ORIGINAL ARTICLE

Video strategies improved health professional knowledge across different contexts: a helix counterbalanced randomized controlled study

Mitchell N. Sarkies[a,b,*], Stephen Maloney[a], Mark Symmons[c], Terry P. Haines[d]

[a]*Department of Physiotherapy, School of Primary and Allied Health Care, Faculty of Medicine, Nursing and Health Science, Monash University Peninsula Campus, McMahons Road, Frankston, 3199 Victoria, Australia*
[b]*Allied Health Research Unit, Monash Health Kingston Centre, 400 Warrigal Road, Cheltenham, 3092 Victoria, Australia*
[c]*Mary MacKillop Institute for Health Research, Australian Catholic University, Melbourne, Australia*
[d]*School of Primary and Allied Health Care, Faculty of Medicine, Nursing and Health Sciences, Monash University Peninsula Campus, McMahons Road, Frankston, 3199 Victoria, Australia*

Abstract

Objective: This study aimed to apply a novel helix counterbalanced randomized controlled trial design to evaluate the effectiveness of video vs. written knowledge translation strategies for improving health professional knowledge of evidence provided in scientific journal articles.

Study Design and Setting: A Helix counterbalanced randomized controlled trial was used to compare the impact of delivering research information via video or written modalities compared to a no-information control across three health contexts. Interventions were delivered and data collected via an online survey to nursing and allied health professionals across five hospitals within a public health service in Melbourne, Australia. A knowledge test measuring alignment between respondent perceived benefit of the intervention and conclusions listed in the journal article was the primary outcome.

Results: There were 119 participants recruited with $n = 13$ incomplete responses. Exposure to the video increased the likelihood of a knowledge test response that was aligned with the research evidence compared to the no-information control (OR 2.61; 95% CI 1.40, 4.89; $P = 0.003$), but this was not the case for exposure to the written modality (OR 1.39; 95% CI 0.75, 2.57; $P = 0.294$).

Conclusion: Providing video knowledge translation strategies to nursing and allied health professionals increases the likelihood they will understand the main findings from scientific journal articles. © 2019 Elsevier Inc. All rights reserved.

Keywords: Implementation; Helix; Counterbalanced; Randomised controlled trial; Falls; Deep vein thrombosis; Video; Written; Evidence; Professional education

1. Introduction

Health service provision does not always reflect current research evidence [1]. This evidence-to-practice gap relates to delayed uptake of new knowledge in practice [2], inappropriate reliance on out-dated evidence [3], practices uninformed by evidence [4], or the continuation of potentially harmful or ineffective practices [5]. These represent substantial opportunity costs, where patient and organizational outcomes could be improved if resources were disinvested from nonevidence-based practices to those with evidence of effectiveness and cost-effectiveness.

Two areas where effort is needed to reduce the evidence-to-practice gap are falls prevention and management of deep vein thrombosis (DVT). There has been a substantial amount of research published on falls prevention, which presents a difficulty for health professionals in identifying clear messages for policy and practice [6]. In addition, there has been a long-standing controversy regarding mobilization vs. bed rest following venous thromboembolism, potentially preventing patients from receiving evidence-based care [7]. Levels of uncertainty and knowledge gaps have been reported in both falls prevention and DVT contexts [8–10]. Although knowledge and beliefs do not necessarily have a causal relationship with practice change,

What is new?

Key findings
- Research evidence delivered to health professionals via video improves knowledge of the evidence disseminated in manuscripts when compared with written information.

What this adds to what was known?
- Professional education workshops have been shown to improve knowledge gaps and elicit changes in falls prevention and other health care practices. The results from this study indicate that video-based knowledge translation strategies may also improve health professional knowledge across different contexts.

What is the implication?
- Use of video abstracts may be a useful adjunct to publishing research in dissemination activities.

What should we change now?
- Further research is needed to understand whether improved knowledge from digital knowledge translation approaches can contribute towards more complex, multifaceted research implementation strategies and improve evidence uptake in health care policy and practice.

they can present a barrier to change, as knowledge and beliefs are considered prerequisites to behavior change [11]. Clinical decision-making aids at point of care can improve adherence to evidence-based guidelines across health contexts [12]; however, if decisions are made at multiple system levels (e.g., patient, clinician, management, policy levels), it can limit the ability of individual clinicians to change practice at the bedside. Therefore, it is hypothesized that improved knowledge at multiple levels of the health system could form a prerequisite for additional implementation efforts aimed at practice change.

