A Knowledge Translation Model for Veteran Suicide Prevention that integrates Data Science, Social Science and Mental Health

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Abstract: Research carried out by the Center for Traumatic Stress Studiesidentified that 21.7% of discharged veterans experienced suicide ideation over the 4-year period between 2010-2014 [1]. This data presents that despite the Government effort, the rate of suicide is increasing and widespread within the Australian veteran community. Our question is how publicly funded suicide prevention programs can be more effective to support veteran mental health. This research is to seek an innovative solution to the government funded programs, to help raise public awareness, to raise compassion within the community and to jointly support veteran mental health. In this paper, we present aKnowledge Translation (KT) Model powered by the idea ofthe Veterans' Wall of Remembrance and veteran community-centred strategies for veteran suicide prevention. The KT model aims to bring the "unspoken" to light, dissemination the "ground truth" to raise stakeholder engagement and joint-accountability of veteran suicide prevention.
Key words: Knowledge Translation Model (KT Model), Veteran Suicide, Veterans' Wall of remembrance, joint-accountability

I. INTRODUCTION

Our study shows that case management methodology within key Government agencies adopts an autocratic leadership approach to veteran suicide prevention, with the main focus on whatthe government can doto support veterans. Suicidal behaviour has a significant impact on communities and societies. Despite this, relatively little advancement has been made in the scientific understanding or treatment of suicidal behaviour [2] Prime Minister Scott Morrison's press release advised that, "too many veterans take their own lives. One veteran taking their own life is too many" [3] Senator Jackie Lambie released a campaign, "Don't forget his name. Because he matters" to promote the ADF who have died by suicide. "We lose on soldier every week. More than 40 veterans have died by suicide this year. The problem is getting worse" [4].

Carers Australia NSW study has also shown that the government-funded services including grievance, case management, or compensation claims amplify the stress, PTSD and suicide risks when veterans and their families are trying to file a claim or waiting for the case management results [5]. One of the fundamental difficulties in compensation claim processes sees government agencies direct veterans or their families to provide medical evidence and supporting documentation to link the claim to a member's service. Due to factors of poor training and staff turnover in the government or sub-contracted agencies, a veteran's data is not always organised or passed on in a systematic way. This shortcoming leads to incomplete and inconsistent information or none regarding the relevant veteran. Often this leads to delays in addressing grievances, which amplifies their mental and physical stress [5].The same study shows that the children of Vietnam veterans have a 300% higher suicide rate than the general community and also that there is an increased likelihood for the children to take their own life following the death of their parent [5,6].

The key question for this research is how to provide innovation to the current government funded suicide prevention programs, how to bring new ideas, practices and technologies together to promote veteran suicide prevention.

II. EXISTING WORK IN THE AREA OF VETERAN SUICIDE PREVENTION

Existing knowledge and research priorities for suicide prevention are generally based on epidemiologically orientated methods with a focus on the use of statistical analysis methods [7]. Recent research suggests that the suicide rate of military personnel and veterans is increasing at an exponential rate. According to the *Constant Battle: Suicide by Veterans* (FADTR, 2016) report that says suicide is a leading cause of death for Australians aged 15 – 44 years, with around eight people dying by suicide each day. Current and former members of the Defence and their families are not immune to this [8]. National rates of suicide increased between 2008 and 2017, and the number of deaths from suicide increased by 9% between 2016 and 2017. In

2015 and then again in 2017, the number of deaths from suicide was recorded at 12.6% deaths per 100,000 population, the highest record in 10 years. The *Constant Battle: Suicide by Veterans* report stated that in order to improve suicide prevention, it is essential to provide veterans with the necessary mental health support [8].

