Using Plan-Do-Study-Act Cycle to Enhance Completeness of Suicide Firearm Reporting

YONGWEN JIANG, PhD; SHANNON YOUNG, BS; KAREN FOSS, MAGALI ANGELONI, DrPH, MBA; ERICA NORCINI, MBA; SAMARA VINER-BROWN, MS

ABSTRACT

The Rhode Island Violent Death Reporting System (RIVDRS) collects comprehensive surveillance data on violent deaths to support violence prevention programs in Rhode Island and nationwide. Successful collection of firearm information is critical to understanding gun violence in public health. A recent quality improvement (QI) project was performed to improve gun information collection in the RIVDRS program. Our aim was to increase the presence of firearm model information for 2014 suicides from 50% to 80% by December 31, 2015. We used the 2014 RIVDRS data and the Plan-Do-Study-Act cycle for this project. Our efforts achieved a 50% increase in the number of firearm model reporting. If we work more closely with police departments, they may understand the data importance, and be more likely to include the firearm information in their reports. We describe this process and provide lessons learned that can be generalizable to other states' violent death reporting system.

KEYWORDS: Rhode Island Violent Death Reporting System, Plan-Do-Study-Act cycle, quality improvement, suicide, firearm

INTRODUCTION

Without cross-sector surveillance systems, effective strategies to prevent violent injuries and deaths will be limited.[1] According to the Centers for Disease Control and Prevention (CDC)'s standardized methodology, the Rhode Island Violent Death Reporting System (RIVDRS), based at the Rhode Island Department of Health (RIDOH), collects comprehensive surveillance data on violent deaths to support violence prevention programs in Rhode Island and nationwide. Successful collection of firearm information is critical to understanding gun violence in public health. Legislators can use firearm data to regulate guns to reduce fatal violent injuries and deaths.[2]

"Quality improvement (QI) is a process by which individuals work together to improve systems and processes with the intention to improve outcomes."[3] A recent QI project was performed to improve gun information collection in the RIVDRS program. A QI project is different from a research study.[4] A QI project encourages us to conduct a small test of change, whereas a research study requires us to interview more people before taking action.[4] A small-scale test of change enables us to observe the test while minimizing potential risks.[5] The smaller the scope, the faster the learning.[4] Our team decided to start with small tests of change.

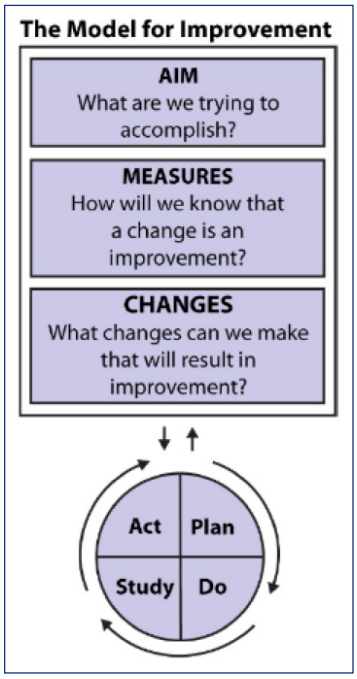
If the problem is identified, QI can help us find the solution. Plan-Do-Study-Act (PDSA) cycle is the most popular QI method used in healthcare.[3] Shewart and Deming initially introduced the PDSA cycle for QI in business, then the Institute for Healthcare Improvement (IHI) recommended it in healthcare use.[3] Our QI team attempted to use a PDSA cycle to identify the problem and root causes, develop, test, and begin implementing solutions. RIVDRS firearm information is mainly obtained from Medical Examiner (ME) records and law enforcement (LE) reports. Our aim was to increase the presence of firearm model information for 2014 suicides in the RIVDRS database from 50% to 80% by December 31, 2015.

METHODS

Since 2004, RIVDRS has collected timely and high-quality characteristics of data in violence-related deaths, including homicides, suicides, legal intervention deaths, unintentional firearm deaths as well as deaths of undetermined intent at the state level.[2] It includes demographic characteristics, mechanisms of injury, location of death, toxicology tests, circumstances preceding the deaths, suspects, intimate partner violence, and gun information.[6] RIVDRS data are disseminated routinely and expeditiously to public health officials, LE officers, policy makers, and the public. Data are used to develop, implement, and evaluate programs and strategies designed to reduce and prevent violent injuries and deaths at the state level.[2] The 2014 RIVDRS data were used for this QI project.

