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Determinants of usefulness in professional behaviour change interventions: observational study of a 15-year national program

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DETERMINANTS OF USEFULNESS IN PROFESSIONAL BEHAVIOUR CHANGE INTERVENTIONS: OBSERVATIONAL STUDY OF A 15-YEAR NATIONAL PROGRAM

AUTHOR LIST

Andre Q Andrade*¹, Vanessa T LeBlanc¹, Lisa M Kalisch-Ellett¹, Nicole L Pratt¹, Anna Moffat¹,
Natalie Blacker¹, Kerrie Westaway¹, John D Barratt¹, Elizabeth E Roughead¹

*Corresponding author. Email: andre.andrade@unisa.edu.au; Phone: +61 8 8302 2314

AUTHORS INFORMATION

1 Quality Use of Medicines and Pharmacy Research Centre, University of South Australia. GPO
Box 2471 Adelaide SA 5001 – Australia

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ABSTRACT

Objective: Educational, and audit and feedback interventions are effective in promoting health professional behaviour change and evidence adoption. However, we lack evidence to pinpoint which particular features make them most effective. Our objective is to identify determinants of quality in professional behaviour change interventions, as perceived by participants.

Design: We performed a comparative observational study using data from the Veterans' Medicines Advice and Therapeutics Education Services (Veterans' MATES) program, a nationwide Australian Government Department of Veterans' Affairs funded program that provides medicines advice and promotes physician adoption of best practices by use of a multifaceted intervention.

Setting: Primary care practices providing care to Australian veterans.

Participants: General practitioners targeted by 51 distinct behaviour change interventions, implemented between November 2004 and June 2018.

Primary and Secondary Outcome Measures: We extracted features related to presentation (number of images, tables and characters), content (polarity and subjectivity using sentiment analysis, number of external links and medicine mentions) and the use of 5 behavioural change techniques (prompt/cues, goal setting, discrepancy between current behaviour and goal, information about health consequences, feedback on behaviour). The main outcome was perceived usefulness, extracted from post-intervention survey.

Results: On average, each intervention was delivered to 9667 general practitioners. Prompt and Goal Setting strategies in the audit and feedback were independently correlated to perceived usefulness ($p=0.043$ and $p=0.013$, respectively). The number of distinct behaviour change techniques in the audit and feedback was correlated with improved usefulness (Pearson coefficient 0.45 [0.19, 0.65], $p=0.001$). No presentation or content features in the educational material were correlated with perceived usefulness.

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3 **Conclusions:** The finding provides additional evidence encouraging the use of behaviour
4 change techniques, in particular prompt and goal setting, in audit and feedback interventions.
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10 11 ARTICLE SUMMARY

12 13 STRENGTHS AND LIMITATIONS OF THIS STUDY

- 14 • The study analyses a large number of discrete interventions over a long period
- 15 • The 15-year duration allowed us to isolate the effect of different features on
16 perceived usefulness
- 17 • Distinct interventions with distinct goals, compared by perceived usefulness
- 18 • Sample size prevented statistical adjustments that could handle potential
19 confounders in observational data

20 21 COMPETING INTERESTS

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28 The authors have no competing interests to declare.
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30 31 FUNDING

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34
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39 execution, analysis or interpretation of data, writing of manuscript or decision to submit the
40 paper for publication.
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INTRODUCTION

Public health interventions play an important role in translating evidence into practice and promoting health professional behaviour change. Multifaceted interventions are effective in improving medicine prescription patterns,[1] radiology referrals,[2] and screening and preventative practices.[3] A common approach to health professional behaviour change is shaping knowledge and promoting better informed clinical decisions. A growing body of evidence suggests that interventions targeting health professional knowledge by a) educational interventions and b) audit and feedback interventions have an effect on clinical performance.[4-8] However, knowledge shaping interventions are commonly the result of a bundle of different actions in a complex environment,[9] which makes it difficult to determine the effect of the individual components. Therefore, while there is evidence to determine the effect of both educational, and audit and feedback interventions, there is no evidence to pinpoint which particular features make them most effective.[10] A deeper understanding based on empirical data can improve intervention design, which currently relies on theory alone.

Since 2004, the Veterans' Medicines Advice and Therapeutics Education Services (Veterans' MATES) program, an Australian Government Department of Veterans' Affairs funded program, has provided medicines advice and promoted physician adoption of best practices by use of a multifaceted intervention, which contains educational material and personalised, patient-specific information and recommendations (audit and feedback component).

The program's longevity offers an opportunity to empirically evaluate which features of educational, and audit and feedback interventions have an impact in its usefulness to physicians. Over the years, the Veterans' MATES program has gone through changes and, despite keeping the core principles consistent, the features of each intervention have differed slightly from the previous. The changes, coupled within a consistent context of implementation, make interventions comparable.

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3 To improve understanding about which features of educational and audit and feedback
4 interventions contribute to success, we analysed data from all interventions implemented in the
5 Veterans' MATES program.
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10 11 12 METHODS

13 14 STUDY DESIGN – THE VETERANS' MATES PROGRAM

15 We performed a comparative observational study [11] to evaluate how implementation features
16 from the educational, and audit and feedback components of the program explained the
17 observed variability in intervention success. We used data from the Veterans' MATES program,
18 comparing 51 distinct interventions that took place between November 2004 and June 2018.
19 The program aims to improve medicine and health services use and health outcomes for all
20 persons in the veteran community by delivering interventions to general practitioners (GPs),
21 pharmacists, other relevant healthcare professionals and veterans.[1] The program's goal is to
22 provide medicine advice to veterans and their primary physicians according to previously
23 identified issues, as detected by epidemiological inquiry.
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36 Since the program's conception, it has been driven by the use of technology and big data to
37 detect health issues and tailor interventions for at-risk groups. During each intervention's
38 development process, an epidemiological analysis is performed on a comprehensive database
39 containing administrative claims data (including medicine dispensings) collected by the
40 Australian Government Department of Veterans' Affairs. The analysis is guided by a clear
41 question to explore potential quality use of medicine issues. Examples include: long term
42 prescription of medicines recommended for acute issues; doses above guideline
43 recommendations; and lack of screening tests for an eligible population.
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54 After identifying the problem, a behaviour change goal is defined. This goal typically aims to
55 promote evidence-based practices, for example encouraging the cessation of medicines without
56 long-term evidence, or the optimisation of therapy according to treatment guidelines. The full
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3 list of topics can be seen at www.veteransmates.net.au. With the problem and goal in mind, an
4
5 intervention is designed. The intervention is informed by Social Cognitive Theory [12], the
6
7 Transtheoretical model,[13] and the health promotion model Precede-Proceed.[14]
8
9 Interventions include three main components: 1) printed and online educational material for
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11 health professionals called the therapeutic brief; 2) printed and online educational material for
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13 veterans, called the veteran brochure; and 3) an audit and feedback document for the GP
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15 containing personalised patient information, called the prescriber feedback. The format of this
16
17 feedback varies depending on the behaviour change goal. Interventions target particular health
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19 professionals and veterans according to criteria developed during the epidemiological analysis,
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21 meaning that only those individuals likely to benefit will receive the intervention. Along with all
22
23 veterans identified using these criteria, the interventions target the main general practitioner
24
25 involved in the veterans' care.
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29 A survey to all targeted participants (health professionals and patients) evaluates intervention
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31 quality, including perceived usefulness and the relevance of this information for patients.
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34 Epidemiological post-intervention analysis evaluates the actual population-level change in
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36 prescription patterns and use of health services, quantifying the effect of interventions. The
37
38 program has been extensively described elsewhere.[1] It has been shown to be effective for
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40 changing professional behaviour in different domains,[1] including promoting medicine
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42 review,[15] osteoporosis screening,[16] uptake of health services,[17] reducing inappropriate
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44 proton pump inhibitor use,[18] and hypnotic use for insomnia.[19]
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48 *FEATURES – EDUCATIONAL COMPONENT*

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50 Within the educational component of the intervention, composed of the printed and online
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52 material, we identified two features that changed over the years: presentation and writing style.
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54 Changes in presentation were related to information organisation, given that the visual identity
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56 of the materials, including font, colour schemes and general document organisation, remained
57
58 consistent. The most relevant variations in presentation included adding tables, images and
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3 more frequent headlines for section subdivision. The presence of contextually appropriate
4 visual cues has been shown to improve knowledge uptake in health education.[20] Visual cues
5 include illustrations and pop-out effects, comprising items that don't match the immediate
6 surrounding environment, such as tables, colour highlights or italic citations. We hypothesised
7 that presentation would affect perceived usefulness due to improved readability and
8 information distribution.
9