Nationally, Australian hospitals allocate approximately AU$590 million per year to prevent falls in hospitals [13]. Falls prevention alarms continue to account for approximately 11% (AU$909 per bed per year) of these resources [13], despite unclear evidence of effectiveness [14,15]; and provision of falls prevention patient education materials alone without one-on-one follow-up from a health professional has demonstrated limited evidence of effectiveness [16]. For the management of DVT, many people diagnosed in the hospital setting are traditionally treated with anticoagulation therapy and bed rest, which is thought to reduce the risk of pulmonary embolism [17]. However, multiple meta-analyses have confirmed that compared with

bed rest, early physical activity as an adjunct to anticoagulation treatment for older people with acute DVT does not increase the risk of pulmonary embolism, may reduce the risk of extension of DVT, and can reduce pain symptoms [18,19].

There is a need to identify better approaches to enable health care professionals, managers, and policy-makers understand and use evidence, given the benefits of research in falls prevention and DVT management may not have always been translated to improved patient and organizational outcomes in a timely manner. Historically, the scientific journal article has been one of the most common approaches to disseminate evidence [20,21]. However, key messages may be missed, as journal articles generally contain large amounts of detail sufficient to enable replication, which can take considerable time and expertise to interpret. Further, they are not typically written with the knowledge users in mind (e.g., health care professional, manager, or policy-maker); and although they might recommend new or changed practices, there tends to be a paucity detail on how this change can be pragmatically made in "real world" settings. Better targeted research reviews can be more palatable. After evaluating the use of research reviews specifically commissioned for health care policy, Campbell et al. (2011) [22] reported that policy-makers perceived them as useful for decision-making. Similar positive perceptions regarding written evidence summaries have been reported across other studies [23,24]; however, although positive perceptions may be a prerequisite for change, they do not necessarily always result in behavior change [20,25−29].

Capitalizing on the popularity of video for conveying and consuming information more generally, there is a trend for communicating technical health information in this mode too [30]. For example, a number of journals have begun posting video versions of research abstracts as an introduction to the full paper [31]. In the case of conveying practice information to health care professionals, the audience may not necessarily be motivated to allocate time in their ordinary workload to read and interpret a scientific journal article. This situation would seem ideal for use of video. Web-based video education has been shown to potentially build knowledge-based capacity for evidence-informed decision-making [32]. However, further evaluative research is needed because of the paucity of evidence supporting the effect of video-based knowledge translation strategies in improving health professional understanding of research evidence.

This study aimed to apply a novel helix counterbalanced randomized controlled trial design to evaluate the effectiveness of video vs. written knowledge translation strategies compared to a control condition for improving nursing and allied health professional knowledge of evidence provided in a scientific journal article across three health contexts.

2. Materials and methods

The study was approved by the Monash University Human Research Ethics Committee (Ref LNR/18/MonH/155). It was also registered with the Australia New Zealand Clinical Trials Registry (ANZCTR), Trial ID: ACTRN12618000695202.

2.1. Design

This study used a controlled, 3-group helix counterbalanced randomized design (Fig. 1). Three study groups examining the success of video and written research evidence summaries, compared with usual care control conditions were evaluated. These knowledge translation strategies aimed to align knowledge with the current research evidence for three health contexts: (1) promoting physical activity as an adjunct to anticoagulant treatment after diagnosis of DVT, (2) written falls prevention patient education materials only without follow-up from a health professional, and (3) bedside pressure sensor alarms to prevent falls. The knowledge translation strategies were delivered, and data were collected via an online survey. In this design, the knowledge translation strategy (independent variable) takes on three levels, which are evaluated across three health contexts. Each knowledge translation strategy level uses a different health context within each participant to avoid contamination. This approach is represented below:

$$R \rightarrow XA1|B1 \rightarrow XA2|B2 \rightarrow XA3|B3 \rightarrow O$$

$$R \rightarrow XA3|B1 \rightarrow XA1|B2 \rightarrow XA2|B3 \rightarrow O$$

$$R \rightarrow XA2|B1 \rightarrow XA3|B2 \rightarrow XA1|B3 \rightarrow O$$

Where R represents random assignment of units to conditions, O indicates unit outcome assessment, A is the knowledge translation strategy, and B is the health context.

2.2. Setting

The study sample was drawn from a major public health service organization in metropolitan Melbourne, Australia. This health service includes five teaching hospitals providing acute and subacute services, with more than 260,000 patient admissions each year.

