Clinically Based Suicide Prevention:

Veterans Affairs Health System Suicide Analytics and the REACH VET Clinical Program

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Office of Suicide Prevention
and Office of Mental Health
Department of Veterans Affairs

Department of Psychiatry
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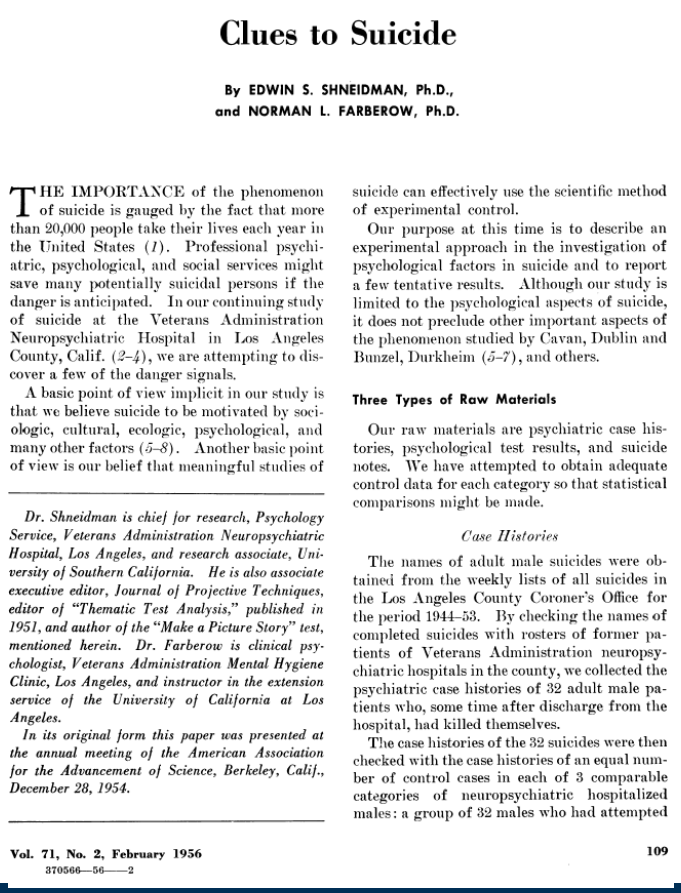
No potential conflicts of interest

Summary

- Suicide prevention is the top priority of the Department of Veterans Affairs (VA).
- Over two decades, VA has:
  - Established ongoing Veteran suicide surveillance and analytics;
  - Pioneered health system suicide prediction algorithms to enhance care;
  - Incorporated the algorithms into clinical programs to enhance care for patients in the VA health system, the Veteran Health Administration (VHA); and
  - Evaluated the effectiveness of these programs.
- This work was been possible due to VA's investment in:
  - Integrated electronic health record systems; and
  - Comprehensive data regarding Veteran suicide mortality.
- These health system operations studies involve large administrative data sources and data analyses are inclusive of patients with documented suicidal ideation and non-fatal attempts.
- Including all Veterans in VHA care enhances the utility of study analyses.

VA Suicide Surveillance and Analytics

- The VA has monitored suicidal behavior since 1950.
- However, site reports identify only about 1 in 3 suicides among Veterans in VHA care. (Palframan et al. 2021)



Clues to Suicide

By EDWIN S. SHNEIDMAN, Ph.D., and NORMAN L. FARBEROW, Ph.D.

THE IMPORTANCE of the phenomenon of suicide is gauged by the fact that more than 20,000 people take their lives each year in the United States (*1*). Professional psychiatric, psychological, and social services might save many potentially suicidal persons if the danger is anticipated. In our continuing study of suicide at the Veterans Administration Neuropsychiatric Hospital in Los Angeles County, Calif. (*2–4*), we are attempting to discover a few of the danger signals.

A basic point of view implicit in our study is that we believe suicide to be motivated by sociologic, cultural, ecologic, psychological, and many other factors (*5–8*). Another basic point of view is our belief that meaningful studies of suicide can effectively use the scientific method of experimental control.

Our purpose at this time is to describe an experimental approach in the investigation of psychological factors in suicide and to report a few tentative results. Although our study is limited to the psychological aspects of suicide, it does not preclude other important aspects of the phenomenon studied by Cavan, Dublin and Bunzel, Durkheim (*5–7*), and others.

Three Types of Raw Materials

Our raw materials are psychiatric case histories, psychological test results, and suicide notes. We have attempted to obtain adequate control data for each category so that statistical comparisons might be made.

