



Feasibility of a primary care patient decision aid for smoking cessation with information about e-cigarettes

Jennifer H. LeLaurin^a, James F. Thrasher^b, Scott M. Strayer^c, John Malaty^d,
Christy Kollath-Cattano^e, Maribeth Williams^d, Oliver T. Nguyen^a, Allie M. Kellner^a,
James M. Smith^f, Ramzi G. Salloum^{a,*}

^a Department of Health Outcomes and Biomedical Informatics, College of Medicine, University of Florida, Gainesville, FL, USA

^b Department of Health Promotion, Education, and Behavior, Arnold School of Public Health, University of South Carolina, Columbia, SC, USA

^c Department of Family Medicine and Population Health, School of Medicine, Virginia Commonwealth University, Richmond, VA, USA

^d Department of Community Health and Family Medicine, College of Medicine, University of Florida, Gainesville, FL, USA

^e Department of Health and Human Performance, College of Charleston, Charleston, SC, USA

^f Division of General Internal Medicine, College of Medicine, University of Florida, Gainesville, FL, USA

ARTICLE INFO

Keywords:

E-cigarettes
Vaping
Shared decision-making
Decision aids

ABSTRACT

Decision aids can promote shared decision making and behavior change and may be effective in helping patients quit smoking. Patients are increasingly using e-cigarettes for smoking cessation; however, little is known about the impact of including e-cigarette information in smoking cessation decision aids. Our objective was to assess the feasibility and acceptability of a smoking cessation decision aid including e-cigarette information. This study was conducted at one family medicine clinic in the United States. We used a pre-post design. In Phase I, the decision aid presented information about approved cessation methods. In Phase II, current e-cigarette users and patients with no intention of quitting received additional information on switching to e-cigarettes. We assessed the impact of the decision aids on quit attempts and abstinence, confidence and readiness to quit, confidence and readiness to switch to e-cigarettes, and patient satisfaction. We enrolled 60 patients in each phase (N = 120). Patients reported higher confidence and readiness to quit after viewing the decision aids and consulting with their physician ($p < 0.01$). Patients reported the decision aid helped prepare them to make a decision about quitting smoking and expressed satisfaction with the decision aid and clinician consultation. We did not observe an impact of including e-cigarette information. Smoking cessation decision aids are acceptable to patients and may promote behavior change. Future studies should explore the impact of providing patients e-cigarette information using larger sample sizes and rigorous designs. Further research is needed to identify strategies to promote shared decision-making regarding e-cigarettes.

1. Introduction

Approximately 14% of adults in the United States were current smokers in 2019 (Cornelius et al., 2020), and smoking remains the leading cause of preventable death. Over two-thirds of adults who smoke want to quit, and while about half of them make a quit attempt each year, only 7% succeed (Babb et al., 2017). The clinical encounter presents a key opportunity to promote smoking cessation since 70% of adults who smoke visit a primary care physician each year (Gravelly et al., 2019). Patients trust and value advice from their clinicians and

often make behavior changes based on this advice (Searight, 2007). In fact, clinician advice is one of the most effective methods of prompting patients to make a smoking cessation attempt (Law and Tang, 1995).

Clinical practice guidelines state that every patient who uses tobacco should be offered treatment and that healthcare delivery systems should institutionalize the consistent identification, documentation, and treatment of every tobacco user seen in a healthcare setting (Fiore et al., 2000). However, there are significant barriers to routine delivery of effective smoking cessation counseling in clinical encounters, including time constraints and lack of clinician knowledge and skills related to

Abbreviations: FDA, U.S. Food & Drug Administration; NRT, Nicotine replacement therapy; HTP, Heated tobacco products.

* Corresponding author at: Department of Health Outcomes and Biomedical Informatics, P.O. Box 100177, Gainesville, FL 32610-0177, USA.

E-mail address: rsalloum@ufl.edu (R.G. Salloum).

<https://doi.org/10.1016/j.pmedr.2022.101745>

Received 11 November 2021; Received in revised form 28 January 2022; Accepted 26 February 2022

Available online 1 March 2022

2211-3355/© 2022 The Author(s).

Published by Elsevier Inc.

This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

smoking cessation counseling and treatment (Vogt et al., 2005). As a result, only 20.1% of smokers report receiving counseling and just 3.8% report receiving a prescription for cessation medication (US Department of Health and Human Services, 2020). There is a pressing need for interventions to improve the frequency and quality of smoking cessation counseling in clinical settings.

When smokers are trying to quit, they are more likely to turn to e-cigarettes than traditional cessation methods, such as nicotine replacement therapy (NRT) or prescription medications (Caraballo et al., 2017). While the body of evidence around the effectiveness of e-cigarettes for cessation is inconclusive (U. S. Preventive Services Task Force et al., 2021), some evidence suggests they may be effective (Kalkhoran and Glantz, 2016; Hartmann-Boyce et al., 2021). One clinical trial found that among smokers ready to quit, using e-cigarettes resulted in abstinence rates nearly twice as high as NRT use (Hajek et al., 2019). There is a general consensus that e-cigarettes are less harmful than traditional cigarettes; however, there is controversy around how much less harmful, as e-cigarettes contain toxins and the long-term effects of their use are unknown (National Academies of Sciences, 2018). While health authorities in the United Kingdom generally advocate that physicians recommend e-cigarettes for smoking cessation (McNeill et al., 2019), professional organizations in the United States generally refrain from promoting e-cigarettes due to a limited body evidence on effectiveness and concerns about long-term health effects (U. S. Preventive Services Task Force et al., 2021). Nevertheless, e-cigarettes remain the most popular method for smoking cessation and e-cigarette users report high satisfaction with e-cigarettes for reducing cigarette use and quitting (Caraballo et al., 2017).

