Understanding Undergraduate Students' eHealth Use and Views of the Patient-Provider Relationship

by

Michelle Anne Reyes

April, 2021

Director of Thesis: Dr. Heather Vance-Chalcraft

Major Department: Biology

eHealth, defined by WHO as "the use of information and communication technologies (ICT) for health", is an innovative tool which broadens accessibility of health information and communication between patients and physicians. It can be utilized as an at home method of learning medical information which is cost-effective and can be tailored to an individual's needs. Within the past few decades, eHealth has grown exponentially in usage alongside technology and has become more prevalent for individuals who are proactive in their health, but little is documented about how undergraduates use eHealth or view the patient-provider relationship. College students frequently use technology and have been assumed from previous studies to utilize eHealth due to convenience and comfort using technology. Little is known about the specific patient-provider relationship model for undergraduates, but a guardian or paternalistic relationship, in which medical decisions are dictated solely by the physician, has been identified as the traditional model with general populations.

This research used surveys and interviews to evaluate how undergraduates view eHealth and the patient-provider relationship. Using data from 527 students enrolled in introductory

biology lab courses, it was found that students are familiar with eHealth but prioritize medical information from their provider as their preferred medical source followed by information from family members. Most students indicated that they want their physician to act more as a counselor or advisor than a guardian. Racial and ethnic disparities were found in how comfortable students were with their medical provider, as well as how frequently the students experienced barriers in sharing health information with their provider. Whether the gender identity of the student matched that of their provider also significantly impacted the student's level of comfort with their provider. This research highlights how physicians and family have a greater influence on undergraduates' health decisions than information discovered through eHealth sources and demonstrates that undergraduates may view the patient-provider relationship differently than the traditional guardian or paternalistic model. In addition, it raises questions about how to reduce racial and ethnic disparities in the patient-physician relationship so that more undergraduates will be comfortable seeking medical advice from a physician, when needed.

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A Thesis

Presented To the Faculty of the Department of Biology

East Carolina University

In Partial Fulfillment of the Requirements for the Degree

Master of Science in Biology

by

Michelle Anne Reyes

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Michelle Anne Reyes

APPROVED BY:

DIRECTOR OF
THESIS

Dr. Heather Vance-Chalcraft, PhD

COMMITTEE MEMBER:

Dr. Jean-Luc Scemama, PhD

COMMITTEE MEMBER:

Dr. Annette Greer, PhD

COMMITTEE MEMBER:

COMMITTEE MEMBER:

COMMITTEE MEMBER:

CHAIR OF THE DEPARTMENT
OF
Biology

Dr. John Stiller, PhD

DEAN OF THE
GRADUATE SCHOOL:

Paul J. Gemperline, PhD

ACKNOWLEDGEMENTS

First, I would like to graciously thank my advisor and mentor Dr. Heather Vance-Chalcraft for all the hard work she has put into my research and thesis, but also my personal and professional development. She has been my advocate since I was an undergraduate at East Carolina University, so I would not be here if it weren't for her kindness and encouragement along the way. In addition, I would like to thank my lab members and their continued support through my research process. Their knowledgeable advice and assistance during my research has helped me along the way and I can't thank them enough for their support.

Second, I would like to thank my committee for assisting me through my research process. I appreciate all the time they have taken out of their days to help me with my thesis and the advice they have given me along the way.

Finally, I would like to thank my mom for her continued support through my academic career and encouraging me to pursue education even if the road has been challenging. I also would like to thank my partner for being my biggest cheerleader and for giving me confidence every time I start to doubt myself.

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CHAPTER 1

I. Introduction

Within the past few decades, eHealth has fundamentally changed health communication between medical professionals and patients by offering an avenue of communication outside of the medical office. The World Health Organization (WHO | eHealth, n.d.) defines eHealth as "the use of information and communication technologies (ICT) for health". The prevalence of eHealth has skyrocketed within the last couple of decades since its emergence in the late 1980's, having the advantages of being a relatively cost-efficient source of health information which can be tailored to an individual based on their search needs (Basch et al., 2018; Escoffery et al., 2005; Evers, 2006; Neuhauser & Kreps, 2010). Individuals may rely on technology to access and research health information so they can make reflections on their health and communicate it to others in their own way (Andreassen et al., 2006). Previous studies have shown that women, minorities, and young adults are more likely to use eHealth compared to other populations, making a "digital divide" between online and offline health information seekers (Asan et al., 2018; Bidmon & Terlutter, 2015; Britt et. al, 2017; De Rosis & Barsanti, 2016; Mistutake et al., 2016). On the contrary, patients may avoid using eHealth based on their time availability, doubt of information accuracy, or inability to search health related information on their own.

The current COVID-19 pandemic illustrates the importance of understanding eHealth usage and eHealth literacy as health information has been in high demand, but available online sources differ widely in the accuracy of the information provided. As social distancing and other restrictions have limited the options for in person interactions, an alternative method of health communication between patient and physicians arose through telehealth. Telehealth offered an

avenue of communication between the patient and provider from the convenience and safety of their home and served as another eHealth resource for individuals.

I-A: eHealth Literacy

While the ability to access eHealth provides an opportunity for individuals to have greater input in their medical decisions, this benefit cannot be realized if the information is not appropriately understood and interpreted by the patient. eHealth literacy has been defined by the US Department of Health and Human Services (Health Literacy | health.gov, n.d.) as "the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions". This definition has been further extended by Norman and Skinner (2006) to say eHealth literacy is "the actual ability to seek, find, and make use of online health information". The relationship between eHealth and eHealth literacy is crucial for the individual receiving health information because it ensures they are finding trustworthy information online and understanding it appropriately. Previous studies (Britt & Hatten, 2013; Hanik, 2011; Kim & Son, 2017) have shown that the average health literacy of most individuals is quite lacking in which they use sources which are unreliable or inaccurate. Thus, expert medical and educational organizations began to create more credible eHealth sites and offer training to teach individuals about appropriate health seeking behaviors through online programs.

Universities have been encouraged to teach undergraduate students about appropriate health seeking behaviors, including appropriate use of eHealth (Britt & Hatten, 2013). These efforts have resulted in the incorporation of health education modules or introductory health courses offered at almost every college or university with the purpose of showing students the broad strokes of important health topics (Escoffery et al., 2005; Evers, 2006). The eHealth

literacy of undergraduate students has been documented through previous studies which measured their perceived and actual literacy. The eHealth literacy of undergraduate students varies internationally and by student characteristics. The perceived eHealth literacy score of students in Japan had a range of 2.3 – 3.6 out of a possible 5 and students in Jordan had an overall mean score of 3.62 (Tubaishat & Habiballah, 2016; Tsukahara et. al., 2020). American undergraduate students are documented to have an average overall score ranging from 3.99 to 4.43, but vary with the types of students being surveyed (older vs. younger, male vs. female, etc.) (Britt & Hatten, 2013; Robb & Shellenbarger, 2014). It has been hypothesized that individuals majoring in health intended fields would have greater perceived eHealth literacy scores, but that has been contradicted by multiple studies which showed the perceived eHealth literacy of students were similar regardless of their major (Britt & Hatten, 2013; Brown & Dickson, 2009; Hanik, 2011; Tsukahara et. al, 2020.).