10
11 Educational content varied according to the subject being covered making it the most difficult to
12 measure and compare. Three over-arching intervention themes were identified: 1) Therapy
13 initiation, which includes the recommendations for prescribing new medicines for known
14 conditions. It usually follows detection of under-use of evidence based medicines in the health
15 claims database. 2) Therapy adjustment or withdrawal, which includes alerts about common or
16 serious side effects associated with the use of a medicine. It usually includes recommendations
17 for stepping down the dosage, or changing or stopping medicines. 3) Service initiation, which
18 includes recommendations to refer patients for funded healthcare services (e.g. screening tests,
19 home medicines reviews or psychology services for mental health conditions).
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23 Two behavioural economic theories guided our feature selection: loss aversion [21] and excess
24 of choice.[22] Loss aversion refers to a tendency to give higher weight to loss than to gain, and
25 engage in riskier behaviour to avoid loss. Excess of choice refers to a tendency to make poorer
26 choices when faced with too many options. The relevance of these features was previously
27 demonstrated in health promotion settings.[23] In a study evaluating messages to promote
28 hand washing,[23] loss and fear inducing (threatening) messages about flu contagion risk were
29 superior to standard messages. Additionally, messages containing simple instructions (coping
30 messages) were superior to multiple webpages containing detailed information about flu
31 contagion.
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35 To capture a proxy of loss aversion and excess of choice, we measured features related to
36 writing style using a natural language processing technique called sentiment analysis.[24]
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3 Sentiment analysis is “the computational study of people’s opinions, appraisals, attitudes, and
4 emotions toward entities, individuals, issues, events, topics and their attributes”.[24] Two
5 common measures of sentiment analysis are polarity and subjectivity. Polarity is a measure of
6 how positive (or negative) a piece of text is, and ranges from +1, meaning positive, to -1,
7 meaning negative. Subjectivity measures how much judgement is embedded in the text by the
8 use of adjectives and adverbs, and ranges from +1 for completely objective to -1 for completely
9 subjective. We performed sentiment analysis using the Python library TextBlob [25] to extract
10 polarity and subjectivity score for each educational material. We hypothesized that more
11 negative and objective (what not to do) would be deemed more useful than positive and
12 subjective (best practices).
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25 We also counted the number of times a medicine was mentioned in the educational component.
26 We used the Anatomical Therapeutic Chemical (ATC) [26] classification to identify medicines
27 names and the sum of all mentions was added as feature. We counted the number of external
28 links, as a measure of the importance of providing access to further information, if needed.
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35 *FEATURES – AUDIT AND FEEDBACK COMPONENT*

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37 To extract features from the audit and feedback document, we analysed 51 prescriber feedback
38 documents and identified five different behavioural change techniques. The behaviour change
39 techniques were coded using the Behaviour Change Techniques Taxonomy v1 (see Box 1).[27]
40 Since more than one technique can be present in the same audit and feedback document, the
41 number of different techniques present in an intervention was considered a feature. One of the
42 authors who has medical background performed manual review to extract behaviour change
43 techniques used in the prescriber feedback documents. Each document was individually
44 inspected and coded. We hypothesised that every additional technique would further increase
45 the usefulness of the intervention.
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57 *FEATURE EXTRACTION*

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3 All educational materials were downloaded from the main program site
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5 (<https://veteransmates.net.au>). We parsed the files to extract text and presentation features,
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7 such as number of special formatting (e.g. table, headline, and external links) (Table 1).
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10 OUTCOME

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13 The main outcome of this study was perceived usefulness. Usefulness is a predictor of continued
14
15 use [28, 29] and guideline / decision support system use.[30] Moreover, it allows the
16
17 comparison of different types of behaviour change interventions. A post-intervention survey
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19 was included with mailed material, containing up to ten questions connected to the
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21 interventions content. We extracted information from post-intervention surveys asking “How
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23 useful have you found the therapeutic brief”. Each responder could select one of four options: 1)
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25 Very useful; 2) Moderately useful; 3) Slightly useful; 4) Not useful. To create an intervention
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27 usefulness score, answers were attributed a score, from 4 (Very useful) to 1 (Not useful). We
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29 averaged the scores per intervention, resulting in a final score ranging from 1 to 4.
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33 We used Pearson correlation coefficient and Mann Whitney U test for hypothesis testing. We used
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35 Python SciPy package v1.1.0 for analysis.[31]
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38 RESULTS

39 INTERVENTION CHARACTERISTICS

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42 Of the 51 interventions, 48 were evaluated and three were excluded due to a lack of outcome
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44 data (perceived usefulness). On average, each intervention was delivered to 9667 GPs, for a
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46 total of 493,015 individual veterans targeted. GPs eligible for multiple interventions were
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48 targeted multiple times. We received, on average, 608 survey responses for each intervention,
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50 totalling 29,809 GP responses (6% median response rate [P25 = 5%; P75=7%]).
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3 Overall, the topics were deemed useful. Figure 1 shows the usefulness scores by intervention
4 theme. Usefulness scores ranged from 3.61 (osteoporosis - Jun 2018) to 2.74 (chronic
5 musculoskeletal pain - Mar 2014), with a median score of 3.17 (sd 0.18).
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10 HYPOTHESIS TESTING

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12 The features exhibited substantial variability over the study period. The exception was the
13 sentiment analysis metrics. Both polarity and subjectivity remained relatively consistent
14 throughout the program duration. This means there was little variation in writing style,
15 regardless of the topic and behavioural goal.
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22 We found a significant influence of the number of behavioural change techniques on perceived
23 usefulness. The addition of behaviour change techniques to audit and feedback improved
24 perceived usefulness. Prompt and Goal Setting strategies were statistically significant (Table 2).
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26 The effect of behaviour change techniques was summative (Figure 2 and Table 2). The sum of
27 techniques was considered as an independent variable and was significantly correlated to
28 perceived usefulness (Table 2).
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36 No presentation or content features were correlated with perceived usefulness (Table 2). The
37 number of external links in the educational material showed a tendency to increased perceived
38 usefulness, but was not statistically significant.
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45 DISCUSSION

46 Our analysis of 48 interventions of an ongoing medicines advice program adds an empirical
47 perspective to designing successful health professional behaviour change interventions. The
48 Veterans' MATES program is a multi-component intervention, including an educational
49 component, an audit and feedback component of patient specific information, and a patient
50 mediated intervention. It has repeatedly demonstrated its effectiveness in changing
51 professional behaviour.[1, 15-19]
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3 Overall, the results suggest that changes in the audit and feedback component significantly
4 improve perceived usefulness. Such demonstration of effect of distinct behaviour change
5 techniques is uncommon in the literature, due to the usually small effect and the sensitivity to
6 contextual changes.[11] Due to the long duration of the program, we were able to demonstrate
7 statistically significant effects of prompts and goal setting in improving the usefulness of the
8 intervention. This finding also reflects the relevance of adding personalised information in an
9 intervention. Every prompt was generated from patient data and reflected information that may
10 have been unknown to the physician. By bringing accurate information in the right context, the
11 prompt creates a trigger that may increase the likelihood of an appropriate action.
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14 We also found that there was an additive effect of using multiple different behaviour change
15 techniques on usefulness. This effect has been described in the context of health promotion.[32,
16 33] This finding suggests that different techniques may independently solve different needs and
17 the use of multiple techniques in the same intervention is not detrimental to effect. In our study,
18 all behaviour change techniques aimed to help physicians in their decision making process, such
19 as suggesting the evidence-based recommended action, providing scientific information or
20 translating patient information (e.g. classifying the dosage as high or low instead of a quantity).
21 This common theme may explain the additive effect of the techniques, as they often complement
22 each other and inform the same choice process.
23
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25 While we hypothesized that presentation and content features would be determinants of
26 usefulness, none of the studied features were correlated with perceived usefulness. Since the
27 beginning of the Veterans' MATES program, aesthetic was deemed important and there have
28 been few significant changes in visual identity over the years. However, information
29 organisation has changed considerably without significant impact in perceived usefulness, as it
30 would be expected if changes improved readability or comprehension. There are three possible
31 explanations for this finding: 1) No impact on usefulness - research has shown that, while design
32 improves usability,[34] it has limited effect on perceived usefulness;[35] 2) threshold effect -
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3 aesthetic has been shown to be important in other contexts, such as digital medium,[36, 37]
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5 therefore a possible explanation is that design and presentation may have a threshold effect,
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7 over which there are diminishing returns; 3) audit and feedback components as confounder –
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9 since prescriber feedback changes dominated the intervention effect, it may have masked the
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11 impact of educational component features.
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15 With respect to content, our goal was to identify the writing style that conveys a clear health
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17 intervention message, e.g. content should be more objective rather than comprehensive, or
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19 normative versus theoretical. Our findings do not support any recommendation concerning
20
21 writing style. In this study, content effect on perceived usefulness was dominated by the
22
23 influence of theme. Physicians tended to evaluate topics about service initiation and therapy
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25 adjustment (recommendations to remove or reduce medicines) more favourably than topics
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27 containing therapy initiation (recommendations to add medicines). This may reflect existing
28
29 physician knowledge about the topic.
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33 The lack of significant findings regarding content features should be interpreted cautiously, due
34
35 to study design and the intrinsic complexity of evaluating communication using automated
36
37 means such as sentiment analysis. The Veterans' MATES program employs trained and
38
39 experienced medical writers with multiple peer review processes that maintain consistent text
40
41 quality. This is evidenced by small variation in the tone and subjectivity scores between
42
43 different interventions. Also, the sentiment analysis algorithm used in this study is based on the
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45 frequency of words deemed as positive/negative and subjective/objective. Therefore, it may not
46
47 be sensitive enough to detect subtler language features. There is evidence in the health
48
49 promotion domain that users prefer messages that are correctly spelled and grammatically
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51 correct and directive rather than passive or interrogative.[38] Emphasis on objectivity and
52
53 clarity are also recommended for creating medical guidelines,[39, 40] though empirical
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55 evidence is still lacking.
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3 Theories and findings regarding message tone are more conflicting,[21, 41] which may reflect a
4 dependency on context. It is well established that loss aversion is a driver for insurance
5 purchase, as the fear of rare but large loss is greater than a small but consistent premium.[21] In
6 addition, negatively framed messages appear to promote behaviour change by creating stronger
7 cognitive responses.[41] A similar reasoning has been applied to medical reasoning giving an
8 important weight to regret during decision making,[42] meaning that a therapeutic decision is
9 only made when the expected usefulness surpasses the potential harm that is always associated
10 with treatment. Other studies have suggested that positive messages may be better received by
11 individuals already motivated to make a behaviour change.[38]

