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Data Linkage Strategies To Advance Youth Suicide Prevention

Agency for Healthcare Research and Quality

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Data Linkage Strategies To Advance Youth Suicide Prevention

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None of the investigators have any affiliations or financial involvement that conflicts with the material presented in this report.

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Preface

The Agency for Healthcare Research and Quality (AHRQ), through its Evidence-based Practice Centers (EPCs), sponsors the development of systematic reviews to assist public- and private-sector organizations in their efforts to improve the quality of health care in the United States. These reviews provide comprehensive, science-based information on common, costly medical conditions, and new health care technologies and strategies. The Office of Disease Prevention of the National Institutes of Health (NIH) requested this report from the EPC Program at AHRQ. AHRQ assigned this report to the Johns Hopkins University EPC (Contract No. 290-2012-00007-I). The report was presented March 29–30, 2016, at an NIH public Pathways to Prevention Workshop, Advancing Research To Prevent Youth Suicide.

Systematic reviews are the building blocks underlying evidence-based practice; they focus attention on the strength and limits of evidence from research studies about the effectiveness and safety of a clinical intervention. In the context of developing recommendations for practice, systematic reviews can help clarify whether assertions about the value of the intervention are based on strong evidence from clinical studies. For more information about AHRQ EPC systematic reviews, see www.effectivehealthcare.ahrq.gov/reference/purpose.cfm.

AHRQ expects that these systematic reviews will be helpful to health plans, providers, purchasers, government programs, and the health care system as a whole. Transparency and stakeholder input are essential to the Effective Health Care Program. Please visit the Web site (www.effectivehealthcare.ahrq.gov) to see draft research questions and reports or to join an email list to learn about new program products and opportunities for input.

If you have comments on this systematic review, they may be sent by mail to the Task Order Officer named below at: Agency for Healthcare Research and Quality, 5600 Fishers Lane, Rockville, MD 20857, or by email to epc@ahrq.hhs.gov.

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Technical Expert Panel

In designing the study questions and methodology at the outset of this report, the EPC consulted several technical and content experts. Broad expertise and perspectives were sought. Divergent and conflicted opinions are common and perceived as healthy scientific discourse that results in a thoughtful, relevant systematic review. Therefore, in the end, study questions, design, methodologic approaches, and/or conclusions do not necessarily represent the views of individual technical and content experts.

Technical Experts must disclose any financial conflicts of interest greater than $10,000 and any other relevant business or professional conflicts of interest. Because of their unique clinical or content expertise, individuals with potential conflicts may be retained. The TOO and the EPC work to balance, manage, or mitigate any potential conflicts of interest identified.

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Prior to publication of the final evidence report, EPCs sought input from independent Peer Reviewers without financial conflicts of interest. However, the conclusions and synthesis of the scientific literature presented in this report do not necessarily represent the views of individual reviewers.

Peer Reviewers must disclose any financial conflicts of interest greater than $10,000 and any other relevant business or professional conflicts of interest. Because of their unique clinical or content expertise, individuals with potential nonfinancial conflicts may be retained. The TOO and the EPC work to balance, manage, or mitigate any potential nonfinancial conflicts of interest identified.

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Data Linkage Strategies To Advance Youth Suicide Prevention

Structured Abstract

Objectives. Linking national, State, and community data systems, such as those used for medical service billing, to existing data from suicide prevention efforts could facilitate the assessment of longer term outcomes. Our objective was to identify and describe data systems that can be linked to data from studies of youth suicide prevention interventions and to identify analytic approaches to advance youth suicide prevention research.

Data sources. We conducted a systematic review to identify studies of suicide prevention interventions and three types of searches to identify data systems providing suicide-related outcomes: (1) a literature search, (2) an environmental scan of gray literature, and (3) a targeted search, through contact with relevant individuals, in six States, two cities, and one tribal community.

Review methods. Two independent reviewers screened all results. Studies and data systems had to be based in the United States; include individuals between 0 and 25 years of age; and include suicide, suicide attempt, or suicide ideation as an outcome.

Results. Of the 47 studies (described in 59 articles) of suicide prevention interventions identified in our systematic review, only 6 studied outcomes by linking to external data systems and only 12 explored treatment heterogeneity through the effects of moderators such as gender or race/ethnicity. We identified 153 unique and potentially linkable external data systems, 66 of which we classified as “fairly accessible” with data dictionaries available.

Conclusions. There is potential for linking existing data systems with suicide prevention efforts to assess the broader and extended impact of suicide prevention interventions. However, sparse availability of data dictionaries and lack of adherence to standard data elements limit the potential utility of linking prevention efforts with data systems.

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Introduction

Despite advances in the diagnosis and treatment of major mental disorders and increases in funding for suicide prevention, annual suicide rates in the United States for those in the 10-14, 15-19, and 20-24 age groups have increased since 2007.[1] In 2014, suicide was the second leading cause of death among people between the ages of 15 to 19 and 20 to 29.[2] According to estimates from the national Youth Risk Behavior Surveillance System at the Centers for Disease Control and Prevention (CDC), each year well over one million high school students are treated by a nurse or doctor for a suicide attempt.[3]

The National Action Alliance for Suicide Prevention (NAASP) (see Appendix A for a list of acronyms), the public-private partnership advancing the National Strategy for Suicide Prevention, developed a suicide prevention research agenda focusing on interventions with the potential to reduce morbidity (attempts) and mortality (deaths) by at least 20 percent in 5 years and at least 40 percent in 10 years. Specifically, the NAASP Task Force prioritized the prevention of "the emergence of suicidal behavior by developing and delivering the most effective prevention programs to build resilience and reduce risk in broad-based populations."[3]

However, identifying the most effective prevention interventions is challenging. Several issues contribute to make the determination of the impact of suicide prevention interventions difficult: (1) suicide is a rare outcome, requiring large studies to demonstrate an intervention effect; (2) misclassification and under-reporting of suicide and suicide attempts occur, owing to stigma and other issues; (3) there is no single, comprehensive, national system to document the scope of non-fatal suicide events; (4) interventions are often complex or "bundled" making it difficult to know which components are responsible for outcomes; and (5) the nature of populations at risk and available interventions require the use of quasi-experimental designs and "natural experiments" to evaluate prevention efforts. In addition, under the current funding structure of 3- to 5-year grant cycles, it is difficult to evaluate the longer-term impact of prevention interventions, especially those directed as primary prevention efforts, which can occur years before the peak period of risk for suicidal behaviors in young adulthood.

Thus, several unanswered questions remain regarding the effectiveness of youth suicide prevention efforts. Leveraging existing data from suicide prevention interventions may help to address these questions. National, State, and community data systems could be linked to existing data from suicide prevention efforts in order to study the longer-term and broader intervention impact. Data systems (a system that includes the collection of data, such as in a database, as well as the information technology infrastructure to maintain and operate the system) exist for purposes of surveillance of suicidal behaviors, for medical service billing, and for administrative purposes. The linkage of existing prevention intervention data to suicidal behavior outcomes could add value for stakeholders. The rapid expansion of electronic health record (EHR) systems and patient registries has created an exceptional opportunity for data linkage.[4] The emergence of State All Payer Claims Databases (APCD) could also significantly facilitate data linkages. APCDs are large-scale databases that systematically collect medical claims, pharmacy claims, and eligibility and provider files from private and public payers. In addition, several States now have established Health Information Exchanges (HIE) that merge health care data from multiple health care systems. As mentioned in NOT-MH-14-015 [Data Sharing Expectations for National Institute of Mental Health (NIMH)-funded Clinical Trials], the widespread data sharing by research communities adds significant value to research and accelerates the pace of discovery.[5]

In the field of suicide prevention, the linking of existing data has not yet been standardized across studies. This is likely due to a number of issues such as cost, feasibility of accessing data

systems, interoperability challenges, and issues of sharing protected health information (PHI). Direct data linkage on an individual-person level may require identifying information which is protected by the Health Insurance Portability and Accountability Act (HIPAA) and also, therefore, explicit informed consent.

Scope of the Project

The aim of the project was to provide an objective description of the state of the science on data linkage strategies and analytic approaches in suicide prevention research, as well as a systematic summary of ongoing research limitations, barriers, challenges, gaps, and opportunities for future data linkage approaches to enhance suicide prevention efforts to serve as the foundation for a National Institutes of Health (NIH) Pathway to Prevention workshop. This project studied data linkage and systems but did not evaluate or compare effectiveness of suicide prevention interventions. We focused on children, youth, and young adults ages 0-25, which spans the age range from when suicide is relatively rare, but when primary preventive efforts may be effective, through adolescence and young adulthood, when suicide rates precipitously increase. We considered all socio-ecologic levels of interventions (individual, community, and policy-level), primary promotion of mental wellness as well as interventions targeting suicidal ideation, attempts, and suicide.

Our project sought to address the following Key Questions (KQs):

KQ1. What national, State, and community data systems can be linked to existing data from suicide prevention interventions in order to add possible value for stakeholders, and what methods are available to link the data systems?

KQ2. Which statistical methods are reliable and valid for analyzing linked - data to avoid misleading conclusions?
a. What are potential sources of bias for these statistical methods?
b. What are the advantages and disadvantages of these different methods?

KQ3. Which statistical methods are reliable and valid for understanding possible moderators in suicide prevention programs to improve targeting interventions to populations?

KQ4. Given the current state of research, what types of methodological/analytic advances would promote further evaluation of youth suicide prevention efforts (e.g., new approaches to data linkage, increased use of common data elements, approaches to intervention harmonization) and facilitate intervention selection and implementation decisions by local community and State-level policymakers?

PICOTS

Table 1 describes the inclusion criteria (PICOTS: Populations, Interventions, Comparators, Outcomes, Timing, Setting) applied to identify studies of suicide prevention interventions. We used the same criteria to identify data systems providing suicide-related outcomes, except that a specific intervention was not required (i.e., I and C not required for data systems).

Table 1. PICOTS description of inclusion criteria for suicide prevention studies and data systems

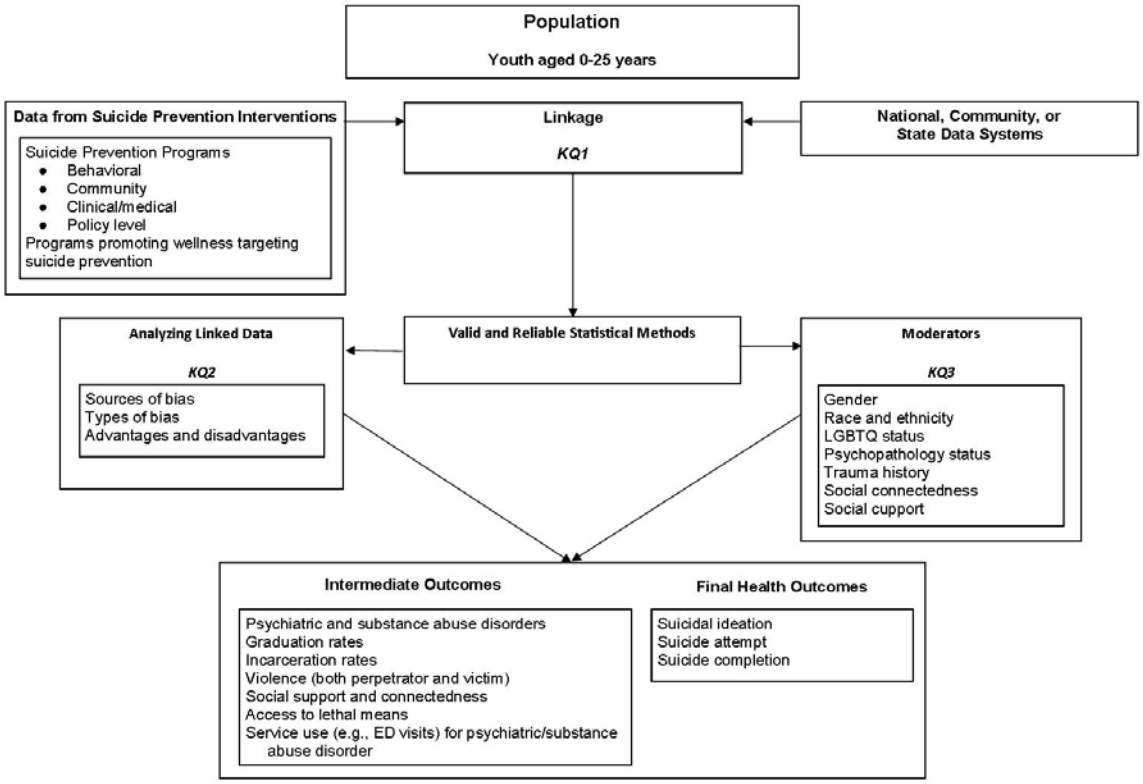
Population(s)	Received intervention: ages 0-25; (longitudinal follow-up past age 25 is acceptable).
Intervention(s) (used for studies)	Behavioral, community, clinical/medical, policy level including studies promoting wellness targeting suicide ideation, suicide attempt, and suicide, or any combination of these interventions and outcomes.
Comparison(s) (used for studies)	Any intervention (including usual care).
Outcome(s) (the primary and intermediate outcomes)	Primary outcome of interest: ● Suicide ideation,* reported within 12 months of data collection ● Suicide attempt, any time point post intervention ● Suicide, any time point post intervention Intermediate outcomes (if primary outcome is present), at any time point post intervention: ● Psychiatric and substance abuse disorders ● Service use (e.g. emergency department visit) for psychiatric/substance abuse disorders ● Graduation rates ● Incarceration rates ● Violence (both perpetrator and victim) ● Social support and connectedness ● Access to lethal means All outcomes were limited to standardized measures.
Timing	Publication date: 1990 or later.
Setting	Studies taking place in the United States only: Schools, home, primary care, emergency department, military bases, Indian reservations, juvenile justice systems, child welfare systems, suicide hotlines, other community settings.

* Suicide ideation reported over the last 12 months reduces the potential for recall bias and provides more relevant information for current prevention and intervention.[6, 7]

Analytic Framework

Figure 1 depicts the Key Questions illustrating how data, in populations of people from 0 to 25 years of age, from suicide prevention interventions (including behavioral, community, clinical/medical, and policy level) can be linked with national, community, or State data systems. Through statistical methods, these linked data can be analyzed to study the broader or longer-term impact of suicide prevention interventions. The study and identification of moderators of intervention impact (e.g., gender, race and ethnicity, LGBTQ (lesbian, gay, bi-sexual, transgender, queer) status, psychopathology status, trauma history, social connectedness, or social support) could suggest which individuals or subpopulations would most benefit from specific suicide prevention interventions. Studying moderators in linked data may be an efficient and cost-effective way of developing more personalized or community-informed prevention efforts.