The distinguished Black Dog Institute has supported the implementation of system approaches to suicide prevention in a number of communities across Australia [9]. The institute is currently trailing the integrated Lifespan Framework for suicide prevention and to support people in the time of severe mental health crisis. The application of the Lifespan lived experience framework as created by Dr. Michelle Banfield and her team at the Australian National University, [10] combines nine strategies that have evidence for suicide prevention into one community-led approach incorporating health, education, frontline services, business and the community [11]. A systemic approach for involving people with lived experience means implementing engagement strategies at each aspect of an organisation in health care delivery and programs across a number of levels of the organisation. [12] The Lifespan Framework includes the data driven decision making strategy with an improved safety approach towards the planning of suicide prevention activities [13]. The Intelligent suicide data systems collects, analyses, interprets and maps data on suicide and suicide attempts with geospatial mapping functionality and data linkage [9]. The findings from both the general Australian population and the American veteran population suggest it would be useful to conduct research to understand the exposure and impact of suicide among the veteran population and improve suicide bereavement support [14].

Carers Australia NSW, a non-government organisation, responded to the Senate Standing committee with a focus on suicidality rates of veteran's partners. Given the high incidence of suicidality and mental health conditions among veterans and ex-service personnel, their submission drew on research regarding mental health carers, including those exposed to suicide, in addition to evidence specifically relating to carers of veterans. Alarmingly, the relative risks for suicidal ideation, planning and attempts were 7.9, 9.7 and 13.8 times higher respectively for veterans compared with the Australian population, and for partners were 6.2, 3.5 and 6.0 times higher than the general population [5].

Consideration is to be placed on the carers which are often family members, partners and friends who have a key role in the lives of people living with a mental health condition. Many experience stigma and isolation and feel overwhelmed by a complex service system. Mental health carers who have been exposed to suicide are reported to have difficulty accessing and understanding the information and services the care recipient requires. Research indicates that mental health carers, especially those exposed to suicide, need simpler service pathways and better information and support as they navigate service systems. Prof. Philip Morris, a psychiatrist says that isolation from others is a powerful risk factor for suicide. Perhaps the most important thing that can be done to prevent suicide is to connect the person at risk with individuals from caring networks of peers, family, and professionals. Personal contact with the person at risk by one or more of the individuals from the caring network reduces isolation and improves self-esteem – both likely to increase the threshold against self-harm. This will mean a more accepting attitude of veteran-based rehabilitation programs that focus on social inclusion and participation [15].

III. THE AIMS, ISSUES AND OBJECTIVES

The project aims to translate the new research used to drive improvement on mental health and psycho-social aspects impacting veterans.There is limited research work or strategies regarding how to establish due-diligence, shared-responsibility and joint accountability to suicide prevention between the Government and the Australian Veteran community agencies. Evidently, there is a lack of research on how to utilise veteran communities' voices and opinions, which form a collective intelligence, to support Australian Government suicide prevention programs. Therefore, this research aims to develop a Knowledge Translation (KT) portal that will assist to establish the strategy to alleviate suicide risk and the adverse events for veterans and their families.

The objectives of this paper are to present the strategic methods for establishing due-diligence, shared-responsibility between the Australian Government and the veteran community. The research shares veterans and their families' voices and opinions on what strategies support suicide prevention and synthesizes data collected from the Knowledge Translation (KT) Portal. The KT portal is inspired by globally recognized Wall of Remembrance sites where the veteran community have a place to pay their respects to veterans who have died. The research collects data from the community about veteran's who have died by suicide, a novel idea that gives the "unspoken" a method to share their life story, to provide evidence and ignite discussion about the best available evidence on Australian Veteran Suicide.

IV. THE KT MODEL FOR VETERAN SUICIDE PREVENTION

The innovation lies on the motto of creation the Australian Veterans Wall of Remembrance Knowledge Translation model, that bring new ideas, practices and technologies together to suicide prevention. It contains two continuous iterative process loop, namely RAP and 5Is, powered by Diffusion of Innovation Theory [16] as shown in Figure 1.

