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TITLE: Technologies for Assessing Behavioral and Cognitive Markers of Suicide Risk

PRINCIPAL INVESTIGATOR: Brian Baucom, PhD

CONTRACTING ORGANIZATION: University of Utah, Salt Lake City, UT 84112

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13. SUPPLEMENTARY NOTES

14. ABSTRACT

The primary aim of the proposed project is to develop cognitive and behavioral markers of suicide risk and to evaluate the predictive utility of these markers over a one year period. We propose to achieve these aims by: (a) collecting cognitive and behavioral data from Reserve component soldiers and their romantic partners in both our research laboratory and participant's homes; (b) processing these data using computer algorithms developed specifically for this study; and (c) testing the predictive accuracy of these markers using follow-up data collected from study participants over 12 months. Data collection is still in progress. There are no research findings to report at this this.

15. SUBJECT TERMS

Suicide risk assessment, suicide prevention, signal processing

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON USAMRMC
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INTRODUCTION:

The primary aim of the proposed project is to develop cognitive and behavioral markers of suicide risk and to evaluate the predictive utility of these markers over a one year period. We propose to achieve these aims by: (a) collecting cognitive and behavioral data from Reserve component soldiers and their romantic partners in both our research laboratory and participant's homes; (b) processing these data using computer algorithms developed specifically for this study; and (c) testing the predictive accuracy of these markers using follow-up data collected from study participants over 12 months.

1. **KEYWORDS:**

Suicide risk assessment, suicide prevention, signal processing

2. **ACCOMPLISHMENTS:**
   What were the major goals of the project?

   Task 1: Obtain IRB approvals
   1a. Initiate IRB proposal (months 1-3)
   1b. Complete annual reports to IRB (months 12-36)
   1c. Complete final report to IRB (month 36)
   Task 2: Hire and train research staff
   2a. Hire and train postdoctoral fellow (months 1-3)
   2b. Train research associates (months 1-3)
   Task 3: Begin and complete baseline data collection
   3a. Participant screening & enrollment (months 6-18)
   3b. Begin baseline data collection (month 6)
   3c. Continue baseline data collection (months 6-18)
   3d. Complete baseline data collection (month 18)
   Task 4: Begin and complete longitudinal tracking and follow-up assessments
   4a. Begin longitudinal tracking and follow-up assessments (month 6)
   4b. Continue longitudinal tracking and follow-up assessments (months 10-30)
   4c. Complete longitudinal tracking and follow-up assessment (month 30)
   Task 5: Use existing data to adapt and refine BSP technologies
   5a. Refine BSP technologies for automatically generating CIRS, SSIRS, & NORS scores (months 3-18)
   5b. Refine BSP technologies for generating feature-derived behavioral markers (months 3-18)
   Task 6: Use refined BSP technologies to measure behavioral markers in study data
   6a. Use refined BSP technologies to automatically generate CIRS, SSIRS, & NORS scores (months 18-24)
   6b. Use refined BSP technologies to generate feature-derived behavioral markers (months 18-24)
   Task 7: Generate cognitive markers in study data
   7a. Generate cognitive markers in study data (months 18-21)
   Task 8: Data analysis, manuscript writing, report writing
   8a. Begin baseline data analyses (month 24)
   8b. Begin data analyses of follow-up data (month 30)
   8c. Manuscript and report writing (months 24-36)
   Completion of tasks:
   1a. 100%
   1b. Ongoing
   1c. Not yet started

Completion of tasks (cont):
2a. 100%
2b. 100%
3a. Ongoing (45%)
3b. Ongoing (45%)
3c. Ongoing (45%)
3d. Not yet started
4a. 100%
4b. Ongoing (45%)
4c. Not yet started
5a. 100%
5b. 100%
6a. Not yet started
6b. Not yet started
7a. Not yet started
8a. Not yet started
8b. Not yet started
8c. 25%

What was accomplished under these goals?

