4 [¶]	-42.6
Falls	1.4 [¶]	2.6 [¶]	3.0	2.1 [¶]	1.4 [¶]	1.9 [¶]	0.7 [¶]	1.6 [¶]	2.0	3.2	2.4	+26.8

Sources: U.S. Department of Labor, Bureau of Labor Statistics, Census of Fatal Occupational Injuries (2003–2013). U.S. Department of Labor, Bureau of Labor Statistics, Quarterly Census of Employment and Wages (2003–2013).

* 2013 data are preliminary.

† Break in Occupational Injury and Illness Classification System series in 2011.

§ Using predicted values from negative binomial regressions over 11 years.

¶ Contain one or more years during which the number of fatalities was <10.

active drilling rigs increased by 71% and the number of oil and gas extraction workers more than doubled (1,2) during 2003–2013, the industry's fatality rate significantly decreased.

Transportation events and contact with objects/equipment events were the most frequent fatal events in the oil and gas extraction industry, which is consistent with previously reported data (7,8). This analysis showed the rate of fatalities caused by contact with objects/equipment experienced the greatest decrease during 2003–2013 ($p < 0.001$), which might be related to the increased use of automated technologies on drilling rigs such as hydraulic catwalks to move drill pipe from ground level to the rig floor and powered tongs used to make and break drilling pipe connections. A recent study found lower non-fatal injury rates on rigs with automated technologies designed to reduce workers' exposure to hazardous equipment (9). This report also found that the transportation-related fatality rate decreased significantly ($p < 0.05$) despite an increase in the number of fatalities. Previous research showed the majority of transportation fatalities were the result of motor vehicle crashes killing occupants of light trucks (e.g., pickup trucks), which are largely unregulated (8). Transportation fatalities did not include deaths while commuting to and from work, as these are not typically considered work-related. However, frequent long distance commutes are common for workers in this industry and are an area of concern.

Collaboration between industry, government, and academic institutions might have contributed to improved safety for workers and likely should continue to drive the fatality rate further down. In 2003, the National Service, Transmission, Exploration and Production Safety Network was founded in South Texas by the Occupational Safety and Health Administration and industry to share best practices in oil and gas safety and health. Since then, the organization has expanded to 22 independent networks serving 15 oil and gas producing states. Another group, the National Occupational Research Agenda Oil and Gas Extraction Sector Council, was created by CDC in 2008 as a partnership program to establish an occupational safety and health research agenda. Since then, the council has created several safety products targeting high-risk workers and activities (10). In addition, regional groups, such as the Appalachian Shale Transportation Safety Workgroup, have formed to identify and share best practices in transportation safety.

This report is subject to at least three limitations. First, it would have been preferable to calculate fatality rates using estimates of the number of full-time equivalent workers, which takes overtime into consideration, but these estimates were not available for this industry. Second, changes made to the Occupational Injury and Illness Classification System for years 2011 and later are considered a break in series. Although

What is already known on this topic?

Fatality rates for workers in the oil and gas extraction industry have historically been higher than the rate for all workers (an average of seven times higher every year since 2003, when fatality rates for oil and gas workers were first added to the data collected). During 2003–2013, an oil and gas boom occurred and the industry doubled its workforce and experienced a 71% increase in active drilling rigs. Although the number of fatal injuries also increased during this time, trends in fatality rates during this boom have not been previously reported.

What is added by this report?

The fatality rate for the oil and gas extraction industry decreased by 36.3% ($p < 0.001$) during 2003–2013, from 29.0 to 19.1 per 100,000 workers per year. The rate for fatalities caused by contact with objects and equipment experienced the greatest decrease (60.8%, $p < 0.001$). Transportation incidents continue to be the leading cause of death.

What are the implications for public health practice?

It is important for oil and gas industry employers to continue to implement safety measures that target causes of the most frequent fatal events, including a land transportation safety policy for all workers who drive as a part of their duties. To target injury prevention programs, it is important that occupational safety and health researchers continue and enhance surveillance efforts to identify and report on risk factors for different types of fatal injuries among different sectors of the oil and gas extraction industry.

event-type categories reported here did not undergo significant change in 2011, clarifications in the order of precedence for the event type categories were issued that might have led to differences in event coding starting in 2011. Lastly, fatal event numbers for 2013 are preliminary and might be incomplete. Historically, transportation event data are the most incomplete, and this could affect the trend.