12
13
14 Translating large scale health professional behaviour change interventions from a concept to a
15 real-life solution is not a straightforward process. Given the inherent complexity of behaviour
16 change interventions, replicating a successful intervention often fails due to poorly understood
17 factors.[43] The strong effect of implementing behaviour change techniques in audit and
18 feedback interventions, particularly prompt and goal setting, suggests a clear recommendation
19 for developers.

20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 STRENGTHS AND WEAKNESSES

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39 As an observational research process, the strength of this study is the number of discrete
40 interventions over a long period of time. The context within which the interventions took place
41 remained sufficiently similar, which allowed us to isolate the effect of different features on
42 perceived usefulness.

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49 However, there are important limitations. The response to the surveys was voluntary and the
50 response rate was small, ranging from 12.9% to 2.8% (mean 6.2%). This may have selected
51 those who benefited from the topic and biased the results. Due to the heterogeneity in
52 behaviour change goal, we used perceived usefulness. Finally, despite 15 years' experience, 51
53 large-scale interventions are likely underpowered for some of the analyses performed. The
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3 small sample also prevented statistical adjustments that could handle potential confounders in
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5 observational data
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8 CONCLUSION

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10 This study demonstrated that prompts and goal setting components improve perceived
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12 usefulness when added to audit and feedback interventions. The addition of multiple different
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14 behaviour change techniques in the audit and feedback component improved usefulness and
15
16 showed a summative effect. None of the content and presentation features extracted from the
17
18 educational component were correlated with changes in perceived usefulness.
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22 LIST OF ABBREVIATIONS

23 Veterans' MATES: Veterans' Medicines Advice and Therapeutics Education Services

24
25
26
27 A&F: Audit and feedback

28
29
30 GPs: General practitioners

31
32
33 TIDieR: Template for Intervention Description and Replication

34
35
36 ATC: Anatomical Therapeutic Chemical

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38
39 DVA: Department of Veterans' Affairs

40 41 42 43 DECLARATIONS

44 45 46 47 PATIENT AND PUBLIC INVOLVEMENT

48 The Veterans' MATES program is supported by multiple stakeholder advisory groups, including
49
50 patients, healthcare professionals and government representatives. They provide input to the
51
52 intervention design and implementation, as well as to the programme of research.
53
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56 57 58 ETHICS APPROVAL AND CONSENT TO PARTICIPATE

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3 An ethics protocol for the study was approved by the University of South Australia Human
4 Research Ethics Committee (ethics protocol P203/04) and the Department of Veterans' Affairs
5 Human Research Ethics Committee (E016/007).
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10 CONSENT FOR PUBLICATION

11
12
13 Not applicable.
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16 AVAILABILITY OF DATA AND MATERIALS

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19 The data that support the findings of this study are available from the Australian Government
20 Department of Veterans' Affairs but restrictions apply to the availability of these data, which
21 were used under license for the current study, and so are not publicly available.
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27 AUTHOR CONTRIBUTIONS

28
29 AQA conceived of, designed, conducted the final analysis for this paper and drafted the
30 manuscript. VTL, JDB and EER developed the protocol and study approach. VTL, AM, NB and
31 KW developed the questionnaires and were involved in data collection. LMKE, NLP and AM
32 were involved in the data analysis. EER conceived of and designed the study, and critically
33 revised the manuscript for important intellectual content. All authors made important
34 contributions to the theoretical approach and interpreting insights. All authors read and
35 approved the final manuscript.
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52 General Practice, The University of Adelaide; Discipline of Public Health, The University of
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1
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3 Adelaide; Repatriation General Hospital, Daw Park; NPS – Better choices, Better health;
4
5 Australian Medicines Handbook; and the Drug and Therapeutics Information Service.
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LEGENDS FOR FIGURES

Figure 1 - Usefulness score box plot by intervention theme

Figure 2 - Average usefulness score of topics by number of behavioural techniques

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TABLES

Behaviour Change Techniques [code according to Behaviour Change Techniques Taxonomy v1]	Prescriber feedback implementation followed by example
Prompt/cues (code 7.1)	Display of a message highlighting a patient-specific issue related to the current topic. E.g. "Patient dispensed an antidepressant and has had no claim for DVA funded psychological therapies in last two years."
Goal setting (code 1.1)	Display of the suggested action followed by a checkbox. E.g. "Action: Consider review."
Discrepancy between current behaviour and goal (code 1.6)	Display questions about a patient condition that, if answered positively, suggest an action is required. E.g. "Has adequate pain relief been achieved with current treatment approach? Could adjuvant pain medicine regime be changed?"
Information about health consequences (code 5.1)	Display the rationale for the suggested change. E.g. "Patient prescribed different medicines that may increase their risk of heat-related illness (see therapeutic brief insert)."
Feedback on behaviour (code 2.2)	Re-interpretation of the prescription data to provide additional data. E.g. translating 20/40mg for low/high dose; providing drug burden indices.

Box 1 - Behaviour Change Techniques and how they were implemented in the Prescriber feedback

Table 1 - List of features extracted from the interventions

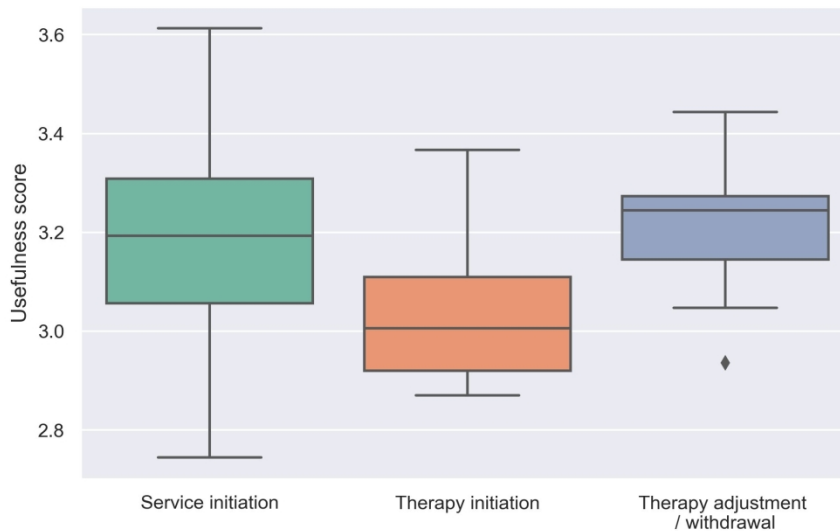
Feature	Category
Number of images	Presentation
Number of tables	Presentation
Average section size (Number of character / Number of headlines)	Presentation
Number of external links	Content
Polarity score	Content
Subjectivity score	Content
Number of medicine mentions	Content
Prompt/cues	Behaviour change technique
Goal setting	Behaviour change technique
Discrepancy between current behaviour and goal	Behaviour change technique
Information about health consequences	Behaviour change technique
Feedback on behaviour	Behaviour change technique

Table 2 - Association between extracted features and perceived usefulness scores

Behavioural technique	Mann Whitney U statistics	p-value
Prompt	155.0	0.030*
Goal setting	150.0	0.005*
Discrepancy	118.0	0.125

Health consequences	70.0		0.554
Feedback	161.0		0.234
Variable	Mean (SD)	Pearson Coefficient (SD)	p-value
Number of distinct Behaviour Change Technique	1.79 (1.05)	0.45 (0.19, 0.65)	0.001*
Number of images	0.60 (1.16)	0.18, (0.11, 0.44)	0.226
Number of tables	1.73 (1.23)	-0.16 (-0.42, 0.13)	0.274
Average section size in number of characters	1718 (1094)	0.11 (-0.18, 0.38)	0.447
Number of external links	6.02 (7.07)	0.25 (-0.04, 0.50)	0.088
Text polarity, score +1 to -1	0.079 (0.041)	0.16 (-0.13, 0.42)	0.283
Text subjectivity, score +1 to -1	0.389 (0.057)	0.10 (-0.18, 0.38)	0.475
Number of medicine mentions	31.08 (23.83)	0.17 (-0.11, 0.44)	0.234

