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Factors associated with young adult engagement with a web-based sickle cell reproductive health intervention

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Abstract

Objective: To determine the factors predicting the engagement of young adults who have sickle cell disease (SCD) or sickle cell trait (SCT) with an online reproductive health education intervention and engagement effects on knowledge.

Methods: The cross-sectional study included 167 participants who completed the web-based intervention either face-to-face (F2F) or online delivery (OL). Measures include: time used relative to length of the intervention narration and media (engagement) and the SCKnowIQ questionnaire. Ordinal regression was conducted.

Results: The sample mean age was 26-years ($SD=5$), 68% were female, 54% had SCD, and 68% were in the F2F group. Adjusting for age, partner sickle cell status, marital status, and education, participants who were female ($p=.003$), had SCD ($p=.018$), or had F2F delivery ($p < .001$) were more likely to spend more time on the intervention. Adjusting for baseline knowledge and modality, more time spent on the intervention was associated with higher posttest knowledge ($p=.006$).

Conclusions: Future studies are necessary to understand reasons underpinning engagement and to investigate other unmeasured factors, such as intervention interactivity elements, that could also be associated with engagement.

Innovation: This study of young adults with SCD or SCT provides much needed insight about their engagement with online reproductive health education.

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Declaration of Competing Interest

None

Keywords

Engagement; Sickle cell disease; Sickle cell trait; Reproductive health education; Webbased intervention; Web-based intervention engagement

1. Introduction

Patients with sickle cell disease (SCD) or sickle cell trait (SCT) may face many barriers in their reproductive healthcare, including but not limited to the lack of adequately informed reproductive health education and counseling [1]. Young adults must be educated on their reproductive options considering the genetic inheritance of sickle cell disease or trait. Research supports that web-based interventions are an adequate method of delivering sexual and reproductive educational information to various populations of adolescents and young adults [2–4]. However, few such interventions exist specifically for individuals with SCD or SCT. This gap led to the development of CHOICES, a web-based sexual and reproductive educational intervention designed for those with SCD or SCT [5–7]. Web-based intervention effects are influenced by user engagement issues, and little is known about factors driving user engagement among young adults with SCD or SCT. The purpose of this study was to examine the various factors associated with the engagement of young adults in a previous investigation of the CHOICES intervention.

CHOICES is an innovative multimedia web-based intervention that provides information on the genetic inheritance of sickle cell and different reproductive options [5–7]. The intervention group showed significantly higher reproductive health knowledge at immediate posttest than the control group who were provided with an ebook containing similar information as would be given at the doctor’s office. The significant increase in reproductive health knowledge of the intervention group was sustained over the two-year study [6,7]. There was, however, no significant group effect on reproductive health intention and behavior [6,7]. One possible explanation for these findings as shown in a previous study was that some participants may have had less than optimal engagement with the intervention [8]. The modalities included online (OL, delivered to participants remotely) and face-to-face (F2F, delivered to participants on a computer via a local host web browser and in the presence of a research assistant). However, there is limited evidence on the personal characteristics or delivery approaches associated with engagement with reproductive health resources for this population. Understanding factors that predict engagement with the CHOICES intervention may improve the overall intervention content and delivery by informing investigators on how to better target and tailor the intervention to suit the audience, leading to an increase of behaviors concordant with parental goals. Our study findings will be a significant addition to the sickle cell reproductive health literature and the broader behavioral intervention engagement literature. As a first of its kind for the SCD and SCT population, our study will provide insights into the factors associated with young adults’ engagement with web-based interventions.

Engagement has been conceptualized as a behavioral construct, which consists of observable behaviors of participants as they interact with the intervention [9,10]. Behaviors such