Although the fatality rate in the oil and gas extraction industry remains an average of seven times higher than among U.S. workers in general (25.1 compared with 3.7 per 100,000 per year), the oil and gas extraction industry has achieved a substantial decrease in fatality rates in recent years. It is important for oil and gas industry employers to continue implementation of safety measures that target causes of the most frequent fatal events. One example is having a land transportation safety policy that outlines safety procedures for all workers who drive as a part of their duties. Another example is adoption of automated technologies that reduce workers' exposure to oil rig hazards. Occupational safety and health researchers need to continue and enhance surveillance efforts and identify risk factors for different types of fatal injuries among different sectors of the oil and gas extraction industry. The data from surveillance efforts will be useful to industry safety and health networks and can be used to create targeted interventions to reduce worker fatalities.

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References

1. Bureau of Labor Statistics. Quarterly census of employment and wages. Washington, DC: US Department of Labor, Bureau of Labor Statistics; 2014. Available at <http://data.bls.gov/cgi-bin/dsrv?en>.
2. Baker Hughes, Inc. North American rig counts. Houston, TX: Baker Hughes; 2104. Available at <http://phx.corporate-ir.net/phoenix.zhtml?c=79687&p=irol-reportsoter>.
3. Bureau of Labor Statistics. Injuries, illnesses, and fatalities: census of fatal occupational injuries (CFOI)—current and revised data. Washington, DC: US Department of Labor, Bureau of Labor Statistics; 2013. Available at <http://www.bls.gov/iif/oshcfoi1.htm>.
4. International Association of Oil & Gas Producers. Land transportation recommended practice. London: International Association of Oil & Gas Producers; 2014. Report no. 365 (Issue 2). Available at <http://www.ogp.org.uk/pubs/365.pdf>.
5. National Institute for Occupational Safety and Health. Preventing work-related motor vehicle crashes. Atlanta, GA: CDC, National Institute for Occupational Safety and Health; 2015. Pub. no. 2015–111. Available at <http://www.cdc.gov/niosh/docs/2015-111/pdfs/2015-111.pdf>.
6. American Petroleum Institute. Recommended practice for occupational safety for oil and gas well drilling and servicing operations. Washington, DC: American Petroleum Institute; 2015. Recommended practice No. 54.
7. CDC. Fatalities among oil and gas extraction workers—United States, 2003–2006. *MMWR Morb Mortal Wkly Rep* 2008;57:429–31.
8. Retzer KD, Hill RD, Pratt SG. Motor vehicle fatalities among oil and gas extraction workers. *Accid Anal Prev* 2013;51:168–74.
9. Blackley DJ, Retzer KD, Hubler WG, Hill RD, Laney AS. Injury rates on new and old technology oil and gas rigs operated by the largest United States onshore drilling contractor. *Am J Ind Med* 2014;57:1188–92.
10. National Institute for Occupational Safety and Health. Oil and gas extraction inputs: national occupational research agenda. Atlanta, GA: CDC, National Institute for Occupational Safety and Health; 2012. Available at <http://www.cdc.gov/niosh/programs/oilgas/nora.html>.

Acute Rheumatic Fever and Rheumatic Heart Disease Among Children — American Samoa, 2011–2012

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Acute rheumatic fever is a nonsuppurative, immune-mediated consequence of group A streptococcal pharyngitis (strep throat). Recurrent or severe acute rheumatic fever can cause permanent cardiac valve damage and rheumatic heart disease, which increases the risk for cardiac conditions (e.g., infective endocarditis, stroke, and congestive heart failure) (1,2). Antibiotics can prevent acute rheumatic fever if administered no more than 9 days after symptom onset. Long-term benzathine penicillin G (BPG) injections are effective in preventing recurrent acute rheumatic fever attacks and are recommended to be administered every 3–4 weeks for 10 years or until age 21 years to children who receive a diagnosis of acute rheumatic fever (3). During August 2013, in response to anecdotal reports of increasing rates of acute rheumatic fever and rheumatic heart disease, CDC collaborated with the American Samoa Department of Health and the Lyndon B. Johnson Tropical Medical Center (the only hospital in American Samoa) to quantify the number of cases of pediatric acute rheumatic fever and rheumatic heart disease in American Samoa and to assess the potential roles of missed pharyngitis diagnosis, lack of timely prophylaxis prescription, and compliance with prescribed BPG prophylaxis. Using data from medical records, acute rheumatic fever incidence was calculated as 1.1 and 1.5 cases per 1,000 children aged ≤18 years in 2011 and 2012, respectively; 49% of those with acute rheumatic fever subsequently received a diagnosis of rheumatic heart disease. Noncompliance with recommended prophylaxis with BPG after physician-diagnosed acute rheumatic fever was noted for 22 (34%) of 65 patients. Rheumatic heart disease point prevalence was 3.2 cases per 1,000 children in August 2013. Establishment of a coordinated acute rheumatic fever and rheumatic heart disease control program in American Samoa, likely would improve diagnosis, treatment, and patient compliance with BPG prophylaxis.