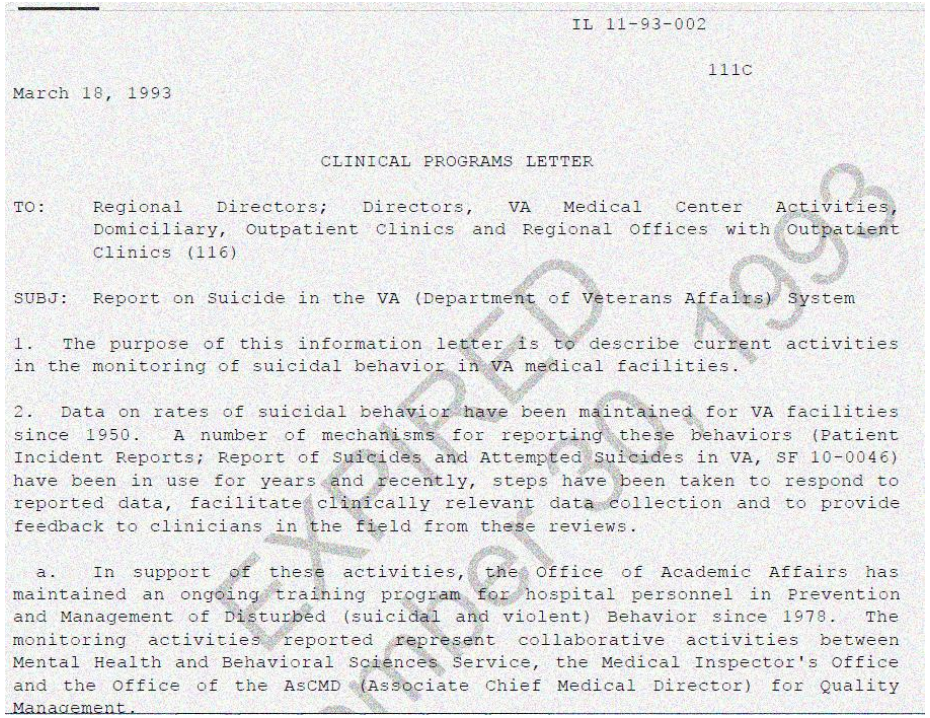
Case Histories

The names of adult male suicides were obtained from the weekly lists of all suicides in the Los Angeles County Coroner's Office for the period 1944–53. By checking the names of completed suicides with rosters of former patients of Veterans Administration neuropsychiatric hospitals in the county, we collected the psychiatric case histories of 32 adult male patients who, some time after discharge from the hospital, had killed themselves.

The case histories of the 32 suicides were then checked with the case histories of an equal number of control cases in each of 3 comparable categories of neuropsychiatric hospitalized males: a group of 32 males who had attempted

Dr. Shneidman is chief for research, Psychology Service, Veterans Administration Neuropsychiatric Hospital, Los Angeles, and research associate, University of Southern California. He is also associate executive editor, Journal of Projective Techniques, editor of "Thematic Test Analysis," published in 1951, and author of the "Make a Picture Story" test, mentioned herein. Dr. Farberow is clinical psychologist, Veterans Administration Mental Hygiene Clinic, Los Angeles, and instructor in the extension service of the University of California at Los Angeles.

In its original form this paper was presented at the annual meeting of the American Association for the Advancement of Science, Berkeley, Calif., December 28, 1954.



IL 11-93-002

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March 18, 1993

CLINICAL PROGRAMS LETTER

TO: Regional Directors; Directors, VA Medical Center Activities, Domiciliary, Outpatient Clinics and Regional Offices with Outpatient Clinics (116)

SUBJ: Report on Suicide in the VA (Department of Veterans Affairs) System

1. The purpose of this information letter is to describe current activities in the monitoring of suicidal behavior in VA medical facilities.

2. Data on rates of suicidal behavior have been maintained for VA facilities since 1950. A number of mechanisms for reporting these behaviors (Patient Incident Reports; Report of Suicides and Attempted Suicides in VA, SF 10-0046) have been in use for years and recently, steps have been taken to respond to reported data, facilitate clinically relevant data collection and to provide feedback to clinicians in the field from these reviews.

a. In support of these activities, the Office of Academic Affairs has maintained an ongoing training program for hospital personnel in Prevention and Management of Disturbed (suicidal and violent) Behavior since 1978. The monitoring activities reported represent collaborative activities between Mental Health and Behavioral Sciences Service, the Medical Inspector's Office and the Office of the AsCMD (Associate Chief Medical Director) for Quality Management.

EXPIRED 1998

Ascertainment of Patient Suicides by Veterans Affairs Facilities and Associations With Veteran, Clinical, and Suicide Characteristics

Kristen M. Palframan, MPH, Benjamin R. Szymanski, PhD, MPH, and John F. McCarthy, PhD, MPH

Objectives. To evaluate the sensitivity of health care facility documentation of suicide deaths among US veterans with recent Veterans Health Administration (VHA) care and assess variation in identification by veteran, clinical, and suicide death characteristics.

Methods. Cross-sectional analyses included 11 148 veterans who died by suicide in 2013 to 2017, per National Death Index death certificate information, with VHA encounters in the year of death or the previous year. Facility suicide ascertainment was assessed per site reports in the VHA Suicide Prevention Applications Network. Bivariate and multivariable analyses assessed ascertainment by decedent demographic, clinical, utilization, and method of suicide characteristics.

Results. Site reports identified 3667 suicide decedents (32.9%). Veteran suicide decedents identified by facilities were more likely to be younger and with clinical risk factors and more recent VHA encounters. Suicide deaths involving poisoning were less likely to be identified than deaths involving other methods.

Conclusions. VHA facility ascertainment of suicide deaths among recent patients was neither comprehensive nor representative. Findings will inform efforts to enhance facility suicide surveillance and veteran suicide prevention. (*Am J Public Health.* 2021;111(S2):S116–S125. https://doi.org/10.2105/AJPH.2021.306262)

VHA Serves Veteran Population with Elevated Suicide Risks

- Elevated suicide risk among VHA patients than for the general U.S. adult population (McCarthy et al., 2009).
  - This offered previously unavailable information for health systems

American Journal of Epidemiology
Published by the Johns Hopkins Bloomberg School of Public Health 2009.

Vol. 169, No. 8
DOI: 10.1093/aje/kwp010
Advance Access publication February 27, 2009

Original Contribution

Suicide Mortality Among Patients Receiving Care in the Veterans Health Administration Health System

John F. McCarthy, Marcia Valenstein, H. Myra Kim, Mark Ilgen, Kara Zivin, and Frederic C. Blow

Initially submitted February 20, 2008; accepted for publication January 12, 2009.