Figure 1. Analytic framework for suicide prevention



ED = Emergency Department; KQ = Key Question; LGBTQ: Lesbian, Gay, Bisexual, Transgender, and Queer

Methods

We identified suicide prevention intervention studies and relevant data systems on suicide prevention (see Table 2) in three parallel phases. In the first phase, we completed a systematic review of published literature to identify suicide prevention studies and existing data systems. The results of this phase informed Key Questions 1, 2, and 3. In the second phase, we completed an environmental scan to identify suicide data systems not reported in published literature. This phase further informed Key Question 1. In the last phase, we performed a targeted search to identify data systems used in selected States, cities, or communities. This phase expanded the results for Key Question 1.

Table 2. Overall search methodology to address Key Questions 1, 2, and 3*

Phase†	Key Question	Search Criteria‡	Search Engines or Data Sources	Number of Raters/ Coders	Suicide Prevention Studies Identification	Data System Identification	Statistical Method Identification	Moderator Identification
1. Systematic Literature Review	KQ1	PICOTS§	• PubMed • Cochrane • Campbell • CINAHL • PsycINFO • ERIC	2	Yes	Yes	-	-
	KQ2			2	Yes	-	Yes	-
	KQ3			2	Yes	-	-	Yes
2. Environ-mental Scan (Web)	KQ1	PICOTS§	• Google • Yahoo • Bing • SPRC • AFSP • AAS	1-2	-	Yes	-	-
3. Targeted Search‖	KQ1	PICOTS§ + Location	Selected State, city, and local government personnel	1-2	-	Yes	-	-

* KQ4 is not included in this table because it reflects a synthesis of opportunities and challenges based on the results of KQ1-3.
‡ Inclusion and exclusion criteria are the same for all searches.
† All phases of the search method required that included studies and data systems included suicide prevention interventions.
§ See Table 1 for the full PICOTS description.
‖ Six States, two cities, and one local community were selected based on suicide rates, geographic location, and the presence of active SAMHSA (Substance Abuse and Mental Health Services Administration) or GLS (Garrett Lee Smith Memorial Suicide Prevention Program) support. Terms representing these States, cities, or local communities were added to the PICOTS terms.
AAS=American Association of Suicidology; AFSP=American Foundation for Suicide Prevention; KQ=Key Question; PICOTS=Population, Interventions, Comparators, Outcomes, Timing, Setting; SPRC=Suicide Prevention Resource Center

Suicide Prevention Studies: Systematic Review

We searched PubMed, The Cochrane Library, Campbell Collaboration Library of Systematic Reviews, Cumulative Index to Nursing and Allied Health Literature (CINAHL), PsycINFO and Education Resources Information Center (ERIC) from January 1, 1990 to December 21, 2015.

We developed a search strategy for PubMed based on medical subject headings (MeSH) and title and abstract terms from eligible articles we identified *a priori*. We used this search to develop strategies for the other search engines (see Appendix B).

We uploaded the articles into DistillerSR (Evidence Partners, Ottawa, Ontario, Canada), a Web-based service for systematic review and data management. We used DistillerSR to track the screening process and results.

The inclusion and exclusion criteria for the systematic review were derived from the PICOTS (see Table 1). Specific exclusion criteria for title and abstract screening and full-text screening were the following: not a study of humans only, does not include data on individuals between the ages of 0 and 25 years, does not include an intervention of interest, does not include a primary outcome of interest, takes place outside of the United States, meeting abstract only, and no original data. We did not limit study inclusion by study population size or study design. Studies published prior to 1990 were not included because, according to the NAASP, suicide became a central issue in the United States in the mid-1990s with the Surgeon General's Call to Action to Prevent Suicide, published in 1999.[8] The amount of abstractable data is significantly limited prior to 1990.

Two reviewers independently screened titles and abstracts first, and then full-text articles. Disagreements about article eligibility that could not be resolved by the two reviewers were resolved by the domain experts on the team. We abstracted data on study characteristics, participant characteristics, intervention characteristics, and suicide outcomes to Microsoft Excel tables. As applicable, we also abstracted the primary analytic method used by the study to link data systems, statistical tests used in the study, and analyses performed. We abstracted variables used in the analyses, as well as those controlled for as covariates. Additionally, we identified and abstracted data system information (e.g., location of database) and how the data were linked to other sources.

A trained research assistant abstracted the data and another team member checked it. In the case of a disagreement, yet another team member reviewed the abstracted data, and the issue was resolved by consensus. If consensus was not attainable for a specific case, it was discussed by the full review team and resolved by majority vote. The same process was used for all data abstraction that was a part of this project. Abstracted data will be uploaded to the Systematic Review Data Repository™ (SRDR), a Web-based data repository, at completion of the project.

Data Systems

We conducted three phases of searches for data systems (described below). For results from these phases, two independent reviewers determined whether the identified data systems (i) met the PICOTS elements and (ii) fulfilled the minimum requirements of a data system that can be useful for linkage to suicide prevention studies. We excluded data systems that did not meet all of these requirements:

(a) Data system is still in existence and underlying data are available and accessible in digital format (e.g., datasets can be downloaded from a current website with or without permission or are available in another format);
(b) Data system can be shared and acquired by others for research purposes (e.g., it has a public or transferable license that allows the data to be used for research purposes);
(c) Data system collects and contains at least one of the primary outcomes; and,
(d) Data system is not a duplicate of another data system already included in the project.

The process of data abstraction for the data systems was the same as for the systematic review. We abstracted data about the PICOTS (see Table 1), such as study and participant characteristics when they were present, as well as details about the data systems and statistical methods. The coding and classification schema for the data systems was adapted and modified from a framework previously developed to evaluate the quality of community-based data sources.[9] The coding schema can be found in Appendix C. The process was limited to the information that could be extracted from information found through online searches. Acquiring data dictionaries or downloading and analyzing the data sources within each of these data systems, if they were not available on the Internet, was considered to be out of the scope of this project.

Phase 1: Systematic Literature Search

We scanned all eligible suicide prevention studies identified in the search for data systems. We also checked articles excluded during the full-text screen that had been tagged as having a database or data systems. These databases were then re-reviewed for inclusion during Phase 2 of the methodology. We sought additional information about the data systems identified from the systematic review using the following methods: searching the Internet for additional information about the data systems; finding the data dictionaries associated with the data system, if available; downloading a sample data set from the data system, if available; reviewing the data sources used in the data system; and, searching for additional reports that may have described the data system in more detail.

Phase 2: Environmental Scan

To identify additional data systems on suicide prevention that may not be reported in the published literature, we conducted an environmental scan of grey literature on suicide prevention programs among youth. We searched the Web for pre-prints, preliminary progress and advanced reports, technical reports, statistical reports, memoranda, state-of-the-art reports, market research reports, theses, conference proceedings, technical specifications and standards, non-commercial translations, bibliographies, technical and commercial documentation, and official documents not published commercially (primarily government reports and documents).[10]

We did not limit the environmental scan to a specific type of document retrieved from the Web (i.e., the document could be an HTML webpage or a document in a downloadable format.) We used the PICOTS (Table 1) to determine whether a specific page/document was applicable. We required the presence of the population of interest (P), one of the primary outcomes (O), timing (T), and setting (S); however, Intervention and Comparison elements of PICOTS were not required.

The search terms and eligibility criteria used in the systematic review were also used for the environmental scan (see Appendix B). We used the advanced search functions of three search engines [Google, Yahoo, and Bing (Microsoft)] to execute the search. These search engines collectively represent 97 percent of the U.S. online search market.[11] Owing to the extensive list of results returned by these search engines, only the first 100 retrieved documents from each database were considered. This limitation was also based on the finding that the precision of search engine results often reduces considerably after the first few dozen retrievals.[12] To ensure a high recall or precision rate, the review team examined every 10 results ranked between the 100th to the 300th results of these search engines. If at least one-third of these results were determined to be relevant to this review, we expanded the environmental scan to include the first 300 results

from all three search engines. We excluded from the review duplicate results across the search engines and data systems that were already identified by the systematic review.

We also conducted an exploration of specific government, foundation, and professional association Web sites (national/Federal, State-level, and local/city/community-level): American Foundation for Suicide Prevention (AFSP), the American Association of Suicidology (AAS), and the Suicide Prevention Resource Center (SPRC) to identify data systems which could be linked to prevention programs.

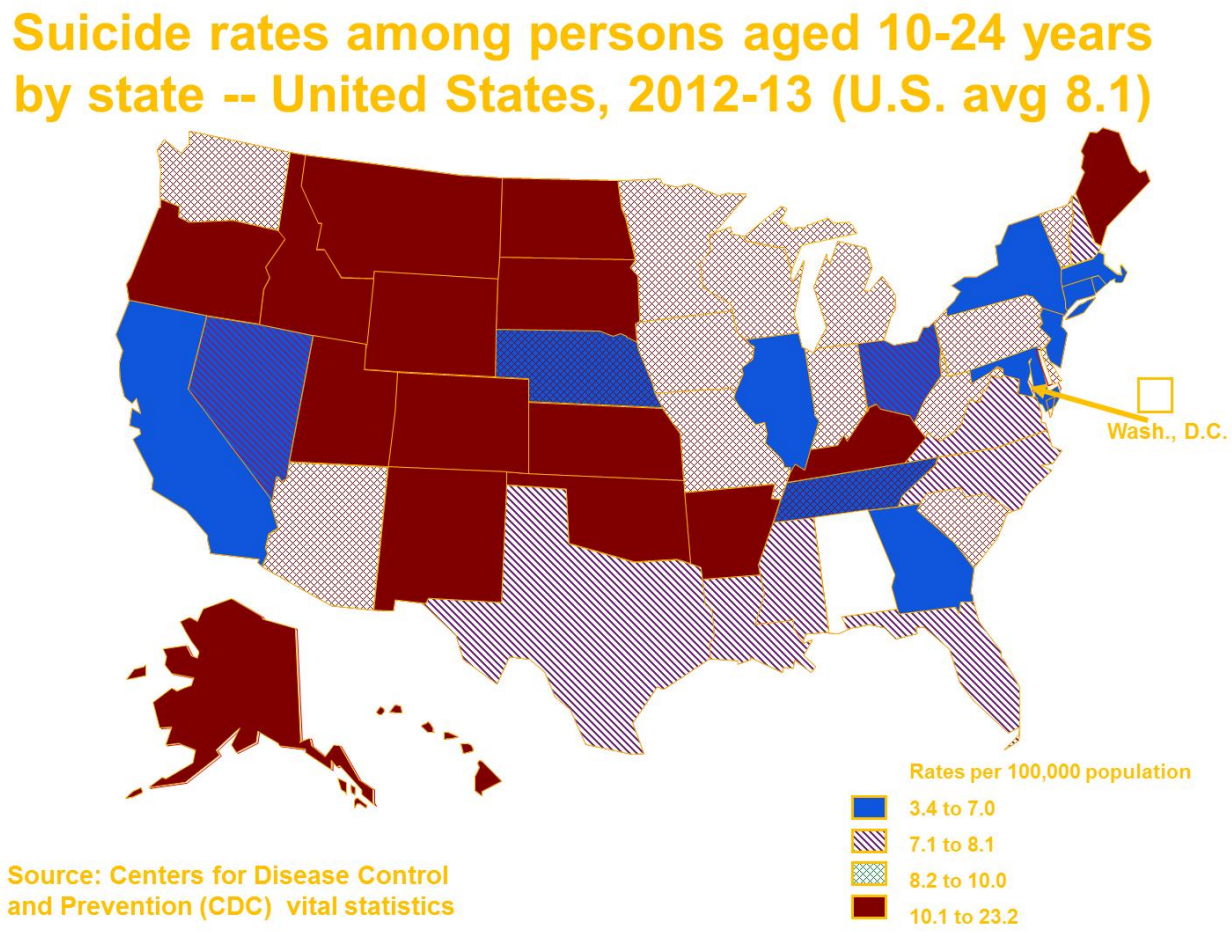
Phase 3: Targeted Search

We conducted a targeted search for data systems providing information on suicide prevention in six States (CA, DE, OR, IL, MD and WI), two cities (Baltimore, MD and Wilmington, DE), and one tribal community (The Menominee Reservation in Wisconsin). It was beyond the scope of this project to complete a more comprehensive review across all States or major cities. We sought data systems that provided information about our primary outcomes (i.e., suicide ideation, suicide attempt, and suicide) (see Figure 2) and were maintained by a State, city, or community-level entity.

The six States were selected based on the following criteria: (1) the State has an active Substance Abuse and Mental Health Services Administration (SAMHSA) Garrett Lee Smith Memorial Suicide Prevention Program State youth suicide prevention grant that should facilitate the acquisition of information about suicide data sources (as SAMHSA has provided resources to facilitate and encourage State grantees to use data systems in their local evaluation procedures so data systems including suicide ideation, suicide attempt and suicide should be familiar to the State's contacts); (2) geographic proximity; matched pairs of States with a suicide rate lower and higher than the national crude average rate of suicide in 2010-2014 (8.4 per 100,000 population among those 10-25 years of age[1]); and, to some extent, (3) familiarity of the research team experts with the data systems of those States. All of the six States match the first and second criteria (see Figure 2). In regards to the second criterion, in the Pacific region, Oregon has a higher suicide rate (10.9/100k) while California has a lower suicide rate (5.9/100k); in the Midwest region, Wisconsin has a higher suicide rate (10.4/100k) while Illinois has a lower suicide rate (6.9/100k); and, finally, in the Mid-Atlantic region, Delaware has a higher suicide rate (8.6/100k) while Maryland has a lower suicide rate (6.7/100k).

We contacted (via email and phone) individuals in each selected State, city, and community to request information on State- and community-level data sources/systems that include suicide ideation, suicide attempt, and suicide among those under 26 years of age. The individuals were the designated contacts provided for State suicide prevention efforts, such as the Garrett Lee Smith Suicide Prevention program, and members of State, city, and community suicide prevention commissions or coalitions.

Figure 2. Suicide rates among persons aged 10–24 years by State -- United States, 2012-13



Note: All races, ethnicities, sexes, and ages; Annualized crude rate for U.S is 11.59; Map generated by CDC Web-based Injury Statistics Query and Reporting System (WISQARS) .Source: CDC vital statistics—WISQARS.

Results

Suicide Prevention Studies

The literature search identified 4,198 unique citations, of which 59 were eligible (Appendix D). Details on study characteristics are available in Appendix E. The 59 articles reported 47 studies. Study population size was highly variable: randomized controlled trials (RCTs) ranged in size from 32 to 2,100 people. Twenty-nine of the studies (62%) had 500 or fewer study participants. Very few (34.0%) of the prevention intervention studies we identified reported on outcomes longer than one year post-intervention. The percentage of female participants ranged from 15.4 percent[13] to 100 percent.[14] Race was reported in most (95%) of the studies. Reporting on race was often limited to only percentages of white participants and black participants, ranging from 8.1 percent white to 85 percent white (where reported). Reporting on education level was rare and, when included, referenced grade levels of participants during the study. Ten studies (21.3%) focused on special populations: military personnel,[15-18] incarcerated individuals,[13,14,19] victims of sexual trauma,[20] people with major depressive disorder,[21] and high-risk youth[22] (Table 3; Appendix E). The 47 studies used a variety of interventions and approaches to prevention; many studies applied more than one approach: behavioral and skill building (19), medication or pharmaceutical (7), psychotherapy (4), education or education/skill building (12), policy (5), screening (5), other (9) (Table 3; Appendix E).