as the amount of time spent on the intervention, areas of the intervention visited, and the number of intervention components interacted with are common measurable activities investigated within this conceptualization [9,11,12]. There have been different perspectives of what factors drive engagement. Some researchers have examined the characteristics of the intervention itself as the primary driver of engagement [13–16]. Interactive components or gamification elements have also been shown to influence intervention engagement [16–18]. The CHOICES intervention included interactive components such as pop-up quizzes, animations, and video clips, although a system error prevented adequately capturing exactly how participants engaged with such components [8]. On the other hand, some researchers have found that personal characteristics such as age, gender, education, and social support may be associated with participants' engagement with web-based interventions [19–21]. These associations reflect mixed findings, with one study showing a positive correlation of such personal characteristics with engagement [19], whereas another reported the opposite [21]. For example, Ben-Zeev et al. [19] found that females were more engaged than males in terms of time spent, averaging .42 more days per week than males, and responding to intervention prompts more often than men. In the same study, they found that participants in the age range of 30 – 45 years were more engaged than younger participants aged 18 – 29 years old in terms of time spent on the engagement. Younger participants, however, responded to intervention prompts and used on-demand intervention features more often than their older counterparts [19].

As a web-based reproductive health intervention for those with SCD or SCT, the factors that drive CHOICES intervention engagement may be unique to this context. For example, the participant's and their partner's sickle cell status are highly relevant for an inherited condition. Those with SCD always pass on one copy of the sickle cell gene to their offspring, whereas those with SCT have a 50% chance of doing so with each pregnancy. Therefore, sickle cell genetic status could be a factor that influences how participants engage with the intervention. Findings indicate that many affected individuals lack reproductive knowledge about genetics and its role in making informed reproductive decisions [22–25].

Delivery modality may also be another factor influencing engagement with the CHOICES intervention. A previous study showed differences in engagement between OL and F2F modalities, and the presence of a researcher may help explain variation in engagement [8]. Finally, social support has been shown to be a positive predictor of intervention engagement [12]. In this study, social support, in the form of the inherent support married couples provide to each other, may be a unique predictor of engagement for reproductive health education for genetic conditions. Married couples may make important family planning decisions together where the decision will affect the entire family [26–28]. Therefore, it is logical to extrapolate that engaging in such a reproductive health intervention may also be associated with marital status.

Other factors of intervention engagement such as age, gender, education level, and acceptability of web-based interventions are also important considerations. Young adults, referred to as “digital natives”, are shown to be very comfortable with receiving healthcare information and education via digital platforms [29,30]. On the other hand, some studies show that older age is a significant predictor of intervention engagement as opposed to

younger participants [19,31]. In fact, one study showed that young adults are more likely to skim through interventions resulting in less time spent on the intervention and, overall, less engagement [32]. Women have been shown to spend longer time and engage more in health interventions than their male counterparts [30]. Similarly, those with tertiary education have been shown to spend more time and engage more with interventions [31]. Finally, findings on the association between acceptability of web-based interventions and engagement have been mixed, with some researchers finding positive correlation [20] whereas others find no significant association and call for further investigation [33].

This study aimed to identify what factors (e.g., age, gender, sickle cell genetic status, marital status, education, partner's sickle cell genetic status, and reported intervention acceptability) are associated with participant engagement with CHOICES, a web-based reproductive health intervention. A secondary aim of this study was to determine if there was an association between our engagement measure and participants' post intervention knowledge scores. Unfortunately, data cleaning in the early stages of our study analyses revealed that several of the intended engagement records such as what activities participants clicked on and completed were not logged by the application. Although data were to be recorded and timestamped for every click each participant made, some data were available on how participants clicked through the intervention. Time data such as length of time spent in each individual program section as well as the selections made at the beginning of the intervention (e.g. use of male or female narration), were recorded. Time data were logged as time used by the participant on items contained within the webpages of each intervention section. The availability of data limited our assessment of engagement in this study to a measure of time, which we characterized as a ratio of time spent on the intervention relative to the estimated time necessary for intervention completion.

2. Methods

2.1. Design

In this cross-sectional study focused on identifying factors associated with intervention engagement, we conducted multivariate analysis of baseline data obtained from the experimental groups of two randomized controlled trials (RCTs) previously conducted to test the effects of the CHOICES intervention. The Institutional Review Board (IRB) at the University of Illinois at Chicago approved the primary RCTs, and the IRB at the University of Florida approved the study as exempt for this secondary analysis of de-identified data shared under a data-use agreement.