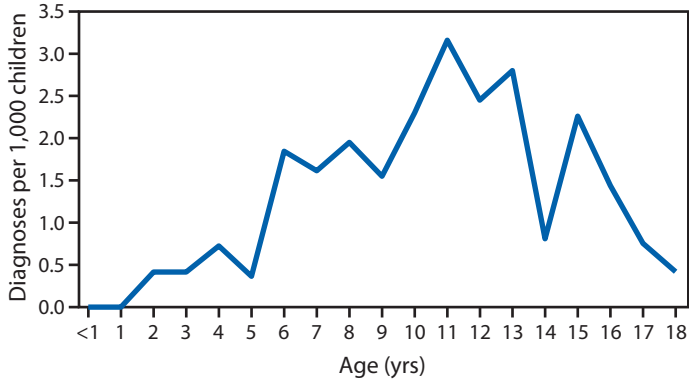
Acute rheumatic fever is no longer a nationally notifiable disease in the United States, and its annual incidence in the continental United States declined in the late 20th century to approximately 0.04–0.06 cases per 1,000 children (4). Exceptions to these low acute rheumatic fever incidence rates in the United States include Samoan persons living in Hawaii and residents of American Samoa, an American territory in the South Pacific (5,6). Acute rheumatic fever rates in Hawaii

have been as high as nearly 0.1 cases per 1,000 children, with even higher rates among persons of Samoan and Hawaiian ethnicity (5). Acute rheumatic fever occurs most commonly among children aged 5–15 years.

Pediatric cases of acute rheumatic fever and rheumatic heart disease were defined as physician-diagnosed acute rheumatic fever or rheumatic heart disease among patients aged ≤18 years who had sought care during 2011–2012 at the hospital in American Samoa. *International Classification of Diseases, Ninth Revision* (ICD-9) codes and BPG prophylaxis registries including patients currently receiving BPG treatment at the hospital were used to identify cases of acute rheumatic fever and rheumatic heart disease during 2011–2012 and to estimate the August 2013 point prevalence of rheumatic heart disease. Acute rheumatic fever diagnostic criteria included classic “Jones criteria” until summer 2012 (7), after which more sensitive Australian and New Zealand guidelines for high-risk areas were used (8). Case finding for inpatients with diagnoses during 2011–2012 was conducted by using ICD-9 codes (390–398). In addition, hospital patient registries for BPG prophylaxis were reviewed to identify additional acute rheumatic fever and rheumatic heart disease patients. Duplicate cases were excluded. Medical records for all identified patients were reviewed to verify acute rheumatic fever or rheumatic heart disease diagnoses and BPG prophylaxis noncompliance, which included recorded missed or late doses. Case-finding using hospital BPG prophylaxis registries was conducted to determine the number of children known to be living with rheumatic heart disease at the time of the study. Acute rheumatic fever incidence (2011–2012) and rheumatic heart disease point prevalence (August 2013) were calculated by using 2010 U.S. Census Bureau data (American Samoa pop. = 55,519, including 24,652 persons aged ≤18 years).

Acute rheumatic fever incidence was 1.1 and 1.5 cases per 1,000 children, for 2011 and 2012, respectively. Of 65 children with physician-diagnosed acute rheumatic fever during 2011–2012, a total of 32 (49%) subsequently received a diagnosis of rheumatic heart disease. Acute rheumatic fever patients were predominantly male (60%); median age at acute rheumatic fever diagnosis was 11 years (range: 2–18 years) (Figure). The 41 patients with available data were of Polynesian (98%) or Fijian (2%) origin. Twelve (18%) patients had a diagnosis of

FIGURE. Average annual rate of acute rheumatic fever diagnoses per 1,000 children, by age — American Samoa, 2011–2012



pharyngitis noted in the medical record during the 6 weeks preceding acute rheumatic fever or rheumatic heart disease diagnosis. Noncompliance with post-acute rheumatic fever prophylaxis with BPG was noted for 22 (34%) patients.