Data Systems

Our literature search, environmental scan, and targeted geographical searches identified 153 unique data systems (Figure 3; Appendix F). Our literature search identified seven unique data systems from the eligible articles of suicide prevention interventions and an additional 43 data systems from the articles screened at the full-text level.

The environmental scan identified 80 unique data systems. Overall, 71 percent of the State and tribal community entities contacted replied with 23 unique data systems identified.

Table 3. Summary of intervention characteristics

Program or Study Name (If Applicable) Author, Year	Intervention Type/Purpose	Setting
Adolescent Suicide Risk Screening		
King, 2012[23]	Screening	Emergency department
Attachment-Based Family Therapy		
Diamond, 2010[24]	Psychotherapy, behavioral/skill building	Emergency department, primary care
Diamond, 2012[20]		
CAMS‡		
Jobes, 2012 [15]	Psychotherapy	Primary care, emergency department, military base
Jobes, 2012[15]		
C-CARE/CAST		
Eggert, 2002[25]	Behavioral/skill building	School
Randell, 2001[26]		School
Thompson, 2001[22]		School and home
Hooven, 2010[27]	Behavioral/Sskill building, education	
Communities That Care		
Oesterle, 2015[28]	Policy/legislation	Community-based
GLS		
Garraza, 2015[19]	Education/training/screening/infrastructure/crisis hotline/community partnerships (Garrett Lee Smith Memorial Suicide Prevention Program)	School/juvenile justice/community-based/primary care
Walrath, 2015[29]	Screening, behavioral, policy changes, outreach, referral to mental health professionals, means restriction	NR*
Good Behavior Game		
Wilcox, 2008[30]	Behavioral/skill building, educational	School
HOPE Family Program/ HOPE Health Education Program		
Lynn, 2014[31]	Behavioral/skill building (HOPE Family Program)	Family housing shelters
National Treatment Improvement Evaluation Study		
Ilgen, 2007[32]	Substance abuse treatment	Primary care (outpatient and residential)
PGC		
Thompson, 2000[33]	Behavioral/skill building	School
Project Chrysalis		
Brown, 2001 [34]	Behavioral/skill building, education	School
Promoting Care		
Hooven, 2012[35]	Behavioral/skill building, education	School and home
SAFETY Program		
Asarnow, 2015[36]	Educational/skill building (SAFETY Cognitive-Behavioral Family Treatment Program)	Emergency department

Table 3. Summary of intervention characteristics (continued)

Program or Study Name (if applicable) Author, Year	Intervention Type/Purpose	Setting
Seattle Social Development Program		
Hawkins, 2005[37]	Educational/skill building (Seattle Social Development Project intervention)	School
SOS		
Aseltine, 2004[38]	Educational	School
Aseltine, 2007[39]		
Student Assistance Program		
Biddle, 2014[40]	Multiple strategies	School
Surviving the Teens Suicide Prevention and Depression Program		
King, 2011[41]	Behavioral/skill building, Education	School
Systemic Crisis Intervention Program		
Gutstein, 1990[42]	Behavioral/skill building	Primary care (outpatient)
TADS		
March, 2007[43]	Medication or pharmaceutical/Behavioral/Skill building (fluoxetine hydrochloride therapy and CBT)	Primary care/community-based
TADS, 2009[44]		
Vitiello, 2009[45]		
TADS- SOFTAD		
Curry, 2011[46]	Medication or pharmaceutical	Primary care/community-based
TASA		
Brent, 2009[47]	Medication or pharmaceutical/behavioral/skill building (psychotherapy and medication management)	Primary care
Vitiello, 2009[48]		
The Coping Cat Program		
Wolk, 2015 [49]	Behavioral/skill building (CBT)	Primary care
TORDIA		
Asarnow, 2011[50]	Medication or pharmaceutical (medication switch and CBT)	Primary care
Emslie, 2010[51]		
Shamseddeen, 2011[52]		
Woldu, 2011[53]		
US Air Force Suicide Prevention		
Knox, 2003[18]	Educational	Military base
YST-1		
King, 2006[54]	Educational/skill building (psychoeducation targeted for support persons)	Primary care (inpatient)

Table 3. Summary of intervention characteristics (continued)

Program or Study Name (if applicable) Author, Year	Intervention Type/Purpose	Setting
YST-2		
King, 2009[55]	Educational/skill building (psychoeducation targeted for support persons)	Primary care (inpatient)
No named prevention program or trial		
Anestis, 2015[56]	Policy/Legislation	NR* (50 U.S. States)
Asarnow, 2011[57]	Behavioral/skill building (Family Intervention for Suicide Prevention)	Emergency department
Brown, 2005[58]	Cognitive therapy	Emergency department
Collins, 2008 [59]	Medication or pharmaceutical	Emergency department/primary care
Cooper, 2006 [60]	Safety-net of mental health services	NR* (acute care hospitals)
Farmer, 1996[13]	Policy/legislation	Emergency department/prison
Fleegler, 2013[61]	Policy/legislation	NR* (50 U.S. States)
Gardner, 2010[62]	Screening	Primary care
Huey, 2004[63]	Behavioral/skill building (multisystemic therapy)	Emergency department
Kaminer, 2006[64]	Aftercare	NR* (outpatient)
Kennard, 2014[21]	Medication or pharmaceutical and psychotherapy (medication management and CBT)	Primary care (outpatient)
Kerr, 2014[14]	Behavioral/skill building (Multidimensional Treatment Foster Care)	Juvenile justice
Olfson, 2003[65]	Medication and pharmaceutical	NR* (county-level suicide rates)
Rathus, 2002[66]	Psychotherapy and behavioral/skill building (Dialectical Behavior Therapy)	Primary care (outpatient)
Rotheram-Borus, 2000[67]	Specialized emergency department (ED) care intervention	Emergency department
Rudd, 1996 [68]	Behavioral/Skill building	Primary care (outpatient)
Segal, 1995[69]	None provided (recommendation for continued intensive impatient treatment)	Emergency department
Spirito, 1992[70]	Followup interviews	Emergency department/home
Warner, 2011[16]	Screening	Primary care/military base
Wharff, 2012 [71]	Behavioral/skill building (family-based crisis intervention)	Emergency department
Wingate, 2005[17]	Behavioral/skill building	Primary care (inpatient and outpatient)/emergency department/military

*Study was not specific in regard to program setting, incorporating county, State, or regional data.

CAMS=The Collaborative Assessment and Management of Suicidality ; CARE=Care, Assess, Respond, Empower; CAST=Coping and Support Training; CATCH-IT=Competent Adulthood Transition With Cognitive Behavioral And Interpersonal Training; C-CARE=Counselors: Care, Assess, Respond, Empower; CBT=cognitive behavioral therapy; ED=emergency department; GLS=The Garrett Lee Smith Memorial Suicide Prevention Program; NASY=National Annenberg Survey of Youth; NR=not reported; PGC=Personal Growth Class; RCT=randomized controlled trial; SOFTADS=Survey of Outcomes Following Treatment for Adolescent Depression; SOS=Signs Of Suicide; TADS=Treatment for Adolescents with Depression Study; TASA=Treatment of Adolescent Suicide Attempters; TORDIA=Treatment of Resistant Depression in Adolescents; YST-1=Youth-Nominated Support Team for Suicidal Adolescents (Version 1); YST-2=Youth-Nominated Support Team for Suicidal Adolescents (Version 2)

Figure 3. Results of the search for data systems

Phase	Potential Data Systems Reviewed	Data Systems Excluded	Unique Data Systems Identified
Systematic Review (included articles)	71	64	7
Systematic Review (excluded articles)	126	83	43
Environmental Scan (Google, Yahoo, Bing)	477	425	52
Environmental Scan (other/directed)	254	226	28
Targeted Search	133	110	23
			Total Data Systems Identified 153

Note: Reasons for exclusion: duplicate data system, did not meet one or more of the PICOTS (populations, interventions, comparisons, outcomes, timing, setting) elements (i.e., did not report outcome information)

Key Question 1. What national, State, and community data systems can be linked to existing data from suicide prevention interventions in order to add possible value for stakeholders, and what methods are available to link the data systems?

Of the 153 data systems we identified, we found that 89.5 percent can be readily acquired for free or for a fee and 74.5 percent can be downloaded from the Internet in an aggregated and anonymized format. Of the data systems available on Web sites, only 1.3 percent permitted an automated registration process to obtain the data while 79.1 percent required confirmation by a data manager. Data dictionaries were accessible for 47.7 percent of the data systems.

Of the data systems identified, 19.0 percent are used primarily for research, 11.1 percent for clinical care or operations, 29.4 percent for administrative services (such as for billing), and 52.3 percent for surveillance (some systems have multiple types of use). The geographic coverage of the data systems is as follows: 36.6 percent provide national-level data, 12.4 percent regional-level, 63.4 percent State-level, and 41.2 percent smaller than State-level (i.e., communities by zip code, county, census block, tribal boundaries, territory, or island) (some data systems provide coverage for more than one geographical unit) (Table 4). A few data systems were identified that are specifically designed with a focus on subgroups of interest, such as tribal communities (0.7%), LGBTQ populations (2%), active duty military service members (6.5%), incarcerated populations (3.3%), and primary school, secondary school, and university students (18.3%).

In regard to data granularity, patient-level data exists allowing for potential individual-level linkage for 96.7 percent of data systems identified; 2.6 percent of data systems only included aggregated data, allowing for ecological linkage to suicide prevention programs by demographic characteristics (59.5%), geographic region (56.2%), clinical specifications (42.5%), and entity type, such as an insurance company, health care provider, educational institution or employer (17.6%). Data sampling was used by 15.7 percent of the data systems identified.

Of the data systems identified, 29.4 percent included data on suicide ideation, 54.2 percent included data on suicide attempts, and 70.6 percent included data on suicide completion. The coverage by the identified data systems for intermediate and secondary outcomes of interest was as follows: 28.1 percent included psychiatric and substance abuse disorders, 38.6 percent included service utilization for psychiatric and substance abuse disorders, 11.8 percent included graduation rates, 5.9 percent included incarceration and arrests, 44.4 percent included violence perpetration and victimization, 10.5 percent included social support and social connectedness, and 39.2 percent included access to lethal means. The types of data systems identified were as follows: 18.3 percent were designed specifically to capture information about suicide, 41.8 percent death records, 43.8 percent health care provider records (EMRs), 47.7 percent population-based surveys, and 5.2 percent health insurance claims data. Of those data systems identified, 94.1 percent are ongoing with prospective data collection, whereas only 5.2 percent have partially stopped data collection. The average year of the start of data collection is 1994.

We classified the 153 data systems into three tiers to identify those that can be linked to existing data from suicide prevention interventions as “fairly accessible,” “potentially accessible,” and “more information needed.” These classifications were based on whether 'individual level data' or 'aggregated data' is offered through one of the following models: (1) the data are freely available on the Web site to download (e.g., public use file); (2) data access

Table 4. Summary of data systems identified for Key Question 1

	Measure	Yes	No	N/A
Geographic Coverage	United States – national	36.6%	63.4%	0.0%
	United States – regional (e.g., east coast)	12.4%	87.6%	0.0%
	United States – State level (e.g., Maryland)	63.4%	36.6%	0.0%
	United States – smaller than State level	41.2%	58.8%	0.0%
	County	32.0%	67.3%	0.7%
	Zip code	15.0%	84.3%	0.7%
	Census block	2.0%	98.0%	0.0%
	Tribal	1.3%	98.7%	0.0%
	Territory	0.7%	99.3%	0.0%
	Islands	0.7%	99.3%	0.0%
	Other	0.0%	0.0%	0.0%
Level of Information Available for This Data System	Data exist and can be acquired (free or for a fee)	89.5%	0.0%	10.5%
	Data are publicly available and can be downloaded (e.g., PUF)	74.5%	21.6%	3.9%
	Data can be acquired but requires an automated registration	1.3%	97.4%	1.3%
	Data can be acquired if confirmed by a person (e.g., needs email communication)	79.1%	0.0%	20.9%
	Data dictionary or code book is accessible	47.7%	52.3%	0.0%
Data System's Primary Use	Research	19.0%	81.0%	0.0%
	Clinical care/operations	11.1%	88.9%	0.0%
	Administrative services (e.g., census)	29.4%	70.6%	0.0%
	Public health (e.g., surveillance)	52.3%	47.7%	0.0%
Suicide Outcome(s) Included	Suicide ideation	29.4%	64.1%	6.5%
	Suicide attempt	54.2%	38.6%	7.2%
	Suicide completion	70.6%	25.5%	3.9%

N/A=not enough information based on what was found to make a yes/no decision; PUF = publicly uploadable file

requires a registration process (often with no additional checks); (3) request is reviewed manually by a person/committee before access to the data is granted; and, (4) whether a data dictionary is available. Based on this classification, 123 data systems were identified as "fairly accessible" (66 of these have a data dictionary available), 20 data systems as "potentially accessible," and "more information is needed" for 12 data systems (Appendix F).

Key Question 2. Which statistical methods are reliable and valid for analyzing linked national, State, and community data systems and suicide prevention data to avoid misleading conclusions?

a. What are potential sources of bias for these statistical methods?

b. What are the advantages and disadvantages of these different methods?

Six studies reviewed linked to outcome data from external national, State, or community data systems (see Table 5). Three of these studies linked data at the individual level, using an individual linking variable such as social security number. Three of these studies linked data at an ecological level, using a variable such as zip code or county.

The studies conducted data analyses with individually-linked data systems using the following methods: logistic regression, Cox proportional hazards models, and simple descriptive statistics. These methods are generally considered appropriate for use with this type of data. The

studies that conducted data analyses with ecologically-linked data used simple regression models (both logistic and multivariate) and t-tests. Regression methods can be appropriate for use with ecological data if they account for clustering with mixed effects models. The studies that used regression models did account for clustering within their models.

Table 5. Summary of analytic methods, data linkage, and data systems used in the prevention studies that linked to external data systems (n=6)

Author, Year	Analytic Method	Linking Level	Brief Results	Data System
Walrath, 2015[29]	Sequential propensity scores; simple regression model	County	Counties that implemented training had significantly lower youth (10 to 24 years of age) suicide rates as compared with counties that did not obtain training.	SAMHSA-Funded Garrett Lee Smith Dataset; U.S. Census Bureau; Bureau of Labor Statistics
Gardner, 2010[62]	Logistic regression	Individual	14% of youth reported a suicidal thought in the previous month.	Nationwide children's hospital EHRs
Collins, 2008[59]	Cox proportional hazards models	Individual	In comparison of mood stabilizers, divalproex was the most common mood stabilizer and demonstrated an increased risk for suicide attempts compared with lithium.	Oregon Medicaid data, Oregon vital statistics
Olfson, 2003[65]	Adjusted linear regression models, t-tests	Region	Regional increase in the adolescent use of antidepressants was associated with a decrease in adolescent suicide attempts.	Pharmacy benefit management organization, CDC's national suicide mortality rates, U.S. Census Bureau, Area resource file
Farmer, 1996[13]	Descriptive statistics	Individual	After a suicide prevention program was implemented, only one suicide was reported; 13 cases of suicide attempt required emergency medical attention.	Galveston County Jail records
Cooper, 2006[60]	Logistic regression	County	Living in a county that offered a minimum safety-net of mental health services significantly reduced suicide risk.	Colorado Trauma Registry, U.S. Census Bureau

CDC=Center for Disease Control and Prevention; SAMSHA =Substance Abuse and Mental Health Services Administration; EHR=electronic health record

Key Question 3. Which statistical methods are reliable and valid for understanding possible moderators in suicide prevention programs to improve targeting interventions to populations?