Understanding and reducing mortality from suicide among veterans is a national priority, particularly for individuals receiving care from the US Veterans Health Administration (VHA). This report examines suicide rates among VHA patients and compares them with rates in the general population. Suicide mortality was assessed in fiscal year 2001 for patients alive at the start of that fiscal year and with VHA use in fiscal years 2000–2001 ($n = 4{,}692{,}034$). Deaths from suicide were identified by using National Death Index data. General population rates were identified by use of the Web-based Injury Statistics Query and Reporting System. VHA rates were 43.13/100,000 person-years for men and 10.41/100,000 person-years for women. For male patients, the age-adjusted standardized mortality ratio was 1.66; for females, it was 1.87. Male patients aged 30–79 years had increased risks relative to men in the general population; standardized mortality ratios ranged from 2.56 (ages 30–39 years) to 1.33 (ages 70–79 years). Female patients aged 40–59 years had greater risks than did women in the general population, with standardized mortality ratios of 2.15 (ages 40–49 years) and 2.36 (ages 50–59 years). Findings offer heretofore unavailable comparison points for health systems. Prior to the conflicts in Afghanistan and Iraq and before recent VHA initiatives, rates were higher among VHA patients than in the general population. Female patients had particularly high relative risks.

Annual VA Reports, Since 2016

2025 National Veteran Suicide Prevention Annual Report

VA conducts the largest national analysis of Veteran suicide rates each year. Findings are made available to the public in an Annual Report in two parts—Part 1: Overview and Part 2: Report Findings. The report is based on national death certificate data currently available through 2023.

National Suicide Data Appendix
All-Cause Mortality Data Appendix

https://www.mentalhealth.va.gov/suicide_prevention/data.asp

Figure 4: Suicide Rate per 100,000, Veterans, by State, 2023

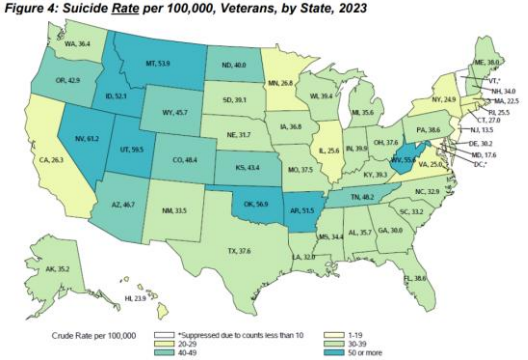


Figure 2: Veteran Suicide Deaths, 2001-2023

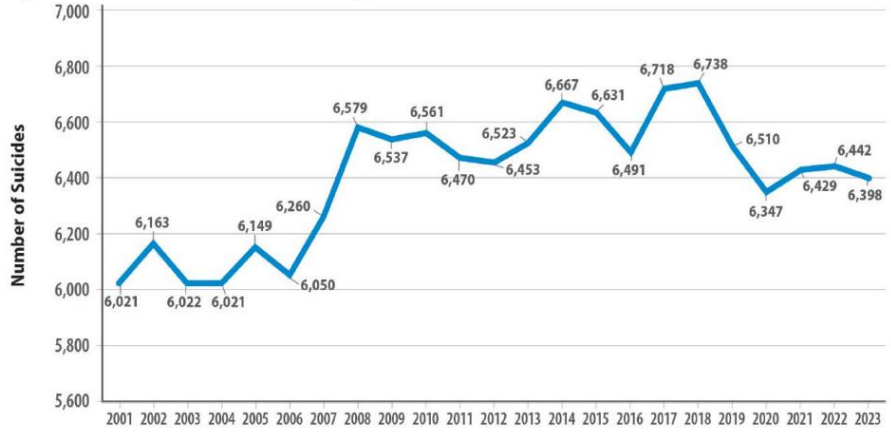
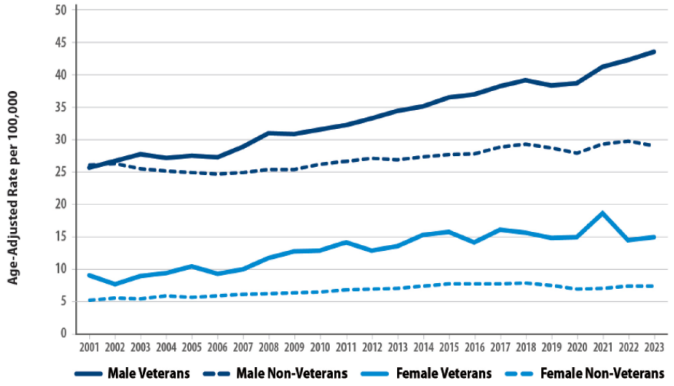
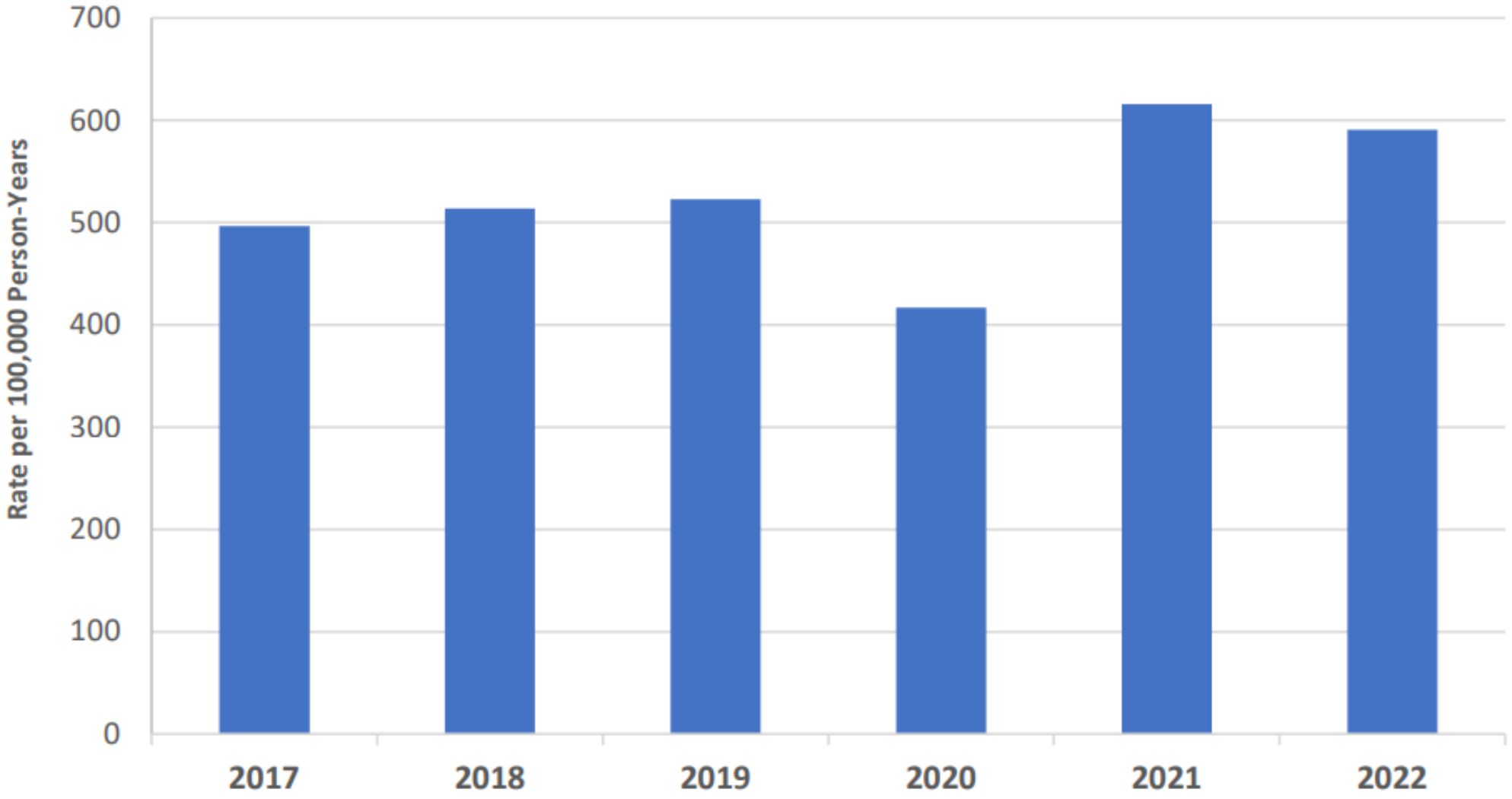