2.2. Sample

Study participants included were 18-to-35-year-old adults with a confirmed diagnosis of SCD or SCT, the ability to read and understand English, and the capability and desire to have children. Those who were legally blind, physically unable to have children, or physically unable to complete the study were excluded. The samples derived from the two RCTs form the two modalities of this study. Participants either completed the study entirely online (OL) or face to face in the presence of a research assistant (F2F). Both modalities shared the same inclusion and exclusion criteria except that individuals that reported having

a friend or relative already enrolled in the study were excluded from the F2F but not the OL RCTs. One participant reported an age outside of our inclusion criteria, but it is unclear if this was an error in completing the online questionnaire since all included participants reported ages that met inclusion criteria prior to beginning the study. Therefore, this participant's data were included in the analysis.

Recruitment of participants in the OL modality was completed through internet-based strategies such as electronic flyers and social network posts. Participants in this modality were recruited from California, Texas, North Carolina, Connecticut, and Illinois. Randomization into the intervention or experimental groups for the OL modality occurred at the state level, with all participants from a state assigned to the state-assigned group. Eleven participants who found our listing online completed the pilot study remotely and are part of the OL group. They were randomized to the intervention ($n = 7$) or control group ($n = 4$) individually. F2F participants were recruited using a combination of internet-based and in-person strategies. Participants were recruited in-person from pediatric and adult sickle cell clinics in the greater Chicago area and via community organizations and public settings or Facebook and Craigslist. Randomization to the control and experimental groups for the F2F modality occurred at the individual level.

The experimental samples from both modalities included 172 participants (OL $N = 58$; F2F $N = 114$). For this analysis, five outliers were excluded as the times logged for these participants (e.g., greater than ten hours logged on a single intervention section) appeared incorrect [8].

2.3. Procedures

Participants signed informed consent and completed study measures on a computer. Participants in both studies completed the same intervention. F2F participants logged on to the program through a local-host internet browser on a touch-screen laptop. OL participants accessed the same program remotely using an internet browser on a computer available to them. Data were collected from F2F participants at times and locations convenient to them, including the research office, their homes, coffee shops, public libraries, and fast-food restaurants. A research assistant was present in the room with participants in the F2F group to obtain consent and assist with opening the program but had no further interaction unless participants asked a question. OL participants completed the intervention entirely at their discretion. Once logged into the program, usage data were collected automatically and written to a Microsoft Access relational database. Each click the participant made (to play a video or animation or navigate through the intervention sections) was captured, recorded, and timestamped. The duration between each timestamped activity was calculated to determine the length of time spent on activities or within sections of the intervention. Participants completed a measure of user acceptability for computer applications.

CHOICES was designed using concepts from the Theory of Reasoned Action and organized using Kolb's Experiential Learning Theory (ELT). The intervention is presented in four sections that reflect Kolb's ELT constructs: concrete experience (*Duane's Story*), reflective observation (Your Thoughts), abstract conceptualization (*Information for You*) and active experimentation (*People's Experiences*) (Figure 1). These four sections of the intervention

must be completed in order, although participants may go back to previous subsections or videos. Participants could either read the intervention or listen to it narrated in a male or female voice. The total amount of time it would take a participant to listen to the entire intervention was 88.3 minutes in the male voice and 84.9 minutes in the female voice. A \$25 gift card was provided as an incentive for the completion of baseline activities.

2.4. Measures

2.4.1. SCKnowIQ—The Sickle Cell Reproductive Health Knowledge Parenting Intent Questionnaire (SCKnowIQ) was used to collect participants' demographic information and other study measures, such as knowledge of SCD reproductive health [34]. The tool's validity and reliability have been reported in a previous study [34].

2.4.2. Computer acceptability scale—Participants also completed the valid and reliable Computer Acceptability Scale (CAS-15), which measures user acceptability for computer applications [35,36]. The total score possible was 30, with higher scores indicating greater acceptability of the intervention. Cronbach alpha of this scale was .76 in this sample.

2.4.3. Estimated time variable—To measure engagement in this study, we created the Estimated Time variable. This ordinal variable represents the total time spent on the intervention relative to the estimated total time necessary to complete the intervention. The total estimated time necessary to complete the intervention was determined by the duration of the intervention when narrated by the female voice. The female narration was used for reference because it was the most frequent choice of participants who played the intervention and was our best estimation of intervention duration. We did not measure the time it would take an average participant to read the entire intervention [8]. The resulting engagement variable had five levels: Less Than 25% of Estimated Time, 25% to 49% of Estimated Time, 50% to 74% of Estimated Time, 75% to 100% of Estimated Time, and Greater than 100% of Estimated Time.