2.3. Eligibility criteria

Registered nurses and enrolled nurses from all inpatient wards, as well as allied health professionals (physiotherapy, occupational therapy, speech pathology, dietetics, social work, psychology, podiatry, and exercise physiology) and allied health assistants at the study hospitals were all eligible to participate in the study. These health care professionals were included as they are regularly involved in delivery of interventions for the health contexts of interest in this study. Nursing staff working in aged care, outpatient, or community
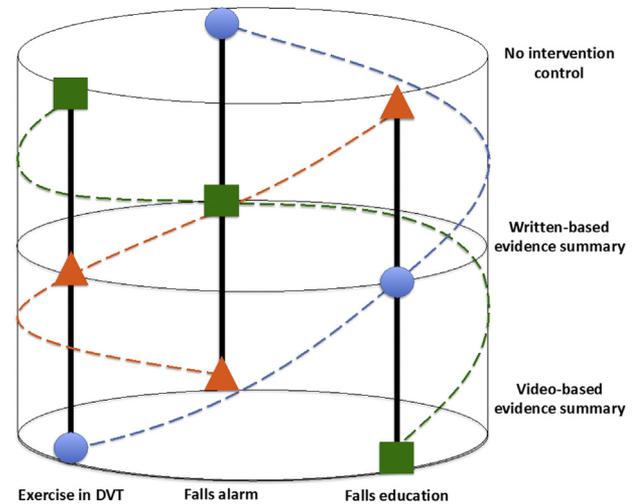

Fig. 1. Three-level helix counterbalanced randomized study model. * circle = group 1; triangle = group 2; square = group 3.

services, and assistant in nursing (AIN) staff working in any setting were excluded as they were not considered to be primary clinical decision-makers or delegated providers of interventions for the health contexts of interest in this study.

2.4. Interventions

Group hospital email addresses for potentially eligible nursing and allied health staff were identified by discussion with nursing unit managers for each inpatient ward and the allied health managers at the study health service. An email was then sent from one of the investigator's staff member email address to invite potential participants to take part in the study. This email provided an access link to the online survey software tool. Potential participants were provided with information on the study in the invitation email and at the beginning of the online survey. Completion of the online survey constituted implied consent. Participants were randomized to one of three groups determining the sequence of knowledge translation strategy to health context exposure on commencement of the survey using an inbuilt randomization feature within the online survey software tool. The knowledge translation strategies were delivered simultaneously at point of randomization via two embedded links in the survey. Participants may select the order they access the interventions and time occurred between. Group allocation was concealed to investigators and participants using the online survey's inbuilt randomization feature, as neither was actively involved in the process. However, participants were not blinded because of the nature of the interventions.

The three research knowledge translation strategy conditions in this study were a video evidence summary, written journal article, and a no-information control condition. A summary of the study group conditions is described according to the Template for Intervention Description and Replication (TIDieR) guidelines in Table 1 [34]. In each health

Table 1. Study group conditions according to the Template for Intervention Description and Replication TIDieR guidelines

TIDieR criteria	(a)	(b)	(c)
Item 1. Brief name	Video evidence summary	Written journal article	No intervention control
Item 2. Why	Video knowledge translation strategy approaches have emerged as a new way for journal publishers to communicate study results by providing video abstracts [31]. A recent study reported increased knowledge as a result of a web-based video education series that aimed to build capacity for evidence-informed decision-making [32].	Providing written evidence summaries is one of the most common traditional dissemination approaches for the translation of research into practice [20,21]. This approach has demonstrated some success but has not been compared with other knowledge translation strategy modes, such as providing video evidence summaries [21].	No intervention control serves as a pragmatic reference standard for implementation science
Item 3. What (materials)	A video summary of available research evidence in the relevant health context area was provided. This video was an animation format with subtitles	A published full-text research article in the relevant health context area was provided [14,18,33]	There was no material provided to the control group during the study period.
Item 4. What (procedures)	The video evidence summary was provided to participants at time of random group allocation. The investigative team developed the video based on the same evidence provided in the written journal article knowledge translation strategy.	The written journal article was provided to participants at time of random group allocation.	No intervention was provided at time of random group allocation.
Item 5. Who	A team of tertiary qualified academics and clinicians, from health care backgrounds in Victoria, Australia, produced the video evidence summary.	A team of tertiary qualified academics and clinicians, from health care backgrounds in Victoria, Australia, selected the written journal article based on their judgment of the highest quality research currently available in the relevant health context areas. An independent expert in the field of rehabilitation confirmed this selection.	No intervention was provided by any persons.
Item 6. How	An electronic version of the video evidence summary was provided via an online survey software tool.	An electronic version of the written journal article was provided via an online survey software tool.	No intervention was provided by any mode.
Item 7. Where	Recruitment occurred online via staff email address. Although these can be accessed by staff offsite, it was anticipated that the majority of participants would access the interventions at their place of work, in the study hospital.	Recruitment occurred online via staff email address. Although these can be accessed by staff offsite, it was anticipated that the majority of participants would access the interventions at their place of work, in the study hospital.	No intervention was provided at any location.
Item 8. When and how Much	One 3-minute video evidence summary was provided to participants at time of random group allocation.	One written journal article in the form of a published full-text research article was provided to participants at time of random group allocation.	No intervention was provided.
Item 9. Tailoring	There was no adaptation planned for the video evidence summary during the study period.	There was no adaptation planned for the written journal article during the study period.	No intervention was provided or adapted during the study period.
Item 10. Modifications	No modifications were made.	No modifications were made.	No modifications were made.
Item 11. How well (planned)	The duration of time taken to complete the online survey provides a proxy measure to whether the video and written intervention were watched and read, respectively. Participants whose survey duration time was less than 3 minutes were considered not to have adhered to the interventions.	The duration of time taken to complete the online survey provides a proxy measure to whether the video and written intervention were watched and read, respectively. Participants whose survey duration time was less than 3 minutes were considered not to have adhered to the interventions.	As no intervention is provided, adherence or fidelity was not assessed for this control intervention during the study period.