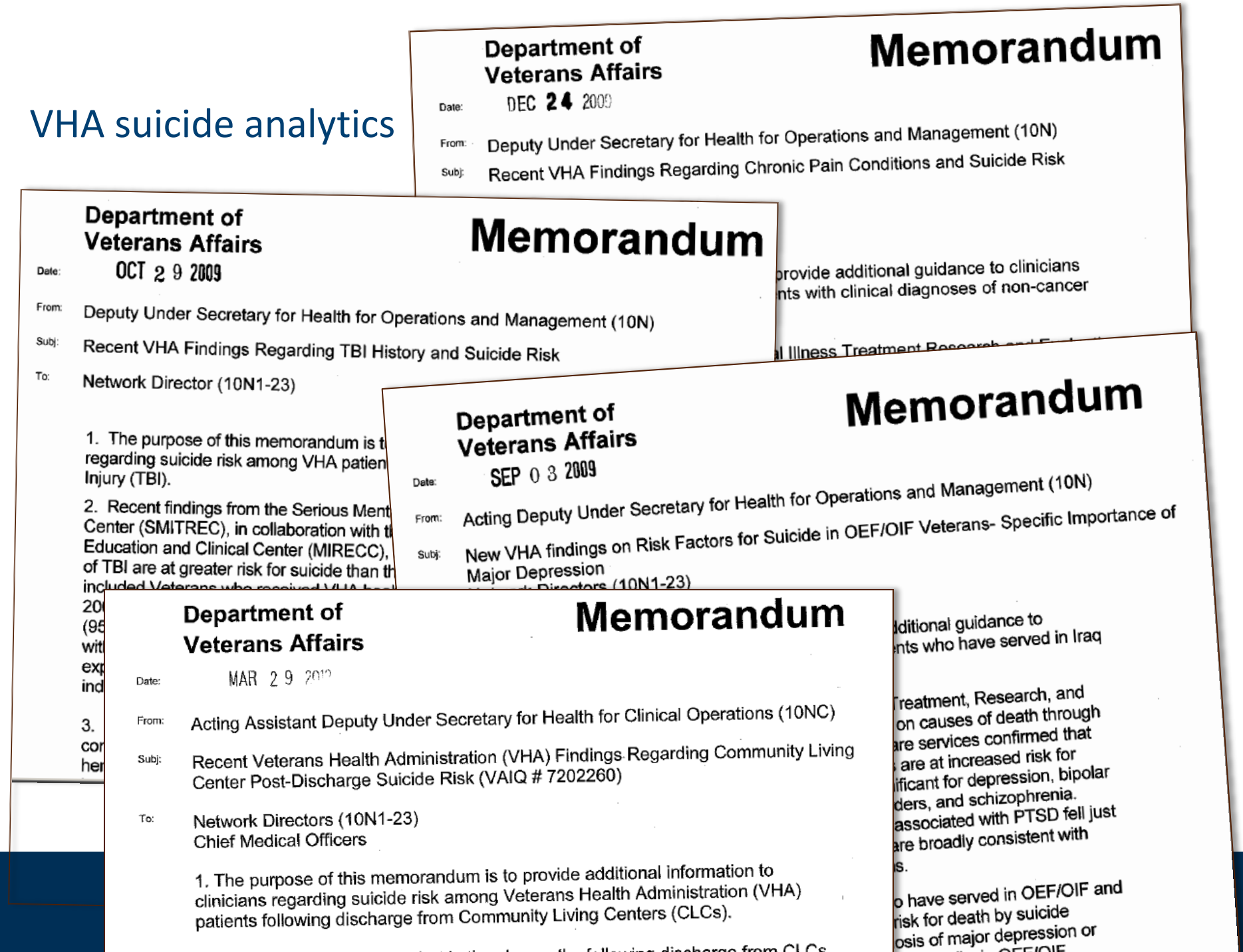
Figure 5: Age-Adjusted Suicide Rate, Veteran and Non-Veteran U.S. Adults, by Sex, 2001-2023