None of the six studies that linked to external data systems (Table 5) conducted statistical analyses to understand moderators of intervention impact. Twelve studies explored the effect of moderators in suicide prevention efforts; all moderation relationships were stated as a-priori hypotheses. Ten of these 12 studies used a form of regression, either linear or logistic, depending on the outcome of interest, and interaction terms to explore moderation (Table 6). This is an effective analytic technique to explore the effects of moderators on suicide prevention interventions. Researchers typically look for a significant interaction term followed by probes to determine whether the effect of the intervention significantly differs for chosen conditional values of the moderator.[72] For example, Rotheram-Borus, et al.[67] were interested in the interaction between the intervention program of interest and baseline psychiatric symptoms. Psychiatric symptoms were coded into a three-category variable: low, moderate, and high. An interaction term was created between symptom severity category and intervention status and included in the linear mixed regression model. This methodology is appropriate for the exploration of moderators in prevention or intervention effectiveness.

Only 12 studies explored moderation effects; much of the research included is primarily focused on the main effects of interventions, and treatment effect heterogeneity is not assessed.

Table 6. Summary of moderator variables and analytic methods in studies that assessed effects of moderators (n=11)

Author, Year	Moderator Variables	Brief Results	Analytic Methods
Diamond, 2012[20]	Sexual trauma	History of sexual trauma did not moderate treatment outcome for attachment-based family therapy.	Hierarchical generalized linear model
King, 2012[23]	Receipt of public assistance, gender	Adolescents whose families did not receive public assistance had higher levels of suicide ideation if assigned to in-person followup.	ANOVAs and logistic regressions
King, 2009[55]	History of multiple suicide attempts, gender	Youth-nominated support team intervention effects were moderated by a history of multiple suicide attempts, demonstrating more rapid decrease in ideation for those with multiple attempts.	Mixed effects models
Kaminer, 2006[64]	Internalizing disorders, externalizing disorders, substance use disorders, suicide ideation	Results of the intervention did not significantly differ by gender, DISC internalizing disorders, DISC substance use disorders, and baseline SIQ scores.	General linear models
King, 2006[54]	Gender	Adolescent girls who received the Youth-nominated support team intervention demonstrated greater decreases in self-reported suicide ideation as compared with girls who did not get the intervention.	Chi-square, Fisher's exact test
Wingate, 2005[17]	Problem solving appraisal	Participants with poor problem solving appraisal at baseline responded better than participants with good problem solving appraisal.	Hierarchical multiple regression
Huey, 2004[63]	Gender, age, ethnicity	Multisystemic therapy was more effective at reducing suicide attempts as compared with emergency hospitalization, this relationship varied by ethnicity, gender, and age.	Mixed effects growth models
Thompson, 2000[33]	Gender	Personal control mediated the relationship between support resources and suicide risk behavior.	Hierarchical linear growth modeling
Rotheram-Borus, 2000[67]	Psychiatric symptoms	The intervention had the greatest impact on maternal emotional distress and family cohesion among suicide attempters who were highly symptomatic.	Linear mixed effects regression model
Curry, 2011[46]	Family income, depressive symptoms, cognitive distortions	Family income, depressive symptoms, and cognitive distortions all moderated the acute outcome of the TADS study.	Logistic regression
Shamseddeen, 2011[52]	School difficulties	Lowest rates of response occurred among adolescents having school difficulties and ending treatment during the active school year.	Multivariate regression
Hawkins, 2005[37]	Sex, poverty, ethnicity	Intervention effects significantly differ by gender but not by childhood poverty. White participants in the full intervention group showed more constructive engagement compared with those in the control group.	MANOVA

ANOVA=analysis of variance; DISC=The Diagnostoc Interview Scale for Children; MANOVA=Multivariate Analysis of Variance; SIQ: Suicidal Ideation Questionnaire

Discussion

Key Findings

- A minority of community, State, and national datasets are currently usable for linkage: 121 of the 153 data systems we identified are fairly accessible, but only 66 of these have a data dictionary available.
- Most linkable datasets have outcomes related to suicide; fewer datasets include suicide ideation and suicide attempts.
- Most of the potentially linkable datasets offer the possibility of linkage at the individual level, but ethical or legal barriers may prohibit linkage at this level.
- Few datasets allow for the detailed study of particular high-risk populations, though variables indicating membership in one of those populations are widely available.
- Lack of readily available codebooks and data dictionaries for datasets limits ready access and the conclusions that can be drawn about the potential utility of linkage.
- Lack of adherence to a standard set of data elements in suicide data systems and prevention studies is a barrier that reduces the potential utility of linkage.
- Of the six studies that linked prevention intervention data with external data systems, three used ecological-level linking and three used individual-level linking. The methods used for data analysis were appropriate.
- Of the six studies that linked prevention intervention data with external data systems, all focused on intervention main effects. None assessed for treatment effect heterogeneity or the impact of moderators. Only 12 studies explored moderation effects.

Data systems are highly variable in terms of geographic reach and the inclusion of data about subpopulations. Of the 153 data systems identified, 36.6 percent are national and 41.2 percent have geographic coverage of areas smaller than a State. All 50 U.S. States are represented by at least one data system, usually the State's vital statistics data. Some States have multiple data systems for possible linkage to prevention programs. For the majority of these sources (89.5%), the data are potentially available for free or for a fee; however, of those, a data dictionary or codebook is readily accessible online for only 47.7 percent. Coverage of special populations at higher risk for suicide attempt and suicide is limited: only one of the systems identified is focused on Native American populations and only 2 percent are specifically focused on LGBTQ populations. Although few data systems allow for the comprehensive study of subpopulations at increased risk for suicide, variables indicating membership in one of those populations are available in 37.9 percent of the data systems.

Some data systems may be more useful to linkage efforts than others, depending on what variables the systems track. Most linkable data systems include suicide as an outcome; however, very large prevention studies are needed for sufficient statistical power to detect a difference in suicide death between intervention groups or over time. Many of the prevention studies identified had small sample sizes. Data systems including suicide ideation and attempts are less common, although the use of systems that include them may be more useful for prevention studies, as these variables are more prevalent than suicide and also have actionable outcomes (i.e. intervention could be initiated if someone at high risk for suicide were identified.) More than 94 percent of the data systems we identified appear to be updated on an ongoing basis, increasing the likelihood that linkage would be useful; however, information on data lags or completeness within the sources we located is not available.

Linking to external data systems could allow for longer-term assessment of suicide prevention interventions yet data system linkage is under-utilized in suicide prevention studies. While we identified 153 unique data systems, we found only six studies that included assessment of outcomes by linking their prevention data to external data systems at the individual or ecological level. The majority of the prevention studies identified have the capability to link to medical record data or mortality data, with patient-level consent. Because hospitals routinely track people who were treated for suicidal behaviors, the expansion of the electronic medical record could make accessing those data much easier. One study we identified[29] showed that suicide prevention programs within geographic boundaries (e.g., counties) can be linked in aggregate or at an ecological level to suicide mortality data to study suicide prevention program impact before and after implementation. In this study, the authors compared data in counties with SAMHSA GLS youth suicide prevention programs to counties without SAMHSA GLS youth suicide prevention programs by linking to suicide mortality data at the county level. Their goal was to examine whether a reduction in youth suicide mortality that could be reasonably attributed to a GLS program occurred between 2007 and 2010. Several existing prevention programs could be enhanced, at low cost, by this type of linkage to data systems.

Of the six studies that linked with external data systems, three used ecological linking methodology and three used individual linking methodology. The analysis methods appropriately handled the different types of data. The bulk of the studies focused on the main effects of interventions and did not assess treatment effect heterogeneity, as only 11 of the 47 studies explored moderation effects.

Findings in Relationship to What Is Already Known

Recently, a resource was published by the Data and Surveillance Task Force (DSTF) of the NAASP, which had been charged with making recommendations for improving national data systems on suicidal behaviors.[73] The DSTF report listed suicide data systems, identifying 28 such systems (26 of which were eligible for inclusion in our project). The DSTF also made several recommendations to improve existing data systems:

1. Coding manuals and national surveys should adopt the use of standard language and definitions. For example, public and private organizations should adopt and promote the use of standard definitions such as those described in the CDC's Self-Directed Violence Surveillance Uniform Definitions and Recommended Data Elements;[74]
2. Suicide data systems should add missing key variables or data elements (e.g., socio-demographics, mechanism of injury) to existing nonfatal data systems to enhance their usefulness;
3. Medical records should include external cause coding (a data element needed to identify suicide attempts) as a requirement for reimbursement by insurance carriers;
4. Systems should capture "real-time" information on hospital emergency visits to improve the monitoring of trends in suicidal behavior;
5. All States should be encouraged to include nonfatal suicidal behavior (suicide attempts) by youth 12 to 17 years of age as a health condition to be reported to the State health department.

Our findings confirm the importance of these five points in addressing the need to make suicide data systems more useful. Our work builds on this, adding information on linkage of suicide data systems to suicide prevention intervention data to study the extended value of the

suicide prevention efforts. To date, this has been a missed opportunity in the field of suicide prevention.

Limitations of the Systematic Review Process

Our ability to determine which prevention studies might be linked to data systems was limited by the lack of available codebooks or data dictionaries outlining specifics about the available data sets. Some of the data dictionaries are available online (48%); however, when we contacted named contact people for each of the other data systems to request information about a data dictionary or codebook, we received no responses.

We were not able to assess data quality for the data systems identified. Only about half of the identified data systems are suicide-specific or had as their primary purpose the collection of data about suicide. The rest of the systems we identified were developed for other purposes (for example, hospital discharge data that happens to include suicide as an admitting or discharge diagnosis). We did not include some data systems, including Behavioral Risk Factors Surveillance System (BRFSS) and crime reports, because they do not have primary suicide outcomes; however, these might be used by other researchers to assess impact on behaviors that are highly correlated with suicidal behavior, including drug overdoses.

Limitations of the Data Systems

Although linkage is possible, serious inadequacies exist in the quality of available suicide mortality and morbidity data: (1) the definitions of suicidal behavior vary greatly; (2) suicide is a rare outcome, so it is challenging to detect an intervention impact on suicide mortality without large studies (up to a million person years); (3) misclassification and under-reporting of suicide and suicide attempt as outcomes due to stigma, lack of information to confirm suicide intent was present, and other issues; (4) there is no single, comprehensive, national system to document the scope of non-fatal suicide attempts. There is regional variation in how suicide is investigated and coded and how people making a determination of suicide are trained. Rockett et al.[75] note that variation in coding in the United States appears to be partially an artifact of geographic region and partially a degree of toxicological assessment in the case ascertainment process. Variation in classification could be driven by sociocultural or political factors (i.e., stigma), economic factors, or forensic factors (i.e., lack of training of providers to elicit the information needed). However, as pointed out by the CDC, the quality of the data on nonfatal suicidal behavior is even more problematic than that of suicides.[74]

According to the DSTF of the NAASP,[76] the data systems currently used to estimate trends in suicidal behavior were not designed solely to address this subject. In these data systems, questions specific to suicidal behavior are often limited and the data systems may have lesser or variable quality in terms of ascertaining suicide morbidity and mortality as outcomes.

The CDC document *Self-directed Violence Surveillance: Uniform Definitions and Recommended Data Elements* addresses definitional inconsistencies as well as common data elements to promote and improve consistency of surveillance.[74] Although the lack of readily available codebooks and data dictionaries limits our ability to say which databases are useful, only the National Violent Death Reporting System (NVDRS) and individual State versions of it adhere to the CDC common data dictionary for suicide databases.[74] The lack of adherence to a standard set of data elements in suicide registries and studies is a barrier to linkage and reduces the potential utility of linkage.

Hospital and International Classification of Diseases (ICD) codes for self-harm are not necessarily suicide attempts; this is an important limitation. Diagnoses may be underreported during hospitalizations or physician visits. The same underlying condition may also be coded in different ways, depending on the clinical circumstances. Definitions of suicide-related constructs should have validity and reliability, but not all behaviors in the CDC Self-Directed Violence Surveillance have demonstrated reliability, validity, and utility. Suicidal behaviors recorded in hospital visits and suicide deaths reflected in mortality data typically reflect only the 'tip of the iceberg' of suicidal events.

Future Research Needs and Opportunities

Potential Benefit of Data Linkage

There are challenges in the United States related to financing the infrastructure required to sustain large-scale, coordinated suicide prevention efforts. Suicide prevention programs have limited ability to study long-term outcomes under the current funding structure. Our results show that longer-term results could be obtained by linkage of prevention efforts to existing data systems.

Linkage to accessible, current surveillance data could help to address the lack of studies testing the impact of early intervention on risk for suicide attempt and suicide.[76] Primary prevention approaches delivered in early development require extended followup periods to track populations through the period of risk onset for suicidal thoughts and behaviors. Randomized trials of prevention programs conducted in early childhood have reported reduced occurrence and severity of mental, emotional, and behavioral problems that increase risk for suicidal behavior later in life (e.g., aggression, depression, substance use, and deviant peer associations);[77,78,79] however, with the exception of Wilcox, et al., (2008)[30] the impact of these programs on reducing suicidal behaviors is unknown at present because evaluators of these interventions have rarely followed their cohorts into the peak age of risk for suicide attempt and suicide and often did not include suicidal behavior in their outcome measures. Also, these interventions were often directed at early development, many years before suicidal thoughts and behaviors typically occur. The Wilcox, et al. (2008)[30] study allowed for decades of longitudinal followup which may no longer be possible in the current research funding climate.

Aside from individual studies of interventions, there are several ongoing national initiatives in the United States targeting key risk factors for suicide, such as the National Child Traumatic Stress Network and Project LAUNCH (Linking Actions for Unmet Needs in Children's Health). These initiatives, and others, represent large investments by the Federal Government with broad national reach and the potential to impact suicide morbidity and mortality, which could be studied by data linkage. Linkage of these prevention data to systems, such as State HIE and the restricted-access NVDRS, would provide the ability to access individual-level quantitative data, as well as incident narrative reports on all suicide decedents. Currently, the NVDRS is available in only 32 States, but it could be expanded to all States. These data are potentially available for linking with other external data systems, if coordinated with State public health departments.