(Continued)

Table 1. Continued

TIDieR criteria	(a)	(b)	(c)
Item 12. How well (actual)	Nineteen participants completed the survey in less than 3 minutes, indicating it is unlikely they watched the full video intervention and read the written intervention.	Nineteen participants completed the survey in less than 3 minutes, indicating it is unlikely they watched the full video intervention and read the written intervention.	Participants had no way to access the video or written intervention for the control health context. Therefore, adherence to the control condition is assumed.

context, a full-text scientific journal article constituted the written evidence journal article, from which the video evidence summary was developed. Videos were standardized based on format (animation), captioning (subtitled with no audio), duration (3 minutes), and software. An independent expert in rehabilitation confirmed the content in relation to the main messages contained within the video (based on the selected journal article). Scientific journal articles were chosen on the basis that they included recommendations for professional practice on the basis of findings. Those recommendations related to physical activity as an adjunct to anticoagulant treatment after diagnosis of DVT, provision of falls prevention education materials to patients without one-on-one follow-up from a health professional, and use of bedside pressure sensor alarms to prevent falls. Participants from across locations and professions were randomly allocated to one of three groups described in Table 2.

2.5. Participant outcomes of interest

Data collection occurred using an online survey software tool. The recruitment, intervention delivery, and data collection all occurred within one period (online survey); therefore, each participant determined time to completion. The video and written interventions were delivered for each health context in a single block before being presented with the survey questions. Participants were prompted to answer the survey questions immediately after the intervention block delivery. Questions are presented in Table 3 and were developed specifically for the purpose of this study to test alignment of knowledge with the research evidence contained in the materials presented.

2.6. Sample size

A sample size of 49 participants in each group (147 total participants) would provide 80% power at a 0.05 significance level for the primary outcome, under the assumption that 70% of knowledge test responses in an intervention group align with the presented research evidence, and 40% in the control group (approximately 30% difference or an odds ratio of 3.5). Adjustment for the relative efficiency (RE) of within-group repeated measures designs (constructed specifically for this research design) was performed using the formula: $RE = 0.5 \ [(1-Pc-p)/(1+(n-1)p)]$, where n = number of units within each cluster across time periods, p = intraclass correlation coefficient (ICC) between units in the same cluster at the same time point, and Pc = the interperiod correlation [35]. An ICC of 0.001 between units was used based on interim analysis data conducted once n = 53 participants had been recruited. We conservatively estimated a similar interperiod correlation of 0.001, estimating a relative efficiency for the within-group repeated measures design of 0.5. This adjustment creates a sample size of 25 participants per group (74 participants in total). We aimed to recruit 30 participants per group (90 total participants) to allow for approximately 20% withdrawal rate or loss to follow-up.

An interim analysis was performed once a sample size of n = 53 participants were recruited from one of the study hospitals. The original target sample size calculation was based on calculations for continuous data, leading to statistically underpowered results from our initial sample at one

Table 2. Group allocation to dissemination strategy and health context sequence

Group	Description
1	Received the video evidence summary education strategy for promotion of physical activity as an adjunct to anticoagulant treatment after diagnosis of deep vein thrombosis, followed by the written journal article education strategy for the provision of falls prevention education materials to patients without one-on-one follow-up from a health professional, and then a no-intervention control in bedside pressure sensor alarms to prevent falls.
2	Received the video evidence summary education strategy in bedside pressure sensor alarms to prevent falls, followed by the written journal article education strategy for promotion of physical activity as an adjunct to anticoagulant treatment after diagnosis of deep vein thrombosis, and then a no intervention control for the provision of falls prevention education materials to patients without one-on-one follow-up from a health professional.
3	Received the video evidence summary education strategy for the provision of falls prevention education materials to patients without one-on-one follow-up from a health professional, the written journal article education strategy in bedside pressure sensor alarms to prevent falls, and the no intervention control for promotion of physical activity as an adjunct to anticoagulant treatment after diagnosis of deep vein thrombosis.

