Drug overdose is a public health crisis in the United States.\(^1\) It is the leading cause of injury death in the U.S., causing about 52,000 deaths in 2015,\(^1,2\) and is a major public health concern in Rhode Island. Based on the age-adjusted rate of death due to drug overdose in 2015, Rhode Island ranked fifth in the U.S. The top five states included West Virginia (41.5 per 100,000), New Hampshire (34.3), Kentucky (29.9), Ohio (29.9), and Rhode Island (28.2).\(^3\) The number of drug overdoses has risen rapidly during 2009–2016. In Rhode Island, the number of drug overdose deaths exceeds the combined number of deaths due to suicide, homicide, and motor vehicle crashes in 2016.

Drug overdose deaths contribute to physical, mental, social, and public health problems, and have a major impact on individuals, families, and communities.\(^4\) One of the Healthy People 2020 goals is to “reduce substance abuse to protect the health, safety, and quality of life for all, especially children.”\(^5\) The increase in drug overdose deaths highlights the urgent need for accurate and timely surveillance. The Rhode Island Department of Health (RIDOH)’s Center for the Office of State Medical Examiners (OSME) certifies about 10% of all deaths that occur within Rhode Island, and is a critical source of information regarding drug overdose deaths. The objectives of this report were to: [1] describe Rhode Island’s longitudinal trends and geographic patterns in unintentional drug overdose death using available medical examiners’ office data; [2] compare Rhode Island’s performance to neighboring states, using the newly-available Centers for Disease Control and Prevention (CDC) data; and [3] generate a linear equation to predict future four-year deaths due to drug overdose in the absence of effective interventions.

**RESULTS**

During 2009 through 2016, 1,745 Rhode Island adults died of a drug overdose. The ages ranged from 16–87 years old and the average age was 42.7 (data not shown). A trend analysis over eight years demonstrated that drug overdose deaths in Rhode Island increased significantly from 2009 to 2016. Specifically, Rhode Island OSME data revealed that the number of drug overdose deaths in Rhode Island increased nearly 2.5-fold over the past eight years. Fentanyl, as the cause of overdoses, was first reported in Rhode Island in March of 2013. Deaths due to fentanyl overdoses rose sharply during 2013–2016, while non-opioid overdose deaths remained stable [Figure 1].

In 2015, Rhode Island ranked 5th among the 50 states and Washington, D.C. for the age-adjusted rate of death due to drug overdose. Rhode Island outpaced neighboring states, except New Hampshire [Figure 2]. In New England, Vermont, Maine, and Connecticut had lower rates than Massachusetts, Rhode Island, and New Hampshire. New England states with statistically significant increases in drug overdose death rates from 2014 to 2015 included Connecticut, Maine, Massachusetts, New Hampshire, and Rhode Island (Table 1).

The crude rates display some area clustering, with the highest (worst) death rates observed in the urban (four core

**METHODS**

**Data sources**

Two data sources were used: [1] The OSME database was searched for all cases from January 2009 through December 2016 with drug overdose reported as cause of death. The death must have occurred within Rhode Island. The underlying cause of death must have been officially confirmed by a medical examiner. [2] The 2015 drug overdose death data on the CDC website was used to rank the 50 states and D.C.\(^3\) Death causes were classified using the International Classification of Diseases, Tenth Revision (ICD–10).\(^3\)

**Data analyses**

[1] GIS map: During 2009–2016, Rhode Island only had two teen deaths due to drug overdose, so we calculated the average annual adult death rate of drug overdose by using Rhode Island’s 2010 census city/town adult (18 years and older) populations. Mapping of drug overdose death rates by cities and towns where overdoses occurred was conducted using ArcGIS 10.2 [Environmental Systems Research Institute, Inc., Redlands, CA]. We employed the Jenks Natural Breaks Classification method to develop the value ranges of the overdose death rate.

[2] Linear equation: The drug overdose deaths were modeled as a function of the year of when they occurred. Based on Rhode Island 2009–2016 data, we generated a linear equation to predict future year deaths due to drug overdose if the current rates were to continue in the absence of effective interventions. A linear equation was used to calculate the annual number of deaths projected for 2017–2020.
cities) and some suburban areas. The four Rhode Island core cities (defined as having 25% or more of children living below the federal poverty threshold) had the highest average annual rates of adult drug overdose deaths and were Woonsocket (48.7 per 100,000 population), Providence (38.2), Pawtucket (37.6), and Central Falls (37.3). The four towns with the lowest adult overdose rates were Little Compton (8.8), Exeter (7.4), Jamestown (5.7), and Barrington (2.1) [Figure 3].

As noted, Rhode Island drug overdose deaths increased for eight consecutive years (2009-2016) and for the total drug overdose deaths, the regression model is statistically significant (p < 0.0001). The linear equation is Prediction = 93.786 + 27.631*(Year - 2008). The linear equation indicates that annual drug overdose deaths could reach 342 deaths in 2017, 370 deaths in 2018, 398 deaths in 2019, and 425 by 2020 in the absence of any interventions [Figure 4].

**DISCUSSION**

Understanding drug overdose death data can help public health professionals target high-risk populations and areas, monitor overdose deaths, and prioritize resources. The authors identify trends and geographic patterns to help strategically assign prevention, response, and treatment resources. Opioid-related drug overdose deaths have risen rapidly over the last eight years in Rhode Island. Such an unsettling trend highlights the importance of comprehensive efforts addressing this crisis in a systematic manner. Efforts focusing on prevention, improving access to substance abuse treatment, increased availability of naloxone, and strategies to promote recovery are currently under way in Rhode Island.6

The OSME data can help Rhode Island identify geographic patterns of drug overdose. Consideration of where overdoses occurred could enhance specific overdose prevention interventions, such as targeted training on naloxone administration.1 This report represents the first known estimate of drug overdose deaths in Rhode Island for the next four years in the absence of effective interventions. The projection can help plan prevention efforts, manage public health resources, and assess whether interventions are effective.5

This report has at least two limitations. (1) The adult (18 years and older) population in New Shoreham is 888 in the 2010 census data. Due to the instability of the small number, the adult drug overdose death rate in New Shoreham is not reported. (2) The study focuses on the city or town where an overdose occurred. However, when this information was
not available (12% of the cases), residency was used as a proxy if decedents lived in Rhode Island.

In summary, there is a clear need for continued surveillance and an interdisciplinary approach to identifying, communicating, and managing the drug overdose crisis. The OSME database will continue to be an effective source in surveillance of drug overdose deaths. If drug overdose deaths in Rhode Island decline, it implies that recent efforts may be effective.

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References

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Disclosure
The authors have no financial interests to disclose.

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