a) The **RAPP** is defined as continuous Research, Awareness, Predict and Prioritization of data, evidence, practices, and technologies underpinned by well-being, welfare, humanity, and social science studies.
b) The **5Is** that are target on data and social services visibility, transparency and trustworthiness:

a. INQUIRY - knowledge synthesis from Data and evidence inquiries
b. IDENTIFICATION – knowledge discovery from data and review of issues, concerns or barriers to predict what need to be done next
c. INTERPRETATION – knowledge translation for practical policy development and relevance to stakeholders
d. INTEGRATION – knowledge integration with the quality data, evidence, practice and technology to inform the government for public policy making
e. IMPLEMENTATION – knowledge evolution through re-design and re-develop the suicide prevention programs to keep the pace with the new data, evidence, practices and emerging technologies.
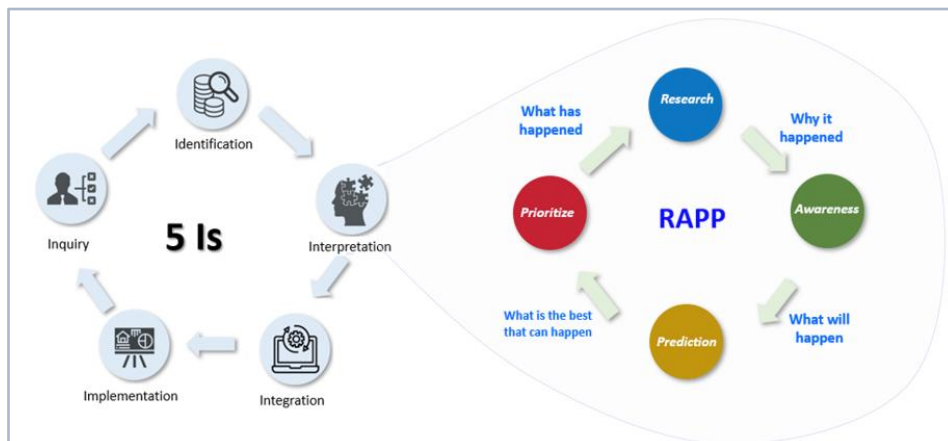

Figure 1. The KT Model- RAPP and 5 Is for Veteran Suicide Prevention

V. THE COMMUNITY-CENTRED KT MODEL THROUGH AUSTRALIAN VETERANS'WALL OF REMEMBRANCE

The innovation of the Knowledge Translation Model (KT Model) is inspired by the world-wide memorial Wall of Remembrance to bring the "unspoken" to life and ignite debate about what the veteran suicide definition is and what suicide prevention solutions could be from the non-government, not-for-profit, and self-organised veteran communities.
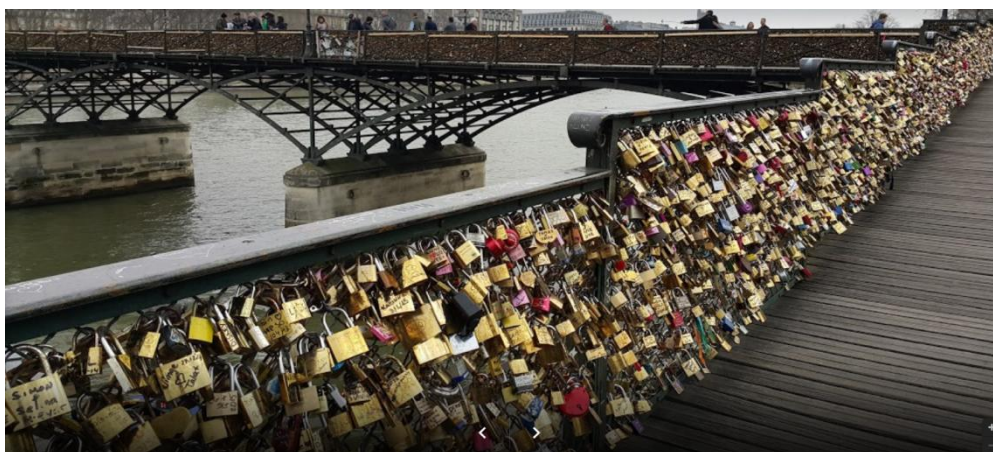

Figure 2. The Remembrance of Pont Des Arts, France [18] serves as an inspiration to the Australian Veteran's Remembrance Wall.