Table 3. Survey description

Outcome	Survey questions
Primary outcome: alignment between respondent-perceived benefit of treatment in each health context and conclusions listed in each journal article	"How beneficial do you think written patient educational materials are for preventing falls in hospital?", "How beneficial do you think bed/chair alarms are for preventing falls in hospital?", and "How beneficial do you think exercise is as an adjunct treatment for deep vein thrombosis (DVT)?". Participants were able to choose the options of "beneficial", "not beneficial but not harmful", or "harmful".
Secondary outcome 1: self reported confidence of judgment in response to knowledge test	Participants were asked: "How certain are you that this judgment of benefit is correct?" and were able to choose the options of "very certain", "somewhat certain", and "uncertain".
Secondary outcome 2: self reported perception of whether practice should be implemented or deimplemented	Participants were asked: "Do you think this strategy should be used to prevent falls in hospital?" and were able to choose the options of "yes", "no", or "unsure".

hospital site from the study health service. The target sample size was amended using appropriate methods for estimating sample size needed to achieve adequate statistical power for cluster within-group repeated measures designs [35]. Four additional hospital sites were required within the study health service to achieve adequate sample size recruitment.

2.7. Analysis

All quantitative data were analyzed using intention to treat principles. Descriptive statistics summarized demographic data. Continuous data are presented as mean and standard deviation (SD). Categorical data are presented as median and interquartile range (IQR), and nominal data as percentage. Statistical significance was set at $P < 0.05$.

Mixed-effects, general linear model analysis were used to determine differences between knowledge translation strategies (video vs. written) for the proportion of participants whose knowledge test response aligns with the research evidence for each health context. The investigators, based on their review of the evidence base and confirmed by an independent expert in rehabilitation, classified responses of "not beneficial but not harmful" as correct for the falls prevention bed alarms and falls prevention education materials alone contexts, and "beneficial" being correct for exercise as an adjunct DVT treatment context. The knowledge translation strategy was entered into this model as a fixed effect, along with the intervention context (bed alarms for falls prevention, falls prevention education materials alone, exercise for DVT). We also included a knowledge translation strategy*intervention context interaction effect. Individual participant identifiers were entered as a random effect. A Bernoulli family and logit link function were employed.

We examined participant responses to the rating of their certainty in their knowledge test response separately for participant responses whose knowledge test response aligned and did not align with the research evidence. For those who aligned, we compared the level of certainty in their judgment using ordered logit regression with data clustered by participant. We included main effects for each knowledge translation strategy and intervention context along with a knowledge translation strategy*intervention context interaction effect. We conducted similar

analyses separately for those whose knowledge test responses did not align with the current research evidence.

We examined participant responses to whether a particular intervention should be used, separately for each health context (bed alarms for falls prevention, falls prevention education materials alone, exercise for DVT) as the evidence of benefit differs between these contexts. We used ordered logit regression with data clustered by participant to examine difference between the effects of each knowledge translation strategy on this outcome.

3. Results

Invitation emails were sent on May 8th, 2018, and the survey was closed on July 31st, 2018, once the recruitment target had been reached. Response rate was unable to be determined, as email distribution from the allied health and nursing managers was unable to be accessed. Of the potentially eligible participants, 119 respondents commenced the online survey and were randomly assigned to Group 1 ($n = 44$), Group 2 ($n = 37$), or Group 3 ($n = 38$) sequence of knowledge translation strategy and health context. There were 13 participants ($n = 7$ from Group 1, $n = 3$ from Group 2, and $n = 3$ from Group 3) who did not complete all 26 questions, leaving a dropout rate of 11% (Fig. 2). The median time to survey completion was approximately 7.27 minutes (IQR 10.28 minutes). Table 4 describes the baseline participant characteristics between each knowledge translation strategy and health context group sequence.