Although many smokers use e-cigarettes in an effort to quit smoking, almost 40% of e-cigarette users report concurrent use of traditional cigarettes (Owusu et al., 2019). Dual users are more likely to attempt to quit smoking, but no more likely to succeed than exclusive cigarette users (Pasquereau et al., 2017). Dual users may require targeted messaging encouraging them to switch completely to e-cigarettes along with information on the uncertainties around their relative safety, as well as on evidence-based cessation methods.

Most smokers view their physician as the best source of information on e-cigarettes and many are interested in discussing e-cigarette use with their physician (Doescher et al., 2018; Wackowski et al., 2015). While physician counseling on e-cigarettes is increasing (Nickels et al., 2017), these conversations remain infrequent (Gravely et al., 2019; Kollath-Cattano et al., 2016). Physician knowledge, perceptions, and recommendation practices regarding e-cigarettes varies widely (Gravely et al., 2019; Kollath-Cattano et al., 2019; Salloum et al., 2021). Physicians report struggling to stay current with evidence related to e-cigarettes and a lack of confidence in discussing the uncertain long-term health effects (Kollath-Cattano et al., 2019). Therefore, interventions are needed to bridge the gap between patient interest in e-cigarettes and physician knowledge and practices.

Decision aids can promote behavior change by facilitating patient engagement and patient-provider communication. Specifically, decision aids are effective in increasing patient knowledge, reducing decisional conflict, and increasing shared decision making (Scalia et al., 2019). They can support shared decision making by presenting patients with possible benefits, harms, and outcomes of different treatment options (Joseph-Williams et al., 2014). Decision aids are presented in a variety of formats (e.g., paper, web-based, video), can be administered prior to or during a clinical encounter, and may be strictly patient-facing or involve interaction with a clinician (Joseph-Williams et al., 2021).

Evidence suggests smoking cessation decision aids may improve patients' knowledge of smoking cessation options and increase the number of quit attempts (Moyo et al., 2018; Agarwal et al., 2018; Tubb et al., 2019); however, information on e-cigarettes as a cessation method has not been included in previous decision aids. Therefore, more information is needed on the impact of decision aids which present evidence-based cessation methods along with information on switching from

cigarettes to e-cigarettes.

1.1. Purpose

In this study, we tested a decision aid containing information on e-cigarettes that was tested by our group in a previous study. The previous study demonstrated high usability and acceptability of the decision aid and found that compared to usual care, implementation of the decision aid was associated with higher rates of smoking-related screening and counseling by clinicians and higher overall patient satisfaction (Kollath-Cattano et al., 2021). This study differs from the previously published study because rather than using usual care as a comparison group (i.e., no decision aid vs. decision aid with e-cigarette information), we used decision aids without e-cigarette information as a comparison group (i.e., basic decision aid vs. decision aid with e-cigarette information). The objective of this study was to assess the acceptability and feasibility of an electronic decision aid designed to facilitate physician-patient discussions on smoking cessation and e-cigarettes. We also sought to obtain preliminary effectiveness data for future studies.

2. Materials and methods

2.1. Design

We used a two-phase design with the second phase serving as the intervention phase. A two-week washout period was implemented between phases. This design was chosen over an individually randomized trial since participants in both study groups would see the same providers, introducing the risk of contamination.

Patients in both phases were grouped according to quit intent and e-cigarette use. The "e-cigarette information eligible" group was comprised of patients with no intent to quit and current e-cigarette users who intended to quit. The "no e-cigarette information" group was comprised of patients who intended to quit and were not current e-cigarette users. Participants were grouped in this manner based on previous research showing U.S. providers are more comfortable discussing e-cigarettes with patients who already use e-cigarettes or do not intend to quit smoking, and are unlikely to recommend e-cigarettes to patients who do not already use them and intend to quit (Kollath-Cattano et al., 2019; Salloum et al., 2021). Additionally, e-cigarette use behavior (e.g., puff duration) influences nicotine delivery, so patients who already use e-cigarettes may benefit from information on how to optimize use of the products to promote cigarette smoking cessation (Maloney et al., 2021).

The study design is presented in Fig. 1. Different patients were enrolled in each phase. In Phase I, patients in both groups viewed a uniform decision aid with information on U.S. Food and Drug Administration (FDA) approved methods for smoking cessation (i.e., NRT and prescription medications) and no information on e-cigarettes. In the Phase II, the patients in the e-cigarette information eligible group were provided information on switching completely to e-cigarettes. E-cigarette information eligible patients who intended to quit cigarettes also received information on FDA-approved methods while those who did not intend to quit received only e-cigarette information. Patients in the no e-cigarette information group were provided information on FDA-approved methods only. Using this design, we would not expect to observe differences in outcomes between phases in the no e-cigarette information group because patients were shown the same information in both phases; however, we might observe differences in outcomes between phases for the e-cigarette information eligible group since Phase II patients received information on e-cigarettes while Phase I patients did not. Ethical approval for this study was granted by the University of Florida Institutional Review Board (#2018-03056). All participants granted written informed consent prior to participating in the study.