Barriers to Data Linkage

There are several barriers or limitations suicide prevention scientists could face regarding the linkage of prevention data to data systems: the adequate ascertainment of those affected by suicide ideation and attempts; costs associated with access to the National Death Index (NDI) and other data systems; sizeable interoperability challenges on a national level, even for routine sharing of clinical data; the lack of adequate access to data dictionaries; and, the possibility that one data system may not have all the outcomes of interest to preventive studies and the consequent need to link to multiple data systems for a more complete picture of outcomes.

Suicide prevention efforts could be sustained by communities after grant or contract funding for suicide prevention programs end; however, there are few resources to sustain the assessment of study outcomes. With minimal resources, existing data systems could be accessed by service systems or public health agencies to assess the impact of suicide prevention activities. Ideally, this would be a bi-directional process whereby those agencies could also use data systems to proactively identify individuals, communities, or subgroups at risk for suicide to whom they could direct outreach and interventions.

There was a lack of studies identified in the literature review addressing the reduction of access to lethal means as a suicide prevention strategy, although many other countries have reduced their suicide rates this way.[80] Means restriction approaches include firearm safety, construction of barriers at jumping sites, detoxification of domestic gas, improvements in the use of catalytic converters in motor vehicles, restrictions on pesticides, reduction of lethality or toxicity of prescriptions, use of lower-toxicity antidepressants, change in packaging of medications to blister packs, and restriction of sales of lethal hypnotics (i.e. barbiturates). Means restriction is the universal approach with the strongest and most consistent evidence of preventing suicide.[56, 61, 81] This approach typically involves linkage to mortality data to study the impact of changes in legislation at the State level.

Because many of the prevention studies identified in the review had small sample sizes, and large sample sizes are needed to find an intervention impact on suicide attempt or suicide, intervention harmonization approaches could be beneficial. Intervention harmonization could help to identify who could benefit from different youth suicide prevention options across subpopulations and provide for personalized and contextualized interventions. Finally, the linkage of suicide morbidity and mortality data to the Collaborative Data Synthesis for Adolescent Depression Trials (R01MH040859), which has combined de-identified data from over 30 prevention and depression treatment trials, could provide great value for a very small investment. Many of the academic medical centers which were funded to recruit for this trial have EMR access. Also, NDI searches could be conducted on each member of the trials, if the proper permissions were obtained.

Data linkage approaches need to protect the privacy and security of individual information on suicidal behaviors and suicide-related risk factors. Because suicidal behaviors are relatively rare events, if a data system includes certain geographic identifiers such as county or school, it might be possible to identify a specific individual. Those carrying out linkage could use processes which ensure that individuals cannot be identified and that identifying data (e.g., name, date of birth, address) is not transferred between data sets. Data linkage procedures could be approved by an International Review Board and subject to data use policies and agreements. The legal feasibility of linkage depends on the applicability to the specific purpose of the data linkage of Federal and State legal protections for the confidentiality of health information and participation

in human research, and also on any specific permissions obtained from individual patients for the use of their health information. Detailed guidelines on the technical and legal aspects of data linkage could be developed to facilitate work in this area. Data sharing agreements are needed.

There is a national discussion about integrating data from health care delivery systems and health insurance systems to create a national health research data infrastructure (e.g., PCORnet, FDA Sentinel, National Institutes of Health Precision Medicine Initiative (NIH PMI)). This type of national resource could advance linkage opportunities to suicide prevention data. Data linkage in suicide prevention needs to be a part of this national discussion.

Suggested Next Steps

- Intervention harmonization: Approaches to advance intervention harmonization might allow for smaller studies of like interventions to be combined to increase statistical power. Biostatistical methods are needed for intervention harmonization across prevention studies aimed at youth suicide, as well as interventions directed at conditions in the causal pathway to suicide. This work could also advance the identification and study of mediators and moderators, which could allow for the targeting of specific interventions at high-risk groups. These new methodologic approaches are necessary because nearly all of the suicide prevention studies are underpowered to address mediation or moderation within their own studies.
- A National suicide outcomes data repository: Such a repository could be created to combine data from several sources to aim to establish better coverage of suicide ideation, suicide attempt, and suicide on a national level.
- Guidelines on data linkage methods and procedures: Such guidelines could be developed to facilitate the linkage of prevention data with external data systems.
- A Technical support center: A support center could be established to assist researchers, prevention scientists, health systems, States, and others with methods and procedures for data linkage.

Conclusions

We identified only six studies that linked suicide prevention efforts with data systems, and none of these explored the effects of moderators. We identified 153 unique data systems, 66 of which we classified as “fairly accessible” with data dictionaries available. There is potential for linking existing data systems with existing suicide prevention efforts to assess the broader and extended impact of suicide prevention programs; however, limited availability of data dictionaries and lack of adherence to standard data elements limits the potential utility of linking prevention efforts with data systems.

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Appendix A. Acronyms

Acronym	Definition
AAS	American Association of Suicidology
AFSP	American Foundation for Suicide Prevention
AHRQ	Agency for Healthcare Research and Quality
ANOVA	Analysis of variance
APCD	All Payer Claims Databases
BRFSS	Behavioral Risk Factors Surveillance System
CAMS	The Collaborative Assessment and Management of Suicidality
CARE	Care, Assess, Respond, Empower
CAST	Coping and Support Training
CATCH-IT	Competent Adulthood Transition With Cognitive Behavioral And Interpersonal Training
C-CARE	Counselors: Care, Assess, Respond, Empower
CDC	Centers for Disease Control and Prevention
CINAHL	Cumulative Index to Nursing and Allied Health Literature
DSTF	Data and Surveillance Task Force
EMR	healthcare provider records (electronic medical records)
EPC	Evidence-base Practice Center
ER	Emergency room
ED	Emergency department
ERIC	Education Resources Information Center
FDA	Food and Drug Administration
GLS	The Garrett Lee Smith Memorial Suicide Prevention Program
HIE	Health Information Exchanges
HIPAA	Health Insurance Portability and Accountability Act
KQ	Key Question
LAUNCH	Linking Actions for Unmet Needs in Children's Health
LGBTQ	Lesbian, gay, bi-sexual, transgender, queer
MeSH	Medical Subject Heading
NAASP	National Action Alliance for Suicide Prevention
NASY+	National Annenberg Survey of Youth
NIH	National Institutes of Health
NR	not reported
NREPP	National Registry of Evidence-based Programs and Practices
NVDRS	National Violent Death Reporting
PGC	Personal Growth Class
PHI	Protected Health Information
PICOTS	Populations, Interventions, Comparators, Outcomes, Timing, Setting
PUF	Participant user files
RCT	Randomized controlled trial
SAMHSA	Substance Abuse and Mental Health Services Administration
SOFTADS	Survey of Outcomes Following Treatment for Adolescent Depression
SOS	Signs Of Suicide
SPRC	Suicide Prevention Resource Center
SRDR	Systematic Review Data Repository™
TADS	Treatment for Adolescents with Depression Study
TASA	Treatment of Adolescent Suicide Attempters
TORDIA	Treatment of Resistant Depression in Adolescents
YST-1	Youth-Nominated Support Team for Suicidal Adolescents (Version 1)
YST-2	Youth-Nominated Support Team for Suicidal Adolescents (Version 2)
WISQARS	Web-based Injury Statistics Query and Reporting

Appendix B. Search Strategies

Table B-1. PubMed search strategy

#	Search
1	suicide/prevention[mh]
2	Suicide, Attempted/prevention[mh]
3	suicid*[tiab] AND (prevent[tiab] OR prevention[tiab])
4	1 OR 2 OR 3
5	clinical trial[pt]
6	“Non-randomized”[tiab]
7	Nonrandomized[tiab]
8	cohort[tiab]
9	“next study”[tiab]
10	observational[tiab]
11	“Case-control”[tiab]
12	“cohort studies”[mh]
13	cross-over studies[mh]
14	prospectiv*[tiab]
15	registr*[tiab]
16	restrospectiv*[tiab]
17	"Comparative Study" [pt]
18	“propensity score”[tiab]
19	“propensity Score”[mh]
20	5 OR 6 OR 7 OR 8 OR 9 OR 10 OR 11 OR 12 OR 13 OR 14 OR 15 OR 16 OR 17 OR 18 OR 19
21	4 AND 20
22	1990:2016[dp]
23	Eng[la]
24	4 AND 20 AND 22 AND 23

Table B-2. Cochrane Library search strategy

#1	MeSH descriptor: [Suicide] explode all trees and with qualifier(s): [Prevention & control - PC]
☐ #2	suicid*:ti,ab,kw (Word variations have been searched)
☐ #3	prevent:ti,ab,kw (Word variations have been searched)
☐ #4	"prevention":ti,ab,kw (Word variations have been searched)
☐ #5	#1 or (#2 and (#3 or #4)
Publication Year from 1990 to 2015	

Table B-3. CINAHL, PsycINFO and ERIC search strategy

S26	S7 AND S23	Limiters - Published Date: 19900101-20151231 Narrow by Language: - English Search modes - Boolean/Phrase
S25	S7 AND S23	Narrow by Language: - English Search modes - Boolean/Phrase
S24	S7 AND S23	Search modes - Boolean/Phrase
S23	S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22	Search modes - Boolean/Phrase
S22	TX propensity score	Search modes - Boolean/Phrase
S21	TX comparative study	Search modes - Boolean/Phrase
S20	TX comparative study	Search modes - Boolean/Phrase
S19	TX retrospective study	Search modes - Boolean/Phrase
S18	TX registry	Search modes - Boolean/Phrase
S17	TX prospectiv*	Search modes - Boolean/Phrase
S16	TX "cross over"	Search modes - Boolean/Phrase
S15	TX case control study	Search modes - Boolean/Phrase
S14	TX observational study	Search modes - Boolean/Phrase
S13	TX cohort study	Search modes - Boolean/Phrase
S12	TX "follow up" OR TX "follow-up" OR TX Followup	Search modes - Boolean/Phrase
S11	TX "next study"	Search modes - Boolean/Phrase
S10	TX "non-randomized"	Search modes - Boolean/Phrase
S9	TX nonrandomized	Search modes - Boolean/Phrase
S8	TX "clinical Trials"	Search modes - Boolean/Phrase
S7	S5 AND S6	Search modes - Boolean/Phrase
S6	S3 OR S4	Search modes - Boolean/Phrase
S5	S1 OR S2	Search modes - Boolean/Phrase
S4	TX Prevention	Search modes - Boolean/Phrase
S3	TX Prevent	Search modes - Boolean/Phrase
S2	TX suicid*	Search modes - Boolean/Phrase
S1	SU Suicide	Search modes - Boolean/Phrase

Table B-4. The Campbell Collaboration Library of Systematic Reviews

suicide AND prevention

Appendix C. Environmental Scan Coding Scheme

Table C-1. Environmental scan coding schema

ID#	Topics	Level	Type	
1	**Data System Specification and Meta Information**	1		x
1	Review method and information source used to find it	2		x
1	*Systematic review*	3	Y/N/?	x
1	IN	4	Y/N/?	x
1	OUT	4	Y/N/?	x
1	*Environmental scan*	3	Y/N/?	x
1	Google	4	Y/N/?	x
1	Yahoo	4	Y/N/?	x
1	Bing	4	Y/N/?	x
1	Appendix A: NREPP Database of Suicide Prevention Programs	4	Y/N/?	x
1	Appendix D: Potential Data Systems	4	Y/N/?	x
1	NAASP paper	4	Y/N/?	x
1	AFSP/AAS/SPRC	4	Y/N/?	x
1	Ad-hoc search	4	Y/N/?	x
1	*Targeted search*	3	Y/N/?	x
1	CA	4	Y/N/?	x
1	OR	4	Y/N/?	x
1	MD	4	Y/N/?	x
1	DE	4	Y/N/?	x
1	IL	4	Y/N/?	x
1	WI	4	Y/N/?	x
1	City	4	Y/N/?	x
1	City name	4	text-name	x
1	Community	4	Y/N/?	x
1	Community name	4	text-name	x
1	Name of the database / data system (if any)	2	text-name	x
1	Data custodian	2		x
1	*Name*	3	text-name	x
1	*Contact email address*	3	email	optional
1	*Contact phone number*	3	phone	optional
1	Web Link/URL	2		x
1	*URL - generic / home page of the study or data custodian*	3	URL	x
1	*URL - data dictionary and/or public use file*	3	URL	x
1	*URL - additional useful links (e.g., reports) #1*	3	URL	x
1	*URL - additional useful links (e.g., reports) #2*	3	URL	optional

Table C-1. Environmental scan coding schema (continued)

ID#	Topics	Level	Type	
1	*URL - additional useful links (e.g., reports) #3*	3	URL	optional
1	*URL - additional useful links (e.g., reports) #4*	3	URL	optional
1	*URL - additional useful links (e.g., reports) #5*	3	URL	optional
1	Level of information avaiable for this data system	2		x
1	*Data exists and can be acquired (free or for a fee)*	3	Y/N/?	x
1	Data is publicly available and can be downloaded (e.g., PUF)	4	Y/N/?	x
1	Data can be acquired but requires an automated registration	4	Y/N/?	x
1	Data can be acquired if confirmed by a person (e.g., needs email comm)	4	Y/N/?	x
1	*Data dictionary or code book is accessible*	3	Y/N/?	x
1	Formal data dictionary (e.g., xml, xls, pdf)	4	Y/N/?	optional
1	Informal data dictionary (e.g., data intake survey)	4	Y/N/?	optional
1	Proxy data dictionaries (e.g., reports) which may not have all variables	4	Y/N/?	optional
1	*Web page for this data system includes*	3	Y/N/?	optional
1	summary of what the data system is about	4	Y/N/?	optional
1	some detailed information about the data system	4	Y/N/?	optional
1	high level of details about the data system	4	Y/N/?	optional
1	Data Use / Functions	2		x
1	*Primary function of the data system / database*	3		x
1	Reseach (e.g., academic, pharma)	4	Y/N/?	x
1	Clinical care / operations	4	Y/N/?	x
1	Administrative services (e.g., census)	4	Y/N/?	x
1	Public health (e.g., surveillance)	4	Y/N/?	x
1	Other	4	text	x
1	*Secondary function of the data system*	3	text	optional
2	**Geographic Coverage**	1		x
2	Countries	2		x
2	*US*	3	Y/N/?	x
2	*Other (non-US)*	3	text-list	x
2	US coverage	2		x
2	*US - national*	3	Y/N/?	x
2	*US - regional (e.g., east coast)*	3	Y/N/?	x
2	*US - state level (e.g., Maryland)*	3	Y/N/?	x
2	*US - smaller than state level*	3	Y/N/?	x
2	County	4	Y/N/?	x
2	Zip code	4	Y/N/?	x
2	Census block	4	Y/N/?	x
2	Tribal	4	Y/N/?	x
2	Teritory	4	Y/N/?	x

Table C-1. Environmental scan coding schema (continued)