3.1. Quantitative outcomes

Main results for the primary outcome: alignment between respondent knowledge test result for each health context and conclusions listed in each journal article are presented in Table 5. Participant knowledge test responses more frequently aligned with the research evidence when exposed to the video compared to no-information in either falls prevention health context. Similarly, participants more frequently correctly rated the treatment benefit of
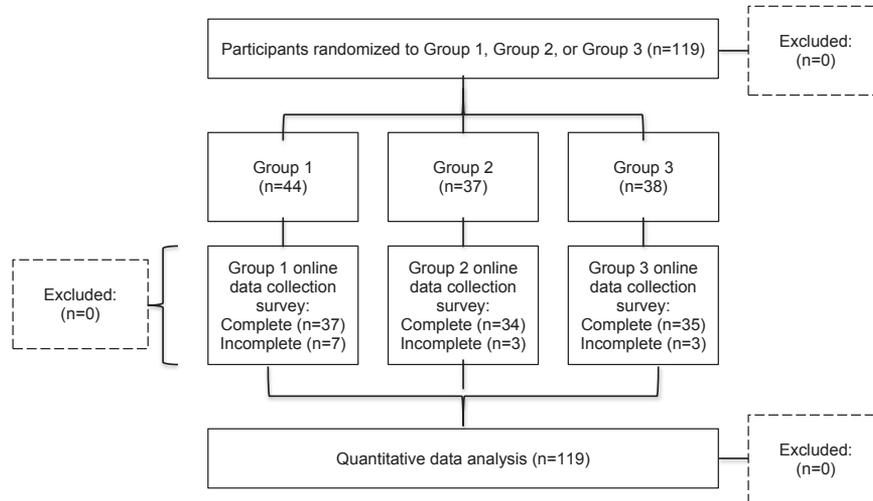
Fig. 2. Study flow chart.

promoting physical activity as an adjunct treatment after diagnosis of DVT, regardless of which knowledge translation strategy was provided.

The effect of knowledge translation strategy across contexts is presented in Table 6. For the primary outcome, exposure to the video increased the likelihood of a knowledge test response that was aligned with the research evidence compared to no-information (OR 2.61; 95% CI 1.40, 4.89; $P = 0.003$), but this was not the case for exposure to the written modality (OR 1.39; 95% CI 0.75, 2.57; $P = 0.294$). There was no significant difference between the video and written modality when compared to the no-information control for the secondary outcomes: self reported confidence of judgment in response to knowledge test, and self reported perception of whether practice should be implemented or deimplemented. Participants were significantly less likely to report self confidence in their knowledge test response for physical activity after diagnosis of DVT (OR 0.60; 95% CI 0.39, 0.92; $P = 0.021$) compared to the bedside pressure sensor alarms to prevent falls health context. For participant's self confidence in their knowledge test response, there was a significant interaction effect identified between the written modality and falls prevention education materials without one-on-one follow-up (OR 0.29; 95% CI 0.09, 0.95; $P = 0.041$). This indicates that the difference in reported self confidence in knowledge test response for the written modality intervention compared to the control was smaller in the falls prevention education materials without one-on-one follow-up context compared to the other two contexts.

4. Discussion

This study is the first to apply a helix counterbalanced randomized controlled trial design to evaluate the effectiveness of knowledge translation strategies. The video modality increased the proportion of participant's knowledge test

alignment with the research evidence across the three health contexts when compared to those who did not receive any information (control). Comparatively, the written journal article was not more effective in improving participant knowledge than providing no-information. Neither of the knowledge translation strategies improved participant's certainty of judgment of response to the knowledge test nor perception of whether practice should be implemented or deimplemented. Applying this knowledge in clinical practice would require further implementation efforts involving human factor engineering and clinical decision-making support before broad improvements in patient outcomes can be achieved.

These study findings were somewhat concordant with previous research examining video and written evidence summaries. Although there is little evidence comparing video and written strategies for knowledge translation in the nursing and allied health professions, some research has been identified in other settings. For example, one study has examined the use of multimedia approaches using voice-over and visual reinforcement to recruit potential study participants, which has been shown to potentially improve knowledge informing consent more than text alone [36]. The videos provided in our study did not include a voice-over component, as many computers based in the study hospital wards do not have adequate sound compatibility. Instead, captioning/subtitles were used. Health professionals are increasingly favoring continuous professional development in computer-based format online. A recent survey of the American Public Health Association members reported more than 50% of respondents preferred online courses [37], which intuitively seems reasonable, given changes in other forms of education provision catering to the next generation of "digital natives" who have been immersed in technology all their lives [38]. However, this does not necessarily follow that online courses are more effective or cost-