I-B: Patient-Provider Relationship

Just as little information is known about undergraduates' eHealth usage, student views of the patient-provider relationship are not well understood. Models of the physician-patient relationship have been described by Emanuel and Emanuel (1992) and Szasz and Hollender (1956). Emanuel and Emanuel (1992) described the physician-patient relationship with four distinctive models: guardian/paternalistic model, a counselor or advisor/interpretive model, a friend or teacher/deliberative model and a technical expert/informative model. Similarly, Szasz and Hollender (1956) described the physician-patient relationship with three distinctive models: activity-passivity, guidance-cooperation, and mutual participation. The commonality among most these models of the physician-patient relationship is that patients are viewed as static or 'childlike' (Grunloh et. al., 2018). These models, however, may not reflect the relationship well

in an era of information gathering by patients, in which the patients need to be reconsidered as individuals capable of taking charge of their health.

This active participation in health care has transformed many patients into ‘consumers’ and has affected two aspects of the doctor-patient relationship: roles and involvement (Grunloh et. al., 2018; Salimzadeh et. al., 2016). Physicians view their role as the one who takes on the responsibility, determines treatment options, and is trustworthy while involvement refers to the aspects which support or deter patients from taking an active role in their care. The role of a physician is directly affected by the involvement of the patient which has become more apparent with the inclusion of eHealth. Andreassen (2006) states that patients are willing to communicate health concerns and information with their physician when there is pre-existing trust in that individual and that this conveyed information gives the patient a sense of relief for not having sole responsibility of their health decisions.

There has been a gradual increase in patient involvement with approximately 28% - 41% of individuals who search the internet for health information sharing it in conversation with their physician (Bylund et al., 2007). This increase in patient involvement has been embraced by some physicians while others have reported it to be extra work (Grunloh et. al., 2018). Gunloh et al. (2018) noted that some medical professionals have felt undermined or challenged when a patient brings in outside information to their appointments. Health care professionals may face obstacles such as a desire to maintain control, lack of time, personal beliefs, and insufficient training in the patient-caregiver relationship. The disconnect between some physicians and patients has been attributed to the medical training they received which historically emphasized the importance of diagnosis and treatment instead of interpersonal and cultural aspects (Lazarus, 2013). Even those

that welcome greater patient involvement may do so while exhibiting characteristics of the "paternalistic model" (Grunloh et. al., 2018).

Proactive patients, although sometimes lacking in health literacy, may have curiosity in their heath conditions and will seek out eHealth prior to appointments or consultations. This information gathering gives patients a sense of control and empowerment and may increase their involvement in decision making and problem solving (Grunloh et. al., 2018; Santana et al., 2011). Bylund (2007) found that patients felt satisfaction from interactions with their physicians if their physicians demonstrated that they took the information seriously by validating or disagreeing with the information.

Individuals who have had higher education are regarded as frequent users of eHealth, more likely to have shifted from relying on a health provider for all health information to having multiple sources of health information due to being able to access health information at home. Thus, they may view physicians in a less paternalistic manner. Undergraduate students have multiple motivations for using eHealth which stem from busy schedules and comfort with convenient, online information. Students may also be motivated to empower themselves by taking accountability for their own health (Santana et al., 2011). Little is known, however, about how undergraduates view the patient-provider relationship.

I-C: Patient Comfort Level and Trust with Their Provider

A patient's level of comfort and trust with their provider is dependent on many factors such as patient needs and whether those needs are met, environmental factors, the patient's perception of their health issues, demographic differences with their medical provider, and whether they have a prior relationship with the medical provider they are seeing (Haywood et.

al., 2010; Nural & Aklan, 2018). Similarly, medical providers who have less experience in treatment may reduce overall patient comfort and trust, but experience is more relevant when the disease or symptom being treated has a greater severity level (Lin, 2015; Nural & Aklan, 2018; Whiteman et. al., 2015). Understanding patients' comfort and trust levels may help in understanding the type of patient-provider relationship patients want as well as the perception they have of their medical provider. Little is known about these issues in populations such as undergraduate students.

I-D: Research Questions and Hypotheses

The purpose of this research is to understand undergraduate students' eHealth usage and their views of the patient-provider relationship. Three predictions were made about this research. First, based on prior literature, undergraduate students will have high eHealth usage and students in pre-health majors will have similar perceived health literacy scores to those in non-health related majors. Second, undergraduate students and their provider will have and want the "Counselor/Advisor" model of the patient-provider relationship instead of the traditional "Guardian/Paternalistic" model due to undergraduate students' use of technology and desire for patient autonomy. Third, students who are more confident sharing eHealth information with their provider will feel more comfortable with their provider.

II. Methods

This study used a mixed methods research approach, combining both quantitative data in the form of survey responses and qualitative data in the form of interviews. The goal of the survey was to capture undergraduate students' demographics, their eHealth usage, perceptions of their eHealth literacy, and information regarding the relationship and level of comfort they have

with their provider. Interviews were conducted for the purpose of gaining a better understanding of more specific topics such as eHealth definition and use, barriers which may impede the patient-provider relationship, and the rationale behind the patient-provider relationship the students had or wanted.

II-A: Survey Creation

A survey was created using a combination of original questions and questions from a validated survey of perceptions of eHealth literacy, called the eHEALS (Appendix A). The original survey questions were formulated to capture respondent demographics (gender identity, race/ethnicity, pre-health intended major, etc.) and information focused on their relationship with their medical provider. Additional questions asked about the information sources individuals used when making decisions about their health and barriers impacting their comfort with their medical providers. To validate the survey, five experts reviewed and provided feedback on the wording and importance of the original questions. After making revisions based on expert feedback, five undergraduates completed the original survey questions and then described how they interpreted each of the questions. Additional revisions were completed for clarification prior to distribution for data collection.

In addition to the author-generated questions, the survey included items related to students' perceptions of their eHealth literacy. These items were drawn from eHEALS, an 8-item published instrument (items denoted by * in Appendix A) designed to measure an individual's perception of their knowledge and ability to find electronic health information and apply that information to health issues (Britt & Hatten, 2013). This scale was developed by Norman and Skinner (2006) to assess eHealth literacy by providing a general estimate of one's perceived eHealth-related skills used to make decisions for an individual or population. The items on

eHEALS are answered on a 5-point Likert scale ranging from “strongly disagree” to “strongly agree” (Appendix A). eHEALS was incorporated into this research study because it was one of the only tested methods of measuring eHealth literacy and was shown to be reliable through item analysis on the 8-item scale at baseline, producing a scale with $\alpha = 0.88$ (Norman & Skinner, 2006). Further, this scale has been validated by two additional research studies which have shown that the internal consistency of the scale was high ($\alpha = 0.93$ and $\alpha = 0.92$) and that there were no concerns for multicollinearity ($\alpha = 0.94$) (Chung & Nahm, 2015, Vaart et. al., 2011). The eHEALS has been shown to be an appropriate measure for populations of various ages.

II-B: Study Population, Survey Distribution, and Data Collection

Undergraduate students were chosen for this research study because they represent a group of young adults who are transitioning out of adolescence. This population may not have had a lot of experience with independently making health decisions, so it important to understand what their perspective is on the patient-provider relationship and eHealth especially since little has been documented about the patient-provider relationship for undergraduate students.