ID#	Topics	Level	Type	
2	Islands	4	Y/N/?	x
2	Other	4	text	x
2	US states	2		x
2	*Alabama (AL)*	3	Y/N/?	x
2	*Alaska (AK)*	3	Y/N/?	x
2	*Arizona (AZ)*	3	Y/N/?	x
2	*Arkansas (AR)*	3	Y/N/?	x
2	*California (CA)*	3	Y/N/?	x
2	*Colorado (CO)*	3	Y/N/?	x
2	*Connecticut (CT)*	3	Y/N/?	x
2	*Delaware (DE)*	3	Y/N/?	x
2	*Florida (FL)*	3	Y/N/?	x
2	*Georgia (GA)*	3	Y/N/?	x
2	*Hawaii (HI)*	3	Y/N/?	x
2	*Idaho (ID)*	3	Y/N/?	x
2	*Illinois (IL)*	3	Y/N/?	x
2	*Indiana (IN)*	3	Y/N/?	x
2	*Iowa (IA)*	3	Y/N/?	x
2	*Kansas (KS)*	3	Y/N/?	x
2	*Kentucky (KY)*	3	Y/N/?	x
2	*Louisiana (LA)*	3	Y/N/?	x
2	*Maine (ME)*	3	Y/N/?	x
2	*Maryland (MD)*	3	Y/N/?	x
2	*Massachusetts (MA)*	3	Y/N/?	x
2	*Michigan (MI)*	3	Y/N/?	x
2	*Minnesota (MN)*	3	Y/N/?	x
2	*Mississippi (MS)*	3	Y/N/?	x
2	*Missouri (MO)*	3	Y/N/?	x
2	*Montana (MT)*	3	Y/N/?	x
2	*Nebraska (NE)*	3	Y/N/?	x
2	*New Hampshire (NH)*	3	Y/N/?	x
2	*New Jersey (NJ)*	3	Y/N/?	x
2	*New Mexico (NM)*	3	Y/N/?	x
2	*New York (NY)*	3	Y/N/?	x
2	*North Carolina (NC)*	3	Y/N/?	x
2	*North Dakota (ND)*	3	Y/N/?	x
2	*Ohio (OH)*	3	Y/N/?	x
2	*Oklahoma (OK)*	3	Y/N/?	x

Table C-1. Environmental scan coding schema (continued)

ID#	Topics	Level	Type	
2	*Oregon (OR)*	3	Y/N/?	x
2	*Pennsylvania (PA)*	3	Y/N/?	x
2	*Rhode Island (RI)*	3	Y/N/?	x
2	*South Carolina (SC)*	3	Y/N/?	x
2	*South Dakota (SD)*	3	Y/N/?	x
2	*Tennessee (TN)*	3	Y/N/?	x
2	*Texas (TX)*	3	Y/N/?	x
2	*Utah (UT)*	3	Y/N/?	x
2	*Vermont (VT)*	3	Y/N/?	x
2	*Virginia (VA)*	3	Y/N/?	x
2	*Washington (WA)*	3	Y/N/?	x
2	*West Virginia (WV)*	3	Y/N/?	x
2	*Wisconsin (WI)*	3	Y/N/?	x
2	*Wyoming (WY)*	3	Y/N/?	x
2	*Other (e.g., islands, teritories…)*	3	text-list	x
3	**Demographic Coverage**	1		x
3	Target population	2		x
3	*American Indian (Tribal)*	3	Y/N/?	x
3	*LGBT*	3	Y/N/?	x
3	*Military*	3	Y/N/?	x
3	*Prison*	3	Y/N/?	x
3	*Students (schools/campuses)*	3	Y/N/?	x
3	*General population*	3	Y/N/?	x
3	*Other*	3	text	x
4	**Data Granularity**	1		x
4	Patient-level data exists (patient-level linkage possible)	2	Y/N/?	x
4	Aggregated on certain dimensions (ecological linkage possible)	2	Y/N/?	x
4	*Demographics*	3	Y/N/?	x
4	*Geographic*	3	Y/N/?	x
4	*Clinical specifications*	3	Y/N/?	x
4	*Entity*	3	Y/N/?	x
4	Data Sampling	2	Y/N/?	x
5	**Variables (if data dictionary is available)**	1		x
5	Dependent variables	2		x
5	*Primary*	3	Y/N/?	x
5	Suicide completion	4	Y/N/?	x
5	Suicide attempt	4	Y/N/?	x
5	Suicide ideation	4	Y/N/?	x

Table C-1. Environmental scan coding schema (continued)

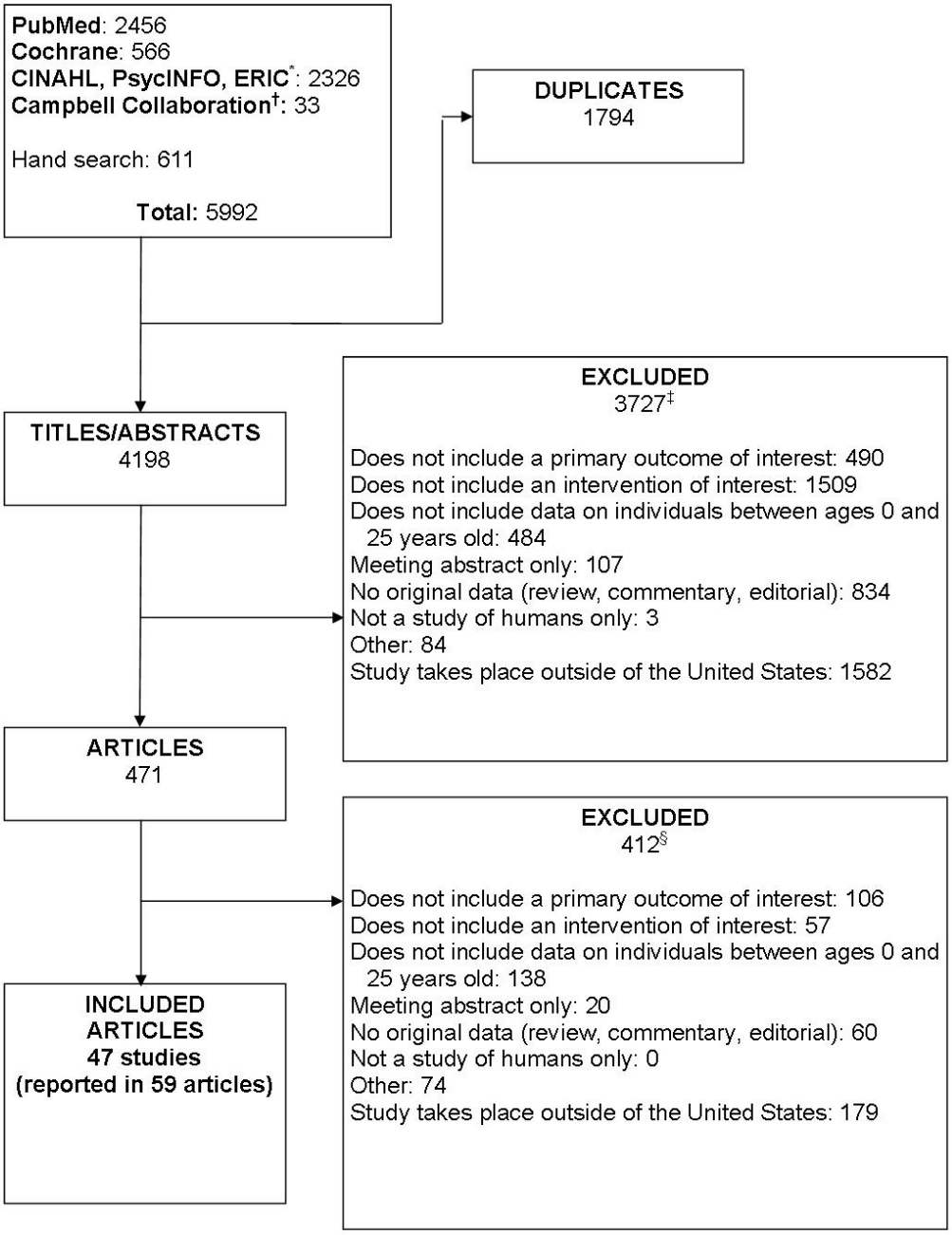
ID#	Topics	Level	Type	
5	*Secondary / Intermediate*	3	Y/N/?	optional
5	Psychiatric and substance abuse disorders	4	Y/N/?	optional
5	Service use for psychiatric and substance abuse disorders (e.g. ER visit)	4	Y/N/?	optional
5	Graduation rates (e.g., educational, training)	4	Y/N/?	optional
5	Incarceration rates	4	Y/N/?	optional
5	Violence (both perpetrator and victim)	4	Y/N/?	optional
5	Social support and connectedness	4	Y/N/?	optional
5	Access to lethal means	4	Y/N/?	optional
5	Other	4	text-list	optional
6	**Data Scalability**	1		x
6	Data types	2		x
6	*Suicide specific*	3	Y/N/?	x
6	*Death records*	3	Y/N/?	x
6	*Healthcare provider records (e.g., EHRs)*	3	Y/N/?	x
6	*Population-based surveys*	3	Y/N/?	x
6	*Health insurance claims*	3	Y/N/?	x
6	*Other*	3	text	x
6	Updates and Data Collection	2		x
6	*Ongoing*	3	Y/N/?	x
6	*Stopped*	3	Y/N/?	x
6	*Year Data Collection Started*	3	date (YYYY)	x
6	*Year Data Collection Stopped*	3	date (YYYY)	x
7	**Data Governance**	1		x
7	Data access	2		x
7	*Unrestricted*	3	Y/N/?	x
7	PUF (public use file) URL	4	URL	optional
7	requires registration	4	Y/N/?	optional
7	*Restricted*	3	Y/N/?	x
7	can be used for research	4	Y/N/?	x
7	can be used for clinical care / operations	4	Y/N/?	x
7	can be used for commercial purposes	4	Y/N/?	x
7	Data commodity	2		x
7	*free*	3	Y/N/?	x
7	*commercial / has a fee*	3	Y/N/?	x
7	*type of license*	3	text	x
8	**Excldue PICOTS Reason**	1	Y/N/?	x
8	Population(s)	2	Y/N/?	x
8	*Explain*	3	text	x

Table C-1. Environmental scan coding schema (continued)

ID#	Topics	Level	Type	
8	Intervention(s)	2	Y/N/?	x
8	*Explain*	3	text	x
8	Comparison(s)	2	Y/N/?	x
8	*Explain*	3	text	x
8	Outcome(s)	2	Y/N/?	x
8	*Explain*	3	text	x
8	Timing	2	Y/N/?	x
8	*Explain*	3	text	x
8	Setting	2	Y/N/?	x
8	*Explain*	3	text	x
8	Other?	2	text	x

Appendix D. Results of the Literature Search

Figure D-1. Results of the literature search



* CINAHL, PsycINFO, and ERIC were searched simultaneously through the EBSCO database
† Campbell Collaboration Library of Systematic Reviews
‡Sum of excluded articles exceeds 3723 because reviewers were not required to agree on reasons for exclusion
§Sum of the excluded articles exceeds 412 because reviewers were not required to agree on the reason for exclusion

Appendix E. Evidence Tables

Evidence Table E-1. Characteristics of studies identified in the literature search

Program or Study Name (if applicable)	Author, Year	Study design	Study start and end dates	Setting	Study location	Linked database/registry (if applicable)	N[a]	% female	Age, mean (SD) or otherwise specified	% Race/ ethnicity	FU (months)
Adolescent Suicide Risk Screening	King, 2012[1]	RCT	2009 to 2010	Emergency department	MI	Adolescent Suicide Risk Screening (ER)	245	53.4	15.32(1.37)	White: 80; African-American: 21.6; Asian 2.9; Hispanic: 5.7; Other: 13.1[b]	NR
Attachment-Based Family Therapy	Diamond, 2010[2]	RCT	2005 to 2007	Emergency department, Primary care	PA	Attachment-Based Family Therapy	66	83	15.1 (1.5)	African-American: 74	6
	Diamond, 2012[3c]	RCT	NR	Emergency department, Primary care	Philadelphia, PA	Attachment-Based Family Therapy	66	83	15.1(1.5)	African-American: 74	6
CAMS: The Collaborative Assessment and Management of Suicidality	Jobes ,[d] 2012[4]	Observational	NR	Primary care, Emergency department, Military base	NR	US Airforce clinical records	55	(66)	29.1 (7.2)	White: 47	NR
	Jobes ,[d] 2012[4]	RCT	NR	Primary care, Emergency department, Military base	Seattle, WA	NR	32	62	29.1 (7.2)	White: 66	NR

Evidence Table E-1. Characteristics of studies identified in the literature search (continued)

Program or Study Name (if applicable)	Author, Year	Study design	Study start and end dates	Setting	Study location	Linked database/registry (if applicable)	N[a]	% female	Age, mean (SD) or otherwise specified	% Race/ ethnicity	FU (months)
C-CARE/CAST (Counselors-CARE and Coping and Support Training)	Eggert, 2002[5]	RCT	NR	School			341	44.6	range: 14 to 19	White: 39.9; African-American: 12.3; Asian: 12.9; Hispanic: 7; Other: 25.8	9
	Randell, 2001[6]	RCT	NR	School			341	Range: 48-59	range: 14 to 19	White: 40	9
	Thompson, 2001[7e]	RCT	NR	School and home	Pacific Northwest urban school districts	Counselors-Child and Adolescent Risk Evaluation (C-CARE); Coping and Support Training (CAST)	460	52	range: 14 to 19	African-American: 18; Euro-American: 49; Asian-American: 4; API: 18; Latino/Hispanic: 1	1, 2.5, 9
	Hooven, 2010[8]	RCT	NR	School and Home			615	60	15.95(1.08)	White: 67	9
Communities That Care	Oesterle, 2015[9]	Community randomized trial	2005-2012	Policy/Legislation	CO, IL, KS, ME, OR, UT, WA	Community Youth Development Study	2407	NR	Range: 10-14	NR	
GLS: The Garrett Lee Smith Memorial Suicide Prevention Program	Garraza, 2015[10]	Observational	2006 to 2009	Education/Training/Screening/Infrastructure/Crisis hotline/ Community Partnerships	466 Counties (exposed) and 1161 Counties (not exposed) in the US	The Garrett Lee Smith Memorial Suicide Prevention Program	173,000	51.5-52.3	Range: 12->26	White, non-Hispanic: 80; Black non-Hispanic: 9; AIAN: 1-2; Asian: 1.2-1.7; multiracial: 1-1.2; Hispanic: 5.5-7.3	NA
	Walrath, 2015[11]	Observational	2000 to 2006	Screening, Behavioral, Policy Changes, Outreach, Referral to mental health professionals, Means restriction	NR	The Garrett Lee Smith Memorial Suicide Prevention Program	2095	50.5	Range: 10 to 24	White: 79.5; African-American: 9.5; Asian; 1.5; Hispanic: 6.1; Other: 3.4	36

Evidence Table E-1. Characteristics of studies identified in the literature search (continued)