2.5. Analysis

Usage data at baseline and the first complete interaction with the intervention were exported from the Access database into an Excel file and finally into SPSS (IBM SPSS Statistics for Windows, version 26.0) for analysis. Descriptive statistics were calculated for the demographics of the study participants, CAS-15 scores, and usage data. We compared demographic characteristics using *chi-square* tests. Multiple linear regression was conducted to determine the association of baseline knowledge scores, modality and time spent on the intervention with posttest knowledge outcome. Ordinal logistic regression with proportional odds was conducted to examine the association of personal characteristics, CAS-15 scores, and intervention modality with usage. Statistical significance was set a priori at a two-sided alpha level of .05.

3. Results

3.1. Descriptive findings

The distribution of the sample and their demographic characteristics are presented in Table 1. The majority of the sample was female ($n = 113$, 68%), was not at risk of conceiving a child with SCD ($n = 124$, 74%), had greater than high school education completed ($n = 122$, 73%) and were unmarried ($n = 146$, 87%). The sample was approximately evenly distributed between SCD (54%) and SCT (46%).

The mean CAS-15 scores are shown in Table 2. Mean scores of the F2F (26.8 ± 1.9) and OL (25.9 ± 3.5) groups were similar ($p = .112$).

Table 3 shows descriptive data for the time used by the different demographic categories. The F2F participants spent more time on the intervention (mean = 76.8 ± 32.4 minutes) compared to the OL sample (mean = 54.6 ± 36.5 minutes) ($p < .001$). Females spent on average 72.7 ± 34.5 minutes whereas their male counterparts spent 63.4 ± 36.3 minutes ($p = .106$). Participants, on average, spent less time than the 84.9 minutes estimated as needed to complete the intervention in its entirety if the narration was used throughout the intervention [8]. Table 4 shows the distribution of the categorical independent variable representing the various ordered time categories. The majority of the OL (54%) and F2F (90%) participants were in the 50% Estimated Time or higher categories. Similarly, females (78%), males (73%), those who had SCT (74%), and SCD (81%) were also mostly in the 50% of Estimated Time or higher categories.

Mean pretest knowledge scores of the complete sample of participants was 9.7 ± 3.7 and their mean posttest scores was 12.3 ± 3.2 . F2F participants had lower pretest and posttest scores on average, 9.3 ± 3.1 and 12.1 ± 3.1 compared to OL participants 10.6 ± 3.4 and 12.8 ± 3.4 .

3.2. Regression analyses

Ordinal logistic regression was performed to determine the predictive value of personal characteristics (age, sickle cell status, education, marital status, and partner's sickle cell status), modality, and CAS-15 scores on the participant's engagement (Estimated Time Variable). The Pearson goodness-of-fit test indicated that the model was a good fit to the observed data, $\chi^2(616) = 578.756$, $p = .856$.

There were three significant predictors of engagement (Estimated Time) in this study (Table 5). Gender, modality, and sickle cell status all had a statistically significant effect on engagement with the intervention adjusting for all the variables in the model. The odds of the OL participants being in higher time categories and spending more time on the intervention were less than the F2F participants ($p < .001$). Female participants had higher odds of being in higher time categories and were likely to spend more time on the intervention than their male counterparts ($p = .003$). Participants with SCT were also less likely to be in the higher time categories to spend more time on the intervention than those with SCD ($p = .018$). The remainder of the independent variables were not statistically significant predictors in the model: age ($p = .706$), marital status ($p = .092$), education ($p = .198$), partners sickle cell status ($p = .610$) and CAS-15 scores ($p = .284$).

Multiple linear regression was performed to examine the association of time spent on the intervention, modality, and baseline knowledge scores with posttest knowledge scores. Baseline knowledge scores were significantly associated with posttest knowledge scores ($p < .001$) after controlling for modality and time spent on the intervention. Adjusting for baseline knowledge scores and modality, time spent on the intervention was significantly associated with posttest knowledge scores following the completion of the CHOICES intervention ($p = .006$) with higher times spent on the intervention indicating higher posttest knowledge scores. Modality was not significantly associated with posttest knowledge scores ($p = .42$) when controlling for baseline knowledge scores and time spent on the intervention.