This study focused on undergraduate students in three laboratory courses at East Carolina University, Greenville NC. These three courses included General Biology Lab for non-science majors (BIOL 1051), Principles of Biology Lab 1 for science majors (BIOL 1101), and Principles of Biology Lab 2 for science majors (BIOL 1201). These classes had a combined enrollment of 666 students at the time of data collection. The undergraduates enrolled in these courses are representative of ECU undergraduates with diverse class ranks, ages, and intended majors. The author-generated items and eHEALS items were combined into a single survey that was administered electronically through Qualtrics to students in these three lab classes during the first semester block of Fall 2020. IRB approval (UMCIRB 20-001788) was received to conduct

this research and students were asked to consent to participate at the beginning of the Qualtrics survey. Students were offered extra credit for opening the survey, even if they did not consent to participate in the research study.

II-C: Survey Data Analysis

Survey responses were imported from Qualtrics (Qualtrics International) to an Excel (Microsoft Corporation) spreadsheet and filtered to discard incomplete or invalid responses. Surveys which were not completely filled out were discarded and if a student had multiple responses, only the initial survey was retained. After removing problematic surveys 527 responses remained for analysis. Any information that could be used to identify a respondent was removed and each respondent was assigned a unique random number as an identifier. Only deidentified data was used for analyses. The cleaned, deidentified data set was imported into SPSS (IBM) for analysis. All Likert scale results were reversed to make the direction of the scores match the intuitive interpretations (e.g., higher Likert score means higher eHealth usage rather than lower). Descriptive statistics were calculated for each question and comparisons were made between different subgroups using t-tests and ANOVAs.

Calculations included the average eHealth usage by undergraduates, as well as their mean perceived eHealth literacy, as measured on the eHEALS items. To calculate the mean perceived eHealth literacy of students, the means of each eHEALS item was calculated. The means of the 8 items were averaged together to find the overall mean eHealth literacy score of each student. Separate ANOVAs were run to determine if the level of student eHealth usage varies with different student characteristics, including having a primary care provider, gender identity, major, race and ethnicity, whether they had taken an introductory health class, and confidence of sharing health information with their medical provider.

Separate ANOVAs were used to determine whether the perceived eHealth literacy differed based on student major (pre-health or not), whether they had taken an introductory health class, whether they used health websites as a source of health information, or by student race and ethnicity. A one-sample t-test was used to determine whether there were significant differences in student preferences for the various patient-provider relationship models, and another t-test to test whether they felt there were differences in how common each patient-physician relationship models was. ANOVA was used to determine if students perceived their relationship with their provider to have changed based on their use of eHealth sources.

Moreover, separate ANOVAs were used to determine if there were significant differences in the level of comfort a student has meeting with their physician based on various student characteristics, including having a pre-existing health condition, having a primary care provider, race and ethnicity, and confidence about sharing health information with their medical provider, as well as whether the gender of the medical provider matched that of the undergraduate student. Finally, separate ANOVAs were used to determine whether students perceived barriers to sharing health information with their providers based on student race and ethnicity or whether they share the same gender identity as their provider.

II-D: Interview Selection and Collection

A subset of survey respondents was contacted with an invitation to complete a follow up interview. Respondents were emailed in alphabetical groups based on last names until all interview slots were filled on a first come, first serve basis. The goal of the interviews was to clarify the themes resulting from the survey, such as additional factors that can influence the patient-provider relationship and how individuals view eHealth through their own words and experiences. Students were able to describe their patient-provider relationship more fully and the

relationship style they wanted to have. The semi-structured interviews were guided by six original discussion questions and followed up with additional clarifying or probing questions, as needed. Interviews were conducted through Cisco WebEx in January and February 2021, taking approximately 15-20 minutes each to complete. Notes were taken during each interview and reviewed afterwards to ensure information captured was appropriate. Students who completed the survey were awarded a $20 Amazon gift card for participation.

III-E: Interview Analysis and Coding Methodology

Interview notes were analyzed using NVivo (QSSR International). A list of initial codes was generated using information from the published literature and the survey information. Additional codes were added, as needed, based on reviewing the interview notes. After a codebook was created (Appendix B), the author and a colleague coded 25% of transcripts, using the revised codebook. Interrater reliability between these two coders was calculated using kappa coefficient. Disagreements in coding were resolved through discussion and assistance of a third party before revising the codebook, coding another interview, and repeating the kappa coefficient. Once a high inter-rater reliability was achieved (kappa = 0.8653), the remaining interview notes were coded by the author and synthesized to identify overarching themes.

III. Results

III-A: Survey Data Results

The survey received over 500 usable responses from undergraduate students, for a response rate of 79.1%. Many of the survey participants were 18 – 20 years old, freshman, female, and white (Table 1). Approximately half of the students intended to major in a pre-health discipline (58.3%), and most did not have a pre-existing health condition (81.2%). It was found

that 69.1% of undergraduate students shared the same gender identity as their primary care provider. The demographic characteristics of our survey participants were found to be representative of the student population at ECU. In the overall ECU population during the Fall 2020 semester, approximately 58.3% of students identified as female and 41.7% of students identified as male (ECU Fact Book), whereas 62.4% of survey respondents identified as female and 37.6% of respondents identified as male. The overall undergraduate population at ECU had 64.1% of students who identified as White, 16.7% of students who identified as Black or African American, and 8.1% of students who identified as Hispanic or Latino in Fall 2020 (ECU Fact Book), while 61.7% of survey respondents identified as White, 19.9% of respondents identified as Black or African American and 7.7% of respondents identified as Hispanic or Latino (Table 1).

The most prioritized sources of health information students reported using were their medical provider, a family member, and an online source such as a health information website (Table 2), with a majority of students (74%) indicating they looked up online sources at least occasionally when making decisions about their health (Table 3). Undergraduate students' eHealth usage did not significantly differ based on whether the student had a primary care provider ($F_{2, 524} = 0.868$, $p = 0.420$) or by the gender of the undergraduate student ($F_{3, 523} = 0.414$, $p = 0.743$). Levels of eHealth usage also did not differ between students in a pre-health intended major and those in other majors ($F_{1, 525} = 0.783$, $p = 0.377$). On the contrary, the level of eHealth usage significantly differed based on the race and ethnicity of the undergraduate students (Figure 1; $F_{7, 519} = 2.251$, $p = 0.029$). A Fisher's LSD test of multiple comparisons showed that white students had significantly lower eHealth usage than Asian ($p = 0.021$) or African American students ($p = 0.003$). In addition, there was a trend for students who have had an introductory

health class to use eHealth more frequently than those who have not had an introductory health class in college or university ($F_{2, 524} = 2.786$, $p = 0.063$). Undergraduate students who reported feeling confident sharing information they find online with their providers were more likely to be higher eHealth users (Figure 2; $F_{1, 525} = 16.125$, $p = 0.000$).

The eHEALS scores (a measure of perceived eHealth literacy) of undergraduate students who were intending to major in a pre-health discipline did not differ from students who were not pre-health ($F_{1, 525} = 1.078$, $p = 0.300$), with students having an average eHEALS score of 2.71 (Table 4). eHEALS scores also did not differ significantly based on whether students had taken an introductory health class in college/university ($F_{2, 524} = 0.416$, $p = 0.660$), whether they used health websites as a source of health information ($F_{6, 520} = 0.778$, $p = 0.587$), or by student race/ethnicity ($F_{7, 519} = 0.500$, $p = 0.835$).