Major activities:
1.   IRB approval obtained from the University of Utah (initial approval: September 21, 2015; final approval: November 25, 2015), University of Southern California (IRB Authorization Agreement received: September 21, 2015), and HRPO (December 1, 2015).
2.   Hired one graduate research assistant, Alexander Crenshaw, for year 2 (September 1, 2017).
3.   Continued funding postdoctoral scholar, Feea Leifker, for year 2 (August 8, 2017).
4.   Trainings for study staff held February 12, 2016; trainings repeated August 25, 2016 and August 29, 2017 to refresh study staff and to train new study staff.
5.   Screening participants initiated February 16, 2016 and is ongoing.
6.   Baseline data collection initiated February 26, 2016 and is ongoing.
7.   Follow-up data collection initiated on August 8, 2016 and is ongoing.
8.   Refinement of existing algorithms for automated coding initiated January 1, 2016 and completed .
9.   Refinement of feature-derived behavioral markers initiated March 7, 2016 and is ongoing.
10.   Additional, existing data sets transferred to USC to provide additional data for refining automated coding algorithms and feature-derived behavioral markers (April 14, 2016).
11.   First project manuscript accepted on March 24, 2017; second project manuscript accepted on September 13, 2017; third project manuscript accepted on September 17, 2017.
12.   Requested a no cost extension to continue participant recruitment into Y4 on May 22, 2018. Approval received May 31, 2018.
13.   Hired additional study staff, Alex Russell and Rikki Carpenter (August 5, 2018) as well as Kent Hinkson and Michael Snell, to assist with participant recruitment (August 6, 2018).

Specific objectives:
1.   Receive University of Utah, University of Southern California, and HRPO IRB approval.
2.   Fully train study staff in study procedures and emergency suicide risk assessment.
3.   Begin enrollment of participants.
4.   Collect baseline data from 120 couples.
5.   Begin follow-up data collection.

Objectives 1, 2, 3, and 5 have been met. Objective 4 has not been met due to continuing difficulties with recruitment.

What opportunities for training and professional development has the project provided?

Nothing to Report.

How were the results disseminated to communities of interest?

Nothing to Report.

What do you plan to do during the next reporting period to accomplish the goals?

Consistent with the plan described in our July 17, 2018 Quarterly report, we plan to continue contacting the ~800 Veterans on our VA supplied list of potential participants. We have hired 2 additional research assistants, who themselves are Veterans, to assist with calling potential Veteran participants, and an addition 2 research assistants to assist with mailing letters to potential Veteran participants. We are on pace to have mailed letters to and have called all 800 potential Veteran participants by June, 2019, leaving us at least two months to screen and enroll all potential participants on the VA provided list. Additionally, one of our former study staff has taken a faculty position in Connecticut and has formed connections with the Connecticut Army National Guard (CANG). She is pursuing the possibility of recruiting Connecticut Guard members and Veterans as well as the likely time needed for approval if CANG is open to this possibility. We do not yet know if this is a realistic possibility and will closely consult with our Scientific Officer, Ms. Michelle Lane, if appears to be a realistic possibility before pursuing any regulatory changes. Finally, in order to increase our rate of recruitment and ensure that we are able to continue pursuing regularly occurring opportunities to recruit National Guard personnel and Reservists in addition to our new recruitment strategy of recruiting veterans, we are continually monitoring our staff's ability to take advantage of all recruitment opportunities and have martialed enough funds that we will hire new staff as needed should our capacity become insufficient at any point.

4. **IMPACT:**
What was the impact on the development of the principal discipline(s) of the project?

Nothing to Report.

What was the impact on other disciplines?

Nothing to Report.

What was the impact on technology transfer?

Nothing to Report.

What was the impact on society beyond science and technology?

Nothing to Report.

5. **CHANGES/PROBLEMS:**
Changes in approach and reasons for change

Nothing to Report.

Actual or anticipated problems or delays and actions or plans to resolve them

Describe problems or delays encountered during the reporting period and actions or plans to resolve them. As noted in our OCT-2016 Annual review and our subsequent reports and reviews, our rate of recruitment is below what we had anticipated. As described above, we have hired new study staff to increase our rate of potential participant communication and are pursuing a

a new recruitment opportunity, the Connecticut Army National Guard, to increase the size of our potential participant pool.

Changes that had a significant impact on expenditures

We did not fund a Clinical psychology graduate student, we reduced Dr. Leifker's funding to 10% and Dr. Bryan's to 2.22%, and Drs. Baucom and Garland did not receive funding in Q4Y3 to preserve funds for recruitment efforts during our NCE. Prior approval to reduce funding levels for Drs. Baucom, Garland, and Bryan was received from Ms. Michelle Lane and Ms. Cathy Sanchez on August 6, 2018.