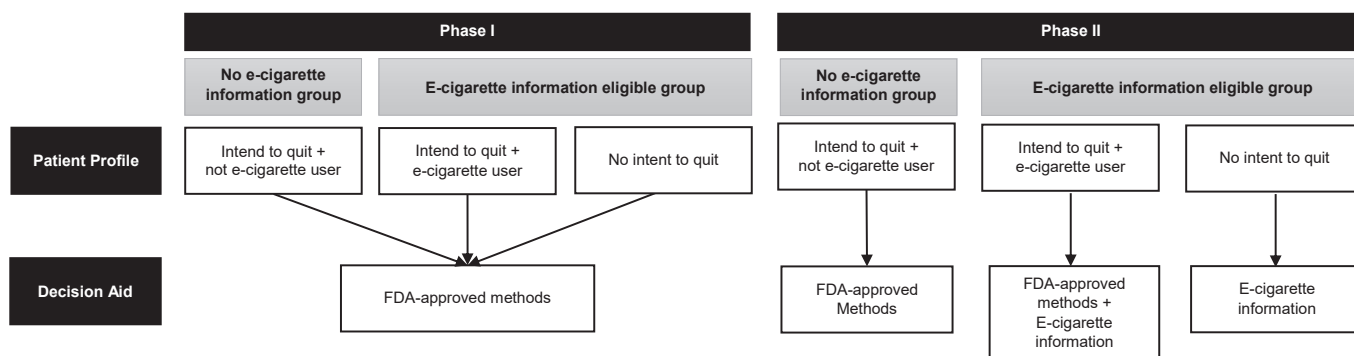


Fig. 1. Study design¹. ¹Different patients were enrolled in Phase I and Phase II.

2.2. Decision aids

Development of the decision aid content has been described previously (Kollath-Cattano et al., 2021). The Phase I decision aid provided an overview of FDA-approved cessation aids (i.e., NRT and prescription medications), including a list of medication brand names (e.g., Nicoderm patch, Chantix, Zyban). The decision aid presented the potential benefits and risks of using each quitting method in relation to health, effectiveness, and cost. The decision aids with e-cigarette information described the products with an accompanying visual of e-cigarette components. As with the FDA-approved methods, the potential benefits and harms of e-cigarettes were presented. Benefits of quitting with e-cigarettes included exposure to fewer harmful chemicals than cigarettes and greater effectiveness when used as complete substitute for cigarettes compared to dual use. Potential risks included exposure to harmful substances and lack of certainty on their effectiveness as a cessation aid. The decision aids were primarily patient-facing with the intention that viewing the decision aid would encourage patients to discuss smoking cessation options with their clinician.

2.3. Setting and participants

This study was conducted at one family medicine clinic affiliated with an academic health system in Florida. Approximately 34 physicians worked in the clinic at the time of the study. The study was conducted from March 2019 to July 2019 (3 months for the Phase I, 2 months for Phase II). Adult patients (≥18 years) who reported smoking in the past 30 days were eligible for the study.

2.4. Recruitment

This study used convenience sampling to recruit participants. When patients checked in for their appointments, they were asked by clinic staff if they smoked cigarettes. Patients who answered affirmatively and also expressed interest in participating in the study were directed to a research assistant who provided a study overview, answered any questions, and obtained informed consent from interested patients.

2.5. Procedures

This study included four assessments (Fig. 2). Immediately prior to their clinical encounter with the provider (i.e., while in the waiting room), participants completed an electronic survey via Research Electronic Data Capture (REDCap) before viewing the decision aid (assessment 1). These surveys included questions that assessed the participants' intent to quit smoking, quit attempt history, and confidence and readiness to quit smoking. The patients then viewed the decision aid and attended their scheduled visit with the clinician. Patients did not bring the decision aid to their visit. Immediately after patients completed their visit, they completed assessment 2, which included sociodemographics,

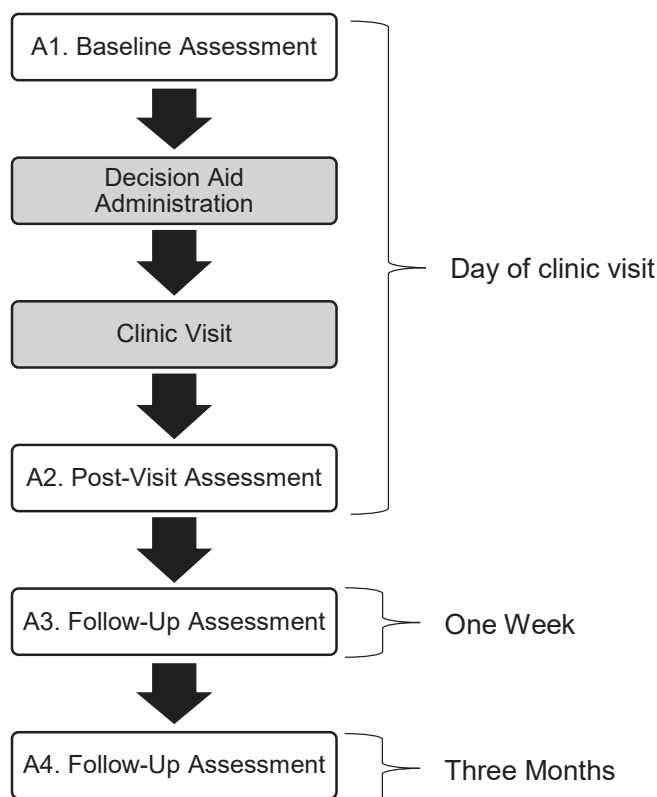


Fig. 2. Schedule of assessments.

confidence and readiness to quit smoking, confidence and readiness to switch completely to e-cigarettes, 4 items from the Preparation for Decision Making Scale (Graham and O'Connor), and questions on overall satisfaction with the decision aid and visit.