*significant association (p<0.05)

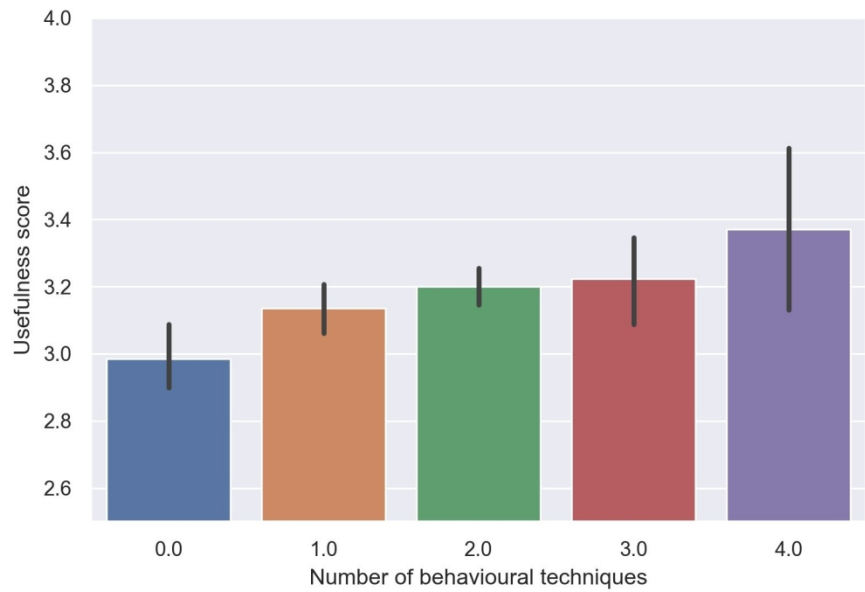


Usefulness score box plot by intervention theme

203x127mm (300 x 300 DPI)

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Average usefulness score of topics by number of behavioural techniques

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The TIDieR (Template for Intervention Description and Replication) Checklist*:

Information to include when describing an intervention and the location of the information

Item number	Item	Where located **	
		Primary paper (page or appendix number)	Other † (details)
1.	BRIEF NAME Provide the name or a phrase that describes the intervention.	_____	www.veteransmates.net.au
2.	WHY Describe any rationale, theory, or goal of the elements essential to the intervention.	_____	_____
3.	WHAT Materials: Describe any physical or informational materials used in the intervention, including those provided to participants or used in intervention delivery or in training of intervention providers. Provide information on where the materials can be accessed (e.g. online appendix, URL).	_____	_____
4.	Procedures: Describe each of the procedures, activities, and/or processes used in the intervention, including any enabling or support activities.	_____	_____
5.	WHO PROVIDED For each category of intervention provider (e.g. psychologist, nursing assistant), describe their expertise, background and any specific training given.	_____	_____
6.	HOW Describe the modes of delivery (e.g. face-to-face or by some other mechanism, such as internet or telephone) of the intervention and whether it was provided individually or in a group.	_____	_____
7.	WHERE Describe the type(s) of location(s) where the intervention occurred, including any necessary infrastructure or relevant features.	_____	_____

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2	WHEN and HOW MUCH		
3	8.	Describe the number of times the intervention was delivered and over what period of time including	4
4		the number of sessions, their schedule, and their duration, intensity or dose.	
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6	TAILORING		
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8	9.	If the intervention was planned to be personalised, titrated or adapted, then describe what, why,	4
9		when, and how.	
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11	MODIFICATIONS		
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13	10.*	If the intervention was modified during the course of the study, describe the changes (what, why,	6
14		when, and how).	
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16	HOW WELL		
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18	11.	Planned: If intervention adherence or fidelity was assessed, describe how and by whom, and if any	9
19		strategies were used to maintain or improve fidelity, describe them.	
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21	12.*	Actual: If intervention adherence or fidelity was assessed, describe the extent to which the	9
22		intervention was delivered as planned.	
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** **Authors** - use N/A if an item is not applicable for the intervention being described. **Reviewers** – use ‘?’ if information about the element is not reported/not sufficiently reported.

† If the information is not provided in the primary paper, give details of where this information is available. This may include locations such as a published protocol or other published papers (provide citation details) or a website (provide the URL).

‡ If completing the TIDieR checklist for a protocol, these items are not relevant to the protocol and cannot be described until the study is complete.

* We strongly recommend using this checklist in conjunction with the TIDieR guide (see *BMJ* 2014;348:g1687) which contains an explanation and elaboration for each item.

* The focus of TIDieR is on reporting details of the intervention elements (and where relevant, comparison elements) of a study. Other elements and methodological features of studies are covered by other reporting statements and checklists and have not been duplicated as part of the TIDieR checklist. When a **randomised trial** is being reported, the TIDieR checklist should be used in conjunction with the CONSORT statement (see www.consort-statement.org) as an extension of **Item 5 of the CONSORT 2010 Statement**. When a **clinical trial protocol** is being reported, the TIDieR checklist should be used in conjunction with the SPIRIT statement as an extension of **Item 11 of the SPIRIT 2013 Statement** (see www.spirit-statement.org). For alternate study designs, TIDieR can be used in conjunction with the appropriate checklist for that study design (see www.equator-network.org).

BMJ Open

Determinants of usefulness in professional behaviour change interventions: observational study of a 15-year national program

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2020-038016.R1
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Date Submitted by the Author:	26-Jun-2020
Complete List of Authors:	<p>Andrade, Andre; University of South Australia, Quality Use of Medicines and Pharmacy Research Centre Le Blanc, Tammy; University of South Australia, Sansom Institute for Health Resarch Kalisch Ellett, Lisa; University of South Australia, Quality Use of Medicines and Pharmacy Research Centre, School of Pharmacy and Medical Sciences Pratt, Nicole; University of South Australia, Sansom Institute for Health Resarch Moffat, Anna; Flinders University Blacker, Natalie; University of South Australia, Quality Use of Medicines and Pharmacy Research Centre Westaway, Kerrie P.; University of South Australia, Quality Use of Medicines and Pharmacy Research Centre Barratt, John; University of South Australia, Sansom Institute for Health Resarch Roughead, Elizabeth; University of South Australia, Sansom Institute for Health Research</p>
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DETERMINANTS OF USEFULNESS IN PROFESSIONAL BEHAVIOUR CHANGE INTERVENTIONS: OBSERVATIONAL STUDY OF A 15-YEAR NATIONAL PROGRAM

AUTHOR LIST

Andre Q Andrade*¹, Vanessa T LeBlanc¹, Lisa M Kalisch-Ellett¹, Nicole L Pratt¹, Anna Moffat¹,
Natalie Blacker¹, Kerrie Westaway¹, John D Barratt¹, Elizabeth E Roughead¹

*Corresponding author. Email: andre.andrade@unisa.edu.au; Phone: +61 8 8302 2314

AUTHORS INFORMATION

1 Quality Use of Medicines and Pharmacy Research Centre, University of South Australia. GPO
Box 2471 Adelaide SA 5001 – Australia

Running title: Moving the needle in evidence translation

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Appendices: 1

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Keywords: professional behaviour change, audit and feedback, primary care, behaviour change technique

ABSTRACT

Objective: Educational, and audit and feedback interventions are effective in promoting health professional behaviour change and evidence adoption. However, we lack evidence to pinpoint which particular features make them most effective. Our objective is to identify determinants of quality in professional behaviour change interventions, as perceived by participants.

Design: We performed a comparative observational study using data from the Veterans' Medicines Advice and Therapeutics Education Services (Veterans' MATES) program, a nationwide Australian Government Department of Veterans' Affairs funded program that provides medicines advice and promotes physician adoption of best practices by use of a multifaceted intervention (educational material and a feedback document containing individual patient information).

Setting: Primary care practices providing care to Australian veterans.

Participants: General practitioners targeted by 51 distinct behaviour change interventions, implemented between November 2004 and June 2018.

Primary and Secondary Outcome Measures: We extracted features related to presentation (number of images, tables and characters), content (polarity and subjectivity using sentiment analysis, number of external links and medicine mentions) and the use of 5 behaviour change techniques (prompt/cues, goal setting, discrepancy between current behaviour and goal, information about health consequences, feedback on behaviour). The main outcome was perceived usefulness, extracted from post-intervention survey.