Significant changes in use or care of human subjects, vertebrate animals, biohazards, and/or select agents

Significant changes in use or care of human subjects

We received approval from the University of Utah IRB and the Salt Lake City Veteran's Administration (SLCVA) to recruit Veterans from a list provided by the SLC VA on 12/11/2017 and HRPO on 1/11/2018. We additionally received approval to recruit veterans who separated within the past 10 years from the University of Utah IRB and the SLCVA on 7/17/2018.

Significant changes in use or care of vertebrate animals

Nothing to Report.

Significant changes in use of biohazards and/or select agents

Nothing to Report.

6. **PRODUCTS:**
- **Publications, conference papers, and presentations**
  Journal publications.

  Nothing to Report.

  Books or other non-periodical, one-time publications.

  Nothing to Report.

  Other publications, conference papers and presentations.

  Nothing to Report.

- **Website(s) or other Internet site(s)**

  Nothing to Report.

- **Technologies or techniques**

  Nothing to Report.

- **Inventions, patent applications, and/or licenses**

  Nothing to Report.

- **Other Products**

Nothing to Report.

7. PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS

What individuals have worked on the project?

Personnel	Role	Percent effort
Baucom, Brian	Principal Investigator	.088
Bryan, Craig	Co-Investigator	.056
Garland, Eric	Co-Investigator	.031
Narayanan, Shrikanth	Co-Investigator	.08
Georgiou, Panayiotis	Co-Principal Investigator	.33
Leifker, Feea	Postdoctoral Research Manager	.508
Crenshaw, Alexander	Graduate Research Assistant	.217
Leo, Karena	Graduate Research Assistant	.375
Riquino, Michael	Graduate Research Assistant	.244
Priddy, Sarah	Graduate Research Assistant	.269
Shivakumar, Prashanth	Graduate Research Assistant	.54
Jati, Arindam	Graduate Research Assistant	.05
Li, Haoqi	Graduate Research Assistant	.34
Md Nasir, Fnu	Graduate Research Assistant	.21
Nallan Chakravarthula, Sandeep	Graduate Research Assistant	.42
Park, Taejin	Graduate Research Assistant	.42
Tseng, Shao-yen	Graduate Research Assistant	.34

Has there been a change in the active other support of the PD/PI(s) or senior/key personnel since the last reporting period?

Changes in active other support for PI Baucom

Dr. Baucom is a Co-Investigator on 6 newly funded federal grants that were awarded during the reporting period:

R34 D. Baucom, Bulik (PI); NIH / NIMH; A Couple-Based Treatment for Bulimia Nervosa (.14 FTE)

Bryan (PI); Department of Defense (DoD); Peer to Peer Programs for Military Suicide Prevention (.05 FTE)

R01 Uchino (PI); NIH / NHLBI; Social Ambivalence and Health (.10 FTE)

Bryan (PI); Department of Defense (DoD); Replication trial of Brief Cognitive Behavioral Therapy to prevent suicide (.10 FTE)

May, Bryan (PI); DoD / MSRC ; Couples Crisis Response Planning to Reduce Post-Discharge Suicide Risk; (.10 FTE)

R34 Huebner (PI); NIH / NIMH; Online intervention development to support parent-child communication about sex (.07 FTE)

Changes in active other support for PI Baucom, cont.

All of these awards are multi-year studies where the bulk of funding for Dr. Baucom occurs in later years of the grants. Additionally, he is serving as a statistical consultant on all of the grants so the vast majority of his responsibilities are limited to data analysis and assistance with manuscript preparation. None of this new funding impacts Dr. Baucom's percent effort to the project that is the subject of this report.

One award previously active award on which Dr. Baucom was a Co-Investigator came to a conclusion during this funding period:

NIJ Kerig (PI); Factors Promoting Risk or Resilience Among Violence-Exposed Youth in the Juvenile Justice System (.07 FTE)

What other organizations were involved as partners?

Organization Name: Salt Lake City Veteran's Administration (SLCVA)
Location of Organization: 500 Foothill Drive, Salt Lake City, UT 84148
Partner's contribution to the project: The SLCVA is contributing time of its VA Information and Computing Infrastructure staff, access to VA software and computers, and collaboration with Dr. William Marchand. The VA is additionally contributing official VA business envelopes for mailing letters to potential Veteran participants.