Suicide Rate, 12 Months Following VHA Documented Non-Fatal Suicide Attempt, Veterans, by Year, 2017-2022



VHA suicide analytics



Department of Veterans Affairs

Memorandum

Date: DEC 24 2009

From: Deputy Under Secretary for Health for Operations and Management (10N)

Subj: Recent VHA Findings Regarding Chronic Pain Conditions and Suicide Risk

provide additional guidance to clinicians
nts with clinical diagnoses of non-cancer

Department of Veterans Affairs

Memorandum

Date: OCT 29 2009

From: Deputy Under Secretary for Health for Operations and Management (10N)

Subj: Recent VHA Findings Regarding TBI History and Suicide Risk

To: Network Director (10N1-23)

1. The purpose of this memorandum is t
regarding suicide risk among VHA patien
Injury (TBI).

2. Recent findings from the Serious Ment
Center (SMITREC), in collaboration with t
Education and Clinical Center (MIRECC),
of TBI are at greater risk for suicide than th
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Department of Veterans Affairs

Memorandum

Date: SEP 03 2009

From: Acting Deputy Under Secretary for Health for Operations and Management (10N)

Subj: New VHA findings on Risk Factors for Suicide in OEF/OIF Veterans- Specific Importance of Major Depression

(10N1-23)

ditional guidance to
nts who have served in Iraq

Treatment, Research, and
on causes of death through
are services confirmed that
are at increased risk for
ificant for depression, bipolar
ders, and schizophrenia.
associated with PTSD fell just
are broadly consistent with
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o have served in OEF/OIF and
risk for death by suicide
osis of major depression or

Department of Veterans Affairs

Memorandum

Date: MAR 29 2012

From: Acting Assistant Deputy Under Secretary for Health for Clinical Operations (10NC)

Subj: Recent Veterans Health Administration (VHA) Findings Regarding Community Living Center Post-Discharge Suicide Risk (VAIQ # 7202260)

To: Network Directors (10N1-23)
Chief Medical Officers

1. The purpose of this memorandum is to provide additional information to clinicians regarding suicide risk among Veterans Health Administration (VHA) patients following discharge from Community Living Centers (CLCs).

Challenges of Risk Identification

- Positive screens for suicidal ideation (item 9 of the Patient Health Questionnaire) were associated with increased risk of suicide, however 72% of suicides occurred among patients who screened negative.

Does Suicidal Ideation as Measured by the PHQ-9 Predict Suicide Among VA Patients?

Samantha A. Louzon, M.P.H., Robert Bossarte, Ph.D., John F. McCarthy, Ph.D., M.P.H., Ira R. Katz, M.D., Ph.D.

Objective: Frequency of suicidal ideation in the past two weeks, assessed by item 9 of the nine-item Patient Health Questionnaire (PHQ-9), has been positively associated with suicide mortality among patients in a setting other than the Veterans Health Administration (VHA). To inform suicide prevention activities at the VHA, it is important to evaluate whether item 9 is associated with suicide risk among patients in the VHA system.

Methods: PHQ-9 assessments (N=447,245) conducted by the VHA between October 1, 2009, and September 30, 2010, were collected. National Death Index data were used to ascertain suicide mortality from the date of PHQ-9 assessment through September 30, 2011. Multivariable proportional hazards regressions were used to evaluate associations between responses to item 9 and suicide mortality.

Results: After the analyses adjusted for covariates, a response of "several days" for item 9 was associated with a 75% increased risk of suicide (hazard ratio [HR]=1.75, 95% confidence interval [CI]=1.24–2.46), a response of "more than half the days" was associated with a 115% increased risk of suicide (HR=2.15, CI=1.32–3.51), and a response of "nearly every day" was associated with a 185% increased risk of suicide (HR=2.85, CI=1.81–4.47), compared with a response of "not at all." However, 71.6% of suicides during the study period occurred among patients who responded "not at all" to item 9 from their most recent PHQ-9.

Conclusions: Higher levels of suicidal ideation, indicated by item 9 of the PHQ-9, were associated with increased risk of suicide among patients in the VHA system.

Psychiatric Services in Advance (doi: 10.1176/appi.ps.201500149)

Need for New Approaches

- By 2013, VHA had implemented innovative suicide prevention strategies
  - Dedicated suicide prevention coordinators
  - Around-the-clock Crisis Line services
  - Trainings regarding suicide risk factors
  - Clinical structures to flag individuals based on suicidal ideation or behavior
- Suicide risk assessment was generally based on
  - provider judgment
  - limited use of structured assessment tools
- Many individual factors were associated with suicide
  - demographic measures (e.g., male gender)
  - clinical diagnoses (e.g., bipolar disorder, depression)
  - Contextual, temporal factors (e.g., recent MH discharge or suicide attempt)
- Yet effect sizes for individual associations were often relatively small
- More comprehensive approaches were needed

Predictive Modeling

- Goal: To develop new approaches to:
  - Identify patients at risk
  - Enhance care
- Strategy: Identify people whose care should be enhanced
  - One target group may be those at highest risk
  - Another includes those at more moderate risk, who account for a substantial proportion of the total burden of suicide
- VA demonstrated
  - Internal validity for a comprehensive predictive model (381 variables)
  - Persistence of risk concentration over time
- Developed practical model for implementation (61 variables)
  - Machine learning techniques