VI. DIFFUSION OF INNOVATION AS THE THEORETICAL FOUNDATION FOR THE KT MODEL

Diffusion of Innovation – is one of the social science theories, and it is about how, why and at what time, and the stages by which a person adopts an innovation, and whereby diffusion is accomplished, include awareness of the need for an innovation, decision to adopt (or reject) the innovation, initial use of the innovation to test it, and continued use of the innovation. There are five main stages [Figure 3] that influence adoption of an innovation, and each of these factors is at play to a different extent in the five adopter categories [16].
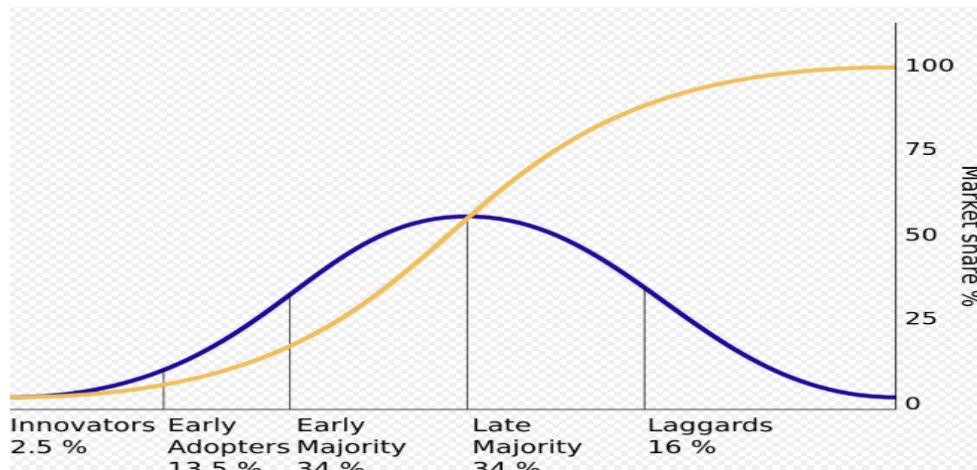

Figure 3. The Diffusion of Innovation Theory [16]

- **Stage 1:** The proposed KT Model utilising the Australian Veterans' Wall of Remembrance, will embrace the community and the government to co-innovation to develop and try the new practice and new technologies for veteran suicide prevention.
- **Stage 2:** It will promote early adopters within the community and the government to integrate the KT model in a social services context.
- **Stage 3:** It will encourage the majority veteran communities and the government to adopt and apply the KT model for social services and to provide leadership in reducing veteran suicide risks.
- **Stage 4:** The proposed KT model will focus on increasing social pressure to the government to improve the suicide prevention programs for the due-diligence with shared-responsibility and joint-accountability in harnessing all of government preventative efforts.
- **Stage 5:** The KT Model will push the innovation further to the government and community for make caring, compassion and moral obligations common in the Australian society.

VII. THE TECHNOLOGY ENABLEMENT OF KT MODEL

We propose a Knowledge Translation Portal to bring the "unspoken" to light, which is inspired by the world-wide Wall of Remembrance. The portal will be a self-organised, non-government, not-for-profit platform that encourages collection and sharing of suicide prevention strategies, methods and tools obtained from heterogeneous sources including veterans, veterans' families, and veteran communities, self-generated content, government and non-government veteran portals [Figure 4].