Among 32 rheumatic heart disease patients with data, 21 (66%) received a diagnosis of rheumatic heart disease without a previous acute rheumatic fever diagnosis noted in the medical record, indicating that certain patients did not seek care or did not receive a diagnosis until after the disease had progressed. The point prevalence of rheumatic heart disease was 3.2 cases per 1,000 children in August 2013. Of 34 pharyngitis diagnoses made during 2011–2012 and reviewed in acute rheumatic fever patient records, three (9%) were made using rapid antigen detection testing, 15 (44%) were made using throat culture, and 16 (47%) were made without any diagnostic testing.

Discussion

In addition to causing pharyngitis, pyoderma, and severe invasive disease (e.g., streptococcal toxic shock syndrome and necrotizing fasciitis), group A streptococcal organisms can trigger postinfection syndromes that result from a crossreaction between patient antibodies to bacterial surface proteins and cardiac, neuronal, and synovial tissues (9). Acute rheumatic fever, characterized primarily by carditis, chorea, and polyarthritides, occurs a minimum of 2–3 weeks after an episode of untreated or inadequately treated pharyngitis. Acute rheumatic fever does not cause lasting damage to the nervous tissue or joints. However, damage to heart valves can be irreversible and is worsened by repeat episodes of acute rheumatic fever (1,3). Permanent valvular damage, or rheumatic heart disease, increases the risk for infective endocarditis, stroke, heart failure, and premature death, and might necessitate valve replacement surgery (2). Because pharyngitis and acute rheumatic fever are most common in children, the recurrence of acute rheumatic

fever, and, thus, the risk for developing rheumatic heart disease, can continue into adolescence and young adulthood.

This investigation highlights a long-standing disparity in the acute rheumatic fever and rheumatic heart disease rates between children in American Samoa and children in the continental United States. In August 2013, rheumatic heart disease point prevalence in American Samoa (3.2 per 1,000 children) was approximately 10 times that previously estimated for industrialized countries (0.3 per 1,000 children) (2). With improved diagnosis and treatment of group A streptococcal pharyngitis, the United States and other industrialized countries have seen a steep decline in rheumatic heart disease prevalence since the mid-20th century. However, in some parts of the world, rheumatic heart disease is the most common cardiac disease of children and young adults (3). The highest rheumatic heart disease rates occur in sub-Saharan Africa, with an estimated 5.7 cases per 1,000 children aged 5–14 years, and in the Pacific region and indigenous populations of Australia and New Zealand, with 3.5 cases per 1,000 (2).

Multiple factors influence rates of acute rheumatic fever and rheumatic heart disease, including host immune factors and lifestyle (e.g., crowding or access to health care), as well as the biologic characteristics of circulating group A streptococcal strains (1). However, opportunities for prevention exist and include improving access to medical care and using evidence-based strategies to identify and treat group A streptococcal pharyngitis early (primary prevention) and diagnose and prevent recurrent acute rheumatic fever and rheumatic heart disease (secondary prevention) (3).

The World Health Organization recommends community-based acute rheumatic fever and rheumatic heart disease control programs, which include penicillin prophylaxis after an acute rheumatic fever diagnosis to prevent recurrent acute rheumatic fever and rheumatic heart disease (1). Coordinated control programs increase acute rheumatic fever and rheumatic heart disease awareness among patients and the community, improve coverage and compliance with penicillin prophylaxis and medical care, and decrease the rate of recurrent disease (3). Current programs are diverse in their delivery and complexity and include patient registries maintained by health care personnel, community-based prophylaxis, monitoring of medical needs (e.g., echocardiography appointments) and prophylaxis compliance, and education about the importance of prompt diagnosis of group A streptococcal pharyngitis (3). Programs in other countries have been shown to reduce morbidity, disability, and mortality from acute rheumatic fever and rheumatic heart disease (1). Before the decline in acute rheumatic fever

incidence in the United States, certain states had prioritized streptococcal disease control and managed control programs.