4. Discussion and conclusion

4.1. Discussion

To the best of our knowledge, this study is the first of its kind to identify the factors associated with the engagement of young adults who have SCD or SCT with a web-based reproductive health education intervention, CHOICES. This reproductive health intervention is highly scalable and a much-needed resource for patients living with SCD or SCT as a web-based intervention. This intervention is especially important for those who would otherwise not have access to such comprehensive information about their reproductive health and options. Understanding the factors associated with participants' engagement is also critically important in refining the intervention for optimal engagement in the future. Our results show that some personal characteristics (gender and sickle cell status) and the intervention delivery modality are predictors of engagement with this intervention. Participants who are female, have SCD, or are learning with the F2F modality are more likely to spend more time on the intervention and have higher engagement. We also found that intervention engagement was significantly associated with posttest knowledge scores of participants. The results in this study shed further light on how participants engaged with this intervention, the importance of engagement on intervention knowledge outcomes and indicate the need for some further fine-tuning of the intervention since engagement time was on average 8 (F2F) to 30 (OL) minutes less than required to complete the full intervention dose (84.9 minutes).

Delivery modality was a significant predictor of participant engagement adjusting for personal characteristic factors. As noted previously [8], we found that the OL participants were more likely to be in the lower time categories than their F2F counterparts. Some studies have indicated that online delivery of health interventions have comparable outcomes to their F2F delivery counterparts [37,38]. Our findings indicate that there is room for improvement in the web-based delivery for remote participants to increase their engagement from a time perspective. As other researchers found, introducing a digital human communication factor (such as messages via email or text) into web-based interventions might increase engagement, reducing the need for F2F interventions [12,39].

Other studies focused on the effect of gender on online intervention engagement [19,40,41]. Similar to our findings, females had higher engagement than males with digital health interventions [19,40,41]. Although our intervention included tailoring for females and males, much of the reproductive suggestions and consequences may have appeared to be geared

more to females than males. For example, suggestions included various methods of birth control that apply to female participants and male participants' sexual partners but only condoms, abstinence and vasectomy specifically apply to men. Additionally, terminating a pregnancy might involve both partners in the decision but is a burden carried specifically by the woman. Finally, the risk of becoming pregnant as a woman with SCD specifically applies to female participants or female sexual partners of male participants. Although familiarity with all of this information is necessary for females and males, it is possible that the men, especially those not married, may not have been as engaged with this information. It would be essential for future tailoring of the intervention to present this information to encourage men to engage with this content.

Results also showed that sickle cell status was a significant predictor of time engagement with the intervention. There are various ways to interpret this finding that those with SCT were less likely to spend more time on the intervention than participants with SCD. On the one hand, participants with SCD may have been more invested in the intervention because of the burden of living with SCD and its impact on reproductive decision-making and potentially sparing their children from these challenges. However, it is possible that this increased length of time spent on the intervention could be a function of differences in the cognitive status of participants with SCD. We did not assess participants' history of cerebrovascular accidents (CVA) within our sample. Unfortunately, CVA is a common comorbidity of those who have SCD [42–44]. CVAs have long been shown to affect cognitive functioning and have more recently been shown to be the case for those with SCD and various other cerebrovascular events such as transient ischemic attacks and silent cerebral infarcts [45–47]. Researchers in one study also noted a difference in processing speeds between people who have SCD and their healthy siblings [46], with those who had SCD having longer processing times. Overall, participants who have SCT typically have less morbidity than those with SCD [46]. They are often neither at risk for CVAs nor live with chronic anemia and pain. Controlling for any other possible changes in their cognitive functioning, those with SCT should have similar cognitive functioning comparable to individuals with normal hemoglobin. In future studies of this educational intervention, it might be prudent to include cognitive assessments of the individuals with SCD.