The portal incorporates A.I. (Artificial Intelligence) techniques which includes: 1) parsing (crawling) data on public websites; 2) analysing user-generated content on the portal; and 3) conjointly mining heterogeneous types of data, images, scans, tables, emails, PDF files, voices and movies. These techniques will reduce human effort on sentiment analysis and enable cognitive understanding of the shared suicide prevention information and strategies, and 4) the contextual analysis will be powered by the provenance graph methods coupled with fuzzy semantics reasoning. This will be used to identify relationships between events and infer logical consequences (reasoning) of causal veteran domain knowledge and subject matter expert opinions. The use of Veteran Blockchain as the backend will support the Australian veteran social network community trust and take advantage of the open transparency, immutability, personal data privacy, security, and traceability that Blockchain can offer.
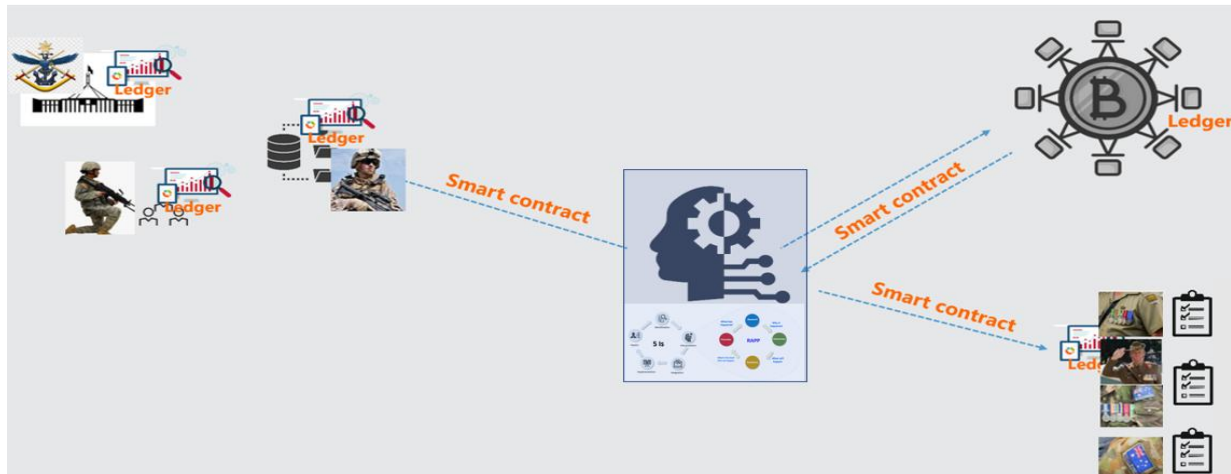
Figure 4. The Technology Enablement for KT Model for Suicide Prevention powered by AI and Blockchain

The two continuous loop pathways form a virtuous cycle for the emergent of innovation to support veteran suicide prevention. These two continuous loop pathways are the core for the KT model which is powered by big data science with 5 I's, through RAPP and assist to identify what happened, why it happened, what will happen and provide a prediction based on the balance of data.

VIII.   THE KNOWLEDGE TRANSLATION STRATEGY– THE VETERAN COMMUNITY-CENTRED BOTTOM-UP STRATEGIES

Much of the current literature, policies, programs, processes, and investments into suicide prevention programs and service place the core responsibilities and onus on the Australia Government. Limited work is available on due-diligence, shared-responsibility, and joint-accountability between the Government and the veteran community for reducing suicide risks has been considered. The KT Model as shown in Figure 5, has 4 major strategies, namely:

Figure 5. The Veteran Community-centred KT Model strategies

(1) A new strategy on due-diligence, shared-responsibility, and joint-accountability between the Australian Government and the veteran community for reducing suicide risks. In this project, we will promote different voices, opinions, understanding, and interpretations to be used for suicide prevention through use the innovative use of NLP (Natural Language Processing) A.I. to handle and reason the information and to manage unclear and ambiguous terms and concepts. The primary goal of the study is the data collection from non-government, not-for-profit, and self-organised Australian veteran communities. That data is then analysed to determine suggestions and opinion on the mental health and suicide prevention at a practical level where we can help put the veteran and veteran community onto the driver seat for solution development.

(2) An Innovation strategy through Australian Veteran Wall of Remembrance knowledge translation incorporating a new set of A.I. algorithms with a provenance graph method and fuzzy c-mean approach will be developed [6, 19]. The techniques will allow the study of currently available information and data and to investigate the origin of the information and data, known as backward and forward provenance. Provenance graphs[20,21,22] are a technique that allows predictions not only from the current or latest data set but also provides the origin of the data for exploration, giving greater confidence in the current forecast. It is a directed graph where nodes are either data elements or events that take in the data items as input, perform an event, and then new data items are generated as output. The arcs link data to the events. The graph can contain sub-graphs to trace new or old event pathways independently. The extended graphs can present direct and indirect data relationship or data-event relationships. This project will develop a forward and backward provenance graphs to

help trace the voice and opinion data through any given sub-provenance graph with a provenance query. Fuzzy e-mean helps to deal with mixed data types and non-numeric features of data sets or combinations of different strata data sets that represent an event or behaviour.