The research team followed up with participants via telephone at one week and three months (assessments 3 and 4) after the initial visit date to assess smoking outcomes, including current smoking status, quit attempts, use of FDA-approved cessation methods, and e-cigarette use. We assessed feasibility via recruitment rate and completion of follow-up data collection for relevant smoking outcome measures. Participants received gift cards for participating in the study (\$20 during the baseline visit, \$10 at one-week follow-up, and \$10 at three-month follow-up). Healthcare providers were briefed about the study before initiation of research activities.

2.6. Data analysis

We summarized the descriptive characteristics of the study sample

and tested for differences between the two phases within each group (e-cigarette information eligible and no e-cigarette information) at multiple timepoints: before viewing the decision aid and meeting with the clinician, immediately after viewing the decision aid and meeting with the clinician, and at 1-week and 3-month follow-up. We examined differences in smoking cessation attitudes (i.e., confidence and readiness to quit) before and after viewing the decision aid and meeting with the clinician by phase and group. We also compared Preparation for Decision Making Scale items and decision aid satisfaction (collected immediately after viewing the decision aid and meeting with the clinician) and smoking outcomes (collected at 1-week and 3-month follow-up) by phase and group.

Continuous variables were analyzed through unpaired t-tests with unequal variances and repeated measures ANOVA. Categorical variables were analyzed via Fisher's exact tests. We treated ordinal data as an approximation of a continuous variable, as traditionally done for survey data in decision aid research. For abstinence and quit attempt outcomes, non-responders were considered to be smokers with no quit attempts. For all analyses, we defined the threshold for statistical significance at $p < 0.05$. Since this was a feasibility study and sample sizes for each phase and group were small, we did not conduct multivariate analyses. Data were analyzed with Stata SE 16.0 (StataCorp LP, College Station, TX).

3. Results

The analytic sample consisted of 120 patients (60patient-sineachphase). On average, participants took between two to three minutes to view the entire decision aid during their clinic visit. The response rate for the one-week and three-month follow-up surveys were 91% and 75%, respectively. Most participants were aged 45 to 64 years old, female, white, and had earned a high school degree or higher. Table 1 displays participant characteristics in each phase, with significant differences found in quit methods used in prior quit attempts (i.e., before the clinic encounter). Among patients who had previously tried to quit smoking, Phase I participants were more likely than Phase II participants to report using e-cigarettes (31.4% versus 12.2%, $p < 0.05$) or receiving clinician's advice (35.3% versus 0.0%, $p < 0.001$) in prior quit attempts.

Data collected from patients immediately before and after viewing the decision aid and meeting with the clinician (assessments 1 and 2) are detailed in Table 2. Results from the three-way repeated measures ANOVA found that for confidence and readiness to quit, the interactions between time (before vs. after viewing the decision aid and meeting with clinician), phase, and group were not significant; however, the time main effect was significant for both measures ($p < 0.05$). Among patients who recalled seeing the decision aid information ($n = 96$) immediately after the meeting with the clinician (assessment 2), most reported being satisfied with the decision aid. There were no significant differences between phases within each group (Table 3).

Using intent-to-treat analysis, 32 (26.7%) patients reported making a quit attempt at one week and 41 (34.2%) reported a quit attempt at three months. Six (5.0%) patients reported smoking abstinence at one week and nine (7.5%) reported abstinence at three months. There were no significant differences in quit attempts, smoking abstinence, use of e-cigarettes, or use of FDA-approved cessation methods between the two phases within each group at either follow up timepoint.

4. Discussion

We examined the effectiveness and acceptability of including e-cigarette content in smoking cessation decision aids. Patients reported increased confidence and readiness to quit smoking after viewing a decision aid and speaking with a clinician; including e-cigarette information in the decision aid for some smoker groups (i.e., those who already use e-cigarettes, those who are not interested in quitting smoking) appeared to have no effect on these outcomes. Overall, most

Table 1
Patient characteristics by study phase (n = 120).

Characteristic	Phase I % (n)	Phase II % (n)
Age, in years		
18 – 44	28.3 (Pasquereau et al., 2017)	31.7 (Wackowski et al., 2015)
45 – 64	66.7 (Solberg et al., 2001)	58.3 (Krishnasamy et al., 2020)
65+	5.0 (Gravely et al., 2019)	10.0 (Fiore et al., 2000)
Sex		
Male	46.7 (Agarwal et al., 2018)	33.3 (Nickels et al., 2017)
Female	53.3 (Graham and O'Connor)	66.7 (Solberg et al., 2001)
Race/ethnicity		
White	45.0 (Moyo et al., 2018)	50.0 (Kollath-Cattano et al., 2021)
Black or African American	45.0 (Moyo et al., 2018)	45.0 (Moyo et al., 2018)
Hispanic or Latino	3.3 (Babb et al., 2017)	0.0 (0)
Other	6.7 (Searight, 2007)	5.0 (Gravely et al., 2019)
Highest education level attained		
Less than high school degree	23.3 ([14])	18.3 (Kalkhoran and Glantz, 2016)
High school degree or GED	40.0 (Scalia et al., 2019)	43.3 (Joseph-Williams et al., 2021)
Trade school or community college	21.7 (Hajek et al., 2019)	30.0 (Doescher et al., 2018)
University degree or higher	15.0 (Caraballo et al., 2017)	8.3 (Law and Tang, 1995)
Smoking frequency		
Daily	80.0 (48)	81.7 (49)
Weekly but less than daily	20.0 (Hartmann-Boyce et al., 2021)	18.3 (Kalkhoran and Glantz, 2016)
Number of cigarettes smoked		
Per day, among daily smokers	13.2 (9.3)	13.4 (8.7)
Per week, among weekly smokers	12.3 (12.0)	14.1 (11.1)
Any lifetime quit attempt(s)	85.0 (51)	81.7 (49)
Quit method(s) used among those with previous quit attempts		
Cold turkey	76.5 (Byron et al., 2018)	59.2 (Tubb et al., 2019)
Clinician's advice	35.3 (Doescher et al., 2018)	0.0 (0)***
In-person counseling	11.8 (Fiore et al., 2000)	8.2 (Searight, 2007)
Quitline and telephone counseling	7.8 (Searight, 2007)	0.0 (0)
Nicotine replacement therapy	49.0 (Joseph-Williams et al., 2014)	30.6 (McNeill et al., 2019)
Prescription medications	13.7 (Vogt et al., 2005)	12.2 (Fiore et al., 2000)
E-cigarettes	31.4 (Owusu et al., 2019)	12.2 (Fiore et al., 2000)*
Intention to quit, next 6 months	68.3 (Légaré et al., 2008)	60.0 (Tattan-Birch et al., 2022;1:CD013790.)