Technologies for assessing behavioral and cognitive markers of suicide risk

PI: Brian Baucom, PhD   **Org:** University of Utah
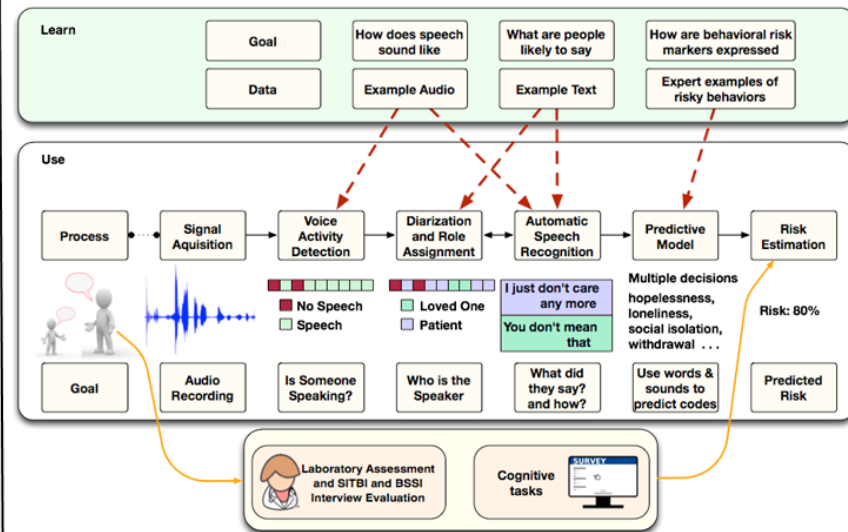
Background

- More than one death by suicide every 13 minutes amongst military personnel
- Accurate and timely assessment of suicide risk one of the most effective ways to prevent injury and death from suicide
- No reliable method for predicting suicide risk in military personnel
- Behavioral (e.g., hopelessness, reassurance seeking) and cognitive (e.g., attentional fixation on suicide-related information) markers could provide new method for objectively assessing risk for suicide
- Recent technology can be adapted for efficient, scalable, and reliable measurement of behavioral and cognitive markers
- Empowers family members by creating a risk assessment tool that can be used at home
- Rich, supplemental, information can be obtained by observing social circle in addition to patient

Approach

- Adapt existing technology for measuring behavioral and cognitive markers of suicide risk using existing data sets
- Observe behaviors of subject, loved ones, family, social circle, and identify behavioral deviations from norm
- Example behaviors of interest: hopelessness, agitation, loneliness, social isolation, engagement and entrainment.
- Collect behavioral, cognitive, interview, and self-report data from 120 couples where at least one partner is active duty National Guardsmen or Reservist in research laboratory
- Create secure internet interface for collecting data at home
- Collect behavioral, cognitive, and self-report data at home after 6 (all forms) and 12 (self-report only) months
- Apply and optimize adapted technology for use in newly collected laboratory and home data
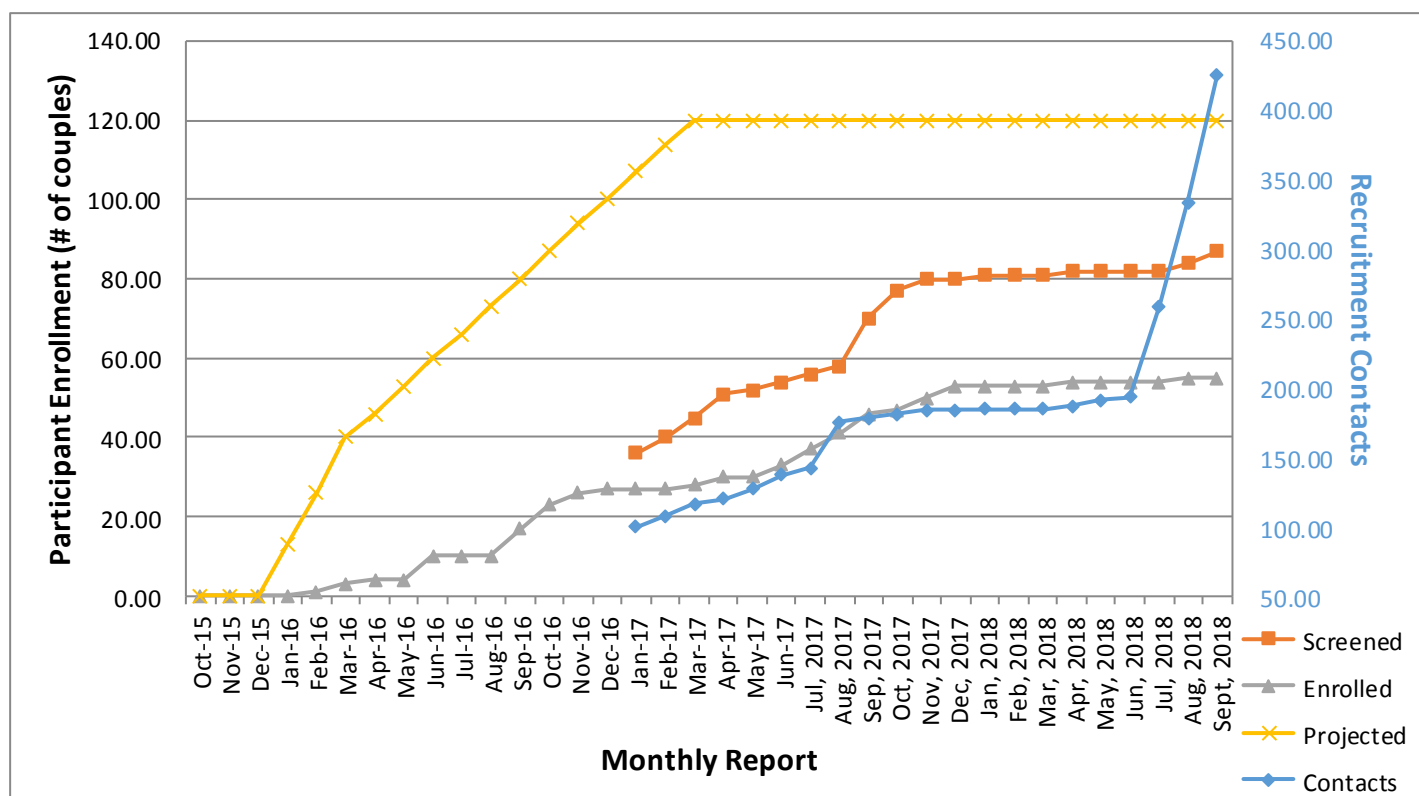
Updated: 10.30.2018