Although age has also been shown to be a significant factor of engagement [19,31], our findings did not show the same significant association. Other researchers showed that younger participants seek health information via web-based channels, although this behavior and engagement may not be sustained long-term [19,48]. As this was a cross-sectional study of the first intervention interaction, we cannot determine if this longitudinal effect on engagement would be similar in our study. Our study included those between 18 and 38 years. There is the possibility that the younger participants were more concerned about their immediate reproductive or parenting goals, which may have affected their interest in the intervention. In turn, their concern may have increased their engagement compared to the older participants, who may have already had children before they participated in the study.

Intervention acceptability has been investigated in correlation with intervention engagement in previous studies with mixed findings [20,33,49]. Our measure of acceptability, CAS scores, was not a significant predictor of engagement in this study. Although acceptability is

positively related to engagement, it may not always be an adequate predictor of engagement. Participants may find the intervention acceptable but may have disengaged from the intervention for a myriad of reasons. For example, they might have found the useful information early in the intervention and disengaged for the remainder [49]. Since 75% of the sample was not at risk of having a child with SCD, the early presentation of information on genetic inheritance may be an example of such disengagement despite high acceptability scores. Measuring acceptability is still an important component of studying participants' engagement with an intervention but it is not by itself a sole indicator of participants' potential engagement with the intervention.

Our measure of engagement was limited by the data available to us, which resulted in a focus on time as a measure of engagement. The study findings showed that there was a significant and positive association between time spent on the intervention and knowledge scores when controlling for baseline knowledge and modality, that is the longer time spent on the intervention, the higher the posttest knowledge scores. This finding provides evidence on the importance of engagement and validity of our engagement measure.

The development of web-based interventions that are engaging is an iterative process as extensive tailoring may be needed. Unfortunately, as most of the intervention development occurs at the front end of the study, very little can be done to fine-tune the intervention during the study. Therefore, it is important to engage with stakeholders and other individuals from the target population who can provide feedback on the content and presentation of information, which would aid in creating engaging material. This front-end work resulted in this intervention that study participants reported as acceptable but had only moderate engagement. This study, however, revealed the importance of additional tailoring of the intervention to the participants' unique characteristics and preferences. In the future, it will be important that investigators leverage the new findings on the factors that predict engagement with the web-based intervention. This will improve the likelihood that participants will display increased engagement in future studies focused on overall effectiveness as a sickle cell reproductive health intervention.

4.2. Limitations

Although important, our findings should be interpreted cautiously with consideration of some limitations. The F2F sample included participants recruited from one geographical area in the United States, limiting generalizability to other regions or countries. Also, there was no measure of cognitive status, which could influence engagement in an educational intervention since silent strokes in those with SCD could cause cognitive impairment. Our engagement variable was critical in providing some more insights into how participants engaged with the intervention in terms of time spent. There is, however, some concern about the use of time as a measure of intervention engagement in this study, as our available data limits our ability to discern if participants were genuinely engaged for the entire duration that was logged. Finally, by using the length of the audio narration as our estimated time to complete the intervention, the actual time required to consume the entire intervention may have been overestimated since it is not clear if participants listened to the entire intervention or possibly read at a faster speed than the narration.

4.3. Innovation

Online educational interventions are an innovative way to reach populations that are in most dire need of important health care information. Given the changes from the last two years of the COVID-19 pandemic, such interventions have been given the spotlight as remote accessibility of healthcare has become more imperative. To the best of our knowledge, this is the first study within sickle cell reproductive health to explore the factors that drive engagement of participants with a web-based health education intervention. Although intervention engagement research is popular within other fields, few studies have focused on participants with sickle cell disease or trait engaging with web-based reproductive health education intervention. CHOICES is a novel intervention for the sickle cell community and with further finetuning based on findings in this and previous studies, CHOICES will be an acceptable means of communicating such pertinent information to a population at risk of passing on a genetically inherited disease.

Our study will serve as a unique addition to the growing literature on sickle cell reproductive health research and online intervention engagement research by giving new insights to the factors that predict young adults' engagement with online sickle cell reproductive health education. Although there were some setbacks in our measurement of engagement, our use of engagement time as characterized by the time used relative to average length of time required to complete the intervention was a unique measure that provided insight into how participants interact with interventions by reading, listening, or doing both. This study also indicates the need for further research with this population to provide deeper understanding of their engagement with online interventions and thus increase the usefulness of such online programs within the community.