Proof of Concept: Methods

- Generated data base for patient-months using data for 2009-2011
  - Included all VHA users who died from suicide, by month, and 1% of VHA users who survived the month
  - Created split samples for *model development* and *validation*
  - Included demographics, variables known to be risk factors, specific events as lag variables, and interactions known to be important
- Developed logistic regression model using development sample
  - Included all variables
  - Sorted and ranked patients by tiers of model-predicted risk
- Evaluated model using validation sample
- Tested how well it predicted suicide over 12 months for all VHA patients alive at the start of the fiscal year 2011

Documented Risk Concentration for Suicide and Other Adverse Outcomes

Predictive Modeling and Concentration of the Risk of Suicide: Implications for Preventive Interventions in the US Department of Veterans Affairs

John F. McCarthy, PhD, Robert M. Bossarte, PhD, Ira R. Katz, MD, PhD, Caitlin Thompson, PhD, Janet Kemp, PhD, Claire M. Hannemann, MPH, Christopher Nielson, MD, and Michael Schoenbaum, PhD

Over the past 8 years, the Veterans Health Administration (VHA), the health system of the Department of Veterans Affairs, strengthened its mental health services and supplemented them with specific programs for suicide prevention.[1,2] However, suicide rates in VHA have been stable, without decreases that can be attributed to these enhancements.[3] The stable rates stand in contrast to increased rates in other US populations, especially middle-aged men,[4,5] and in veterans who do not use VHA[3,6]; VHA programs may have mitigated population-wide increases. Nevertheless, the finding that suicide rates in VHA remain high represents a strong call for action.

Although epidemiological research has identified an array of risk factors for suicide, effect sizes are, in general, small to moderate.[7,8]

Objectives. The Veterans Health Administration (VHA) evaluated the use of predictive modeling to identify patients at risk for suicide and to supplement ongoing care with risk-stratified interventions.

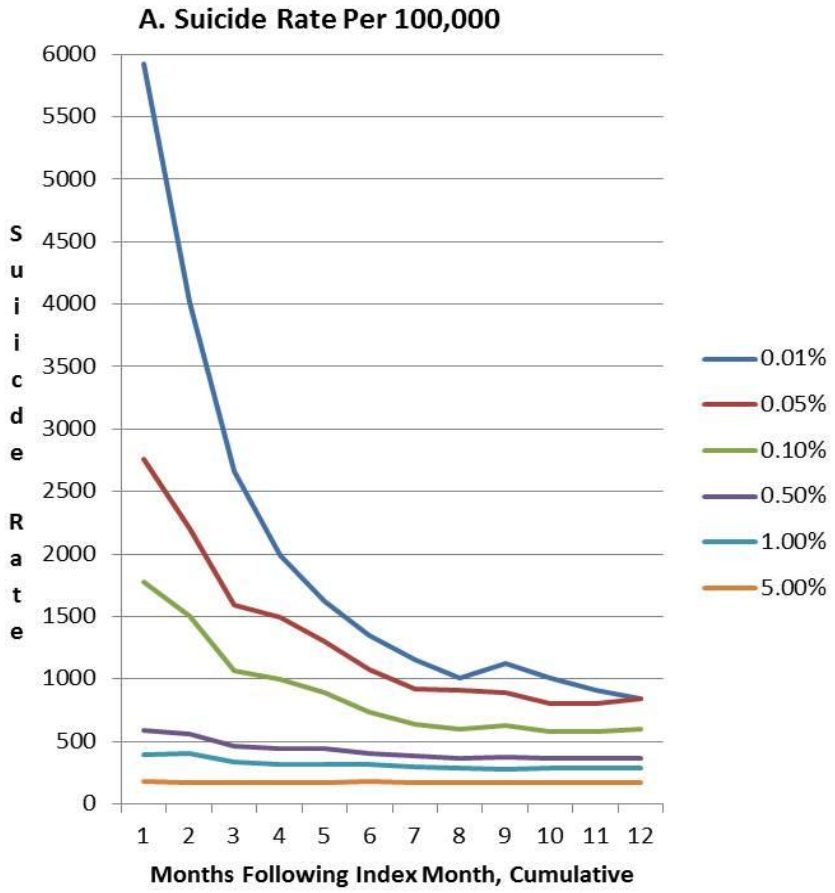
Methods. Suicide data came from the National Death Index. Predictors were measures from VHA clinical records incorporating patient-months from October 1, 2008, to September 30, 2011, for all suicide decedents and 1% of living patients, divided randomly into development and validation samples. We used data on all patients alive on September 30, 2010, to evaluate predictions of suicide risk over 1 year.