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 2

Confidence and readiness to quit smoking and switch to e-cigarettes, by group and phase at assessments 1 and 2 (mean, SD).

Variable	E-cigarette Information Eligible Group		No E-cigarette Information Group	
	Phase I (n = 28)	Phase II (n = 34)	Phase I (n = 32)	Phase II (n = 26)
Confidence to quit smoking				
Before viewing the decision aid and meeting with the clinician	5.5 (2.9)	5.1 (3.1)	6.8 (3.2)	6.7 (3.1)
After viewing the decision aid and meeting with the clinician	6.0 (3.3)	5.9 (3.4)	6.8 (3.1)	7.6 (2.7)
Readiness to quit smoking				
Before viewing the decision aid and meeting with the clinician	5.6 (3.7)	5.5 (3.7)	9.1 (1.7)	9.0 (2.1)
After viewing the decision aid and meeting with the clinician	5.8 (3.7)	6.4 (3.5)	9.3 (1.4)	9.3 (2.0)
Confidence to switch to e-cigarettes^b				
After viewing the decision aid and meeting with the clinician	4.8 (4.2)	5.9 (3.7)	2.7 (3.2)	4.9 (4.0)
Readiness to switch to e-cigarettes^b				
After viewing the decision aid and meeting with the clinician	4.4 (4.1)	4.9 (3.6)	2.7 (3.3)	4.6 (4.1)

^aIn the e-cigarette information eligible group, the Phase I decision aid did not include e-cigarette information and the Phase II decision aid included e-cigarette information

^bAll items scored from 1 to 10, with 1 representing least confident/ready and 10 representing most confident/ready.

^cConfidence and readiness to switch to e-cigarettes were not measured before viewing the decision aid and meeting with the clinician.

^dNo statistically significant interactions among time (before/after viewing decision aid and meeting with clinician), phase, and group.

patients were satisfied with the decision aid and felt it increased their satisfaction with the clinical encounter.

We found that readiness and confidence to quit smoking improved after exposure to the decision aid and clinic visit, regardless of whether the decision aid contained e-cigarette content. Because we assessed outcomes after the patients' clinic visit, we cannot determine if these changes were due to the decision aid, the consultation with the clinician, or both. Clinician counseling on smoking cessation has been documented as an important driver of motivating patients to quit, but this counseling is not routinely provided (King et al., 2013; Maciosek et al., 2017). Studies have shown decision aids are effective in promoting physician-patient communication (Scalia et al., 2019). Another study using the same decision aid tested in this study found it was effective in facilitating conversations on smoking cessation (Kollath-Cattano et al., 2021). Therefore, decision aids may promote delivery of evidence-based smoking cessation treatment in clinical settings.

We did not observe any effect of including information on switching completely to e-cigarettes in the decision aid. This may be explained by the fact that at baseline, Phase I patients were more likely to have experience using e-cigarettes for smoking cessation than Phase II participants. Due to their experience with e-cigarettes, Phase I participants may have been more confident and ready to switch completely to e-cigarettes at baseline. However, we did not assess these variables at baseline and we are unable to determine if this was the case. Additionally, initial news reports of e-cigarette or vaping product use associated lung injury emerged during the latter part of the study period, which could have had a disproportionate impact on the Phase II participants' willingness to use e-cigarettes as a cessation method (Krishnasamy et al., 2020).

Table 3

Patient acceptability of decision aid and overall satisfaction by group and phase at assessment 2 (mean, SD).

Variable	E-cigarette Information Eligible Group		No E-cigarette Information Group	
	Phase I (n = 25)	Phase II (n = 21)	Phase I (n = 27)	Phase II (n = 23)
Preparation for Decision Making (1–5)				
Decision aid facilitated better decisions on quitting	3.3 (1.6)	3.1 (1.2)	3.9 (1.2)	3.5 (1.2)
Decision aid facilitated reflection on benefits/limitations of quitting methods	3.5 (1.6)	3.8 (0.8)	3.7 (1.2)	3.8 (1.0)
Decision aid helped identify questions to ask to clinician	3.4 (1.6)	3.0 (1.4)	3.7 (1.4)	3.5 (1.3)
Decision aid identified topics on what matters most	3.6 (1.5)	2.9 (1.4)	3.9 (1.3)	3.6 (1.1)
Overall Satisfaction (1–5)				
Decision aid increased satisfaction with visit	3.3 (1.6)	2.6 (1.5)	3.7 (1.4)	3.4 (1.3)
Satisfied with decision aid	3.9 (1.2)	3.7 (1.3)	4.4 (0.9)	4.3 (0.8)

^aIn the e-cigarette information eligible group, the Phase I decision aid did not include e-cigarette information and the Phase II decision aid included e-cigarette information.