Table 4. Baseline participant characteristics

Characteristic	Group 1 (n = 44)	Group 2 (n = 37)	Group 3 (n = 38)
Profession:			
Registered nurse	17 (39%)	14 (38%)	18 (47%)
Enrolled nurse	2 (5%)	1 (3%)	0 (0%)
Physiotherapist	6 (14%)	13 (35%)	6 (16%)
Occupational therapist	2 (5%)	3 (8%)	3 (8%)
Speech pathologist	3 (7%)	0 (%)	0 (%)
Dietician	1 (2%)	2 (5%)	1 (3%)
Social work	2 (5%)	1 (3%)	1 (3%)
Allied health assistant	4 (9%)	0 (%)	2 (5%)
Podiatry	0 (0%)	0 (%)	2 (5%)
Clinical psychology	0 (0%)	0 (0%)	1 (3%)
Neuropsychologist	0 (0%)	0 (0%)	1 (3%)
Unknown	7 (16%)	3 (8%)	3 (8%)
Highest level of formal qualification:			
Certificate 1-4	4 (9%)	1 (3%)	4 (11%)
Diploma	5 (11%)	0 (%)	2 (5%)
Bachelor's degree	17 (39%)	18 (49%)	17 (45%)
Bachelor's degree (honors)	3 (7%)	6 (16%)	5 (13%)
Post graduate certificate	1 (2%)	1 (3%)	0 (%)
Post graduate diploma	0 (0%)	0 (0%)	1 (3%)
Master's degree (coursework)	6 (14%)	6 (16%)	5 (13%)
Master's degree (research)	1 (2%)	1 (3%)	0 (0%)
Doctoral degree (research)	0 (0%)	1 (3%)	0 (0%)
Doctoral degree (coursework and research)	0 (0%)	0 (0%)	1 (3%)
Unknown	7 (16%)	3 (8%)	3 (8%)
Years experience:			
Less than 1 yr	5 (11%)	5 (14%)	1 (3%)
Between 1 and 2 yr	1 (2%)	4 (11%)	5 (13%)
Between 2 and 5 yr	8 (18%)	7 (19%)	9 (24%)
Between 5 and 10 yr	10 (23%)	9 (24%)	8 (21%)
Greater than 10 yr	13 (30%)	9 (24%)	12 (32%)
Unknown	7 (16%)	3 (8%)	3 (8%)

Percent (%) values subject to rounding error.

effective than face to face interventions to improve knowledge. Hence, the importance of performing high-level experimental studies using randomized controlled designs to compare approaches.

Generally there was a low level of correct responses to the knowledge test for each health context. The percentage correct and knowledge improvements were concordant with previous studies exploring health professional falls

Table 5. Summative results for the primary outcome (alignment between self reported rating of treatment benefit and current research evidence)

	Knowledge translation strategy		
Health context	Control	Written	Video
Context 1: Bedside pressure sensor alarms to prevent falls	6/44 (14%)	8/38 (21%)	15/37 (39%)
Context 2: falls prevention education materials alone without follow-up from a health professional	10/37 (27%)	14/44 (32%)	18/38 (47%)
Context 3: promoting physical activity after diagnosis of deep vein thrombosis	26/38 (68%)	27/37 (73%)	31/44 (70%)

Data presented as n = correct/incorrect (percentage correct).
Percent (%) values subject to rounding error.

Table 6. Main results for the primary and secondary outcomes of each knowledge translation strategy across contexts

Item	Item wording	Knowledge translation strategy OR (95% CI)			Health context OR (95% CI)	
		Control vs. written	Control vs. video	Written vs. video	Pressure sensor falls prevention alarms vs. falls prevention education materials alone without follow-up	Pressure sensor falls prevention alarms vs. physical activity as an adjunct treatment for DVT
1	How beneficial do you think bed/chair alarms are for preventing falls in hospital? How beneficial do you think written patient educational materials are for preventing falls in hospital? How beneficial do you think exercise is as an adjunct treatment for deep vein thrombosis (DVT)?	1.39 (0.75, 2.57); $P = 0.294$	2.61 (1.40, 4.89); $P = 0.003$	1.88 (1.02, 3.46); $P = 0.044$	1.73 (0.96, 3.12); $P = 0.070$	10.79 (5.30, 21.97); $P < 0.001$
2	How certain are you that this judgment of benefit is correct?	1.34 (0.82, 2.20); $P = 0.245$	1.46 (0.94, 2.28); $P = 0.095$	1.10 (0.71, 1.70); $P = 0.676$	1.13 (0.71, 1.78); $P = 0.604$	0.60 (0.39, 0.92); $P = 0.021$
3	Do you think this strategy should be used to prevent falls in hospital? Do you think this strategy should be used as an adjunct treatment for deep vein thrombosis (DVT) in hospital?	0.77 (0.44, 1.36); $P = 0.370$	0.63 (0.36, 1.11); $P = 0.112$	0.81 (0.49, 1.34); $P = 0.423$	1.06 (0.63, 1.80); $P = 0.823$	1.25 (0.73, 2.13); $P = 0.417$

