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Intervention

The effects of two health information texts on patient recognition memory: A randomized controlled trial

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ABSTRACT

Objective: To compare the effects of two health information texts on patient recognition memory, a key aspect of comprehension.
Methods: Randomized controlled trial ($N = 60$), comparing the effects of experimental and control colorectal cancer (CRC) screening texts on recognition memory, measured using a statement recognition test, accounting for response bias (score range −0.91 to 5.34). The experimental text had a lower Flesch–Kincaid reading grade level (7.4 versus 9.6), was more focused on addressing screening barriers, and employed more comparative tables than the control text.
Results: Recognition memory was higher in the experimental group (2.54 versus 1.09, $t = -3.63$, $P = 0.001$), including after adjustment for age, education, and health literacy ($\beta = 0.42$, 95% CI: 0.17, 0.68, $P = 0.001$), and in analyses limited to persons with college degrees ($\beta = 0.52$, 95% CI: 0.18, 0.86, $P = 0.004$) or no self-reported health literacy problems ($\beta = 0.39$, 95% CI: 0.07, 0.71, $P = 0.02$).
Conclusion: An experimental CRC screening text improved recognition memory, including among patients with high education and self-assessed health literacy.
Practice implications: CRC screening texts comparable to our experimental text may be warranted for all screening-eligible patients, if such texts improve screening uptake.

1. Introduction

Next to verbal interactions in face-to-face or telephonic patient-provider encounters, text documents are the most common way of providing patient health information [1,2]. Given the high prevalence of low literacy in the United States (U.S.) [3], a general recommendation for maximizing patient comprehension is to make health information texts as simple as possible (e.g. by reducing reading level), without losing key context and meaning [1]. While observational studies provide support for this recommendation [4], evidence from randomized controlled trials (RCTs) is scant.

In the past 30 years, only seven published RCTs have explored the effects of simplified health information texts on comprehension, with mixed findings [5–11]. Focus health issues in the various RCTs were warfarin use [7], human immunodeficiency virus infection risk [11], polio vaccination [5,6], smoking [9], and informed consent for experimental chemotherapy [8,10]. The limited number of trials in this realm, with differing health topics and mixed findings, suggest the need for further RCTs comparing comprehension of different health information texts, encompassing additional health topics.

No RCTs have compared patient comprehension of colorectal cancer (CRC) screening documents that differ in design and content focus. This is a key research gap given that CRC screening is a relatively complex health topic given several available test options, each with differing pros and cons [12]. Perhaps, in part, for this reason, CRC screening knowledge and uptake are low in the U.S. population relative to other evidence-based cancer screening tests [13–16]. Further, no trials have addressed whether patient education level and health literacy may influence comprehension of different CRC screening texts. This is also important to research, since CRC screening knowledge and uptake are low among less educated and less literate persons in the U.S. [13–16]. Theoretically, text design features anticipated to facilitate comprehension (e.g. lower reading level, use of comparative tables) should most benefit persons with low education and literacy. Of particular clinical interest and practical importance is whether patient *self-assessed*

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health literacy is associated with comprehension of different texts. National quality improvement blueprints encourage universal health literacy assessment in clinical settings [1], yet time constraints often preclude the use of objective measures, prompting exploration of employing brief patient self-assessment "screeners" [17–19].

Prior RCTs comparing patient comprehension of different health texts used various measures to assess comprehension, a complex, multi-faceted construct (process) that cannot be directly observed, and for which controversy exists regarding optimal measurement [20]. None of the prior RCTs sought to measure *inferential comprehension*, or inference of meanings not directly explained (i.e. implicit) in a text, a conceptually high level activity of clear relevance to health education and behavior [21]. However, validly and reliably measuring inferential comprehension is difficult, since it is strongly dependent on reasoning skills [22]. Fortunately, assessing inferential comprehension may not be critical when comparing the degree to which different texts *explicitly* convey basic information regarding a given health topic, since this is essentially a matter of lower level or *literal comprehension* [21]. Furthermore, literal comprehension is a prerequisite to and predictive of inferential comprehension [21–24]. Likely for these reasons, prior RCTs have examined text effects on one or both of two aspects of literal comprehension: *recall memory*, the ability to remember elements of a previously viewed text without visual prompting [5,6,8,11]; and *recognition memory*, the ability to accurately recognize previously viewed information when encountered again in written form [7,9–11].