Results: On average, each intervention was delivered to 9667 general practitioners. Prompt and Goal Setting strategies in the audit and feedback were independently correlated to perceived usefulness ($p=0.043$ and $p=0.013$, respectively). The number of distinct behaviour change techniques in the audit and feedback was correlated with improved usefulness (Pearson

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3 coefficient 0.45 [0.19, 0.65], $p=0.001$). No presentation or content features in the educational
4 material were correlated with perceived usefulness.
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8 **Conclusions:** The finding provides additional evidence encouraging the use of behaviour
9 change techniques, in particular prompt and goal setting, in audit and feedback interventions.
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16 ARTICLE SUMMARY

17 STRENGTHS AND LIMITATIONS OF THIS STUDY

- 18 • The study analyses a large number of discrete interventions over a long period
- 19 • The 15-year duration allowed us to isolate the effect of different features on
20 perceived usefulness
- 21 • Distinct interventions with distinct goals, compared by perceived usefulness
- 22 • Sample size prevented statistical adjustments that could handle potential
23 confounders in observational data

24 COMPETING INTERESTS

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33 The authors have no competing interests to declare.
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36 FUNDING

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40 This work was funded by the Australian Government Department of Veterans' Affairs (DVA) as
41 part of the Veterans' Medicines Advice and Therapeutics Education Services (Veterans' MATES)
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44 execution, analysis or interpretation of data, writing of manuscript or decision to submit the
45 paper for publication.
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INTRODUCTION

Public health interventions play an important role in translating evidence into practice and promoting health professional behaviour change. Multifaceted interventions are effective in improving medicine prescription patterns,[1] radiology referrals,[2] and screening and preventative practices.[3] A common approach to health professional behaviour change is shaping knowledge and promoting better informed clinical decisions. A growing body of evidence suggests that interventions targeting health professional can change clinical performance. Examples of effective interventions include educational interventions and audit and feedback interventions.[4-8] However, knowledge shaping interventions are commonly the result of a bundle of different actions in a complex environment,[9] which makes it difficult to determine the effect of the individual components. Moreover, audit and feedback interventions may influence behaviour by affecting domains beyond knowledge, such as beliefs about capabilities, motivations and goals, and creating social influences.[10] Therefore, while there is evidence to determine the effect of both educational, and audit and feedback interventions, there is no evidence to pinpoint which particular features make them most effective.[11] A deeper understanding based on empirical data can improve intervention design, which currently relies on theory alone.

Since 2004, the Veterans' Medicines Advice and Therapeutics Education Services (Veterans' MATES) program, an Australian Government Department of Veterans' Affairs funded program, has provided medicines advice and promoted physician adoption of best practices by use of a multifaceted intervention, which contains educational material and personalised, patient-specific information and recommendations (audit and feedback component).

The program's longevity offers an opportunity to empirically evaluate which features of educational, and audit and feedback interventions have an impact in its usefulness to physicians. Over the years, the Veterans' MATES program has gone through changes and, despite keeping the core principles consistent, the features of each intervention have differed

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3 slightly from the previous. The changes, coupled within a consistent context of implementation,
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5 make interventions comparable.
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8 To improve understanding about which features of educational and audit and feedback
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10 interventions contribute to success, we analysed data from all interventions implemented in the
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12 Veterans' MATES program. Our aim is to identify whether content features, presentation
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14 features or the use of behaviour change techniques is associated with changes in perceived
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16 usefulness by receiving general practitioners.
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21 METHODS

22 STUDY DESIGN – THE VETERANS' MATES PROGRAM

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24 We performed a comparative observational study [12] to evaluate how intervention features
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26 from the educational, and audit and feedback components of the program explained the
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28 observed variability in intervention success. We used data from the Veterans' MATES program,
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30 comparing 51 distinct interventions that took place between November 2004 and June 2018.
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32 The program aims to improve medicine and health services use and health outcomes for all
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34 persons in the veteran community by delivering interventions to general practitioners (GPs),
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36 pharmacists, other relevant healthcare professionals and veterans.[1] The program's goal is to
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38 provide medicine advice to veterans and their primary physicians according to previously
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40 identified issues, as detected by epidemiological inquiry.
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45 Since the program's conception, it has been driven by the use of technology and big data to
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47 detect health issues and tailor interventions for at-risk groups. During each intervention's
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49 development process, an epidemiological analysis is performed on a comprehensive database
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51 containing administrative claims data (including medicine dispensings) collected by the
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53 Australian Government Department of Veterans' Affairs. The analysis is guided by a clear
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55 question to explore potential quality use of medicine issues. Examples include: long term
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3 prescription of medicines recommended for acute issues; doses above guideline
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5 recommendations; and lack of screening tests for an eligible population.
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8 After identifying the problem, a behaviour change goal is defined. This goal typically aims to
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10 promote evidence-based practices, for example encouraging the cessation of medicines without
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12 long-term evidence, or the optimisation of therapy according to treatment guidelines. With the
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14 problem and goal in mind, an intervention is designed. The intervention is informed by Social
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16 Cognitive Theory [13], the Transtheoretical model,[14] and the health promotion model
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18 Precede-Proceed.[15] The full list of topics are available at www.veteransmates.net.au, the
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20 influence of the aforementioned theories in intervention development is further discussed in
21
22 [1]. Interventions include three main components: 1) printed and online educational material
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24 for health professionals called the therapeutic brief; 2) printed and online educational material
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26 for veterans, called the veteran brochure; and 3) an audit and feedback document for the GP
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28 containing personalised patient information, called the prescriber feedback. An example of the
29
30 current version of the feedback can be seen in Figure 1. The format of this feedback varies
31
32 depending on the behaviour change goal. Interventions target particular health professionals
33
34 and veterans according to criteria developed during the epidemiological analysis, meaning that
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36 only those individuals likely to benefit will receive the intervention. Along with all veterans
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38 identified using these criteria, the interventions target the main general practitioner involved in
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40 the veterans' care.
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45 Stakeholder (health professionals and patients) perceptions of the service were evaluated using
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47 one-page response forms (survey) mailed at the time of the intervention. The surveys have ten
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49 questions designed with a double role of collecting new information and reinforcing important
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51 educational content. It contains questions to evaluate intervention quality including perceived
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53 usefulness, our main outcome described below, and the relevance of this information for
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55 patients. In some interventions, the survey also included commitment questions, e.g. asking
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57 doctors how many patients they would review. Epidemiological post-intervention analysis
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3 evaluates the actual population-level change in prescription patterns and use of health services,
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5 quantifying the effect of interventions. The program has been extensively described
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7 elsewhere.[1] It has been shown to be effective for changing professional behaviour in different
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9 domains,[1] including promoting medicine review,[16] osteoporosis screening,[17] uptake of
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11 health services,[18] reducing inappropriate proton pump inhibitor use,[19] and hypnotic use
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13 for insomnia.[20]
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15 16 17 *ANALYSIS – EXTRACTED FEATURES FROM THE EDUCATIONAL COMPONENT* 18

19 Within the educational component of the intervention, composed of the printed and online
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21 material, we identified two features that changed over the years: presentation and writing style.
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23 Changes in presentation were related to information organisation, given that the visual identity
24
25 of the materials, including font, colour schemes and general document organisation, remained
26
27 consistent. The most relevant variations in presentation included adding tables, images and
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29 more frequent headlines for section subdivision. The presence of contextually appropriate
30
31 visual cues has been shown to improve knowledge uptake in health education.[21] Visual cues
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33 include illustrations and pop-out effects, comprising items that don't match the immediate
34
35 surrounding environment, such as tables, colour highlights or italic citations. We hypothesised
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37 that presentation would affect perceived usefulness due to improved readability and
38
39 information distribution.
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43 Educational content varied according to the subject being covered making it the most difficult to
44
45 measure and compare. Three over-arching intervention themes were identified: 1) Therapy
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47 initiation, which includes the recommendations for prescribing new medicines for known
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49 conditions. It usually follows detection of under-use of evidence based medicines in the health
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51 claims database. 2) Therapy adjustment or withdrawal, which includes alerts about common or
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53 serious side effects associated with the use of a medicine. It usually includes recommendations
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55 for stepping down the dosage, or changing or stopping medicines. 3) Service initiation, which
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3 includes recommendations to refer patients for funded healthcare services (e.g. screening tests,
4 home medicines reviews or psychology services for mental health conditions).
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8 Two behavioural economic theories guided our feature selection: loss aversion [22] and excess
9 of choice.[23] Loss aversion refers to a tendency to give higher weight to loss than to gain, and
10 engage in riskier behaviour to avoid loss. Excess of choice refers to a tendency to make poorer
11 choices when faced with too many options. The relevance of these features was previously
12 demonstrated in health promotion settings.[24] In a study evaluating messages to promote
13 hand washing,[24] loss and fear inducing (threatening) messages about flu contagion risk were
14 superior to standard messages. Additionally, messages containing simple instructions (coping
15 messages) were superior to multiple webpages containing detailed information about flu
16 contagion.
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19 To capture a proxy of loss aversion and excess of choice, we measured features related to
20 writing style using a natural language processing technique called sentiment analysis.[25]
21 Sentiment analysis is “the computational study of people’s opinions, appraisals, attitudes, and
22 emotions toward entities, individuals, issues, events, topics and their attributes”.[25] Two
23 common measures of sentiment analysis are polarity and subjectivity. Polarity is a measure of
24 how positive (or negative) a piece of text is, and ranges from +1, meaning positive, to -1,
25 meaning negative. Subjectivity measures how much judgement is embedded in the text by the
26 use of adjectives and adverbs, and ranges from +1 for completely objective to -1 for completely
27 subjective. We performed sentiment analysis using the Python library TextBlob [26] to extract
28 polarity and subjectivity score for each educational material. We hypothesized that more
29 negative and objective (what not to do) would be deemed more useful than positive and
30 subjective (best practices).
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54 We also counted the number of times a medicine was mentioned in the educational component.