4.4. Conclusion

In conclusion, this study revealed some factors associated with the engagement of young adults with a web-based sickle cell reproductive health education intervention. Factors such as gender, sickle cell status, and delivery modality, which were significant predictors of engagement, offer clues for future studies, such as introducing digital human communication strategies for future web-based interventions. Also, there is a need to include cognitive assessments in future educational studies within this population. These findings indicate that further fine-tuning of the CHOICES intervention is necessary to facilitate optimal knowledge gain since more engagement was significantly associated with higher knowledge scores. Lastly, this is one of the first studies within the sickle cell population focused on intervention engagement. Future studies are necessary to further investigate other unmeasured factors associated with web-based intervention engagement, such as the level of cognition of participants and intervention elements as interactivity or gamification.

At this stage of our research, findings provide useful considerations for clinicians as they provide reproductive health education and patient resources. Such education and resources must be tailored as specifically as possible to the unique characteristics of participants such as gender, sickle cell status, marital status, and cognitive ability. As we continue to fine-tune our intervention based on these findings, we believe that CHOICES, a potentially

highly engaging, patient-centered, reproductive health education resource, will be available for clinicians to share with individuals with SCD and SCT.

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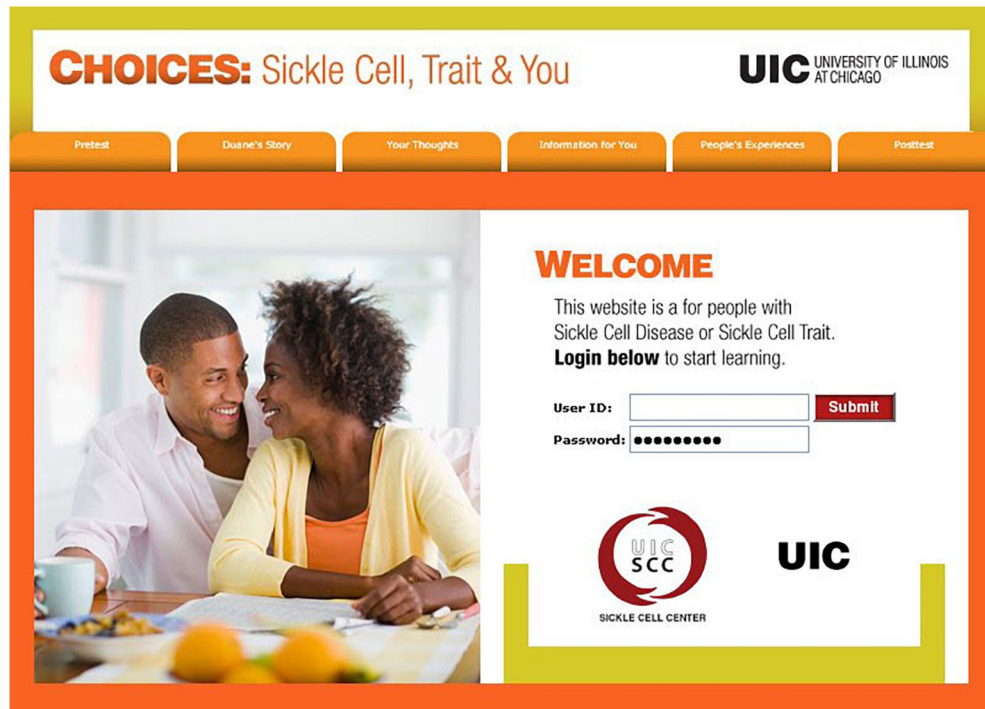


Fig. 1. Intervention login page which displays intervention sections Copyright 2021 D.J. Wilkie & A.M. Gallo, used with permission.

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Table 1

Demographic variables of the entire sample and by delivery modality.