Timeline and Cost

Activities	FY 1	FY 2	FY 3
Train BSP algorithms	▇▌		
Create secure internet interface	▇▌		
Collect laboratory- and home-based data from 120 couples	▇▌		
Apply and refine BSP technologies		▇	▌
Collect 6 and 12 month follow-up data		▇▌	
Apply and evaluate adapted technology to newly collected data		▌▇	
Estimated Budget ($K)	**$833**	**$833**	**$833**

Total expenditure to date: $1,738,026

Recruitment Line Graph

Note. Contacts = number of couples who have contacted us about being potentially interested in participating in the study, screened = number of couples where both partners have verbally indicated a willingness to participate in the study, both partners have completed the screening assessment, and are eligible for study participation, enrolled = number of couples who have completed at least one study assessment.

Number of couples screened, enrolled, and projected are plotted on the vertical axis on the left, and number of couples contacted are plotted on the vertical axis on the right.

Enrollment table (*N* = 55 couples)

	Index participants with no history of suicidal ideation or attempt	Index participants with a history of suicidal ideation	Index participants with a history of one or more suicidal attempt(s)
Men	25 index	13	3
Women	9	3	4
Reserve Component SMs	34	16	6
Veterans	0	0	1
Army NG	23	12	4
Air Force NG	11	2	1
Army Reserve	4	2	0
Air Force Reserve	4	0	1
Army Veteran	0	0	1

Sample size for analysis table ($N = 55$ couples, 65 individuals)

	Military participants with no history of suicidal ideation or attempt	Military participants with a history of suicidal ideation	Military participants with a history of one or more suicidal attempt(s)
Men	33 (25 index + 8 non-index)	13	3
Women	9	3	4
Reserve Component SMs	42 (34 index + 8 non-index)	16	6
Veterans	0	0	1
Army NG	23	12	4
Air Force NG	11	2	1
Army Reserve	4	2	0
Air Force Reserve	4	0	1
Army Veteran	0	0	1

Note: Total number of participants in this table is greater than the number of couples in the enrolled participants table due to both partners being in the Reserves in 10 couples. In eight of these dual participant couples, both partners are in the no history of suicidal ideation or attempt group. Because analyses will be conducted at the individual level, these additional 10 participants will be included in analyses resulting in a total of sample size 65 participants for the purpose of analysis.