55 We used the Anatomical Therapeutic Chemical (ATC) [27] classification to identify medicines
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3 names and the sum of all mentions was added as feature. We counted the number of external
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5 links, as a measure of the importance of providing access to further information, if needed.
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8 *ANALYSIS – EXTRACTED FEATURES FROM THE AUDIT AND FEEDBACK COMPONENT*

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11 To extract features from the audit and feedback document, we analysed 51 prescriber feedback
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13 documents and identified five different behaviour change techniques. To identify relevant
14
15 codes, one of the authors who has medical background performed manual review to extract
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17 behaviour change techniques used in a random sample of prescriber feedback documents (10
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19 documents). The rules and prototypical examples were presented and discussed with the
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21 original intervention developers prior to coding (see Box 1). The behaviour change techniques
22
23 were coded using the Behaviour Change Techniques Taxonomy v1.[28] Since more than one
24
25 technique can be present in the same audit and feedback document, the number of different
26
27 techniques present in an intervention was considered a feature. After consensus, a set of rules
28
29 for coding was created and applied to each document. Questions and borderline cases were
30
31 brought back to the group for discussion. We hypothesised that every additional technique
32
33 would further increase the usefulness of the intervention.
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37 *ANALYSIS - FEATURE EXTRACTION PROCEDURE*

38 All educational materials were downloaded from the main program site
39
40 (<https://veteransmates.net.au>). We parsed the files to extract text and presentation features,
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42 such as number of special formatting (e.g. table, headline, and external links) (Table 1).
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46 *ANALYSIS - OUTCOME*

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48 The main outcome of this study was perceived usefulness. Usefulness is a predictor of continued
49
50 use [29, 30] and guideline / decision support system use.[31] Moreover, it allows the
51
52 comparison of different types of behaviour change interventions. A post-intervention survey
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54 was included with mailed material, containing up to ten questions connected to the
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56 interventions content. We extracted information from post-intervention surveys asking “How
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58 useful have you found the therapeutic brief”. Each responder could select one of four options: 1)
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3 Very useful; 2) Moderately useful; 3) Slightly useful; 4) Not useful. To create an intervention
4 usefulness score, answers were attributed a score, from 4 (Very useful) to 1 (Not useful). We
5 averaged the scores per intervention, resulting in a final score ranging from 1 to 4.
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10 We used Pearson correlation coefficient and Mann Whitney U test for hypothesis testing. We used
11 Python SciPy package v1.1.0 for analysis.[32]
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15 16 17 RESULTS

18 19 INTERVENTION CHARACTERISTICS

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21 Of the 51 interventions, 48 were evaluated and three were excluded due to a lack of outcome
22 data (perceived usefulness). On average, each intervention was delivered to 9667 GPs, for a
23 total of 493,015 individual veterans targeted. GPs eligible for multiple interventions were
24 targeted multiple times. We received, on average, 608 survey responses for each intervention,
25 totalling 29,809 GP responses (6% median response rate [P25 = 5%; P75=7%]).
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34 Overall, the topics were deemed useful. There were 15 'Service initiation' topics (e.g.
35 recommendation of bone mineral density testing), 23 'Therapy adjustment' topics (e.g.
36 recommendation to cease unnecessary anticholinergic medicines) and 10 'Therapy initiation'
37 topics (e.g. recommendation to use emollients for dermatitis exacerbations). Figure 22 shows
38 the usefulness scores by intervention theme. Usefulness scores ranged from 3.61 (osteoporosis -
39 Jun 2018) to 2.74 (chronic musculoskeletal pain - Mar 2014), with a median score of 3.17 (sd
40 0.18).
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50 51 HYPOTHESIS TESTING

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53 The features exhibited substantial variability over the study period. The exception was the
54 sentiment analysis metrics. Both polarity and subjectivity remained relatively consistent
55 throughout the program duration. This means there was little variation in writing style,
56 regardless of the topic and behavioural goal. Prompts was the most common behaviour change
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3 technique, used in 36 interventions (75%), followed by Goal Setting (33 interventions, 69%).
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5 The least common behaviour change technique was Information about health consequences,
6
7 present in four interventions (8%).
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10 We found a significant influence of the number of behaviour change techniques on perceived
11
12 usefulness. The addition of behaviour change techniques to audit and feedback improved
13
14 perceived usefulness. Prompt and Goal Setting strategies were statistically significant (Table 2).
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16 The effect of behaviour change techniques was summative (Figure 3 and Table 2). The sum of
17
18 techniques was considered as an independent variable and was significantly correlated to
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20 perceived usefulness (Table 2).
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24 No presentation or content features were correlated with perceived usefulness (Table 2). The
25
26 number of external links in the educational material showed a tendency to increased perceived
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28 usefulness, but was not statistically significant.
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31 32 33 DISCUSSION

34 Our analysis of 48 interventions of an ongoing medicines advice program adds an empirical
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36 perspective to designing successful health professional behaviour change interventions. The
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38 Veterans' MATES program is a multi-component intervention, including an educational
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40 component, an audit and feedback component of patient specific information, and a patient
41
42 mediated intervention. It has repeatedly demonstrated its effectiveness in changing
43
44 professional behaviour.[1, 16-20]
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48 Overall, the results suggest that changes in the audit and feedback component significantly
49
50 improve perceived usefulness. Such demonstration of effect of distinct behaviour change
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52 techniques is uncommon in the literature, due to the usually small effect and the sensitivity to
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54 contextual changes.[12] Due to the long duration of the program, we were able to demonstrate
55
56 statistically significant effects of prompts and goal setting in improving the usefulness of the
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58 intervention. This finding also reflects the relevance of adding personalised information in an
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3 intervention. Every prompt was generated from patient data and reflected information that may
4 have been unknown to the physician. By bringing accurate information in the right context, the
5 prompt creates a trigger that may increase the likelihood of an appropriate action.
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10 We also found that there was an additive effect of using multiple different behaviour change
11 techniques on usefulness. This effect has been described in the context of health promotion.[33,
12 34] This finding suggests that different techniques may independently solve different needs and
13 the use of multiple techniques in the same intervention is not detrimental to effect. In our study,
14 all behaviour change techniques aimed to help physicians in their decision making process, such
15 as suggesting the evidence-based recommended action, providing scientific information or
16 translating patient information (e.g. classifying the dosage as high or low instead of a quantity).
17 This common theme may explain the additive effect of the techniques, as they often complement
18 each other and inform the same choice process.
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30 While we hypothesized that presentation and content features would be determinants of
31 usefulness, none of the studied features were correlated with perceived usefulness. Since the
32 beginning of the Veterans' MATES program, aesthetic was deemed important and there have
33 been few significant changes in visual identity over the years. However, information
34 organisation has changed considerably without significant impact in perceived usefulness, as it
35 would be expected if changes improved readability or comprehension. There are three possible
36 explanations for this finding: 1) No impact on usefulness - research has shown that, while design
37 improves usability,[35] it has limited effect on perceived usefulness;[36] 2) threshold effect -
38 aesthetic has been shown to be important in other contexts, such as digital medium,[37, 38]
39 therefore a possible explanation is that design and presentation may have a threshold effect,
40 over which there are diminishing returns; 3) audit and feedback components as confounder -
41 since prescriber feedback changes dominated the intervention effect, it may have masked the
42 impact of educational component features.
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3 With respect to content, our goal was to identify the writing style that conveys a clear health
4 intervention message, e.g. content should be more objective rather than comprehensive, or
5 normative versus theoretical. Our findings do not support any recommendation concerning
6 writing style. In this study, content effect on perceived usefulness was dominated by the
7 influence of theme. Physicians tended to evaluate topics about service initiation and therapy
8 adjustment (recommendations to remove or reduce medicines) more favourably than topics
9 containing therapy initiation (recommendations to add medicines). This may reflect existing
10 physician knowledge about the topic.
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21 The lack of significant findings regarding content features should be interpreted cautiously, due
22 to study design and the intrinsic complexity of evaluating communication using automated
23 means such as sentiment analysis. The Veterans' MATES program employs trained and
24 experienced medical writers with multiple peer review processes that maintain consistent text
25 quality. This is evidenced by small variation in the tone and subjectivity scores between
26 different interventions. Also, the sentiment analysis algorithm used in this study is based on the
27 frequency of words deemed as positive/negative and subjective/objective. Therefore, it may not
28 be sensitive enough to detect subtler language features. There is evidence in the health
29 promotion domain that users prefer messages that are correctly spelled and grammatically
30 correct and directive rather than passive or interrogative.[39] Emphasis on objectivity and
31 clarity are also recommended for creating medical guidelines,[40, 41] though empirical
32 evidence is still lacking.
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48 Theories and findings regarding message tone are more conflicting,[22, 42] which may reflect a
49 dependency on context. It is well established that loss aversion is a driver for insurance
50 purchase, as the fear of rare but large loss is greater than a small but consistent premium.[22] In
51 addition, negatively framed messages appear to promote behaviour change by creating stronger
52 cognitive responses.[42] A similar reasoning has been applied to medical reasoning giving an
53 important weight to regret during decision making,[43] meaning that a therapeutic decision is
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3 only made when the expected usefulness surpasses the potential harm that is always associated
4 with treatment. Other studies have suggested that positive messages may be better received by
5 individuals already motivated to make a behaviour change.[39]
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10 Translating large scale health professional behaviour change interventions from a concept to a
11 real-life solution is not a straightforward process. Given the inherent complexity of behaviour
12 change interventions, replicating a successful intervention often fails due to poorly understood
13 factors.[44] The strong effect of implementing behaviour change techniques in audit and
14 feedback interventions, particularly prompt and goal setting, suggests a clear recommendation
15 for developers.
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23 24 STRENGTHS AND WEAKNESSES