Regarding their medical provider, 83.7% of survey respondents indicated they have a primary care physician. Students reported that they thought the "counselor/advisor" patient-provider model was most common (56.5%) ($t_{526} = 67.350$, $p = 0.000$) and responded that it was the patient-provider relationship model they wanted most (58.3%) ($t_{526} = 79.722$, $p = 0.000$) compared to the other possible models (Table 5). A narrow majority of students (50.7%) reported that they share the information they find online with their provider and most (74.6%) feel confident doing so. Additionally, respondents indicated that they did not think that accessing online health sources had changed their relationship with their medical provider (67.2%). However, whether the student perceived their relationship with their provider to have changed based on accessing eHealth sources depended on whether the student and physician shared the same gender identity (Figure 3; $F_{1, 525} = 6.695$, $p = 0.010$). Students whose gender identity was the same as their provider were significantly more likely to indicate their relationship had not

changed due to access to eHealth. In general, though, most respondents indicated that they are very comfortable all the time (48.8%) or almost every time (39.7%) they meet with their physician. Students who have a pre-existing health condition were not significantly more or less comfortable when meeting with their medical provider ($F_{2, 523} = 0.927$, $p = 0.397$) than people without a pre-existing condition. Students who have a primary care provider, though, are significantly more comfortable with their provider than those who do not (Figure 4; $F_{2, 524} = 13.903$, $p = 0.000$). The level of comfort a student reported to have with their provider varied with the student's race and ethnicity (Figure 4; $F_{7, 519} = 1.973$, $p = 0.057$). A Fisher's LSD test of multiple comparisons showed that Black/African American students were significantly less comfortable with their providers than Asian students ($p = 0.016$). Not surprisingly, respondents who feel confident when sharing information from online sources with their physician are also those who feel significantly more comfortable meeting with their provider (Figure 4; $F_{1, 525} = 51.468$, $p = 0.000$). Students with the same gender identity as their provider felt significantly more comfortable with their provider than those who had a different gender identity (Figure 4; $F_{1, 525} = 7.601$, $p = 0.006$).

Whether students reported barriers to sharing health information with their providers varied by student race and ethnicity (Figure 5; $F_{7, 519} = 2.630$, $p = 0.011$). A Fisher's LSD test of multiple comparisons indicated that black/African American students reported more barriers than did white students. Students who share a gender identity with their physician were equally likely to report barriers sharing health information with their provider as students who have a different gender identity from their provider ($F_{1, 525} = 1.649$, $p = 0.200$).

III-B: Interview Data Results

Interviewees generally reflected similar demographics as survey respondents (Table 6). The final codebook had nine different codes (Appendix B) which captured aspects of the patient-provider relationship, eHealth sources used, and the influence of the COVID-19 pandemic on eHealth usage and the patient-provider relationship. These nine codes were synthesized into three broad themes: Professionalism, Information Accuracy, and Relationship Status. Professionalism was identified due to the frequency of the nodes PRO and PANDEMIC. This theme identifies how undergraduate students' value the professionalism physicians can provide when making decisions about their health, but due to COVID-19 and pandemic restrictions, students have indicated how difficult it can be to talk and connect to their physician. Students described that they felt making health decisions was easier with a physician because they are the 'professionals' and have better expertise knowledge on health information. On the contrary, due to the inability to see their provider in person and relying more on virtual meetings such as telehealth, students have described the decision-making process to be more difficult. Many interviewees recounted telehealth as an inadequate form of communication with their provider especially when they are trying to be diagnosed. An interviewee stated that 'going in person' is a better alternative to telehealth because is it more personal and 'more can be accomplished' regarding being diagnosed or getting a check-up, although they recognize that telehealth is a safer alternative due to the current pandemic.

A second theme identified from the interviews was Information Accuracy due to the frequency of the nodes SOURCE: INT and INFO DOUBT. This theme identifies the perception from undergraduate students that the information they are obtaining through online sources lacks credibility in comparison to health information they obtain from their medical provider. Several interviewees mentioned that the ability to look up information at home is beneficial for them

because it lets them learn more about the health topic of concern, but they feel anxious that they may unwittingly obtain misinformation. Due to this information doubt in online health resources, students try to verify the information they have seen online with their medical provider.

A final theme identified from the interviews was Relationship Length due to the frequency of the nodes RS: PHY, + ENCOURAGEMENT, COMFORT. The length of the relationship between the undergraduate student and their medical provider influenced how much positive encouragement they received from their provider to utilize eHealth as well as how comfortable a student was when meeting with their physician. Interviewees who reported having a long-term relationship with their medical provider (i.e., since childhood) stated that they were more likely to discuss eHealth information with them.

IV. Discussion

This research study sought to understand undergraduate students' use of eHealth and their perception of the patient-provider relationship. The research study tackled three specific hypotheses: 1) Undergraduate students will have high eHealth usage and students in pre-health majors will have similar perceptions of their health literacy as those in non-health related majors, 2) Undergraduate students will want the "Counselor/Advisor" model of the patient-provider relationship instead of the traditional "Guardian/Paternalistic" model due to undergraduate students' use of technology and desire for patient autonomy, and 3) Undergraduate students who are more confident sharing online health information with their providers will be comfortable with their provider.

In this study, the majority of students reported looking up online health resources. Previous studies have shown that undergraduate students more frequently use eHealth

information and resources compared to other age groups due to their access to technology and ease of use (Bidmon & Terlutter, 2015; De Rosis & Barsanti, 2016). Students who have had an introductory health course before were more likely to use eHealth in comparison to those who have already, or are currently enrolled in, a health course. It is possible that students are made more aware of online health sources through these courses and are therefore more likely to consult them after taking the course. For example, topics such as sexual health and drug abuse are some of the eHealth topics most commonly searched by college students and are also frequently covered topics in introductory health courses at colleges and universities (Escoffery et. al., 2005).

The analyses indicated that white students are less likely to use eHealth over Asian students and Black or African American students. This contradicts what has been found in previous studies which have shown that white students were more likely to use eHealth than their peers (Britt et al., 2017; Reiners et al., 2019). It is possible that minority students used eHealth sources at a higher rate than white students because they were less comfortable with their provider and felt more frequent barriers to sharing health information with their provider, specifically Black or African American individuals who perceive their provider to have biases against them (Kanter et. al., 2020). If the provider lacks cultural sensitivity, the patient-provider interactions may be unappealing to patients and reduce patient comfort and trust (Tucker et. al., 2014). Thus, minority students may try to reduce the need to visit their provider by accessing health information online.

Similar to previous studies which highlighted that undergraduate students had a perceived eHealth literacy score average around three (Britt & Hatten, 2013; Robb & Shellenbarger, 2014), our undergraduate students for both intended pre-health majors and non-health related majors

had scores just under three. Thus, the hypothesis that pre-health and non-pre-health majors would have similar perceived eHealth literacy scores was supported. The perceived eHealth literacy scores did not vary based on student major or whether they had taken an introductory health course at college or university. This could imply that the introductory health courses offered in higher education are not sufficient in giving students confidence in their ability to properly find and evaluate health information online.