Characteristic	Category	Total Sample (N=167)		OL (n=54)		F2F (n=113)		p
		Frequency	%	Frequency	%	Frequency	%	
Gender	Female	113	68	43	80	70	62	.022
	Male	54	32	11	20	43	38	
Sickle Cell Status	Sickle Cell Trait	77	46	30	56	47	42	.090
	Sickle Cell Disease	90	54	24	44	66	58	
Partner Sickle Cell Status	At Risk	43	26	12	22	31	27	.471
	Not At Risk	124	74	42	78	82	73	
Education	High School Diploma	45	27	6	11	39	35	.001
	Greater Than High School Completed	122	73	48	89	74	65	
Marital	Not Married	146	87	46	85	100	88	.546
	Married	21	13	8	15	13	12	

Note. OL = Online; F2F = face-to-face.

Table 2

Descriptive results of continuous predictive variables.

Variable	Total Sample (N= 167)				OL (n=54)				F2F (n=113)			
	M	SD	Min	Max	M	SD	Min	Max	M	SD	Min	Max
Age	25.7	5.1	18	38	26.7	5.3	19	38	25.3	4.9	18	35
CAS-15	26.6	2.5	7	29	25.9	3.5	7	29	26.8	1.9	19	29

Note. OL = Online; F2F = face-to-face; CAS-15 = Computer Acceptability Scale 15 item score.

Table 3

Descriptive results of time used by demographic categories.

		Total Time Used (Minutes)				
		M	SD	Min	Max	p
Modality	OL	54.64	36.50	9.72	188.13	<.001
	F2F	76.82	32.44	7.97	179.27	
Gender	Female	72.65	34.52	14.67	188.13	.106
	Male	63.36	36.30	7.97	179.27	
Sickle Cell Status	Sickle Cell Trait	66.01	33.16	11.82	188.13	.253
	Sickle Cell Disease	72.76	36.87	7.97	179.27	
Partner Sickle Cell Status	At Risk	69.93	29.59	14.67	137.97	.639
	Not At Risk	69.55	37.14	7.97	188.13	
Education	High School Diploma	68.32	34.70	9.72	170.32	.864
	Greater Than High School Completed	70.14	35.60	7.97	188.13	
Marital Status	Not Married	67.68	34.30	7.97	188.13	.074
	Married	83.31	39.59	14.67	163.90	

Note. OL = Online; F2F = face-to-face.

Table 4

Distribution of categorical independent variables in the various time categories (dependent variable).

	Estimate Time Categories											
	<25%		25%-49%		50%-74%		75%-100%		>100%			
	n	%	n	%	n	%	n	%	n	%	n	%
Modality												
	7	13	18	33	12	22	9	17	8	15		
	2	2	9	8	32	28	32	28	38	34		
Gender												
	2	2	19	17	28	25	32	28	32	28		
	7	13	8	15	16	30	9	17	14	26		
Sickle status												
	5	6	14	18	18	23	25	32	15	19		
	4	4	13	14	26	29	16	18	31	34		
Partner's Sickle Cell Status												
	1	2	8	19	8	19	14	33	12	28		
	8	6	19	15	36	29	27	22	34	27		
Education												
	4	9	5	11	14	31	8	18	14	31		
	5	4	22	18	30	25	33	27	32	26		
Marital												
	8	5	25	17	41	28	33	23	39	27		
	1	5	2	10	3	14	8	38	7	33		

Note. OL = Online; F2F = face-to-face.

Table 5

Regression effects of personal characteristics, CAS-15 score and modality on ordinal time used variable.

	Estimate	Std. Error	Wald	Odds Ratio	<i>p</i>
Age	-.012	.031	.142	.988	.706
CAS Score	.062	.058	1.148	1.064	.284
Modality (OL) ^a	-1.800	.344	27.306	.165	<.001
Gender (Female) ^b	.987	.330	8.919	2.682	.003
Sickle Cell Status (SCT) ^c	-.747	.316	5.602	.474	.018
Partner Sickle Cell Status (At Risk) ^d	.171	.335	.260	1.187	.610
Education (High School) ^e	-.443	.344	1.658	.642	.198
Marital (Not Married) ^f	-.793	.470	2.848	.453	.092

Note. CAS-15 = Computer Acceptability Scale; OL = Online; SCT = sickle cell trait.

^aReference group is F2F modality.

^bReference group is male.

^cReference group is SCD.

^dReference group is participants who have partner's that do not put them at risk for a child with SCD

^eReference group is greater than high school diploma.

^fReference group is married.