The morbidity typically associated with rheumatic heart disease, and the disparity between rates in American Samoa and the continental United States, warrant discussion of coordinated control and mandatory public health reporting of acute rheumatic fever and rheumatic heart disease cases in American Samoa. A rheumatic heart disease control program ideally would be operated with local staff members and include measures demonstrated to be successful in controlling acute rheumatic fever and rheumatic heart disease in other high-risk areas, with particular emphasis on timely diagnosis and treatment of group A streptococcal pharyngitis (3). In American Samoa, families often choose traditional remedies over medical care, and this study found that few patients with acute rheumatic fever had a recent diagnosis of pharyngitis. In addition, hospital physicians often rely on clinical, rather than laboratory, diagnosis of pharyngitis. Although penicillin prophylaxis is the only proven cost-effective secondary rheumatic heart disease prevention method, education of health care providers about adherence to clinical practice guidelines for pharyngitis diagnosis and treatment is crucial for acute rheumatic fever and rheumatic heart disease prevention (10).

The findings in this report are subject to at least three limitations. First, this study is likely affected by ascertainment bias, because it only reports acute rheumatic fever patients who sought care at the hospital. Those using traditional remedies for acute rheumatic fever symptoms and patients with mild disease might not seek care. Second, despite multiple case-finding modalities (i.e., registries and medical billing), physicians at the hospital do not assign ICD-9 codes and certain acute rheumatic fever diagnoses might have been missed by the coding staff. The pediatric BPG registry included only currently treated patients. Patients treated during 2011–2012 might have been removed from the registry because of death or emigration. In addition, if not in the adult registry, patients who transitioned from the pediatric to adult medicine service might have been lost to follow-up, and although the hospital serves the majority of residents, a limited number of persons might go off-island for health care. Therefore, this report likely underestimates the number of cases of pediatric acute rheumatic fever and rheumatic heart disease in American Samoa. Finally, medical records were not reviewed for concordance with acute rheumatic fever and rheumatic heart disease diagnostic criteria, potentially affecting the sensitivity and specificity of case ascertainment.

What is already known on this topic?

Inadequately treated group A streptococcal pharyngitis can lead to development of acute rheumatic fever and subsequent rheumatic heart disease, both of which are found at high rates among children living in the South Pacific. Long-term penicillin injections are effective in preventing recurrent acute rheumatic fever attacks and subsequent development of rheumatic heart disease.

What is added by this report?

This report describes a continued high incidence of acute rheumatic fever and prevalence of rheumatic heart disease in American Samoa. In August 2013, rheumatic heart disease point prevalence (3.2 per 1,000 children) was approximately 10 times that estimated for industrialized countries. The report also highlights the extent to which missed diagnoses, missed opportunities for treatment, and treatment noncompliance might contribute to the high rate of rheumatic heart disease.

What are the implications for public health practice?

Efforts to improve pharyngitis diagnosis and treatment and compliance with penicillin prophylaxis might reduce the burden of acute rheumatic fever and rheumatic heart disease among children in American Samoa. These goals might be effectively met by establishment of a coordinated disease control program.

Rheumatic heart disease is expected to cause considerable lifelong morbidity in American Samoa, where it is approximately 10 times more common than in the continental United States. Recommendations to curb rheumatic heart disease in American Samoa are manifold, including improving pharyngitis diagnosis and treatment with concurrent efforts to improve patient compliance with BPG prophylaxis. These goals might be met efficiently and cost-effectively by establishment of a coordinated acute rheumatic fever and rheumatic heart disease control program.

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References

1. World Health Organization. Rheumatic fever and rheumatic heart disease. World Health Organ Tech Rep Ser 2004;923:1–122.
2. Carapetis JR, Steer AC, Mulholland EK, Weber M. The global burden of group A streptococcal diseases. *Lancet Infect Dis* 2005;5:685–94.
3. Carapetis JR, Brown A, Wilson NJ, Edwards KN; Rheumatic Fever Guidelines Writing Group. An Australian guideline for rheumatic fever and rheumatic heart disease: an abridged outline. *Med J Aust* 2007;186:581–6.
4. Stockmann C, Ampofo K, Hersh AL, et al. Evolving epidemiologic characteristics of invasive group A streptococcal disease in Utah, 2002–2010. *Clin Infect Dis* 2012;55:479–87.
5. Chun LT, Reddy DV, Yim GK, Yamamoto LG. Acute rheumatic fever in Hawaii: 1966 to 1988. *Hawaii Med J* 1992;51:206–11.
6. Erdem G, Dodd A, Tuua A, et al. Acute rheumatic fever in American Samoa. *Pediatr Infect Dis J* 2007;26:1158–9.
7. Special Writing Group of the Committee on Rheumatic Fever, Endocarditis, and Kawasaki Disease of the Council on Cardiovascular Disease in the Young of the American Heart Association. Guidelines for the diagnosis of rheumatic fever. Jones criteria, 1992 update. *JAMA* 1992;268:2069–73.
8. National Heart Foundation of Australia, Cardiac Society of Australia and New Zealand. Diagnosis and management of acute rheumatic fever and rheumatic heart disease in Australia—an evidence-based review. Sydney, Australia: National Heart Foundation of Australia; 2006. Available at <http://doctor-ru.org/main/1800/1805.pdf>.
9. Martin JM, Green M. Group A *Streptococcus*. *Semin Pediatr Infect Dis* 2006;17:140–8.
10. Shulman ST, Bisno AL, Clegg HW, et al. Clinical practice guideline for the diagnosis and management of group A streptococcal pharyngitis: 2012 update by the Infectious Diseases Society of America. *Clin Infect Dis* 2012;55:1279–82.