The Model for Improvement (**Figure 1**) was used for the QI project. We received a binder with the Public Health QI Encyclopedia and the Rhode Island Department of Health's current QI plan.[7] The QI team received 13.5 hours of in class training and 13 hours of online training,[7] which included discussing the aim statement, developing measures, demonstrating and practicing QI tools and methods, and learning the PDSA cycle (**Figure 1**). There were ten Public Health Improvement Exchange (PHIX) meetings, which provided the opportunity for each QI initiative to present their project

Figure 1. The Model for Improvement



Source: Institute for Healthcare Improvement (IHI) Open School Online Course QI 201: Guide to the IHI Open School Quality Improvement Practicum (http://www.ihi.org/)

and receive feedback. The QI projects culminated in an oral presentation at the PHIX meeting and a poster presentation at the RIDOH Annual QI Fair.[7]

Force field analysis is used to analyze the weight of each contributing force.[8] It is an effective tool to identify restraining and driving forces of a problem, and it helps us visualize and prioritize the factors.[8] We brought the QI project to our team and conducted a brainstorming session. **Table 1** displays the negative and positive forces of our mini-QI project.

We used three measures: (1) balancing measure: the QI project affected other RIVDRS work. Although our QI project was a mini-project, it took more time and had more parties involved than we expected. For instance, it took about 24 hours to target-review 10 suicide files just focusing on firearm information. (2) Process measure: increase completeness of suicide firearm type and make. If we knew firearm type and make, it would be easier for us to find the firearm model. (3) Outcome measure: increase percentage of completeness of suicide firearm models.

We had three values: (1) Baseline value: we used 50% of the 2014 suicide firearm model data requiring improvement as the baseline value; (2) Target value: we documented the 2014 firearm data following successful completion of PDSA cycles. If the intervention was effective, we anticipated 80% of suicide firearm model information would be complete; (3) Actual value: we recorded status of the data following completion of PDSA cycles. This may be the same as, or different from, the target value during each PDSA cycle.[9]

RESULTS

Multiple PDSA cycles were utilized to gain knowledge in the initial cycle, which raised some questions and showed some opportunities for improvement.[3] Usually, the easier change(s) is made in the first cycle and the more difficult changes are implemented in the next cycle.[3]

PLAN – Find Opportunity for Improvement

By checking the 2014 raw data, we identified the problem: RIVDRS firearm information was incomplete due to the lack of data available. In order to keep our QI project manageable, we only focused on suicide deaths and four firearm fields including type, caliber or gauge, make, and model. Based on our force field analysis (**Table 1**), we identified the following probable root causes: (1) web-based system does not include all firearm makes or models. (2) Gun information mainly comes from police reports, which are not consistently included since there is no mandatory protocol for LE to provide firearm make and model. (3) Firearm make/model might not be in LE reports. If the gun is in their possession, LE can reexamine it and provide missing data. We proposed the following improvement theory or method: If we can reach out to each police department, then we may collect more of the missing information.

DO – Test the Improvement Theory

We reviewed the 2014 raw RIVDRS data and found that Rhode Island had 20 firearm suicides in 2014. There were 10 firearm suicides without the firearm model information. The following strategies were used to improve firearm information collection. (1) We target-reviewed CME and LE reports, which included many narratives. It is possible to miss entering data into the system due to over 700 unique data elements.[6] When we narrowed our focus on firearm information, we were able to capture some firearm types and makes that were either not specified or unavailable at earlier abstraction. CDC also requests RIVDRS to randomly select 5% of the violent death incidents for re-abstraction to evaluate the high inter-rater reliability of abstraction and data entry. This annual effort is different from our target-reviewing files, where we only focused on the 10 firearm suicides

Table 1. Negative and Positive Forces in the Force Field Analysis

	Negative Force	Positive Force
1	Short of budget	Familiar with current process
2	Low priority (firearm data)	CDC provided standard protocol
3	Process is labor-consuming	Supported by team members and CDC
4	Information may not always match the options (drop-down menu) in the RIVDRS database.	Developing strong interdepartmental working relationships encourages positive response when we request missing data
5	Police Department not mandatory to provide firearm make & model	Our team members spent hours compiling the data and constructing sound narratives to ensure RIVDRS accurate and complete and make RIVDRS one of the best.

CDC, Centers for Disease Control and Prevention; RIVDRS, Rhode Island Violent Death Reporting System.

with the firearm model missing and only focused on firearm information. (2) We bought a Shooter's Bible 106th Edition with pictures of guns to use as a reference to identify guns from photos in LE reports. However, the handbook does not cover all makes and models, so this strategy ultimately was not helpful. (3) When we abstracted the data, some gun information did not match our options. If we did not find makes or models in the drop-down menu, we entered them in "Other Firearm Make Text" and/or "Other Firearm Model Text" fields. (4) We reached out to eight related police departments to improve firearm data.