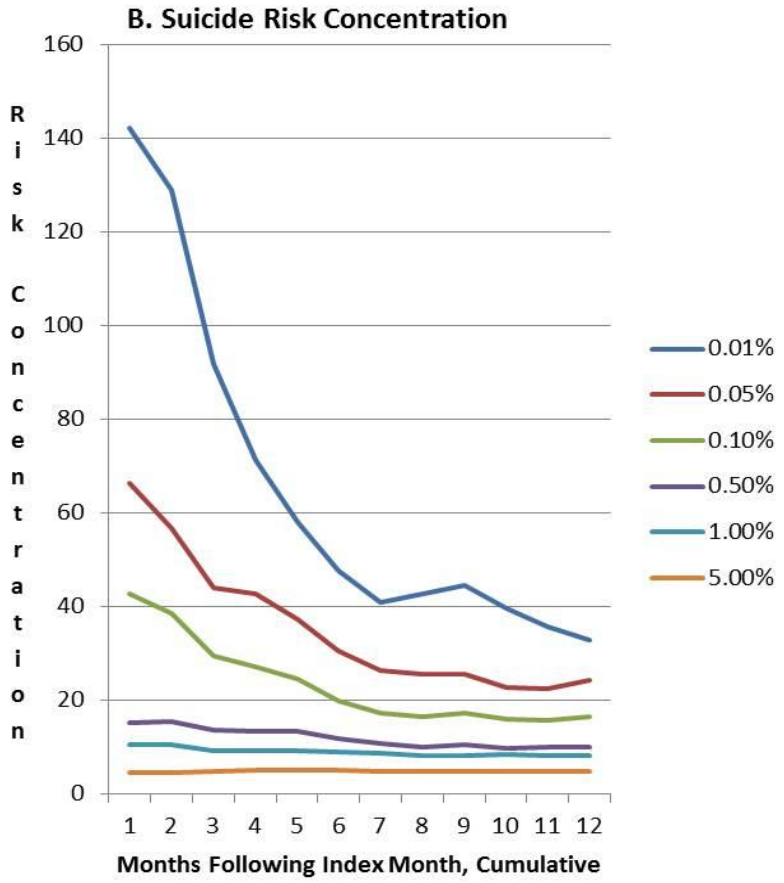
Results. Modeling demonstrated that suicide rates were 82 and 60 times greater than the rate in the overall sample in the highest 0.01% stratum for calculated risk for the development and validation samples, respectively; 39 and 30 times greater in the highest 0.10%; 14 and 12 times greater in the highest 1.00%; and 6.3 and 5.7 times greater in the highest 5.00%.

Conclusions. Predictive modeling can identify high-risk patients who were not identified on clinical grounds. VHA is developing modeling to enhance clinical care and to guide the delivery of preventive interventions. (*Am J Public Health.* Published online ahead of print June 11, 2015: e1–e8. doi:10.2105/AJPH.2015.302737)

Prediction: Rate and Risk Concentration Trajectories

Prediction Sample, Suicide Risk Concentration (A) and Suicide Rate (B) over 12 Months, Top Tiers of Predicted Probability

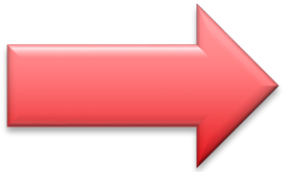




Refinement for Implementation

- To facilitate real-time computation, minimize over- fitting, and address problems related to correlated measures, VA applied *machine learning methods* *(Kessler et al., 2017).*
  - 10-fold cross-validation forward stepwise logistic regression to determine optimal number of predictors
  - Elastic net penalized logistic regression to determine the particular predictors
  - Resolved on model with 61 predictors and an algorithm for non-linearities and interactions

- This has been applied in program implementation



Enhanced Care

Recovery Engagement And Coordination for Health – Veterans Enhanced Treatment (REACH VET)

- Applies algorithm monthly to complement clinical risk strategies
- Identifies patients in top 0.1% risk tier at local facility
- Notifies providers
- Asks providers to reevaluate and enhance the care as appropriate in collaboration with the Veteran
- Late 2016: Pilot work
- Early 2017: National roll-out

REACH VET Processes

REACH VET Coordinators

1. Access the dashboard
2. Identify appropriate provider
3. Communicate with identified provider
4. Document in EMR

MH and Primary Care Providers

1. Receive notification about a high risk Veteran
2. Re-evaluate care
3. Consider treatment enhancement strategies
4. Outreach the Veteran
5. Document in EMR

VHA Implementation of REACH VET Program

- REACH VET has been implemented at all VHA facilities.
- Program metrics increased after initial implementation.

	March 2017	December 2018	September 2021
Coordinator acknowledgement that patients were identified	87%	98%	100%
Provider acknowledgement	51%	91%	99%
Care evaluations	46%	88%	99%
Outreach attempt prevalence	43%	86%	99%
Percentage of outreach attempts that were successful	74%	71%	89%

JAMA Network Open™

Original Investigation | Psychiatry

Evaluation of the Recovery Engagement and Coordination for Health–Veterans Enhanced Treatment Suicide Risk Modeling Clinical Program in the Veterans Health Administration

John F. McCarthy, PhD; Samantha A. Cooper, MPH; Kallisse R. Dent, MPH; Aaron E. Eagan, MPH; Bridget B. Matarazzo, PsyD; Claire M. Hannemann, MPH; Mark A. Reger, PhD; Sara J. Landes, PhD; Jodie A. Trafton, PhD; Michael Schoenbaum, PhD; Ira R. Katz, MD

JAMA Network Open. 2021;4(10):e2129900. doi:10.1001/jamanetworkopen.2021.29900 October 18, 2021 1/11

PRE-RELEASE VERSION – INCLUDES INFORMATION EMBARGOED UNTIL AT LEAST 10AM ON 10/18/2021

Intention to Treat Framework, Select Items

REACH VET

Implementation

Processes

Treatment Engagement

- Services Receipt
- Treatment maintenance

Care Processes

- Safety Planning

Services Utilization

- Mental Health Encounters
- Emergency Department Use

Outcomes

Mortality

- All-cause
- External cause
- Non-External
- Suicide

Suicide attempts

Hypotheses

Entry into REACH VET would be associated with …

H1: … enhanced **treatment engagement** (more scheduled and completed appointments, fewer missed appointments, more outpatient mental health encounters)

H2: … Enhanced **quality of care** (documented completion of a safety plan for patients without documentation in the prior 2 years)