The recall memory measures in prior RCTs employed open-ended verbal questioning of participants, requiring study personnel judgment in determining the appropriateness of responses, potentially resulting in bias. The recognition memory measures in the prior RCTs were written multiple choice and/or true-false items, which are vulnerable to educated guessing and response bias (e.g. a tendency to prefer true to false answers) [25]. Verbal open-ended recall memory questions and written multiple choice and true-false recognition memory questions also are susceptible to confounding by pre-existing knowledge of the health topic, since they typically do not require participants to correctly identify *verbatim* passages (e.g. complete sentences) from viewed texts.

Employing a signal detection theory-grounded approach to measuring recognition memory can help to minimize the effects of response bias and background knowledge confounding on recognition memory scores, providing a purer estimation of the effects of texts themselves on literal comprehension. Signal detection theory recognizes that most human decisions are made under conditions of uncertainty [26]. The theory further recognizes that under such conditions, human judgments do not always arise from a fully balanced, well-reasoned, and accurate assessment of the situation, but instead are often driven largely or fully by educated guessing, innate biases (e.g. response option preferences), or the overriding influence of background contextual knowledge. These underlying tenets of signal detection theory have been employed to inform an approach to measuring recognition memory that minimizes response bias and background knowledge confounding. Briefly, a written recognition memory test is developed incorporating an equal number of verbatim statements extracted from each study text being compared in a RCT [27,28]. Study participants are then asked to identify the statements that appeared in their randomly assigned text. Both correctly identified statements ("hits" – a measure of sensitivity) and incorrectly identified statements ("false alarms" – those that had actually appeared in the other study text – to capture response bias effects) are employed to calculate a summary discriminability or *d* prime (d') score – essentially, an indicator of the "true signal" relative to "noise" (bias and confounding effects) in participant responses. This approach is well-established in psycholinguistic and cognitive science studies but, to our knowledge, has not been used in text comprehension RCTs in the biomedical realm [27–29].

We conducted a RCT, comparing patient recognition memory of an experimental colorectal cancer screening (CRC) information text and of a control CRC screening text. The experimental text was written at a lower Flesch–Kincaid reading grade level, focused more on addressing practical CRC screening barriers, and relied more heavily on tabular presentation of information than the control text. We also explored the roles of patient education level and self-assessed health literacy in influencing text recognition memory. We employed a written signal detection theory-grounded measure to derive a recognition memory d' score, accounting for both item recognition sensitivity and response bias effects. We hypothesized that: (1) compared with controls, experimental group patients would have better recognition memory of their randomly assigned text; and (2) the benefit in recognition memory would be restricted to patients with less education and lower self-assessed health literacy.

2. Methods

2.1. Study setting, sample recruitment, and randomization

Study activities were conducted from September 2009 through March 2010. The local institutional review board approved the study (ClinicalTrials.gov identifier: NCT00965965).

English-speaking persons aged 50–75 years receiving primary care from a family physician or general internist at one of two offices in the Sacramento, California area were telephoned to solicit their participation. The lower and upper age cut points for study participation were selected based on U.S. Preventive Services Task Force evidence-based CRC screening guidelines, which recommend routine screening in all adults aged 50–75 [12]. Patients were asked whether they had received fecal occult blood testing (FOBT) within the past year, flexible sigmoidoscopy within 5 years, or colonoscopy within 10 years. Those answering "no" to these questions and reporting adequate eyesight to read printed text were eligible to participate.

Eligible patients who agreed to participate met with study personnel at a central location, where written informed consent was obtained, followed by random assignment to read one of the study texts. Randomization was at the level of the individual patient, implemented in blocks of 10 patients to help ensure a balance in sample size across the two study groups over time [30], using sealed shuffled envelopes containing group assignments. We estimated that a sample of 44 patients (22 per group) would yield 90% power to detect a small effect (0.3 standard deviations) on recognition memory, the outcome of interest. We conservatively targeted recruitment of 60 patients (30 per group), to ensure an adequate sample in the event of attrition or missing data.

After randomization, participants completed a pre-intervention questionnaire, read their assigned text, and then completed a comprehension test (see Section 2.3). Participants received a $30 gift card after completing these activities.

2.2. Study texts

Both study documents presented information exclusively in text form (e.g. no pictures were included). The experimental text (Appendix 1) was developed collaboratively by several highly experienced family physicians and general internists with expertise in colorectal cancer screening, including three of the current study authors (A.J., R.L.K., P.F.). The text was developed with the goal of presenting information regarding CRC screening test options, benefits, potential harms, and practical inconveniences