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26 As an observational research process, the strength of this study is the number of discrete
27 interventions over a long period of time. The context within which the interventions took place
28 remained sufficiently similar, which allowed us to isolate the effect of different features on
29 perceived usefulness.
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36 However, there are important limitations. The response to the surveys was voluntary and the
37 response rate was small, ranging from 12.9% to 2.8% (mean 6.2%). This may have selected
38 those who benefited from the topic and biased the results. Due to the heterogeneity in
39 behaviour change goal, we used perceived usefulness. Finally, despite 15 years' experience, 51
40 large-scale interventions are likely underpowered for some of the analyses performed. The
41 small sample also prevented statistical adjustments that could handle potential confounders in
42 observational data
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51 52 CONCLUSION

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54 This study demonstrated that prompts and goal setting components improve perceived
55 usefulness when added to audit and feedback interventions. The addition of multiple different
56 behaviour change techniques in the audit and feedback component improved usefulness and
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3 showed a summative effect. None of the content and presentation features extracted from the
4
5 educational component were correlated with changes in perceived usefulness.
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8 LIST OF ABBREVIATIONS

9 Veterans' MATES: Veterans' Medicines Advice and Therapeutics Education Services

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13 A&F: Audit and feedback

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16 GPs: General practitioners

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19 TIDieR: Template for Intervention Description and Replication

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22 ATC: Anatomical Therapeutic Chemical

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25 DVA: Department of Veterans' Affairs
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29 DECLARATIONS

30 31 32 33 PATIENT AND PUBLIC INVOLVEMENT

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36 The Veterans' MATES program is supported by multiple stakeholder advisory groups, including
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38 patients, healthcare professionals and government representatives. They provide input to the
39
40 intervention design and implementation, as well as to the programme of research.
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43 ETHICS APPROVAL AND CONSENT TO PARTICIPATE

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46 An ethics protocol for the study was approved by the University of South Australia Human
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48 Research Ethics Committee (ethics protocol P203/04) and the Department of Veterans' Affairs
49
50 Human Research Ethics Committee (E016/007).
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53 CONSENT FOR PUBLICATION

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56 Not applicable.
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59 AVAILABILITY OF DATA AND MATERIALS

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3 The data that support the findings of this study are available from the Australian Government
4 Department of Veterans' Affairs but restrictions apply to the availability of these data, which
5 were used under license for the current study, and so are not publicly available.
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10 AUTHOR CONTRIBUTIONS

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13 AQA conceived of, designed, conducted the final analysis for this paper and drafted the
14 manuscript. VTL, JDB and EER developed the protocol and study approach. VTL, AM, NB and
15 KW developed the questionnaires and were involved in data collection. LMKE, NLP and AM
16 were involved in the data analysis. EER conceived of and designed the study, and critically
17 revised the manuscript for important intellectual content. All authors made important
18 contributions to the theoretical approach and interpreting insights. All authors read and
19 approved the final manuscript.
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31
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38 Australian Medicines Handbook; and the Drug and Therapeutics Information Service.
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LEGENDS FOR FIGURES

Figure 1 - Example of the audit and feedback document for the "Recovering from pain" topic

Figure 2 - Usefulness score box plot by intervention theme

Figure 3 - Average usefulness score of topics by number of behaviour techniques

For peer review only

TABLES

Behaviour Change Techniques [code according to Behaviour Change Techniques Taxonomy v1]	Prescriber feedback implementation followed by example
Prompt/cues (code 7.1)	Display of a message highlighting a patient-specific issue related to the current topic. E.g. "Patient dispensed an antidepressant and has had no claim for DVA funded psychological therapies in last two years."
Goal setting (code 1.1)	Display of the suggested action followed by a checkbox. E.g. "Action: Consider review."
Discrepancy between current behaviour and goal (code 1.6)	Display questions about a patient condition that, if answered positively, suggest an action is required. E.g. "Has adequate pain relief been achieved with current treatment approach? Could adjuvant pain medicine regime be changed?"
Information about health consequences (code 5.1)	Display the rationale for the suggested change. E.g. "Patient prescribed different medicines that may increase their risk of heat-related illness (see therapeutic brief insert)."
Feedback on behaviour (code 2.2)	Re-interpretation of the prescription data to provide additional data. E.g. translating 20/40mg for low/high dose; providing drug burden indices.

Box 1 - Behaviour Change Techniques and how they were implemented in the Prescriber feedback

Table 1 - List of features extracted from the interventions

Feature	Category
Number of images	Presentation
Number of tables	Presentation
Average section size (Number of character / Number of headlines)	Presentation
Number of external links	Content
Polarity score	Content
Subjectivity score	Content
Number of medicine mentions	Content
Prompt/cues	Behaviour change technique
Goal setting	Behaviour change technique
Discrepancy between current behaviour and goal	Behaviour change technique
Information about health consequences	Behaviour change technique
Feedback on behaviour	Behaviour change technique

Table 2 - Association between extracted features and perceived usefulness scores

Behaviour technique	Mann Whitney U statistics	p-value
Prompt	155.0	0.030*
Goal setting	150.0	0.005*
Discrepancy	118.0	0.125

Health consequences	70.0		0.554
Feedback	161.0		0.234
Variable	Mean (SD)	Pearson Coefficient (SD)	p-value
Number of distinct Behaviour Change Technique	1.79 (1.05)	0.45 (0.19, 0.65)	0.001*
Number of images	0.60 (1.16)	0.18, (0.11, 0.44)	0.226
Number of tables	1.73 (1.23)	-0.16 (-0.42, 0.13)	0.274
Average section size in number of characters	1718 (1094)	0.11 (-0.18, 0.38)	0.447
Number of external links	6.02 (7.07)	0.25 (-0.04, 0.50)	0.088
Text polarity, score +1 to -1	0.079 (0.041)	0.16 (-0.13, 0.42)	0.283
Text subjectivity, score +1 to -1	0.389 (0.057)	0.10 (-0.18, 0.38)	0.475
Number of medicine mentions	31.08 (23.83)	0.17 (-0.11, 0.44)	0.234

*significant association (p<0.05)

Veterans' MATES Australian Government
Department of Veterans' Affairs
Date: 15/03/2020

Dear DR P SURNAME

This Veterans' MATES information aims to assist you to review gabapentinoids (pregabalin or gabapentin) that may cause harmful side effects when used long term. It is advisory in nature. The information is based on DVA claims that indicate that a veteran has had multiple dispensings of pregabalin or gabapentin in a 12 month period.

Consider whether your patient will benefit from non-pharmacological pain therapy and, if warranted, whether adjusting the dose or ceasing gabapentinoids is appropriate. Please consider within the context of this patient's current treatment.

