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Original Article

Acceptability and Efficacy of the SMARxT Media Literacy Education Program to Counter Pharmaceutical Marketing Influences among Medical Trainees

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ABSTRACT

Background: Evidence-based prescribing (EBP) results in decreased morbidity and reduces medical costs. However, pharmaceutical marketing influences medication requests and prescribing habits, which can detract from EBP. Media literacy, which teaches critical thinking, is a promising approach for buffering marketing influences and encouraging EBP. The authors developed the "SMARxT" media literacy education program around marketing influences on EBP decision-making. The program consisted of six videos and knowledge assessments that were delivered as an online educational intervention through the Qualtrics platform.

Methods: In 2017, we assessed program feasibility, acceptability, and efficacy of enhancing knowledge among resident physicians at the University of Pittsburgh. Resident physicians (n=73) responded to pre-test items assessing prior knowledge, viewed six SMARxT videos, and responded to post-test items. A 6-month follow-up test was completed to quantitatively assess sustained changes in knowledge and to qualitatively assess summative feedback about the program (n=54). Test scores were assessed from pre- to post-test and from pre-test to follow-up using paired-sample t-tests. Qualitative results were synthesized through content analysis.

Results: Proportion of correct knowledge responses increased from pre-test to immediate post-test (31% to 64%, P<0.001) at baseline. Correct responses also increased from pre-test to 6-month follow-up (31% to 43%, P<0.001). Feasibility was demonstrated by 95% of enrolled participants completing all baseline procedures and 70% completing 6-month follow-up. Quantitative measures of acceptability yielded positive scores and qualitative responses indicated participants' increased confidence in understanding and countering marketing influences due to the intervention. However, participants stated they would prefer shorter videos, feedback about test scores, and additional resources to reinforce learning objectives.

Conclusion: The SMARxT media literacy program was efficacious and acceptable to resident physicians. Participant suggestions could be incorporated into a subsequent version of SMARxT and inform similar clinical education programs. Future research should assess program impact on real-world prescribing practices.

Keywords: Pharmaceutical marketing, Industry influence, Residency training, Online learning, Medical education, Evidence-based prescribing, SMARxT

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Introduction

In the United States, 3 billion prescriptions are written annually, yet many prescribers do not use evidence-based prescribing (EBP) (1). Deviation from EBP results in morbidity and mortality and contributes to rising healthcare costs (2, 3). A major contributor to non-EBP is the influence of direct-to-consumer marketing and prescriber "detailing" (i.e., pharmaceutical representative visits to provide drug details) (4). Since 1994, the World Health Organization has suggested that physicians receive training to account for pharmaceutical industry marketing practices (5). However, as this practice is not adequately incorporated into training programs, resident physicians at the beginning of their clinical careers may be particularly vulnerable to pharmaceutical industry influences (6, 7). Media literacy programs represent a novel approach to critical thinking about medication marketing by developing skills for analyzing and evaluating media messages such as advertisements, and empowering informed decision-making (8-10). To our knowledge media literacy has not been used to reduce the influence of pharmaceutical messaging on EBP.

We developed the SMARxT program to optimize EBP decision-making (11). Central to this program are six animated video sessions that illustrate examples of pharmaceutical industry influence on prescribing behavior. The videos were developed and narrated by physicians and include scenarios where physicians interact with patients and with each other around EBP and clinical decision making. After an introduction video, each of the remaining videos follow the "SMARxT" moniker, reflecting 5 core domains of EBP within the overarching media literacy framework: 1.) Simplify, 2.) Master marketing, 3.) Ally, 4.) Read critically, and 5.) Tools. The modules are presented sequentially and each module has 5-7 corresponding questions to assess knowledge about topics covered in the videos. A previous study among medical students describes the SMARxT modules in detail (11). The current study sought to 1.) determine SMARxT program feasibility and acceptability, and 2.) assess efficacy for increasing knowledge about pharmaceutical industry influence among resident physicians. We hypothesized that this program would be acceptable (H1) and that participants would demonstrate improved knowledge of the covered topics at immediate post-test (H2a) and 6-month follow-up (H2b). To test these hypotheses, we used a single-arm, longitudinal study design where resident physicians completed pre-test and post-test knowledge assessments pertaining to pharmaceutical influence on EBP. Assessments were presented as educational examinations of knowledge that included multiple-choice questions (one correct answer and four distractor options; see Appendix), based on information presented in the SMARxT videos. To assess efficacy, assessments were completed before, immediately after, and 6-months after exposure to the SMARxT training modules and scores were compared over time. Participant retention and qualitative feedback were used to assess feasibility and acceptability, respectively.