Notes from the Field

Outbreak of Skin Lesions Among High School Wrestlers — Arizona, 2014

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Skin infections are a common problem among athletes at all levels of competition; among wrestlers, 8.5% of all adverse events are caused by skin infections (1). Wrestlers are at risk because of the constant skin-to-skin contact required during practice and competition. The most common infections transmitted among high school wrestlers include fungal infections (e.g., ringworm), the viral infection herpes gladiatorum caused by herpes simplex virus-1 (HSV-1), and bacterial infections (e.g., impetigo) caused by *Staphylococcus* or *Streptococcus* species, including methicillin-resistant *Staphylococcal aureus* (MRSA) (2). On February 7, 2014, the Maricopa County Department of Public Health was notified of multiple wrestlers who reported skin lesions 2 weeks after participating in a wrestling tournament at school A. The tournament was held on January 24–25 and included 168 wrestlers representing 24 schools. The county health department initiated an investigation to identify cases of skin lesion, determine lesion etiology, identify risks associated with lesion development, and provide guidance for preventing additional cases.

Questionnaires were distributed to all wrestlers on teams that participated in the tournament and reported at least one skin lesion in a team member following the tournament. Medical records were obtained to verify lesion diagnosis where available. To include persons infected before and after the tournament, probable cases were defined as one or more skin lesions reported during January 1–March 1, 2014, by a wrestler who competed on a team that participated in the school A tournament. A confirmed case was a probable case with a physician-diagnosed skin lesion or laboratory-confirmation of a bacterial or viral infection of the skin.

A total of 47 cases (37 confirmed) were identified. Impetigo was the most common reported physician diagnosis (17 cases [46%]), followed by HSV-1 infection (11 [30%]), tinea corporis (two [5%]), and MRSA (two [5%]). One wrestler with physician-diagnosed HSV-1 reported having lesion onset 4 days before the January tournament and wrestling in the tournament with uncovered arm lesions. During the 2–9 days after the tournament, seven athletes who had wrestled in the tournament developed HSV-1 infection; during the 5–14 days after the tournament, three teammates who had not wrestled developed HSV-1. Another wrestler with physician-diagnosed

impetigo reported having wrestled in the school A tournament with uncovered lesions on the head and neck. Subsequently, eight wrestlers who had participated in the tournament experienced impetigo 3–14 days after the tournament, and four teammates who did not participate in the tournament experienced impetigo 5–10 days after the tournament.

The Maricopa County Department of Public Health recommended that 1) wrestlers with visible, uncovered lesions be excluded from competition, 2) wrestling mats be disinfected between each match with a disinfectant approved by the Environmental Protection Agency as effective against MRSA and HSV-1, and 3) hand sanitizer be provided for use by all wrestlers during practices and competitions. In addition to implementing these recommendations, the Arizona Interscholastic Association also provided third-party clinicians who performed skin checks on each wrestler before competing.

This outbreak was caused by coincident spread of two distinct skin pathogens among high school wrestlers who had participated in the school A tournament. HSV-1 and impetigo caused by *Staphylococcus* or *Streptococcus* species were likely spread during the school A tournament by wrestlers who competed with uncovered lesions. CDC, the National Athletic Trainers' Association, and the National Federation of State and High School Associations have each released statements and guidelines providing athletic staff and players with education regarding skin lesion prevention, lesion identification, and management (3,4). The *Journal of the American Osteopathic Association* also has published an evidence-based review with return-to-play guidelines for common dermatologic infections among athletes (5). This outbreak highlights the need for athletes, their coaches, and athletic directors to follow well-established infection control guidelines, including keeping all skin lesions covered with a clean, dry dressing, and excluding athletes from competitions when lesions cannot remain covered.