^bResponse options: 1 = not at all, 2 = a little, 3 = somewhat, 4 = quite a bit, or 5 = a great deal.

^cNo statistically significant differences between phases within groups were observed.

Research indicates that many smokers want to discuss e-cigarettes with their physicians (Doescher et al., 2018; Wackowski et al., 2015). Since physicians often lack confidence in their ability to counsel patients on e-cigarettes, both smokers and physicians could benefit from interventions which provide up to date information on the benefits and harms of e-cigarettes for smoking cessation. Introducing decision aids in flexible formats (e.g., electronic delivery) which can be regularly updated with the latest scientific evidence may fulfill this need, which will likely increase as other novel tobacco products are introduced into markets. For example, the tobacco industry has rapidly expanded the global market for heated tobacco products (HTPs) that produce fewer harmful chemicals than combustible cigarettes. Nevertheless, studies of exposure biomarkers from consumers are inconclusive; some potentially harmful chemicals are higher in HTPs than in cigarettes, and the product is too new to evaluate long-term health risks from use (Tattan-Birch et al., 2022; Stepanov and Woodward, 2018). In July 2020, the US FDA allowed Philip Morris International to market its HTP IQOS using information about lower exposure to harmful chemicals (U.S. Food and Drug Administration, 2020). Such statements imply reduced harm, and many consumers perceive reduced exposure claims as indicative of reduced harm (Byron et al., 2018). Future decision aids can integrate information about emerging tobacco products to help inform consumers about such complex information.

Consistent with previous research (Kollath-Cattano et al., 2021), patients in our study reported that the decision aid helped prepare them to discuss smoking cessation with their physician. Further, patients were generally satisfied with the decision aid and its impact on their clinical visit. Most smokers want to quit and are receptive to clinician counseling on smoking (Babb et al., 2017; Solberg et al., 2001), and our findings indicate that decision aids are an acceptable method of facilitating these discussions. We did not assess acceptability from the perspectives of providers and staff, or the impact of the decision aid on visit length. Future studies should explore the acceptability of decision aids from multiple perspectives and assess potential workflow impacts.

Decision aids may be effective in improving shared decision making and promoting behavior change, but their impact will not be realized if they are not integrated into routine clinical care. Several challenges have been identified to implementing them in routine care, including time constraints and workflow issues (Légaré et al., 2008). To minimize the impact of the intervention on visit length, we chose to administer the decision aid prior to the patient's visit. We also used an electronic format that could be integrated into electronic health record systems and patient portals, thereby limiting disruption of clinical workflows. Further research is needed to assess the best strategies for implementing decision aids into routine practice.

Our results should be interpreted in light of the following limitations. First, this was a pilot study that enrolled a relatively small sample size, which may limit our ability to detect differences among outcomes. Second, results were collected from one family medicine clinic in an academic medical center in the Southeastern United States, limiting generalizability of results to patients from other organizations or regions. Finally, due to the small sample size used, we did not perform multivariate analyses. Further research is needed to confirm these findings using larger and more rigorous study designs.

5. Conclusions

Patient decision aids are a viable mechanism to promote conversations on smoking cessation. While we did not observe any impact of introducing decision aid content related to e-cigarettes, our findings indicate that decision aids are useful and acceptable to patients who smoke and may help prepare them to quit smoking. Future studies should seek to confirm these findings using larger sample sizes and rigorous designs.

6. Ethics approval and consent to participate

All research involving human data was performed in accordance with institutional guidelines and the Declaration of Helsinki. This study was approved by the University of Florida Institutional Review Board (#2018-03056). All participants provided written informed consent.

Funding

This work was supported by the University of Florida College of Medicine and the University of South Carolina Arnold School of Public Health.