STUDY – Analyze Results

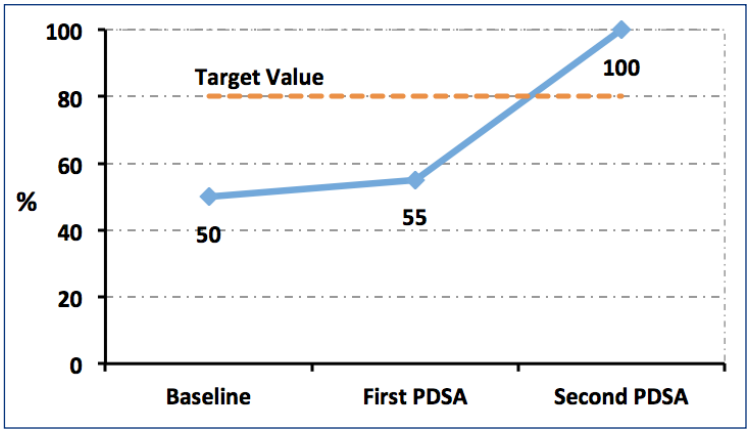
After target-reviewing the files, we captured one missing firearm type, three firearm makes, and one firearm model (**Table 2**). After reaching out to each related police department, we captured the model information for nine firearms. Our baseline value was 50%, target value was 80%, and actual value was 100% (**Figure 2**). These efforts achieved a 50% increase in the number of firearm model reporting.

Table 2. Firearm Information among 20 Suicide Deaths in 2014 RIVDRS

Firearm	Pre-intervention		Post-intervention (1st PDSA)		Post-intervention (2rd PDSA)	
	n	%	n	%	n	%
Caliber or Gauge	20	100.0				
Firearm type	19	95.0	20	100.0		
Firearm make	17	85.0	20	100.0		
Firearm model	10	50.0	11	55.0	20	100.0

RIVDRS, Rhode Island Violent Death Reporting System;
PDSA, Plan-Do-Study-Action.

Figure 2. Change of Firearm Model Information in 2014 Suicide Deaths after Quality Improvement



PDSA: Plan-Do-Study-Action

ACT – Adapt and Expand

The interventions were clearly effective, but labor intensive. Fewer firearm fields in our database ensured our project was small and manageable. In the "Act" phase of the cycle, we made a decision to adapt the changes. This decision was driven by the following suggestions: (1) because firearm information is not in one place in police reports, we should determine a better system to capture these firearm fields and reduce overlooking them; (2) we can list the most important fields in a spreadsheet and ask police departments to fill them; (3) most firearm suicides occur in non-core cities and police departments in those cities or towns may be understaffed and/or lack investigators. We should work closely with police departments and have a broad cooperation.

DISCUSSION

Why did we choose improving firearm information collection as our mini-QI project? IHI recommends the scope of the project can be very small.[10] Compared to other modules in the RIVDRS database, there are fewer firearm fields in the weapon module. We needed to ensure our QI project was small and manageable.

In the CDC Secure Access Management Services (SAMS), there are eight fields including firearm type, caliber or gauge, make, model, gun stored loaded, stored locked, owner, and firearm stolen. It is hard to collect the last four fields, as police would need to consistently interview witnesses or family members. The Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) can provide more detailed firearm information. RIVDRS requested ATF reports from LE sources before, but as of 2014, LE no longer requests ATF reports. As a result, our mini-QI project focused on only the first four firearm fields.

Firearm information in homicides has proven more difficult to collect, since some homicides are unsolved and/or the firearm is not recovered. Even solved homicides present an additional challenge, as information is often held back until the case has been fully prosecuted. This can result in very long time lags, with data often not available until after the RIVDRS data for the year are closed out. In contrast, when a suicide occurs, police arrive on the scene, secure the gun, and then can collect the firearm type, make, model, caliber or gauge. Since firearm data for suicides is more accessible than firearm data for homicides, we focused on firearm suicide deaths.

LESSONS LEARNED

First, if we can work more closely with police departments, they may understand the importance of the data, and be more likely to include the firearm information in their reports. Second, if we work with the CDC to revise the online data fields, then we will be able to put in makes and/or models that are not listed in the drop-down menu, therefore leading

to a more complete record. Third, how can we build what we learned into our routine work? How does this QI project affect our daily work? Since RIVDRS has hundreds of fields, it is not practical to reach out to each police department for each piece of missing information. Maybe we can prioritize our missing data by town/city.

Fourth, if we can make the firearm data more available to injury prevention programs or policy makers, they may be more likely to utilize the RIVDRS system and data to make decisions. However, how to get legislators to use RIVDRS firearm data effectively is a big concern. There were some patterns of firearm suicides: (1) most victims used a handgun; (2) .22/.32/.35 calibers were the most popular; and (3) Smith & Wesson was the most common make; however, there are thousands of models. How can model information best be used? Since examples of this application in the public health area could not be found; we could contact other states to determine how they disseminate and apply their firearm information.