There are advantages and disadvantages to students using eHealth as a health information resource. Students can utilize eHealth to access information on specific topics which cater to their interests and health needs with ease due to technology and the fact that they are able to use eHealth from the comfort of their home (Basch et al., 2018; Escoffery et al., 2005; Evers, 2006; Neuhauser & Kreps, 2010). On the other hand, students run the risk of finding low quality information, lacking training to use eHealth services, , and increasing the risk of developing cybercondria which refers to an increase in the level of anxiety concerning an individual's own health as a result of seeking health information online (Ariens et. al., 2017; Vâjâean & Bãban, 2015).

These students indicated most frequently that they want a "counselor/advisor" model of relationship with their medical provider. This result differs from previous literature which has stated that adults commonly have a "guardian/paternalistic" relationship model with their physician (Grunloh et. al., 2018). The shift in the patient-provider relationship may be accounted for by the recent increase in accessibility to health information leading to a desire for greater patient autonomy. These characteristics are mentioned as important factors in challenging the traditional dynamic between a patient and provider because as patients take more responsibility, they allocate less decision making to the provider (Grunloh et. al., 2018). The

"counselor/advisor" relationship model reflects shared decision making where patients are able to make their own decisions about their treatment (Bernabeo & Holmboe, 2013). Through shared decision making, the patient and provider work collaboratively to make health-related decisions, but there are concerns with how effective this process is due to the need to have both patient and provider competencies such as knowledge, skills, and attitudes. Alternatively, the difference between the preference for a "counselor/advisor" model in undergraduates and the previously reported "guardian/paternalistic" relationship for adults may reflect a difference between undergraduate populations and other adult populations. Future research will be needed to clarify this distinction.

The survey results indicated that undergraduate students did not perceive that their use and access of online health resources influenced their patient-provider relationship. On the contrary, interviewees reported that there has been a change in their relationship with their medical provider due to the transition to online appointments in place of regular in-person appointments due to the COVID-19 pandemic. With this transition, students felt that the lack of face-to-face meeting with their physician caused communication issues between the patient and provider. Students stated that they felt that their relationship with their provider was insufficient because of their inability to see the physician in person which reduced their accessibility to the physician as a source of health information. The online appointments may cause a gap in the relationship between patient and provider in which patients may feel like they are less likely to receive the advice or counseling they desire over the phone or video chat in comparison to an in-person appointment with their physician.

Most undergraduate students indicated that they were comfortable with meeting with their providers. In the interviews, students expressed that they felt physicians were better able to

diagnose and treat problems in person than online through telehealth appointments. Since students feel comfortable with their physician, they are less likely to delay or avoid seeing a health care professional or withhold health information from their medical provider. Thus, their health conditions are less likely to go untreated or undiagnosed. Students may be more likely to avoid physicians during the COVID-19 pandemic, however, due to a desire to avoid telehealth appointments. Future research will be needed to determine if students have delayed medical appointments during the pandemic, and if so, whether that has long-term health consequences.

Students reported feeling more comfortable meeting with their medical provider when their gender identity matched that of their provider. This comfort may stem from empathy as they perceive their medical provider to better understand what they are going through than if their provider is of a different gender identity (Nolen et. al., 2016). The same may be true for patients who share the same racial or ethnic identity as their medical provider (Beach et. al., 2011). Previous literature has shown that patients who share similar characteristics as their medical provider are more likely to trust and be comfortable with that medical provider because of shared experiences (Derose etl al., 2001; Mainous et. al., 2004), but it has been shown to matter more to female patients than male patients.

Black students also reported more barriers in comparison to white students when it comes to talking to their medical providers about health information. This difference may be due to the medical provider not being the same gender identity and racial or ethnic identity as the patient as well as if that patient has a negative family history with medical providers. Previous studies have highlighted that race may impact the quality of communication in patient-provider relationships (Beach et. al., 2011). Generational trauma and perceived microaggressions can play a huge role in patient trust and comfort during medical appointments and is commonly found in black

populations due to medical mistreatment of that community (Goosby & Heidbrink, 2013; Kanter et. al., 2020). To reduce future health disparities and encourage more patient comfort, medical providers can promote open communication with the patient and encourage them to voice their concerns if they are uncomfortable. Similarly, medical providers can provide patients with resources or referrals to other medical providers if they feel like there is a gap in the service that they are able to provide due to differences such as gender or race/ethnicity. It has shown that racial/ethnic patients tend to have a stronger relationship with providers from their own race or ethnicity, but that most racial/ethnic minorities in the US do not see providers from their own race or ethnicity (Beach et. al., 2011). Medical providers who are receptive to a patient's discomfort can have a discussion with that patient to see if the discomfort is something they can reduce for future appointments (Bassett & Galea, 2020; Orsi et. al., 2010).

Within the past few decades, medical schools have incorporated cultural competency training to their curriculum to prepare students on treating a wide variety of individuals. Cultural competence has become a necessary part of medical education because schools want culturally sensitive future physicians who can bring awareness to health disparities (Swanberg et. al., 2015). This training is aimed to improve several topics such as physician-patient communication, collaboration, and patient satisfaction (Deliz et. al., 2019; Kripalani et. al., 2006). In addition to confronting cultural biases, these trainings challenge medical students to avoid assumptions about patients, as medical students have been shown to assume that patients do not understand medical information (LeBlanc et al., 2014). Competency trainings differ based on medical schools, with some focusing on specific populations such as those based on sociocultural factors and other schools focusing on more generalized training (Deliz et. al., 2019).

To increase perceived eHealth literacy, additional training may be needed for undergraduate students to feel more comfortable using appropriate online health information and form effective patient-provider relationships. In addition, medical providers should be aware of eHealth usage among young adults such as undergraduate students and attempt to use their medical expertise to inform discussions about online health information patients are bringing to them. Open discussions about eHealth with their provider may increase student confidence in their eHealth literacy.

This research study had several limitations. All data were self-reported by students and do not include independent tracking of eHealth usage or student interactions with their providers. In addition, similar to previous studies, students' competency accessing and using online health information was not tested directly, only students' perception of their eHealth literacy was. The study population came from a single university, which limits the inferences that can be made. Finally, these data were collected during the worldwide COVID-19 pandemic and may be influenced by this atypical event. Further research would benefit from surveying undergraduates at other universities, having additional eHealth literacy data that is not only based solely on student perception, and collecting data in non-pandemic times.

In conclusion, eHealth has made medical information accessible for many populations and has become an interesting topic to understand from the perspective of an undergraduate student. A finding was that undergraduate students' have an average or slightly low eHealth literacy score and that the patient-provider relationship model they most wanted was the "counselor/advisor" model. Undergraduate students would benefit from having additional training with utilizing and finding appropriate online health resources to boost their eHealth literacy score. Similarly, understanding that characteristics such as demographics and patient

comfort and trust are important factors that attribute to the relationship model. It is important to understand the perceptions undergraduate students' have of their medical providers as well as the relationship they have with them because it allows us to have insight on health disparities and gaps in knowledge these young adults may have about healthcare. Furthermore, it will help medical professionals and providers understand how they may improve their communication and interactions with students when they come in for appointments.

Table 1. Demographic characteristics of survey participants (N = 527).