Methods

Research design: The study design was a single-arm (non-randomized), longitudinal survey assessment (pre-test, post-test, and 6-month follow-up), to assess feasibility, acceptability, and efficacy of the SMARxT educational intervention for resident physicians. There were no changes to the study design that took place after participants were enrolled. This study was approved by the University of Pittsburgh IRB and electronic informed consent was obtained from all study participants.

Sampling: We worked with residency directors and chief residents to recruit from the internal medicine residency training program at the University of Pittsburgh Medical Center. Recruitment and enrollment opened in July 2016 and closed in June 2017. At that time, the residency program included approximately 156 categorical residents, 16 dual-focused Internal Medicine and Pediatrics

residents, 10 transitional year residents, and 16 preliminary year residents who were eligible to participate. There were no additional inclusion or exclusion criteria. This study utilized convenience sampling – drawing from a source that is conveniently accessible and one whose characteristics are defined for a purpose that is relevant to the study – and the sample size was determined as the number of participants who were enrolled (N=77). Thus, a traditional sample size calculation, which aims to ensure generalizability of results to a broader population, was not conducted.

Tools: The SMARxT program consists of six videos and knowledge assessments that were delivered as an online educational intervention through the Qualtrics online survey platform. After the first introductory video, the five remaining videos aligned with the "SMARxT" moniker as: Simplify, Master marketing, Ally, Read critically, and Tools. Videos were an average of 13:12 long (minutes:seconds; Range: 9:41–17:20). Videos were privately hosted on the Vimeo platform, to be accessible only to enrolled study participants after the baseline survey. Video content has been further described in a previous study (11), and final knowledge assessment items are included as an Appendix to the current study.

Validity and reliability: Multiple-choice items assessing knowledge of SMARxT program content were adapted from a set of 62 items used in a prior study of the SMARxT program among medical students (11). In this prior work, content validity and authenticity were evaluated in the initial phases of item development and assured by reviewing video modules for corresponding material (i.e., that fact-based questions could be answered based on the available educational content). After removal and revision of problematic items in the previous study (e.g., ineffective distractor options, multiple possible answers, difficulty too low), we arrived at 38 final items, with 5–7 representing each module (see Appendix). The literature on test development differentiates between scales and indices, whereby *scales* group items as they reliably assess latent constructs of interest (e.g., self-report indicators of psychosocial phenomena) and *indices* include items as appropriate to assess overall performance (e.g., scores on an educational test) (12). Because the present study used an index approach to assess accumulation and retention of factual knowledge (i.e., correct answers to fact-based questions about content covered in SMARxT videos), there was no assumption that items should reliably correlate (i.e., internal consistency) nor that scores would remain stable over time (i.e., test-retest). Thus, reliability of items was not formally, quantitatively assessed in the present study.

Data collection: After enrollment, participants were instructed to complete pre-test assessments, watch all SMARxT videos, and then to complete post-test assessments. No feedback was provided about participants' correct or incorrect responses to assessment questions. Post-tests included knowledge-based items identical to those seen on the pre-test and also solicited open-ended feedback about knowledge gained and potential impact on prescribing practices related to the program. Participants were given 1 month to complete the self-paced study procedures and weekly email reminders were sent to encourage progress. After 6 months, participants received a follow-up assessment including the same knowledge-based items as were included on the post-test. Participants were remunerated $25 for each assessment that was completed.

Analysis: To assess efficacy of the educational modules in increasing knowledge, we computed change in overall correct answers from pre- to post-test and pre-test to follow-up, including all individuals with complete data within each module. To assess significance of the mean change between testing times, we performed paired sample t tests. We reported percentages of correct responses for each item at each time point (see Appendix). Additionally, we used 2-tailed t tests to compare those with missing follow-up assessments to those without in terms of pre-test scores. Statistical analyses were

performed using Stata 15, and 2-tailed P values of <.05 were considered significant. To assess program acceptability, 5 items were used with an 11-point response scale (-5=Strongly disagree, 0=Neither agree nor disagree, +5=Strongly agree). Finally, we assessed responses to open-ended questions using content analysis. Two independent coders reviewed responses for the 4 open-ended questions (see Appendix). Coders developed open coding frameworks to capture themes in participant responses, met to adjudicate and refine codes, and developed a hierarchical coding framework to group related codes. This resulted in two primary codes—program content and program delivery—with several sub-categories (e.g., program content included: clinical strategies, tools & resources, conceptual awareness, and facts & trivia).