Educational material explaining the rationale for these recommendations can be found at [Veterans' MATES website](#)

FIRST & SURNAME* **DOB: <DD/MM/YYYY>** **Gender: <Male or Female>** **ACCOMMODATION: Community**
 <Residential address>

Relevant claims history for pain

Month	Pregabalin dose ¹ (mg)	Opioid dose (OME) ²
Feb-2019	75	
Mar-2019	75	
Apr-2019	75	
May-2019	75	
Jun-2019	150	
Jul-2019	150	10
Aug-2019	75	10
Sep-2019	75	22
Oct-2019	75	27
Nov-2019	75	27
Dec-2019	75	30
Jan-2020	75	30

¹Daily average dose per month (mg), estimated from dispensing data
²Oral morphine equivalent daily average dose per month (mg), estimated from dispensing data

Notes

Latest Home Medicines Review (HMR) claim	None claimed in the last 2 years
Latest Psychologist visit	None claimed in the last year

Medicine(s)	Last Dispensed	Other Prescriber
Pregabalin (Lyrica) Cap 75 mg	04/01/20	Yes
Tramadol hydrochloride (Tramal SR) controlled release Tab 50 mg	02/01/20	No
Oxycodone hydrochloride (OxyNorm) Cap 10 mg	02/01/20	No

Suggested actions:

- Review indication for use of medicine(s). Confirm pain is neuropathic.
Rationale: The majority of evidence for effectiveness of gabapentinoids is limited to diabetic neuropathic pain and post-herpetic neuralgia. There is limited evidence for effectiveness of gabapentinoids when a neuropathic component is not well established.
- Review duration of use, consider tapering and ceasing.
Rationale: Recommended duration of use of gabapentinoids is no longer than 6 months.
- Check for side effects of medicine(s). Consider risks for driving or falling.
Rationale: One-third to one-half of patients taking gabapentinoids suffer from dizziness or somnolence.
- Review need for therapy, consider potential for cessation.
Rationale: Patient received doses of pregabalin of below 150 mg per day. Potentially subtherapeutic dose for neuropathic pain.
- Patient co-dispensed opioids. This increases the risk of side effects in a dose-dependent manner.
- Consider referral for a Home Medicines Review (HMR) for review of medicines for pain.

Along with this letter, you will receive information about 4 other patients eligible for this module. If you wish to be involved with RACGP CPD or ACRRM PDP for this clinical audit activity please follow this link to view the requirements. Note: This activity is only available until 25 June 2020. [Claim CPD points](#)

*Based on claims for medicines and services according to the DVA Health Claims Database. Patient specific information is based on claims to DVA from all healthcare providers. Some of the medicines listed might have been prescribed by other doctors. You have been identified as the general practitioner who has written most of the recent prescriptions for this patient.

This information has been endorsed by the DVA Editorial Committee, which includes representatives from the AMA and RACGP.
 For general comments and feedback please contact MATES.comments@unisa.edu.au
 For specific questions about the program contact the Veterans' MATES Health Professional Helpline on 1800 500 869.

Figure 1 – Example of the audit and feedback document for the “Recovering from pain” topic

170x243mm (96 x 96 DPI)

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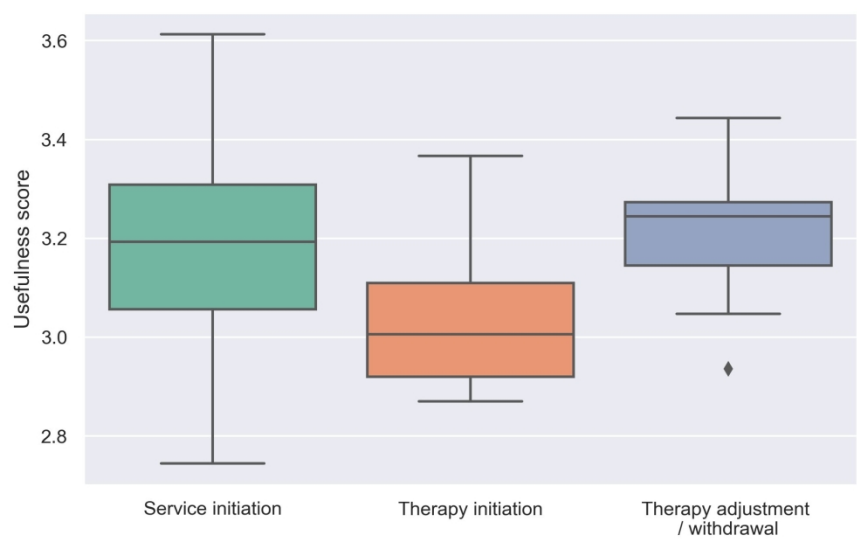


Figure 2 – Usefulness score box plot by intervention theme

203x127mm (300 x 300 DPI)

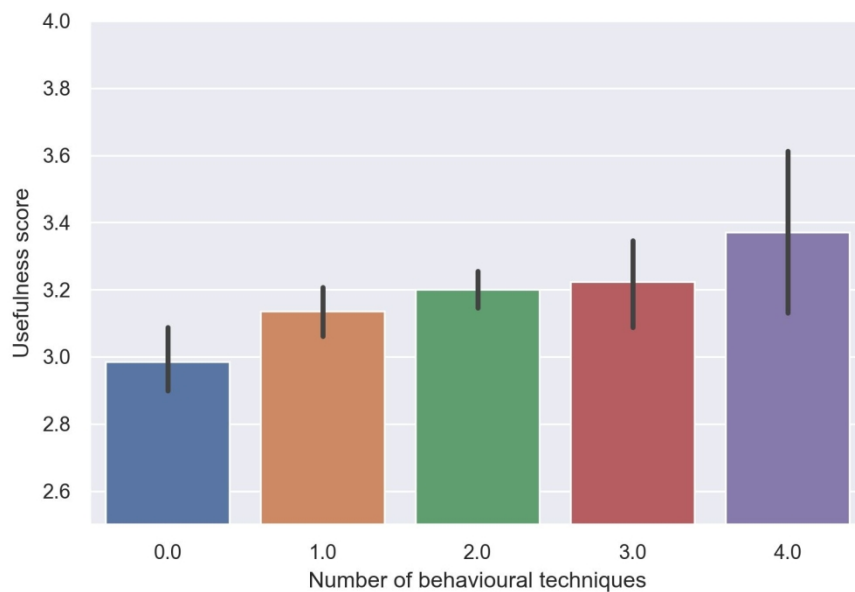


Figure 3 - Average usefulness score of topics by number of behaviour techniques

152x101mm (300 x 300 DPI)

The TIDieR (Template for Intervention Description and Replication) Checklist*:

Information to include when describing an intervention and the location of the information

Item number	Item	Where located **	
		Primary paper (page or appendix number)	Other † (details)
1.	<p>BRIEF NAME</p> <p>Provide the name or a phrase that describes the intervention.</p>	_____	www.veteransmates.net.au
2.	<p>WHY</p> <p>Describe any rationale, theory, or goal of the elements essential to the intervention.</p>	_____	_____
3.	<p>WHAT</p> <p>Materials: Describe any physical or informational materials used in the intervention, including those provided to participants or used in intervention delivery or in training of intervention providers. Provide information on where the materials can be accessed (e.g. online appendix, URL).</p>	_____	_____
4.	<p>Procedures: Describe each of the procedures, activities, and/or processes used in the intervention, including any enabling or support activities.</p>	_____	_____
5.	<p>WHO PROVIDED</p> <p>For each category of intervention provider (e.g. psychologist, nursing assistant), describe their expertise, background and any specific training given.</p>	_____	_____
6.	<p>HOW</p> <p>Describe the modes of delivery (e.g. face-to-face or by some other mechanism, such as internet or telephone) of the intervention and whether it was provided individually or in a group.</p>	_____	_____
7.	<p>WHERE</p> <p>Describe the type(s) of location(s) where the intervention occurred, including any necessary infrastructure or relevant features.</p>	_____	_____

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WHEN and HOW MUCH

8. Describe the number of times the intervention was delivered and over what period of time including the number of sessions, their schedule, and their duration, intensity or dose.

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TAILORING

9. If the intervention was planned to be personalised, titrated or adapted, then describe what, why, when, and how.

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MODIFICATIONS

10.* If the intervention was modified during the course of the study, describe the changes (what, why, when, and how).

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HOW WELL

11. Planned: If intervention adherence or fidelity was assessed, describe how and by whom, and if any strategies were used to maintain or improve fidelity, describe them.

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12.* Actual: If intervention adherence or fidelity was assessed, describe the extent to which the intervention was delivered as planned.

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** **Authors** - use N/A if an item is not applicable for the intervention being described. **Reviewers** – use ‘?’ if information about the element is not reported/not sufficiently reported.

† If the information is not provided in the primary paper, give details of where this information is available. This may include locations such as a published protocol or other published papers (provide citation details) or a website (provide the URL).

‡ If completing the TIDieR checklist for a protocol, these items are not relevant to the protocol and cannot be described until the study is complete.

* We strongly recommend using this checklist in conjunction with the TIDieR guide (see *BMJ* 2014;348:g1687) which contains an explanation and elaboration for each item.

* The focus of TIDieR is on reporting details of the intervention elements (and where relevant, comparison elements) of a study. Other elements and methodological features of studies are covered by other reporting statements and checklists and have not been duplicated as part of the TIDieR checklist. When a **randomised trial** is being reported, the TIDieR checklist should be used in conjunction with the CONSORT statement (see www.consort-statement.org) as an extension of **Item 5 of the CONSORT 2010 Statement**. When a **clinical trial protocol** is being reported, the TIDieR checklist should be used in conjunction with the SPIRIT statement as an extension of **Item 11 of the SPIRIT 2013 Statement** (see www.spirit-statement.org). For alternate study designs, TIDieR can be used in conjunction with the appropriate checklist for that study design (see www.equator-network.org).

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