	Number	%
Gender Identity		
Female	329	62.4
Male	196	37.2
Other	1	0.2
Do not wish to answer	1	0.2
Age		
18-20	472	89.6
21-24	45	8.5
25+	10	1.9
Class Rank		
Freshman	298	56.5
Sophomore	146	27.7
Junior	55	10.4
Senior	28	5.3
Racial/Ethnic Identity		
American Indian or Alaska Native	7	1.3
Asian	23	4.4
Black or African American	105	19.9
Hispanic or Latino	39	7.4
Native Hawaiian or Other Pacific Islander	2	0.4
White	325	61.7
Other	21	4
Do not wish to answer	5	0.9
Taken an Introductory Health Course?		
Yes	210	39.8
No	219	41.6
Currently Enrolled	98	18.6
Pre-Existing Health Condition?		
Yes	88	16.7
No	428	81.2
Do not wish to answer	10	1.9

Table 2. Number and percent of survey respondents indicating each ranking for sources they prioritize when making health decisions (1 = top priority, 8 = lowest priority).

Ranking	Family		Ranking	Social Media	
	Number	%		Frequency	%
1	118	22.4	1	2	0.4
2	207	39.3	2	5	0.9
3	140	26.6	3	26	4.9
4	48	9.1	4	32	6.1
5	9	1.7	5	113	21.4
6	2	0.4	6	252	47.8
7	0	0	7	89	16.9
8	3	0.6	8	8	1.5
	Friends			**Health Information Websites**	
	Frequency	%		Frequency	%
1	6	1.1	1	15	2.8
2	35	6.6	2	158	30
3	111	21.1	3	97	18.4
4	194	36.8	4	58	11
5	132	25	5	112	21.3
6	36	6.8	6	79	15
7	12	2.3	7	8	1.5
8	1	0.2	8	0	0
	Partner			**Television**	
	Frequency	%		Frequency	%
1	3	0.6	1	0	0
2	40	7.6	2	1	0.2
3	125	23.7	3	4	0.8
4	141	26.8	4	11	2.1
5	133	25.2	5	19	3.6
6	45	8.5	6	100	19
7	29	5.5	7	365	69.3
8	11	2.1	8	27	5.1
	Medical Source			**Other**	
	Frequency	%		Frequency	%
1	390	72.1	1	3	0.6
2	72	13.7	2	9	1.7
3	22	4.2	3	2	0.4
4	40	7.6	4	3	0.6
5	6	1.1	5	3	0.6
6	4	0.8	6	9	1.7
7	3	0.6	7	21	4

8	0	0	8	477	90.5

Overall Ranking	Mean Rank
1- Medical Provider	1.57
2- Family	2.32
3- Health Information Websites	3.69
4- Friends	4.09
5- Partner	4.27
6- Social Media	5.66
7- Television	6.69
8- Other	7.72

Table 3. Number and percent of respondents indicating how often they use online health sources when making decisions about their health.

	Number	%
All the time	38	7.2
Almost every time	83	15.7
Occasionally	269	51
Very seldom	122	23.1
Not at all	15	2.8

Table 4. Means of each eHEALS question and the average eHEALS score of students.

	Mean
Q1. I know how to find helpful health resources on the internet.	2.83
Q2. I know how to use the internet to answer my health questions.	2.79
Q3. I know what health resources are available on the internet.	2.76
Q4. I know where to find helpful health resources on the internet.	2.75
Q5. I know how to use the health information I find on the internet to help me.	2.72
Q6. I have the skills I need to evaluate the health resources I find on the internet.	2.69
Q7. I can tell high quality from low quality health resources on the internet.	2.94

Q8. I feel confident in using information from the internet to make health decisions.	2.22
Average eHEALS score:	2.71

Table 5. Number and percent of respondents indicating how common they think each type of patient-provider relationship is, and which model they want.

	Believe is Most Common		**Want**	
Relationship Models	**Number**	**%**	**Number**	**%**
Guardian/Paternalistic	84	15.9	41	7.8
Counselor/Advisor	298	56.5	307	58.3
Technical Expert	122	23.1	120	22.8
Friend/Teacher	23	4.4	59	11.2

Table 6. Demographic characteristics of individuals participating in an interview (N = 12).

	Number	%
Gender Identity		
Female	9	75
Male	3	25
Other	0	0
Do not wish to answer	0	0
Age		
18-20	11	91.7
21-24	1	8.3
25+	0	0
Class Rank		
Freshman	10	83.3
Sophomore	1	8.3
Junior	0	0
Senior	1	8.3
Racial/Ethnic Identity		
American Indian or Alaska Native	0	0
Asian	1	8.3
Black or African American	2	16.7

Hispanic or Latino	1	8.3
Native Hawaiian or Other Pacific Islander	0	0
White	6	50
Other	2	16.7
Do not wish to answer	0	0
Pre-Health Intended		
Yes	9	75
No	3	25
Taken an Introductory Health Course?		
Yes	2	16.7
No	7	58.3
Currently Enrolled	3	25
Pre-Existing Health Condition?		
Yes	1	8.3
No	10	83.3
Do not wish to answer	1	8.3

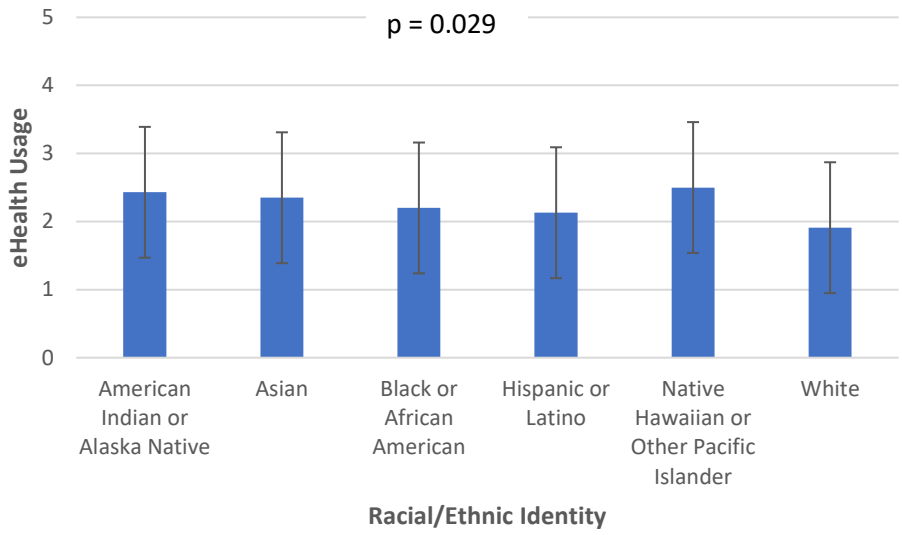

Figure 1. eHealth usage based on racial and ethnic identity (higher values correspond to higher eHealth usage).