Results

Of 77 individuals enrolled, 73 (95%) completed baseline procedures and 54 (70%) completed 6-month follow-up evaluation. Baseline demographics for gender and residency program year are included in Table 1. There were no significant differences in pre-test scores between those with and without follow-up data (P values ranging from .12 to .86 among knowledge domains). Overall scores on the knowledge-based items improved significantly from pre-test to post-test (31.3% correct and 63.7% correct, respectively; t=11.4, P<0.001), and increases were apparent across all SMARxT content modules (Table 2). These increases suggest evidence of the validity of SMARxT as an effective tool for increasing knowledge surrounding pharmaceutical influence on EBP. Although a decline in scores was

Table 1: Descriptive Statistics for Baseline Demographics (N=73)

Demographic	n	%
Gender		
Male	41	56.2
Female	32	43.8
Postgraduate year (PGY)		
PGY-1	26	35.6
PGY-2	29	39.7
PGY-3	18	24.7

Table 2: Summary Knowledge Scores by SMARxT Module

Module	Possible Range	Mean Score* (SD)		
		Pre-test	Post-test	Follow-up
Introduction	0-6	2.77 (1.38)	4.38 (1.24)	3.81 (1.70)
Simplify	0-6	1.36 (1.08)	3.66 (1.39)	2.11 (1.22)
Master Marketing	0-7	1.81 (1.24)	4.34 (1.63)	2.73 (1.33)
Ally	0-7	2.09 (1.32)	5.04 (1.44)	4.00 (2.11)
Read Critically	0-7	2.43 (1.17)	4.40 (1.21)	3.55 (1.84)
Tools	0-5	1.28 (0.86)	2.58 (1.08)	2.66 (1.07)

*Participants with follow-up data

Table 3: Descriptive Statistics for Program Acceptability Items (N=73)

Item	Mean	SD	Range
Video sessions were entertaining.	2.29	1.83	-5, +5
Video sessions were informative.	3.40	1.06	+1, +5
I learned new information from this program.	3.58	1.26	+1, +5
Test questions were reasonable.	1.97	2.16	-4, +5
I would recommend this program to medical residents.	2.89	1.81	-4, +5

apparent from post-test to follow-up (42.7% correct), the follow-up scores remained significantly higher than baseline scores (t=9.4, P<.001). Self-reported acceptability of the program was generally positive, with strong indicators that the video sessions were informative and that the program imparted new information (Table 3). Based on qualitative feedback from participants and our oversight of study procedures, there were no unanticipated problems related to harms or unintended effects of this study.

Within the open-ended qualitative data, the category of *program delivery* included sub-categories of *aesthetic quality*, *pedagogy*, *length & flow*, and *tools & resources*. Feedback related to *aesthetic quality* tended to be positive and focused on engagement (e.g., illustrations) and entertaining delivery. For example, one participant stated, "[The] illustrations made things more interesting to watch." Negative feedback related to *aesthetic quality* was less common, but appraised the videos as "corny" or "patronizing." The majority of feedback related to *pedagogy* was positive and tended to focus on the use of clinical vignettes as a teaching tool (e.g., "I liked the clinical pearls I can use") as well as the use of videos (e.g., "The videos were most helpful and relayed useful information"). Negative feedback related to *pedagogy* focused on the pre- and post-test assessments. Participants expressed that the assessments should have been interspersed throughout the modules rather than presented at the end and that feedback be provided to further reinforce key concepts. Additionally, some participants suggested that including brief summaries after each module would enhance knowledge retention. With regard to *length & flow*, the majority of feedback indicated that the video modules were too long and repetitive. Finally, participants had specific feedback related to *tools & resources*, some of whom expressed a desire for links to tools and resources mentioned in the modules.

Program content included sub-categories of *clinical strategies*, *tools & resources*, *conceptual awareness*, and *facts & trivia*. Feedback related to *clinical strategies* (e.g., real-world scenarios) was positive, as participants indicated that these aspects were engaging and helped to enhance recall and later use in clinical settings. *Tools & resources* were viewed favorably, with participants indicating that they downloaded recommended apps and used prescribing guidelines. *Conceptual awareness*, which included broad understandings about industry influence and marketing strategies, remained particularly memorable. Specifically, concepts related to industry influence on prescribing (e.g., article ghostwriting, clinic detailing, misleading advertisements) were explicitly mentioned by participants at follow-up. Finally, *facts & trivia* were portrayed in a mostly negative manner by participants who expressed frustration about the somewhat trivial nature of assessment items. In general, participants would have liked more practical (i.e., clinical strategies, tools & resources) program content and less testing around historic or ancillary facts.