CRedit authorship contribution statement

Jennifer H. LeLaurin: Writing – original draft. **James F. Thrasher:** Conceptualization, Funding acquisition, Writing – review & editing. **Scott M. Strayer:** Writing – review & editing. **John Malaty:** Resources, Writing – review & editing. **Christy Kollath-Cattano:** Writing – review & editing. **Maribeth Williams:** Resources, Writing – review & editing. **Oliver T. Nguyen:** Formal analysis. **Allie M. Kellner:** Writing – review & editing. **James M. Smith:** Writing – review & editing. **Ramzi G. Salloum:** Conceptualization, Funding acquisition, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- Cornelius, M.E., Wang, T.W., Jamal, A., Loretan, C.G., Neff, L.J., 2020. Tobacco product use among adults—United States, 2019. *Morb. Mortal. Wkly. Rep.* 69 (46), 1736–1742.
- Babb, S., Malarcher, A., Schauer, G., Asman, K., Jamal, A., 2017. Quitting smoking among adults—United States, 2000–2015. *Morb. Mortal. Wkly. Rep.* 65 (52), 1457–1464.
- Gravelly, S., Thrasher, J.F., Cummings, K.M., Ouimet, J., McNeill, A., Meng, G., Lindblom, E.N., Loewen, R., O'Connor, R.J., Thompson, M.E., Hitchman, S.C., Hammond, D., Heckman, B.W., Borland, R., Yong, H.-H., Elton-Marshall, T., Bansal-Travers, M., Gartner, C., Fong, G.T., 2019. Discussions between health professionals and smokers about nicotine vaping products: results from the 2016 ITC Four Country Smoking and Vaping Survey. *Addiction* 114 (S1), 71–85.
- Searight, H.R., 2007. Efficient counseling techniques for the primary care physician. *Prim Care* 34 (3), 551–570.
- Law, M., Tang, J.L., 1995. An analysis of the effectiveness of interventions intended to help people stop smoking. *Arch. Intern. Med.* 155 (18), 1933–1941.
- Fiore, M.C., Bailey, W.C., Cohen, S.J., Dorfman, S.F., Goldstein, M.G., Gritz, E.R., et al., 2000. Treating Tobacco Use and Dependence: Clinical Practice Guideline. US Department of Health and Human Services, Public Health Service, Rockville, MD.
- Vogt, F., Hall, S., Marteau, T.M., 2005. General practitioners' and family physicians' negative beliefs and attitudes towards discussing smoking cessation with patients: a systematic review. *Addiction* 100 (10), 1423–1431.
- Substance Abuse and Mental Health Services Administration; Office of the Surgeon General. Smoking cessation: a report of the Surgeon General. Washington, DC: US Department of Health and Human Services; 2020.
- Caraballo, R.S., Shafer, P.R., Patel, D., Davis, K.C., McAfee, T.A., 2017. Quit methods used by US adult cigarette smokers, 2014–2016. *Prev. Chronic Dis.* 14, E32.
- U. S. Preventive Services Task Force. 2021. Interventions for Tobacco Smoking Cessation in Adults, Including Pregnant Persons: US Preventive Services Task Force Recommendation Statement. *JAMA* 325(3), 265–279.
- Kalkhoran, S., Glantz, S.A., 2016. E-cigarettes and smoking cessation in real-world and clinical settings: a systematic review and meta-analysis. *Lancet Respir. Med.* 4 (2), 116–128.
- Hartmann-Boyce J, McRobbie H, Lindson N, Bullen C, Begh R, Theodoulou A, et al. 2021. Electronic cigarettes for smoking cessation. *Cochrane Database Syst. Rev.* 4, CD010216.
- Hajek, P., Phillips-Waller, A., Przulj, D., Pesola, F., Myers Smith, K., Bisal, N., Li, J., Parrott, S., Sasieni, P., Dawkins, L., Ross, L., Goniewicz, M., Wu, Q.i., McRobbie, H. J., 2019. A randomized trial of e-cigarettes versus nicotine-replacement therapy. *N. Engl. J. Med.* 380 (7), 629–637.
- National Academies of Sciences E, Medicine. Public health consequences of e-cigarettes: National Academies Press; 2018.
- McNeill, A., Brose, L.S., Calder, R., Bauld, L., Robson, D. 2019. Vaping in England: an evidence update February 2019. A report commissioned by Public Health England London: Public Health England.
- Owusu, D., Huang, J., Weaver, S.R., Pechacek, T.F., Ashley, D.L., Nayak, P., Eriksen, M. P., 2019. Patterns and trends of dual use of e-cigarettes and cigarettes among U.S. adults, 2015–2018. *Prevent. Med. Rep.* 16, 101009. <https://doi.org/10.1016/j.pmedr.2019.101009>.
- Pasquereau, A., Guignard, R., Andler, R., Nguyen-Thanh, V., 2017. Electronic cigarettes, quit attempts and smoking cessation: a 6-month follow-up. *Addiction* 112 (9), 1620–1628.
- Doescher, M.P., Wu, M., Rainwater, E., Khan, A.S., Rhoades, D.A., 2018. Patient perspectives on discussions of electronic cigarettes in primary care. *J. Am. Board Fam. Med.* 31 (1), 73–82.
- Wackowski, O.A., Bover Manderski, M.T., Delnevo, C.D., 2015. Smokers' sources of e-cigarette awareness and risk information. *Prev. Med. Rep.* 2, 906–910.
- Nickels, A.S., Warner, D.O., Jenkins, S.M., Tilburt, J., Hays, J.T., 2017. Beliefs, practices, and self-efficacy of US physicians regarding smoking cessation and electronic cigarettes: a national survey. *Nicotine Tob. Res.* 19 (2), 197–207.
- Kollath-Cattano, C., Thrasher, J.F., Osman, A., Andrews, J.O., Strayer, S.M., 2016. Physician advice for e-cigarette use. *J. Am. Board Fam. Med.* 29 (6), 741–747.
- Kollath-Cattano, C., Dorman, T., Albano, A.W., Jindal, M., Strayer, S.M., Thrasher, J.F., 2019. E-cigarettes and the clinical encounter: Physician perspectives on e-cigarette safety, effectiveness, and patient educational needs. *J. Eval. Clin. Pract.* 25 (5), 761–768.
- Salloum, R.G., LeLaurin, J.H., Lee, J.-H., Lafata, J.E., Williams, M., Wang, Y., Smith, J. M., Staras, S.A.S., Strayer, S.M., Thrasher, J.F., 2021. Primary care physician perspectives on recommending E-cigarettes to smokers: a best-worst discrete choice experiment. *J. Gen. Intern. Med.* 36 (11), 3353–3360.
- Scalia, P., Durand, M.-A., Berkowitz, J.L., Ramesh, N.P., Faber, M.J., Kremer, J.A.M., Elwyn, G., 2019. The impact and utility of encounter patient decision aids: systematic review, meta-analysis and narrative synthesis. *Patient Educ. Couns.* 102 (5), 817–841.
- Joseph-Williams, N., Newcombe, R., Politi, M., Durand, M.-A., Sivell, S., Stacey, D., O'Connor, A., Volk, R.J., Edwards, A., Bennett, C., Pignone, M., Thomson, R., Elwyn, G., 2014. Toward minimum standards for certifying patient decision aids: a modified Delphi consensus process. *Med. Decis. Making.* 34 (6), 699–710.
- Joseph-Williams, N., Abhyankar, P., Boland, L., Bravo, P., Brenner, A.T., Brodney, S., Coulter, A., Giguère, A., Hoffman, A., Körner, M., Langford, A., Légaré, F., Matlock, D., Moumjid, N., Munro, S., Dahl Steffensen, K., Stirling, C., van der Weijden, T., 2021. What works in implementing patient decision aids in routine clinical settings? A rapid realist review and update from the international patient decision aid standards collaboration. *Med. Decis. Making.* 41 (7), 907–937.