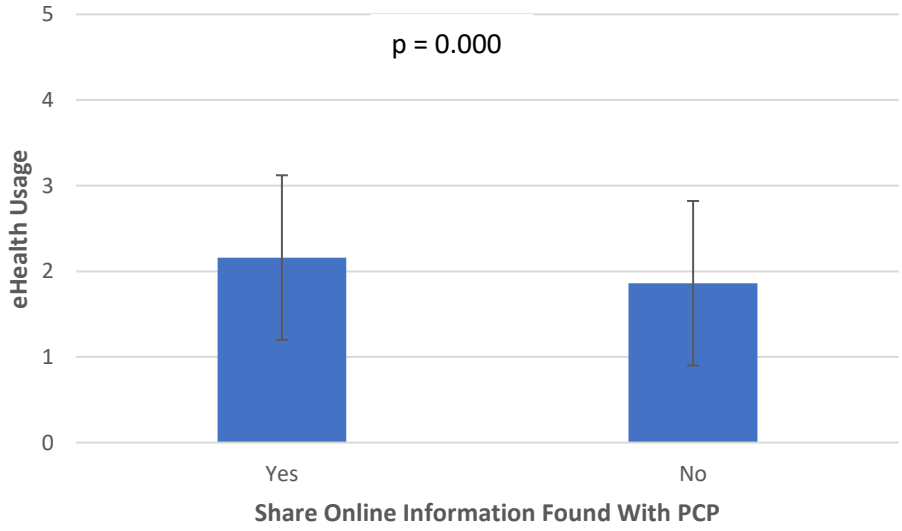

Figure 2. eHealth usage differed based on if a student shares online information they find with their medical provider (higher values correspond to higher eHealth usage).

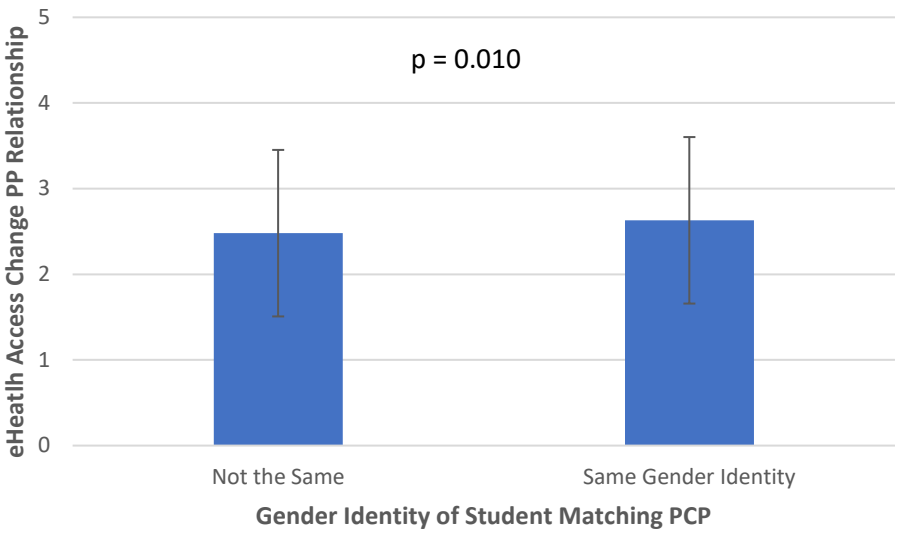

Figure 3. Whether students perceive their access to eHealth information has changed their patient-provider relationship differed based on if their provider has the same gender identity as the student (higher scores indicate less likely to have changed their relationship).

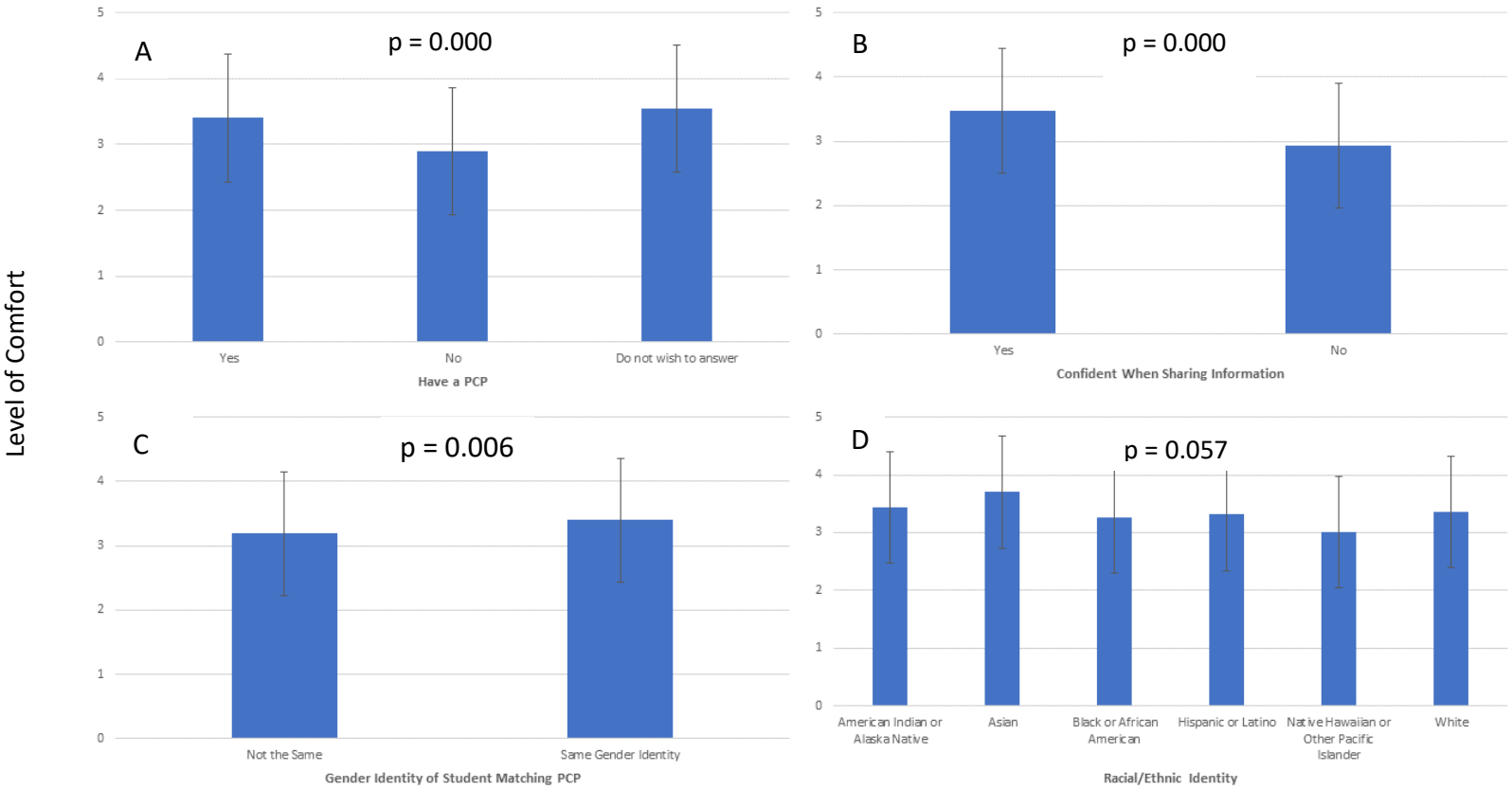

Figure 4. Relationship between the level of comfort (higher values mean a patient is more comfortable) students experience when visiting their medical provider based on A) if they have a primary care provider (PCP), B) if a student feels confident sharing online information they find with their medical provider , C) if the gender of the student and the medical provider match , and D) the racial/ethnic identity of the student.