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References

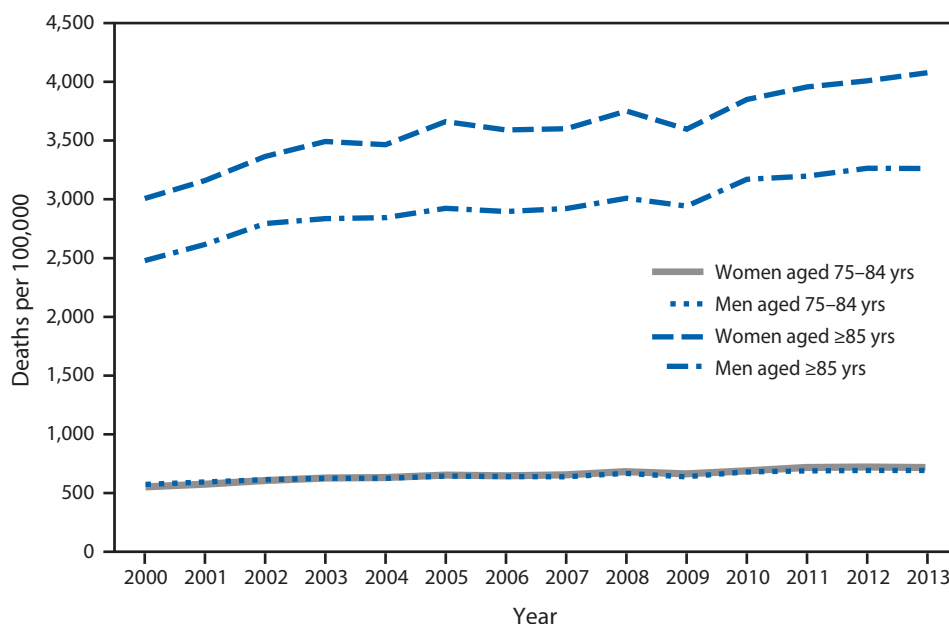
1. Yard EE, Collins CL, Dick RW, Comstock RD. An epidemiologic comparison of high school and college wrestling injuries. *Am J Sports Med* 2008;36:57–64.
2. Turbeville SD, Cowan LD, Greenfield RA. Infectious disease outbreaks in competitive sports: a review of the literature. *Am J Sports Med* 2006;34:1860–5.

3. National Federation of State High School Associations. General guidelines for sports hygiene, skin infections and communicable diseases. Indianapolis, IN: National Federation of State High School Associations; 2014. Available at <http://www.nfhs.org/sports-resource-content/general-guidelines-for-sports-hygiene-skin-infections-and-communicable-diseases/>.
4. CDC. MRSA information for coaches, athletic directors, and team healthcare providers: 5 steps to take if you think an athlete might have a skin infection. Atlanta, GA: US Department of Health and Human Services, CDC; 2013. Available at <http://www.cdc.gov/mrsa/community/team-hc-providers/index.html>.
5. Likness LP. Common dermatologic infections in athletes and return-to-play guidelines. *J Am Osteopath Assoc* 2011;111:373–9.

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Death Rates* from Dementia† Among Persons Aged ≥75 Years, by Sex and Age Group — United States, 2000–2013



* Per 100,000 population.

† Deaths from dementia include underlying and contributing causes of death coded F01 (vascular dementia), F03 (unspecified dementia) or G30 (Alzheimer's disease) according to the *International Classification of Diseases, 10th Revision*.

During 2000–2013, death rates for dementia per 100,000 population increased for both men and women among persons aged 75–84 years and ≥85 years. Among persons aged 75–84 years, the rate increased 21% for men and 31% for women. Among persons aged ≥85 years, the rate increased 32% for men and 36% for women. Among persons aged ≥85 years, death rates were higher for women than men throughout the period, with death rates 25% higher among women than men in 2013 (4,077.4 versus 3,261.6 per 100,000 population).

Source: National Vital Statistics System. Multiple cause of death data, 2000–2013. Available at <http://wonder.cdc.gov/mcd-icd10.html>.

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