Fifth, measurement is not the aim; improvement is the aim.[10] RIVDRS will continue to track progress on data collection. We hope that whatever positive change we make in our RIVDRS system stays long after our project is over. Our approach eliminated some unnecessary complexity to allow for easier adoption to other modules, such as circumstance, suspect, toxicology, or intimate partner violence modules. On September 1, 2016, CDC announced ten new awardees for the National Violent Death Reporting System (NVDRS), which expands NVDRS from 32 to 42 participating states and territories. We describe this process and provide lessons learned that can be generalized to other states to improve firearm data collection on violent deaths.

In summary, QI is an ongoing process and cannot be done without the following key component or features: (1) interdisciplinary support; (2) team work; (3) open communication; (4) continuous improvement, and making QI a culture.[10]

References

1. Sumner SA, Mercy JA, Dahlberg LL, Hillis SD, Klevens J, Houry D. Violence in the United States: Status, challenges, and opportunities. JAMA. 2015;314:478-488
2. Parks SE, Johnson LL, McDaniel DD, Gladden M. Surveillance for violent deaths – National Violent Death Reporting System, 16 states, 2010. MMWR Surveill Summ. 2014;63:1-33
3. Seidl KL, Newhouse RP. The intersection of evidence-based practice with 5 quality improvement methodologies. J Nurs Adm. 2012;42:299-304
4. Institute for Healthcare Improvement. IHI open school online course QI 102: The model for improvement: Your engine for change (http://www.ihi.org/). 2015
5. Institute for Healthcare Improvement. IHI open school online course QI 106: Mastering PDSA cycles and run charts (http://www.ihi.org/). 2015
6. National Center for Injury Prevention and Control. National Violent Death Reporting System web coding manual version 5.1 (revision date: 6/30/2015). 2015:194
7. Alexander-Scott N. Rhode island department of health: Quality improvement plan 2016-2018. 2016:30
8. Morgan JW, Duffy GL. Public health quality improvement encyclopedia. Public Health Quality Improvement Encyclopedia. 2012:174
9. Centers for Disease Control and Prevention. Standardized performance measurement framework for the national public health improvement initiative (nphii). 2014:32
10. Institute for Healthcare Improvement. IHI open school online course QI 201: Guide to the IHI open school quality improvement practicum (http://www.ihi.org/). 2015

Acknowledgments

This research was funded by a Centers for Disease Control and Prevention (CDC) grant (1U17CE002615-01 Revised) awarded to the Rhode Island Department of Health, Office of State Medical Examiners. The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Rhode Island Department of Health and JSI Research & Training Institute, Inc.. We would like to thank the Office of Vital Records, the Office of State Medical Examiners, the Rhode Island State Police and local law enforcement agencies, and the crime laboratory who provided data in a timely manner and without whom RIVDRS would be non-existent. We gratefully appreciate David G. De Tora, Senior Medicolegal Death Investigator of the Medical Examiner's Office, for his generous help. We gratefully appreciate instructors including Magali Angeloni, Stacey Aguiar, Erica Norcini, and Christelle Farrow of the Rhode Island Department of Health, for all their passion, hard work, and dedication to the great QI Team 4 training program. With support from the supervisor Samara Viner-Brown, the epidemiologist of RIVDRS received foundational and advanced QI training.

Authors

Yongwen Jiang, PhD, is a Senior Public Health Epidemiologist in the Center for Health Data and Analysis at the Rhode Island Department of Health, Providence, Rhode Island and is Assistant Professor of the Practice of Epidemiology, School of Public Health, Brown University.

Shannon Young, BS, is a consultant who serves as the data abstractor/data manager of the Rhode Island Violent Death Reporting System, through a contract with JSI Research & Training Institute, Inc.

Karen Foss is a consultant who serves as the data abstractor/data manager of the Rhode Island Violent Death Reporting System, through a contract with JSI Research & Training Institute, Inc.

Magaly Angeloni, DrPH, MBA, is the Director of Academic Center at the Rhode Island Department of Health and an instructor of the QI Team 4 training program.

Erica Norcini, MBA, is a Senior Human Services Policy and Systems Specialist for the Office of Food Protection at the Rhode Island Department of Health and an instructor of the QI Team 4 training program.

Samara Viner-Brown, MS, is the Chief of the Center for Health Data and Analysis at the Rhode Island Department of Health, and serve as the co-PI and the program manager of RIVDRS.

Disclaimer

The views expressed in this article are those of the authors and do not necessarily reflect the position or policy of the Rhode Island Department of Health or JSI Research & Training Institute, Inc.

Disclosures

The authors of this manuscript have no competing interests and no conflicts of interest to disclose.

Correspondence

Yongwen Jiang
The Center for Health Data and Analysis
Rhode Island Department of Health
3 Capitol Hill, Providence, RI 02908
401-222-5797, Fax: 401-222-4415
Yongwen.Jiang@health.ri.gov