Discussion

Results indicate the program is feasible and acceptable for medical residents, supporting H1. Scores on knowledge assessments were significantly higher from pre-test to post-test (H2a) and pre-test to 6-month follow-up (H2b), indicating that the program had the intended measurable impact. These findings align our work with the broader literature identified through a systematic review of "digital learning to improve safe and effective prescribing" (13). Specifically, at least 19 prior studies have examined – and all have found positive effects for – digital education on increasing knowledge about EBP. However, only three of these prior studies reported sustained effects on knowledge lasting up to 6-months, which situates our longitudinal study of the SMARxT program among the most rigorous studies in this realm. Although we found significant knowledge gain—and participants found the information clinically and educationally useful—this does not necessarily indicate that the modules affected

EBP. In future work, it will be beneficial to do longer term follow-up and to include a control group for these purposes. It will also be beneficial to progress toward more rigorous study outcomes that have been identified in the literature (13), to assess digital education interventions' effects on physician prescribing behaviors (n=11 studies) and on patient outcomes (n=6). In the interim, additional refinements may enhance acceptability of program delivery and content. For example, we did not provide feedback about correct or incorrect answers to test questions as this would have raised issues of validity for post-test and follow-up assessments. In real-world educational contexts, direct feedback on knowledge-based items (e.g., correct or incorrect answers) would be valuable to physicians. This opportunity for development was indicated by our study participants as well as through six prior studies on digital education for pharmaceutical prescribing (13). Additionally, as we were assessing the impact of the video modules, we did not include additional external resources that participants indicated would have provided additional value. Other recommended changes will help improve delivery and content, such as removing knowledge items that were seen as problematic (e.g., trivial facts, not indicating conceptual understanding). Videos could also be split into shorter segments with knowledge items interspersed between segments, which was recommended through the current study and was an approach favored by medical students who participated in a prior study of the SMARxT program (11). Given our initial findings and these opportunities to further enhance the program's acceptability, the SMARxT program seems worthy of further implementation and assessment.

Digital education can be as effective as in-person instruction and can also augment instruction to improve knowledge acquisition for healthcare practitioners (14). To our knowledge, there are no medical training curricula that use media literacy strategies to improve EBP among physician trainees, but such training offers an important approach to reduce the influence of pharmaceutical company marketing on EBP practices (6). Thus, the SMARxT educational program offers a feasible, acceptable, and efficacious approach to provide this training alongside existing curricula. Future work should endeavor to assess the effectiveness of SMARxT training on prescribing behaviors and patient outcomes, and to identify the optimal timing of receiving the SMARxT program along the course of medical training.

Conclusion

Overall, the current SMARxT program met expectations with regard to feasibility and acceptability in a sample of resident physicians. Because the current study established gains and retention of knowledge related to the core program features (i.e., videos), it seems reasonable to realign the program in a manner that further aides program delivery (e.g., including ancillary learning materials, providing feedback on correct/incorrect answers). These changes will address concerns that were raised by participants about length, interactivity, and provision of additional resources. In future studies, it will be valuable to further assess how the SMARxT program impacts real-world prescribing behavior, with the overall objective of increasing resilience against industry influence on EBP.

Authors' Contribution

J.B.C.: substantial contributions to conception and design, acquisition of data, analysis and interpretation of data, drafting the article and revising it critically for important intellectual content, final approval of the version to be published; A.S.: substantial contributions to conception and design, analysis and interpretation of data, drafting the article and revising it critically for important intellectual content, final approval of the version to be published; A.J.K.: substantial contributions to conception and design, acquisition of data, analysis and interpretation of data, drafting the article and revising it critically for important intellectual content,

final approval of the version to be published; M.S.W.: acquisition of data, revising article critically for important intellectual content, final approval of the version to be published; J.E.S.: substantial contributions to conception and design, revising article critically for important intellectual content, final approval of the version to be published; B.A.P.: substantial contributions to conception and design, revising article critically for important intellectual content, final approval of the version to be published

Conflict of Interest: None declared.

Ethical Consideration

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards This research study was approved by the University of Pittsburgh Institutional Review Board. Protocol ID: PRO14080516. Informed consent was obtained from all individual participants included in the study.

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