(3) The Knowledge Translation Strategy is to use the lived experiences of many existing military, ex-service members, veterans, reservists, cadets and civilians at the Department of Defence and their families who have experienced PTSD and 'lost' family members after returning from the battlefield. The project is supported by many veterans who are active members of the self-organised veteran community.

(4) The Knowledge Translation Strategy aims to prevent adverse events and reduce further mental stress for those who are filing a grievance, suicide cases, and compensation claims. This will be done via a strategically designed and validated-legitimate hearing.

(5) The Knowledge Translation Strategy will be implemented as a portal for suicide prevention through Australian Veterans' Wall of Remembrance. We propose the intelligent APP [17] for the KT model. The KT Model development will be working with Veterans', through all possible research programs and training curriculums. Through co-innovation and co-design of a knowledge translation portal that address suicide prevention and providing fruitful results, which can help inform how government can best provide veteran services and reduce suicide risk.

To the best of our knowledge, no existing research work uses provenance graphs and fuzzy methods for veteran voice and opinion analysis for suicide prevention. The **innovation lies** at the multidisciplinary intersection between I.T., data science and human endeavours. The proposed cross-disciplinary research aims to address the complexity of the suicide prevention problem through non-government, not-for-profit and self-organised veteran communities. This is for a better understanding of key factors and systemic issues that lead to over-due solutions for suicide prevention. This will enable the potential veterans' voices and opinions to be heard, due-diligence being present along with shared-responsibility and joint-accountability in harnessing all of government preventative efforts.

IX. RESULTS AND EVALUATION OF THE KNOWLEDGE TRANSLATION PORTAL

Our veteran volunteers have provided deep knowledge, resources and lived experiences to the project team. The volunteers represent the Australian Defence Force veterans with a combined 30-40 years of experience working within the Defence. Additionally, the research is supervised and guided by an experienced veteran from Royal Australian Air Force with over 30 years of military experience. The team is also actively working with the Department of Defence and communicating with the Minister of Veteran's Affairs, and Department of Veteran's Affairs.

Research will be conducted using inductive analysis of qualitative data, thereby identifying and organising the data into important patterns and themes in order to construct a framework for presenting the key findings [27].Additionally, the opinions and voices from non-government, not-for-profit organisations, and self-organised veteran social communities such as Soldier On Australia [23], Contact Magazine [24], Veterans for Peace [25], and self-organisedAustralian Veteran Remembrance Facebook groups [26] will be collected, including voices and opinions from current and former serving members, veterans and veterans' families who volunteer their experiences of veteran suicide bereavement.

Qualitative Data research methods will enable the team to analyse, interpret, validate, test and support continuous study. The outcome will be the continuous development and improvement of the Knowledge Translationportal presented in this paper.

X. CONCLUSION

This paper presents a KT Model for veteran suicide prevention and answers our questionof how to make our million-dollar Government funded research program more effective. We have developed a KT model, which is veteran community-centered model– embraced by a Veterans' Wall of Remembrance – a strategy to Knowledge Translation portal. The KT portal is a bottom-up community-based approach, that is distinguished from any existing Government programs or portals. A.I powered analytics underpins the strategic solution for support shared responsibilityand joint accountability between the Government and the veteran community to reduce suicide risks.

This novel application is not singularly aimed at the public to remember veterans or loved ones, but to bring the 'unspoken' aspects to light, in addition to ignite discussion of the social aspects of veteran suicide; what about what the definition of veteran suicide should be; what suicide prevention programs are effective, and a collection of intelligence of the voices and opinions from non-government, not-for-profit, and a self-organised community.

The findings from both the general Australian population and the American Veteran population suggest it would be useful to conduct research to understand the exposure and impact of suicide among the Australian veteran population to help improve bereavement support [14]. We believe such model will help reducing

adverse events by easing the mental stress when filing a grievance, sharing of veteran suicide experiences and opinions, through a web-based legitimate hearing – virtual hearing portal with voice digitalization and key points summarization for public records about their problems method, thus supporting the well-being of veterans.

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