Program or Study Name (if applicable)	Author, Year	Study design	Study start and end dates	Setting	Study location	Linked database/registry (if applicable)	N[a]	% female	Age, mean (SD) or otherwise specified	% Race/ ethnicity	FU (months)
Good Behavior Game	Wilcox, 2008[12]	RCT	1985 to 2002	Behavioral/Skill building, Educational	Baltimore, MD		1196	51	range: 19-24	White: 34; African-American: 66	24
HOPE Family Program/ HOPE Health Education Program	Lynn, 2014[13]	Observational	NR	Behavioral/Skill building	New York, NY		28	45	12.8 (1.2)	Latino/ Hispanic: 40; Black: 43; Black/Hispanic/racial mix: 17;	NR
National Treatment Improvement Evaluation Study	Ilgen, 2007[14]	Observational	NR	Substance abuse treatment	NR	National Treatment Improvement Evaluation Study	3733	36	32.7(7.8)	NR	NR
Personal Growth Class	Thompson, 2000[15]	Three group repeated measures design	1990 to 1993	Behavioral/Skill building	Urban high schools (no state)	Personal Growth Class	106	58.5	NR	NR	5, 10
Project Chrysalis	Brown, 2001[16]	RCT and Interviews for the qualitative portion	1994 to 1999	Behavioral/Skill building, Education	OR	Project Chrysalis	1108	100	range: 15.13-15.44	Non-white: 26-43.1	12, 24
Promoting CARE	Hooven,[†] 2012[17]	RCT	NR	Behavioral/Skill building, Education	Seattle, WA	Promoting CARE	615	60	16 (NR)	White: 66; African-American: 4; Asian 8; Other: 17	15
SAFETY Program	Asarnow, 2015[18]	Observational	2006-2010	Educational/Skill building	NR	WISQARS, Law Center to Prevent Gun Violence	35	86	14.89 (1.6)	White: 40; Hispanic: 34; Black: 11; Asian-Other: 14	33

Evidence Table E-1. Characteristics of studies identified in the literature search (continued)

Program or Study Name (if applicable)	Author, Year	Study design	Study start and end dates	Setting	Study location	Linked database/registry (if applicable)	N[a]	% female	Age, mean (SD) or otherwise specified	% Race/ ethnicity	FU (months)
Seattle Social Development Project	Hawkins, 2005[19]	Non-RCT followup	NR	Educational/Skill building	Seattle, WA		437-643 (dependent on the outcome measured)	NR	21	NR	NA
SOS Suicide Prevention Program	Aseltine, 2004[20]	RCT	2001 to 2002	Educational	GA and CT		2100	51.4	NR[g]	White: 15.5; African-American: 25.4; Other: 5.7	3
	Aseltine, 2007[21]	RCT	2001-2002	Educational	GA, MA, and CT		4133	52.0	NR[g]	White: 25.4; Black: 38.6; Hispanic: 35.3; Other: 0.7	3
Student Assistance Program	Biddle, 2014[22]	Observational	1997 to 2006	Multiple Strategies	PA	PA Department of Education (SAP Online)	2112	66.5	range: 13 to 21	White:81.7; African-American: 7.9; Asian 2	NR
Surviving the Teens Suicide Prevention and Depression Program	King, 2011[23]	Pre-post	NR	Behavioral/Skill building, Education	OH	NR	966	56.1	14.1(0.79)	White:85; African-American: 4.1; Asian1.7; Hispanic: 2.4; Other: 6.8	3
Systemic Crisis Intervention Program	Gutstein, 1990 [24]	Observational	NR	Behavioral/Skill building	Houston, TX	Systemic Crisis Intervention Program	47	25	14.4 (NR)	White: 61.7; African-American: 10.6; Asian: 2.1; Other: 25.5	18

Evidence Table E-1. Characteristics of studies identified in the literature search (continued)

Program or Study Name (if applicable)	Author, Year	Study design	Study start and end dates	Setting	Study location	Linked database/registry (if applicable)	N[a]	% female	Age, mean (SD) or otherwise specified	% Race/ ethnicity	FU (months)
TADS	March, 2007[25]	RCT	NR	Primary care/Community-based	NR	Treatment of Adolescents with Depression Study	327	45	14.6(1.5)	White: 74; African-American: 11.3; Other: 9.8	1.5, 3, 4.5, 6, 8, 9
	TADS, 2009[26]	RCT	NR	Primary care/Community-based	NR	Treatment of Adolescents with Depression Study	327	55	14.6(1.5)	White: 74; African-American: 11.3; Hispanic: 9.8	3, 6, 9
	Vitiello, 2009[27]	RCT	NR	Primary care/Community-based	NR	Treatment of Adolescents with Depression Study	439	54	14.6 (1.5)	NR White: 74	3, 9
TADS-SOFTAD	Curry, 2011[28]	Observational	NR	Primary care/Community-based		TADS- SOFTAD	196	56.1	18 (1.8);	White: 79; African-American: 8; Hispanic: 9; Other: 4	63
TASA: Treatment of Adolescent Suicide Attempters	Brent, 2009[29h]	RCT	NR	Medication or Pharmaceutical/Behavioral/Skill building	NR	Treatment of Adolescent Suicide Attempters Study	124	77.4		White: 66.9; African-American: 12.9; Hispanic: 15.3; Other: 4.8	1.5, 3, 4.5, 6
	Vitiello, 2009[30]	Mixed: Randomized or determined by study participant	2004 to 2007	Medication or Pharmaceutical/Behavioral/Skill building	MD, NY, NC, PA, TX		439	54	14.6(1.5)	White: 74	6
The Coping Cat Program	Wolk, 2015[31]	RCT Data drawn from 2 RCTs	NR	Primary care	PA	NR	66	51.5	mean: 27.23 (at time of follow-up)7-14 (at time of intake)(3.54 (at time of follow-up))	White: 84.8	84-228

Evidence Table E-1. Characteristics of studies identified in the literature search (continued)

Program or Study Name (if applicable)	Author, Year	Study design	Study start and end dates	Setting	Study location	Linked database/registry (if applicable)	N[a]	% female	Age, mean (SD) or otherwise specified	% Race/ ethnicity	FU (months)
TORDIA: Treatment of Resistant Depression in Adolescents	Asarnow, 2011[32]	RCT	2001 to 2007	Medication or Pharmaceutical	CA, OR, PA, RI, TX		327	69.7	range: 15.9 to 18 (1.6)	White: 83.2	6
	Emslie, 2010[33]	RCT	2001 to 2007	Medication or Pharmaceutical	CA, OR, PA, RI, TX		334	69.8	15.9 (1.6)	White: 82.9	6
	Shamsed deen, 2011[34]	RCT	2001 to 2007	Medication or Pharmaceutical	CA, OR, PA, RI, TX		334	69.8	15.9(1.6)	White: 82.9	6
	Woldu, 2011[35]	RCT	2001 to 2007	Medication or Pharmaceutical	CA, OR, PA, RI, TX		334	NR	Range:12 to 18	NR	6
US Air Force suicide prevention programme	Knox, 2003[36i]	Quasi-experimental	1990 to 2002	Educational	US		5,260,292[b]	NR	NR	NR	144
Youth-Nominated Support Team for Suicidal Adolescents (Version 1)	King, 2006[37]	RCT	1998 to 2000	Educational/Skill building	MI		289	68.2	15.3(1.5)	White: 82.4; African-American: 10.2; Other: 7.4	6
Youth-Nominated Support Team-version II	King, 2009[38]	RCT	2002 to 2008	Educational/Skill building	MI		448	71.2	15.6(1.3)	White: 84; African-American: 6; Hispanic: 2; Other: 8	12
Single studies	Anestis, 2015[39]	Observational	2013 to 2013	Policy/Legislation	National database	WISQARS	NR	NR	NR	NR	NA
	Asarnow, 2011[40]	RCT	2003 to 2005	Behavioral/Skill building	CA		181	69.0	14.7 (2)	White: 33; African-American: 13; Other: 54	2

Evidence Table E-1. Characteristics of studies identified in the literature search (continued)

Program or Study Name (if applicable)	Author, Year	Study design	Study start and end dates	Setting	Study location	Linked database/registry (if applicable)	N[a]	% female	Age, mean (SD) or otherwise specified	% Race/ ethnicity	FU (months)
Single studies (continued)	Brown, 2005[41]	RCT	1999 to 2002	Cognitive therapy	PA (Philadelphia)		120	60.8	range: 18 to 66	White: 35	18
	Collins, 2008[42]	Observational	1998 to 2003	Medication or Pharmaceutical	OR	OR state Medicaid and mental health databases	12662	65.8	38.7(14.2)	NR	NA
	Cooper, 2006[43]	Observational	1998 to 2002	Safety-net of mental health services	CO	CO Health and Hospital Association (note no findings via Google for this, did find CO Hospital Association CHA) discharge records	1317[j]	729 (55.4)	range: 18 to 24	NR	12
	Farmer, 1996[44 k]	Case report	1989 to 1994	Policy/Legislation	TX		13	15.4	29 (NR)	White: 53.8; African-American: 30.7; Other: 15.4	60
	Fleegler, 2013[45l]	Observational	2007 to 2010	Policy/Legislation	All states	Centers for Disease Control and Prevention WISQARS	121,084	NR	NR	NR	36
	Gardner, 2010[46]	Non-RCT: treatment based on referral	2005 to 2006	Screening	OH		1503	58	range: 10 to 21	White: 34; African-American: 57; Other: 9	6
	Huey, 2004[47]	RCT	NR	Behavioral/Skill building	SC		156	35	12.9 (2.1)	African-American: 65; Asian; Other: 1	12
	Kaminer, 2006[48]	RCT	NR	Aftercare	CT		177	37	15.9 (1.2)	White: 77; African-American: 7; Hispanic: 12; Other: 4	3
	Kennard, 2014[49m]	RCT	NR	Medication or Pharmaceutical and psychotherapy	TX	NR	144	53.5	13.8(2.6)	White: 81.9; African-American: 10.4; Asian145; Hispanic: 29.9; Other: 6.3	7

Evidence Table E-1. Characteristics of studies identified in the literature search (continued)

Program or Study Name (if applicable)	Author, Year	Study design	Study start and end dates	Setting	Study location	Linked database/registry (if applicable)	N[a]	% female	Age, mean (SD) or otherwise specified	% Race/ ethnicity	FU (months)
Single studies (continued)	Kerr, 2014[50]	RCT	1997 to 2006	Behavioral/Skill building	NW United States		166	100	15.3 (1.2)	Caucasian: 68; Black: 1.8; Hispanic: 11.4; Native American: 0.6; Asian: 0.6; multiracial: 16.9; Other: 0.6	24-36
	Olfson, 2003[51n]	Observational	1990 to 2000	Medication and Pharmaceutical			See note	NR	range: 10 to 19	NR	120
	Rathus, 2002[52]	Quasi-experimental	NR	Psychotherapy and Behavioral/Skill building	New York, NY	Adolescent Depression and Suicide Program (ADSP)	111	NR	NR	White: 8.1; African-American: 17.1; Asian 0.9; Hispanic: 67.6; Other: 6.3	3
	Rotheram-Borus, 2000[53]	Quasi-experimental	1991 to 1994	Specialized emergency room (ER) care	NY		211	26.5	14.9(1.4)	Hispanic: 87.1	18
	Rudd, 1996[54]	RCT	NR	Behavioral/Skill building	NR	NR	264	17.9	22 (2.3)	White: 60.6; African-American: 25..8; Asian; 1.5; Hispanic: 10.6; Other: 1.5	1, 6, 12, 18, 24
	Segal, 1995[55]	Observational	NR	NR	MI	NR	42	NR	14.5(1.4)	NR	6
	Spirito, 1992[56]	Observational	NR	Follow-up interviews	NR	NR	130	86.9	median: 15; range: 13 to 18	White: 73	Spirito, 1992[56]
	Warner, 2011[57]	Observational	2007 to 2008	Screening	GA	Surveillance of Combat and Operational Stress Reactions	21031	8.9	range: 18 to 40+	NR	Warner, 2011[57]
	Wharff, 2012[58]	Case control study	2001 to 2002	Behavioral/Skill building	Boston, MA	Boston Children's Hospital ER	250	74.8	15.6(1.5)	White: 65; African-American: 16; Asian 2; Other: 14	Wharff, 2012[58]
	Wingate, 2005[59]	RCT	NR	Behavioral/Skill building			98	18.4	22(2.5)	White: 62; African-American: 23; Hispanic: 10; Other: 5	Wingate, 2005[59]

Evidence Table E-1. Characteristics of studies identified in the literature search (continued)

CAMS=The Collaborative Assessment and Management of Suicidality ; CARE=Care, Assess, Respond, Empower; CAST=Coping and Support Training; CATCH-IT=Competent Adulthood Transition With Cognitive Behavioral And Interpersonal Training; C-CARE=Counselors: Care, Assess, Respond, Empower; GLS=The Garrett Lee Smith Memorial Suicide Prevention Program; NASY+National Annenberg Survey of Youth; NR=not reported; PGC=Personal Growth Class; RCT=randomized controlled trial; SOFTADS=Survey of Outcomes Following Treatment for Adolescent Depression; SOS=Signs Of Suicide; TADS=Treatment for Adolescents with Depression Study; TASA=Treatment of Adolescent Suicide Attempters; TORDIA=Treatment of Resistant Depression in Adolescents; WISQARS = web-based injury statistics query and reporting YST-1=Youth-Nominated Support Team for Suicidal Adolescents (Version 1); YST-2=Youth-Nominated Support Team for Suicidal Adolescents (Version 2); SAFETY= Safe Alternatives for Teens & Youths

[a]At baseline
[b] Race: percentages total greater than 100% as participants were able to select multiple racial identities
[c]Experienced sexual trauma
[d] Single study where two slightly different interventions were applied; Military population
[e] High-risk youth
[f] Same population as Hooven, 2010—different followup periods
[g] Takes place in high school: can assume ages 13-19
[h] Participant characteristics given not by arm, but by subsequent suicide attempts or events; Due to difficulty with recruitment the participants were either randomized of chose their preferred.
[i]Active-duty military personnel
[j] This is the N of participants with suicidal behavior (attempters).
[k] Prison population
[l] This study looks at firearm related deaths over all 50 states. The N here is the number of deaths from 2007-2010.
[m]Youth with major depressive disorder
[n]Large dataset of 588 zip codes from 1990 and 2000

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Appendix F. Included Data Systems