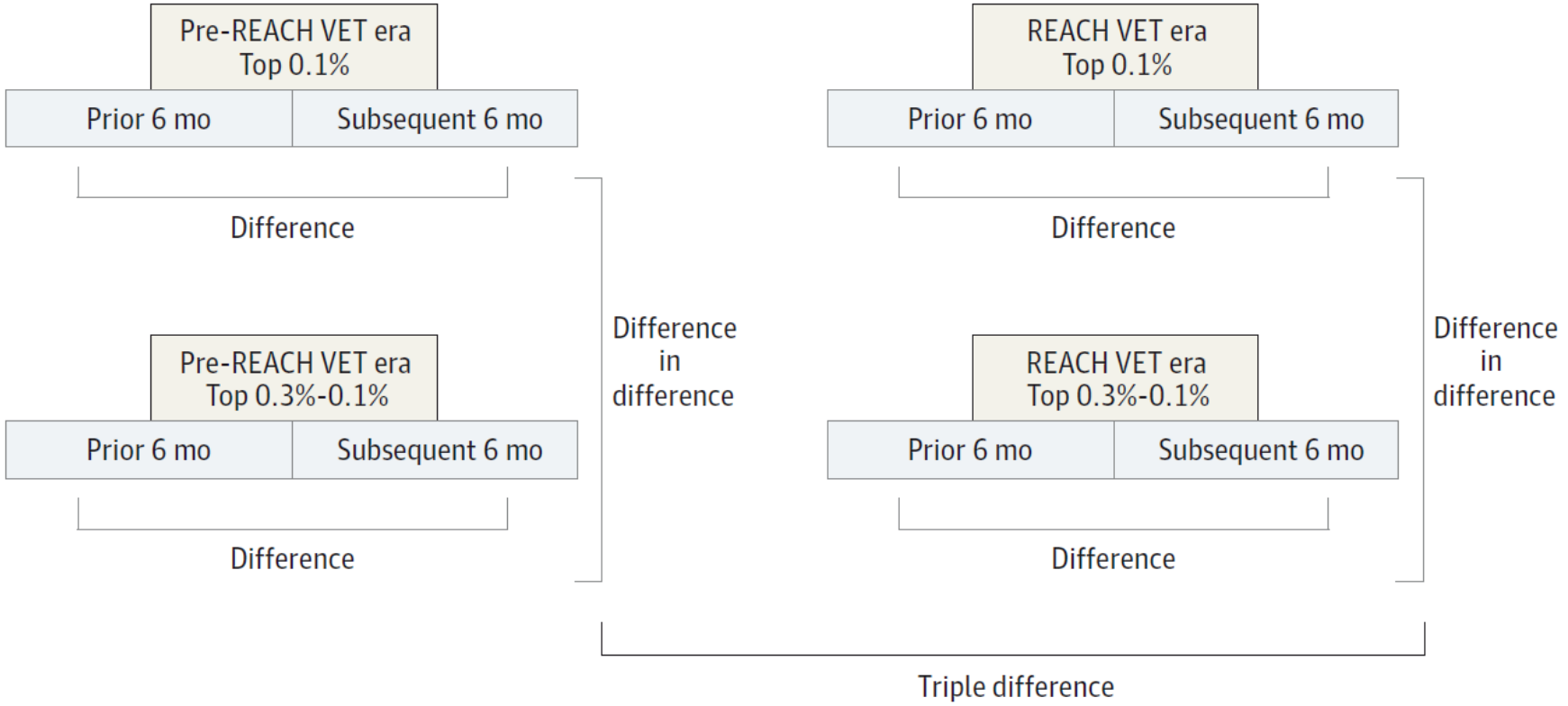
H3: … reduced **acute care needs** (fewer inpatient mental health admissions and emergency department visit days)

H4: … reduced **suicide-related behavior** (suicide attempts, suicide deaths)

H6: … reduced **non-suicide external cause and all-cause mortality**

Triple Differences Design

Figure. Triple Differences Analysis Design



McCarthy et al., 2021, JAMA Network Open

Further Analyses Regarding Mortality Outcomes

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Research Letter | Psychiatry

The REACH VET Program and Mortality Outcomes Among Veterans at High Risk of Suicide

Kallisse R. Dent, MPH, MS; Samantha Cooper, MPH; John F. McCarthy, PhD, MPH

REACH VET Effectiveness Findings

- Evaluation findings document positive outcomes (McCarthy et al., 2021) :
  - increased completed outpatient appointments
  - reduced missed appointments
  - reduced inpatient mental health admissions
  - reduced emergency department visit days
  - greater initiation of suicide safety plans; and
  - reductions in documented suicide attempts.
- No significant associations were found with mortality outcomes (suicide, non-suicide external cause mortality, all-cause mortality).
- Negative findings regarding mortality outcomes were documented for REACH VET in a follow-up analysis (Dent et al., 2025).

Suicide Prevention Analytics in the VA Health System

- Largest integrated health system in the United States
  - Serves large patient population (~6 million per year)
  - Integrated electronic health record information systems
  - VA conducts ongoing surveillance of CDC National Death Index death certificate data.
- Capacity for rapid implementation of clinical initiatives and monitoring
  - Suicide predictive modeling work began in 2013 (McCarthy et al., 2015)
  - Algorithm was refined for national implementation (Kessler et al, 2017)
  - REACH VET was implemented nationally in 2016/2017
  - Effectiveness evaluations (McCarthy et al., 2021; Dent et al., 2024)
  - Program and algorithm enhancements are ongoing
    - REACH VET 2.0 algorithm implemented in June 2025

Inclusion of in Suicide Analytics of Patients with Documented Suicidal Behavior

- Did VA analyses include individuals with suicidal behavior?
  - Yes, the analysis examined data from the VHA electronic health record for all patients in VHA care.
  - It was an operations analysis and examined data for all patients.
  - Analyses were limited to secondary data analyses. No Veterans were contacted in the process of conducting surveillance or predictive modeling analyses.
  - The predictive algorithm is used prospectively to assist clinicians with identifying a high-risk clinical subpopulation.

Contact Information

Thank you!

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VA Office of Suicide Prevention

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