CI, confidence interval; OR, odds ratio.

prevention knowledge [8,10,39]; however, there was little previous literature for comparison regarding DVT care. Knowledge test responses for the benefit of physical activity as an adjunct to anticoagulant treatment postdiagnosis of DVT more often aligned with the research evidence, regardless of which knowledge translation strategy was provided. Participants were also more confident of this judgment. Context is a practical issue for any implementation study [40], as it is a potential confounder representing the normal conditions in which knowledge translation strategies must be integrated if they are to be useful in practice [41]. The evidence provided in the DVT context had been published earlier (2008) than the evidence in either falls prevention context and was based on a systematic review of studies rather than a single study. It is possible that nursing and allied health staff were already aware of this evidence, or more receptive as it was based on a higher level of evidence according to the National Health and Medical Research Council (NHMRC) evidence hierarchy [42,43].

Journal publishers can consider the results from this study when deciding whether to adopt video to accompany written abstracts for online articles. Future randomized controlled trials and cost benefit analyses may be needed to identify whether videos can drive journal article traffic

(e.g., reads, downloads, and citations) that warrant the cost (real and opportunity) of producing them. Improvements in public engagement, information dissemination, and journal impact might be achievable if information can be provided to health professionals in their preferred format. Scientific journals and authors of articles could potentially identify papers with direct and rigorous practice-related recommendations (e.g., systematic reviews) and produce videos for the purpose of professional development. We have demonstrated that a helix counterbalanced design is feasible to use, provided relative efficiency in statistical power, and allowed the simultaneous comparison of two different knowledge translation strategies across three health contexts. Researchers may consider the applicability of this research design for prospective studies, where questions around the applicability of multiple knowledge translation strategies in different health contexts arise. This design-based solution potentially retains external validity by evaluating strategies across multiple contexts and ensures internal validity through controlled randomization. Future studies may consider the benefits of applying a helix counterbalanced design when conducting large cluster randomized controlled trials, where health organizations are randomized to study groups. The improved "balance" achieved through within-group repeated measures design may

improve the relative efficiency of statistical power and reduce risk of an imbalance of factors impeding or facilitating change between knowledge translation strategy and control groups.

4.1. Limitations

This study examined the effect of two different knowledge translation strategies on knowledge, confidence, and intention outcomes. These outcomes precede behavior change and eventual health outcome changes, which are the end goal of implementation efforts. Changes in knowledge do not necessarily lead to behavior and health outcome changes [44]; therefore, assumptions regarding flow-on effects from improved knowledge to practice change are avoided. The majority of participants completed the study survey in sufficient time to have watched the video and read the written journal article. However, out of 119 participants, 19 completed the survey in less than 3 minutes. These participants were assumed not to have watched the video or read the written knowledge translation strategy before answering the survey questions as they would not have had enough time. The online survey software did not enable control of time to completion to encourage engagement with the interventions. Ideally, it would be preferable for all participants to have full engagement with each knowledge translation strategy but this is not always possible in practice. Engagement rates reported in this trial are similar to those reported in other implementation studies where up to 30% of participants may not engage fully with provided strategies [45], given these strategies must overcome considerable barriers to research implementation [1].

5. Conclusion

Providing video evidence summaries to nursing and allied health professionals increases the likelihood they will understand the main findings from research papers. Use of video abstracts may be a useful adjunct to publishing research in dissemination activities. The helix counterbalanced randomized design provided a feasible approach to evaluating the effect of multiple knowledge translation strategies across different health contexts. Further research is needed to determine whether improved knowledge from digital approaches to knowledge translation can contribute towards more complex, multifaceted research implementation strategies to improve evidence uptake in health care policy and practice.

CRediT authorship contribution statement

Mitchell N. Sarkies: Conceptualization, Methodology, Software, Formal analysis, Investigation, Resources, Data curation, Writing - original draft, Writing - review & editing, Visualization, Project administration. **Stephen Maloney:** Conceptualization, Resources, Writing - review & editing, Visualization, Supervision. **Mark Symmons:** Conceptualization, Writing - review & editing, Visualization, Supervision. **Terry P. Haines:** Conceptualization, Methodology, Software, Formal analysis, Resources, Data curation, Writing - review & editing, Visualization, Project administration, Supervision.

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