- Moyo, F., Archibald, E., Slyer, J.T., 2018. Effectiveness of decision aids for smoking cessation in adults: a quantitative systematic review. *JBI Database System Rev. Implement. Rep.* 16 (9), 1791–1822.
- Agarwal, S.D., Kerwin, M., Meindertma, J., Wolf, A.M.D., 2018. A novel decision aid to encourage smoking cessation among patients at an urban safety net clinic. *Prev. Chronic. Dis.* 15, E124.
- Tubb, M.R., Vonder Meulen, M.B., Pallerla, H., Regan, S., Doarn, C.R. 2019. Clinical evaluation of e-Quit worRx: a mobile app to enhance smoking cessation shared decision making in primary care. *Mhealth* 5, 22.
- Kollath-Cattano, C., Thrasher, J.F., Salloum, R.G., Albano, A.W., Jindal, M., Durkin, M., Strayer, S.M., 2021. Evaluation of a smoking cessation patient decision aid that integrates information about e-cigarettes. *Nicotine Tobacco Res.* 23 (11), 1880–1888.
- Maloney, S.F., Hoetger, C., Rudy, A.K., Eversole, A., Sawyer, A.N., Cobb, C.O., et al. 2021. Randomized controlled trials using electronic nicotine delivery systems as smoking cessation aids require an accurate, empirically-based understanding of the nicotine delivery profile of the products under study. *J. Public Health Emerg.* 5.
- Graham, I., O'Connor, A. Preparation for Decision Making Scale [Available from: <https://decisionaid.ohri.ca/docs/develop/Tools/PrepDM.pdf>].
- King, B.A., Dube, S.R., Babb, S.D., McAfee, T.A., 2013. Patient-reported recall of smoking cessation interventions from a health professional. *Prev. Med.* 57 (5), 715–717.
- Maciosek, M.V., LaFrance, A.B., Dehmer, S.P., McGree, D.A., Flottemesch, T.J., Xu, Z., Solberg, L.L., 2017. Updated priorities among effective clinical preventive services. *Ann. Fam. Med.* 15 (1), 14–22.
- Krishnasamy, V.P., Hollowell, B.D., Ko, J.Y., Board, A., Hartnett, K.P., Salvatore, P.P., Danielson, M., Kite-Powell, A., Twentyman, E., Kim, L., Cyrus, A., Wallace, M., Melstrom, P., Haag, B., King, B.A., Briss, P., Jones, C.M., Pollack, L.A., Ellington, S., Abbas, A., Adebayo, A., Atti, S., Boehmer, T., Carter, E., Chandra, G., Eckhaus, L., Hamilton, J., Israel, M., Li, Z., Loretan, C., Lynfield, R., Nataraj, N., Pomeroy, M., Schrodt, C., Smith, H., Thomas, K., Werner, A., 2020. Update: characteristics of a nationwide outbreak of E-cigarette, or vaping, product use-associated lung injury - United States, August 2019-January 2020. *MMWR Morb. Mortal. Wkly. Rep.* 69 (3), 90–94.
- Tattan-Birch, H., Hartmann-Boyce, J., Kock, L., Simonavicius, E., Brose, L., Jackson, S., et al. 2022. Heated tobacco products for smoking cessation and reducing smoking prevalence. *Cochrane Database Syst. Rev.* 1, CD013790.
- Stepanov, I., Woodward, A., 2018. Heated tobacco products: things we do and do not know. *Tob. Control.* 27 (Suppl 1), s7–s8.
- U.S. Food and Drug Administration. FDA Authorizes Marketing of IQOS Tobacco Heating System with 'Reduced Exposure' Information 2020 [Available from: <https://www.fda.gov/news-events/press-announcements/fda-authorizes-marketing-iqos-tobacco-heating-system-reduced-exposure-information>].
- Byron, M.J., Jeong, M., Abrams, D.B., Brewer, N.T., 2018. Public misperception that very low nicotine cigarettes are less carcinogenic. *Tob. Control.* 27 (6), 712–714.
- Solberg, L.L., Boyle, R.G., Davidson, G., Magnan, S.J., Carlson, C.L., 2001. Patient satisfaction and discussion of smoking cessation during clinical visits. *Mayo Clin. Proc.* 76 (2), 138–143.
- Légaré, F., Ratté, S., Gravel, K., Graham, I.D., 2008. Barriers and facilitators to implementing shared decision-making in clinical practice: update of a systematic review of health professionals' perceptions. *Patient Educ. Couns.* 73 (3), 526–535.