Table F-1. Data systems with fairly accessible information and data dictionaries

Organization	Data System Name
AHRQ - Healthcare Cost and Utilization Project (HCUP)	Nationwide Inpatient Sample (NIS)
AHRQ - Healthcare Cost and Utilization Project (HCUP)	Kids' Inpatient Database (KID)
AHRQ - Healthcare Cost and Utilization Project (HCUP)	Nationwide Emergency Department Sample (NEDS)
AHRQ - Healthcare Cost and Utilization Project (HCUP)	State Inpatient Databases (SID)
AHRQ - Healthcare Cost and Utilization Project (HCUP)	State Ambulatory Surgery and Services Databases (SASD)
AHRQ - Healthcare Cost and Utilization Project (HCUP)	State Emergency Department Databases (SEDD)
American Association of Poison Control Centers (AAPCC)	National Poison Data System (NPDS)
American College of Surgeons	National Trauma Data Bank (NTDB)
Army	Army Study To Assess Risk and Resilience in Servicemembers (STARRS)
California Department of Public Health (CDPH) Portal: California EpiCenter	California Electronic Violent Death Reporting System (VDRS)
California Department of Public Health (CDPH) California Health and Human Services Open Data Portal (CHHS Open Data) California Department of Public Health Vital Statistics Advisory Committee (VSAC) California Health and Human Services Agency's Committee for the Protection of Human Subjects (CPHS)	California Death Data Files
CDC	National Survey of Prison Health Care (NSPHC)
CDC - National Center for Health Statistics (NCHS)	National Death Index (NDI)
CDC - National Center for Health Statistics (NCHS)	National Health and Nutrition Examination Survey (NHANES) (up to 2004)
CDC - National Center for Health Statistics (NCHS)	National Ambulatory Medical Care Survey (NAMCS)
CDC - National Center for Health Statistics (NCHS)	National Hospital Ambulatory Medical Care Survey (NHAMCS)
CDC - National Center for Health Statistics (NCHS) Portal: National Vital Statistics System (NVSS)	National Mortality Followback Survey (NMFS)
CDC - National Syndromic Surveillance Program (NSSP)	BioSense Data
CDC Portal: Web-based Injury Statistics Query and Reporting System (WISQARS)	National Violent Death Reporting System (NVDRS)
Census	National Longitudinal Mortality Study (NLMS)
Colorado Department of Public Health and Environment Portal: Colorado Health Information Dataset (CoHID)	Colorado Death Certificates and Data
Colorado Department of Public Health and Environment Portal: Colorado Health Information Dataset (CoHID)	Colorado Injury Hospital Data
Colorado Hospital Association (CHA)	Colorado Hospital Association Discharge Data
Connecticut Department of Health	Connecticut School Health Survey
Consumer Product Safety Commission	National Electronic Injury Surveillance System (NEISS)
DoD	DoD Survey of Health Related Behaviors
DoD Armed Forces - Armed Forces Health Surveillance Branch	Defense Medical Surveillance System (DMSS)

Table F-1. Data systems with fairly accessible information and data dictionaries (continued)

Organization	Data System Name
Federal Transit Administration	National Transit Database - Safety & Security Time Series Data
Florida Department of Health	Florida Death Rate Query System
Florida Health	Florida Injury Surveillance Data System
Healthy Minds Network	Research on Adolescent and Young Adult Mental Health
Illinois Department of Human Services (IDHS)	Illinois Youth Survey (IYS)
Illinois Department of Public Health (IDPH)	Illinois Trauma Registry Database
Illinois Department of Public Health (IDPH) - Emergency Medical Services	Illinois Prehospital Data Program
Illinois Department of Public Health (IDPH) Portal: EMS Data Reporting System	Illinois Hospital Discharge Database
Maine Health Data Organization (MHDO)	Maine All Payer Claims Database (APCD)
Maine Health Data Organization (MHDO)	Maine Hospital Inpatient and Outpatient Data
Maryland Department of Health and Mental Hygiene (DHMH)	Maryland Medicaid Claims
Maryland Department of Health and Mental Hygiene (M-DHMH)	Maryland Violent Death Reporting System (VDRS)
Michigan Department of Education	Michigan Youth Risk Behavior System (YRBS)
Minnesota Department of Health	Minnesota Injury Data Access System (MIDAS)
Missouri Department of Health &Senior Service	Missouri Death Records
Missouri Department of Health &Senior Service	Missouri Patient Abstract System (Hospital Discharges)
National Center for Health Statistics (NCHS) Portal: CDC WONDER (Wide-ranging Online Data for Epidemiologic Research)	Mortality Medical Data System (Multiple and Underlying Cause of Death Data Files)
National Center for the Review and Prevention of Child Deaths (NCRPCD)	National Child Death Review Case Reporting System
National Highway Traffic Safety Administration - EMS	National EMS Information System (NEMSIS)
National Institute of Mental Health (NIMH)	Collaborative Psychiatric Epidemiology Surveys (CPES)
New Mexico Department of Health	New Mexico Violent Death Reporting System (VDRS)
New York State Department of Health	New York State Statewide Planning and Research Cooperative System (SPARCS)
NIH - NIAAA (National Institute on Alcohol Abuse and Alcoholism)	National Epidemiologic Survey on Alcohol and Related Conditions (NESARC)
NIH and University of North Carolina	The National Longitudinal Study of Adolescent to Adult Health (Add Health)
Oregon Health Authority	Oregon Adolescent Suicide Attempt Data System (ASADS)
Oregon Health Authority	Oregon Healthy Teen Survey
Oregon Health Authority - Public Health Division	Oregon Student Wellness Survey
PennState Center for Collegiate Mental Health (CCMH)	CCMH Data Navigator
Pennsylvania Department of Education's Safe Schools Office	Pennsylvania Network for Student Assistance Services
Substance Abuse and Mental Health Service Administration (SAMHSA)	Emergency Department Data / Drug Abuse Warning Network (DAWN)
Substance Abuse and Mental Health Service Administration (SAMHSA)	Population Data / National Survey on Drug Use and Health (NSDUH)

Table F-1. Data systems with fairly accessible information and data dictionaries (continued)

Organization	Data System Name
Substance Abuse and Mental Health Service Administration (SAMHSA) - Mental Health Facilities Data	National Mental Health Services Survey (N-MHSS)
Suicide Prevention Data Center (SPDC)	The Garrett Lee Smith Memorial Suicide Prevention Program
Veteran Affairs	VA Behavioral Health Autopsy Program (BHAP)
Virginia Health Information	Virginia Hospital Discharges
Washington State Department of Health	Washington Healthy Youth Survey
Washington State Department of Health	Washington State Vital Statistics and Population Data (Death Data)
Washington State Department of Health	Washington State Comprehensive Hospital Abstract Reporting System (CHARS)
Wisconsin Hospital Association (WHA) - WHA Information Center	Wisconsin WIpop Data - Inpatient and Outpatient Discharge Summaries

CCMH=Center for Collegiate Mental Health;CDC=Centers for Disease Control and Prevention;CHA=Colorado Hospital Association;DoD=Department of Defense;EMS=Emergency Medical Services;NIH=National Institutes of Health;PA=Pennsylvania;UNC=University of North Carolina;WHA=Wisconsin Hospital Association;WIpop=Wisconsin population

Table F-2. Data systems with fairly accessible information but no accessible data dictionary

Organization	Data System Name
Alaska Department of Health and Social Services (ADHSS) - Statewide Suicide Prevention Council	Alaska Detailed Causes of Death
Arizona Department of Health Services; Office of Injury Prevention	Arizona Child Fatality Review Program
Bureau of Justice Statistics - Suicide and Homicide in State Prisons and Local Jails	[National] Deaths in Custody Reporting Program (DCRP)
California - Los Angeles County Public Health Department - Vital Records Office	Los Angeles County Mortality Dataset
California - Office of Statewide Health Planning and Development (OSHPD)	California Hospital Discharge Data
California Department of Corrections and Rehabilitation (CDCR)	California CDCR COMPSTAT
CDC	School-Associated Violent Death Study (SAVD)
CDC - National Center for Health Statistics (NCHS)	National Hospital Discharge Survey (NHDS)
CDC - National Center for Health Statistics (NCHS)	National Hospital Care Survey (NHCS)
Colorado Department of Public Health and Environment Portal: Colorado Health Information Dataset (CoHID)	Colorado Violent Death Report System (VDRS)
Connecticut Department of Public Health - State Vital Records Office	Connecticut Vital Records
Connecticut Department of Public Health - The Office of Injury Prevention	Connecticut Violent Death Reporting System (VDRS)
Connecticut Hospital Association & Connecticut Office of Health Care Access (OHCA)	Connecticut Chime Data
Delaware Child Death, Near Death and Stillbirth Commission (CDNDSC)	Delaware Child Death Review
Delaware Health and Social Services - Division of Public Health	Delaware Electronic Reporting and Syndromic Surveillance System (DERSS)
Delaware Health and Social Services - Division of Public Health - Delaware Health Statistics Center	Delaware Hospital Discharge Data
Georgia - Fulton County Medical Examiner	Georgia "Holds Our Medical Examiner Records" (HOMER)
Illinois Department of Public Health (IDPH)	Illinois Violent Death Reporting System (VDRS)
Illinois Department of Public Health (IDPH) - Center for Health Statistics	Illinois Vital Statistics
Illinois Department of Public Health (IDPH) - Center for Health Statistics Portal: iQuery	Illinois Project for Local Assessment of Needs (IPLAN)
Kentucky - Division of Medical Examiner's Services	Kentucky Medical Examiner Reports
Los Angeles County Public Health Department - The Injury & Violence Prevention Program (IVPP)	Los Angeles Injury Data and Reports
Maine Department of Health and Human Services - Maine Suicide Prevention Program	Maine Data, Research and Vital Statistics
Maryland Department of Health and Mental Hygiene (DHMH)	Maryland Vital Statistics and Reports (Death Certificates)
Massachusetts - Executive Office of Health and Human Services (EOHHS)	Massachusetts Violent Death Reporting System (VDRS)
National Center on Safe Supportive Learning Environments (NCSSLE)	School Climate Survey Compendia
Nebraska Department of Health and Human Services	Nebraska Child & Maternal Death Review Team
Nebraska Department of Health and Human Services	Nebraska Death Certificates
New Mexico Department of Health	New Mexico Youth Resiliency & Risk Survey (YRRS)
New Mexico Department of Health	New Mexico Vital Records
New York State Department of Health	New York State Vital Statistics

Table F-2. Data systems with fairly accessible information but no accessible data dictionary (continued)

New York State Department of Health	New York State Suicide and Self-Inflicted Injuries
NIDA Substance Abuse and Mental Health Data Archive (SAMHDA)	Drug Abuse Treatment Outcome Survey (DATOS)
NIMH	Treatment for Adolescents with Depression Study (TADS)
NIMH and University of Pittsburgh	Treatment of SSRI-Resistant Depression In Adolescents (TORDIA)
Ohio Department of Health	Ohio Death Data and Statistics
Oklahoma Office of the Chief Medical Examiner	Oklahoma Medical Examiner Reports
Oklahoma State Department of Health (OSDH)	Oklahoma Violent Death Reporting System (VDRS)
Oregon Health Authority	Oregon Injury and Fatality Data
Oregon Health Authority	Oregon Death with Dignity Act Database
Oregon Health Authority	Oregon Death Data
Oregon Health Authority - Public Health Division	Oregon Violent Death Reporting System (VDRS)
Oregon State Police - Medical Examiner Division	Oregon Medical Examiner Reports
Texas Department of State Health Services - Center for Health Statistics	Texas Health Data (Death Data)
Truven Health Analytics	Truven MarketScan
UCLA Center for Health Policy Research	California Health Interview Survey (CHIS)
University of Pittsburgh - NIMH	Sequenced Treatment Alternatives to Relieve Depression
Utah Department of Health's Public Health Data Resource	Utah Public Health Indicator Based Information System (IBIS)
Virginia Department of Health	Virginia Violent Death Reporting System (VDRS)
Virginia Department of Health - Office of the Medical Examiner	Virginia Medical Examiner Reports
Washington State Department of Health	Washington State Injury Data Tables
Washington State Department of Health	Washington State Death with Dignity Data
Wisconsin Department of Health Services	Wisconsin Violent Death Reporting System (VDRS)
Wisconsin Department of Health Services	Wisconsin Death Database
Wyoming Department of Health	Wyoming Vital Records - Suicide Data

CDC=Centers for Disease Control and Prevention;CDCR= California Department of Corrections and Rehabilitation;COMPSTAT=Computer Statistics;LA=Los Angeles;NCHS=National Center for Health Statistics;NIDA=National Institute on Drug Abuse;NIMH=National Institute of Mental Health

Table F-3. Data systems with potentially accessible information

Organization	Data System Name
American College Health Association	National College Health Assessment (NCHA)
Association for University and College Counseling Center Directors (AUCCCD)	Directors Surveys
Bureau of Justice Statistics	Arrest-Related Deaths
Bureau of Justice Statistics	National Corrections Reporting Program (NCRP)
California Department of Public Health (CDPH)	California County Health Status Profiles
Delaware Health and Social Services - Delaware Health Statistics Center	Delaware STIPDA Injury Data
DoD	DoD Recruit Mortality Registry (RMR)
DoD	Department of Defense Suicide Event Report (DoDSER)
Los Angeles County Child & Adolescent Suicide Review Team	Los Angeles County Child & Adolescent Suicide Review
New Jersey Department of Health	New Jersey Violent Death Reporting System (VDRS)
North Carolina Department of Health and Human Services	North Carolina Surveillance and Vital Statistics Data
San Francisco Department of Public Health	San Francisco Violent Injury Reporting System
Suicide Prevention Action Network (SPAN) of Idaho	Idaho Youth Risk Behavior Survey (YRBS)
Tennessee	Tennessee Medicaid data
Texas Department of State Health Services - Center for Health Statistics	Texas Youth Risk Behavior Survey (YRBS)
Texas Department of State Health Services - Center for Health Statistics	Texas Injury Statistics
UChicago, Harvard, Columbia and NIJ	Project on Human Development in Chicago Neighborhoods (PHDCN)
Veteran Affairs	VA Suicide Surveillance and Clinical Support System
Virginia Department of Health	Virginia Syndromic Surveillance Data
WHO	WHO Mortality Database

CDC=Centers for Disease Control and Prevention;NIJ=National Institute of Justice;STIPDA= State and Territorial Injury Prevention Directors Association;DOD=Department of Defense;WHO=World Health Organization

Table F-4. Data systems with no information available on specifications

Organization	Data System Name
Annenberg Public Policy Center	National Annenberg Survey of Youth Datasets
Army	Army Behavioral Health Integrated Data Environment (ABHIDE)
CDC - Division of Adolescent and School Health (DASH)	Youth Risk Behavior Surveillance System (YRBSS)
Delaware Health and Social Services - Division of Public Health - Office of Vital Statistics	Delaware Birth and Death Records
Indian Health Services	IHS Behavioral Health Data Mart and Reporting System
Maryland Department of Health and Mental Hygiene (M-DHMH)	Maryland Assessment Tool for Community Health (MATCH)
National Center for Deaf Health Research (NCDHR)	Deaf Health Survey
National Emergency Number Association (NENA 911)	NENA [Database Name Unknown]
Tennessee	Tennessee Medicaid data
University of Pittsburgh	Pittsburgh Girls Study
VA - VISN 2 Center for Suicide Prevention	VA MIRECC/CoE
Washington State Department of Health	Washington State Trauma Registry (WTR)

CDC=Centers for Disease Control and Prevention;CoE= centers of excellence;HIS=Indian Helath Services;MIRECC=Mental Illness Research, Education and Clinical Centers;VA=Veterans Health Administration;VISN=Veterans Integrated Service Networks