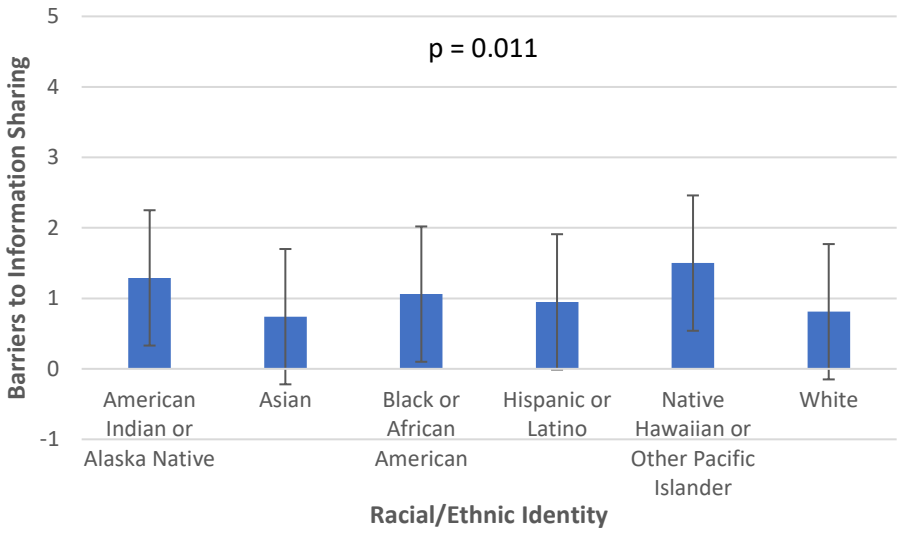

Figure 5. Students of different racial/ethnic identities perceive different frequencies of barriers to sharing health information with their medical provider (higher values indicate more frequent barriers).

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APPENDIX A: Survey Questions

Note: Likert scale survey questions were reversed before analyses to ease interpretation. For example, higher eHealth usage on the survey is indicated by lower Likert scales but in the analysis stage higher eHealth usage is reflected as a higher score.

1) What is your age?
    a) 18-20
    b) 21-24
    c) 25+
2) What is your class rank? (Based on semester hours)
    a) Freshman
    b) Sophomore
    c) Junior
    d) Senior
3) What is your gender identity?
    a) Female
    b) Male
    c) Other
    d) Do not wish to answer
4) What is your racial or ethnic identification?
    a) American Indian or Alaska Native
    b) Asian
    c) Black or African American
    d) Hispanic or Latino

e) Native Hawaiian or Other Pacific Islander

f) White

g) Other

h) Do not wish to answer

5) What is your major?

a) Enter data

6) Do you intend to pursue a health related career (medical, dental, physician assistant, physical therapy, occupational therapy, etc.)?

a) Yes

b) No

7) Have you taken an introductory health course at the university/college level (i.e., Health 1000 at ECU)?

a) Yes

b) No

c) Currently enrolled

8) Do you have any pre-existing health condition?

a) Yes

b) No

9) Where do you get your health information?

a) Online source

i) Enter if available

b) Personal source (family, friend, etc.)

c) Medical source (family doctor, physician, etc.)

d) School source (health center, health class, teacher, etc.)

10) When you look up health information, who is it for usually? (Mark all that apply)

a) Self

b) Partner

c) Friend

d) Family

e) Other

11) How often do you use online sources when making decisions about your health?

a) All the time

b) Almost every time

c) Occasionally

d) Very seldom

e) Not at all

12) Rank what sources you prioritize when making health decisions (1 = top priority, 8 = lowest priority)

a) Family

b) Friends

c) Partner

d) Medical provider

e) Online source: Social media

f) Online source: Health information websites (i.e., WebMD)

g) Television

h) Other

i) Enter data

13) How accurate do you believe your source of health information is?

a) Very accurate

b) Somewhat accurate

c) Average

d) Not every accurate

e) Not accurate at all

14) Do you believe you have the skills to understand and utilize the health information you gather from the internet?

a) Yes

b) No

15) Do you feel comfortable when you are meeting with a physician?

a) All the time

b) Almost every time

c) Occasionally

d) Very seldom

e) Not at all

16) What model of relationship do you believe most patient-physicians relationships follow?

a) Guardian/Paternalistic: Patient submits to objective/non-personal values while the provider acts as a guardian and decides all actions for the patient

b) Counselor/Advisor: Patient has some personal understanding relevant to medical care while the provider acts as a counselor or adviser

c) Technical Expert: Patient has choice of, and control over medical care while the provider acts as competent technical expert

d) Friend/Teacher: Patients have moral self-development relevant to medical care while the provider acts as a friend or teacher

17) What model of relationship would you like to have with your physician?

a) Guardian/Paternalistic: Patient submits to objective/non-personal values while the provider acts as a guardian and decides all actions for the patient

b) Counselor/Advisor: Patient has some personal understanding relevant to medical care while the provider acts as a counselor or adviser

c) Technical Expert: Patient has choice of, and control over medical care while the provider acts as competent technical expert

d) Friend/Teacher: Patients have moral self-development relevant to medical care while the provider acts as a friend or teacher

18) Has your ability to access online health sources changed your relationship with your physician or medical provider?

a) Yes

b) Somewhat

c) No

19) When/if you see a medical provider, do you consult with them about the information you find through online sources?

a) Yes

b) No

20) When/if you see a medical provider, do you feel confident/comfortable when telling them about the information you find through online health sources?
    a) Yes
    b) No
21) Does the gender of your physician influence your level of trust during appointments?
    a) Yes
    b) Somewhat
    c) No
22) What is the gender identity of your physician?
    a) Male
    b) Female
    c) Other
    d) Do not wish to answer
23) Are there barriers that restrict or prohibit you from discussing health information you find with your physician?
    a) All the time
    b) Almost every time
    c) Occasionally
    d) Very seldom
    e) Not at all
        i) Please explain
24) Are you encouraged by your physician to research health information on your own?
    a) All the time

b) Almost every time

c) Occasionally

d) Very seldom

e) Not at all

How strongly do you agree or disagree with the following statements.

25) I know how to find helpful health resources on the internet*

a) Strongly agree

b) Agree

c) Neither agree nor disagree

d) Disagree

e) Strongly disagree

26) I know how to use the internet to answer my health questions*

a) All the time

b) Almost every time

c) Occasionally

d) Very seldom

e) Not at all

27) I know what health resources are available on the internet*

a) All the time

b) Almost every time

c) Occasionally

d) Very seldom

e) Not at all

28) I know where to find helpful health resources on the internet*

a) All the time

b) Almost every time

c) Occasionally

d) Very seldom

e) Not at all

29) I know how to use the health information I find on the internet to help me*

a) All the time

b) Almost every time

c) Occasionally

d) Very seldom

e) Not at all

30) I have the skills I need to evaluate the health resources I find on the internet*

a) All the time

b) Almost every time

c) Occasionally

d) Very seldom

e) Not at all

31) I can tell high quality from low quality health resources on the internet*

a) All the time

b) Almost every time

c) Occasionally

d) Very seldom

e) Not at all

32) I feel confident in using information from the internet to make health decisions*

a) All the time

b) Almost every time

c) Occasionally

d) Very seldom

e) Not at all

APPENDIX B: Interview Codebook

Code	Description	Examples
PANDEMIC	Any relation of eHealth to telehealth or the current pandemic	• Seeing less of the physician • Easier to have a relationship in person than over the phone • Harder to make decisions without physician there
SOURCE: INT	Mention of medical information sources from the internet	• Electronics • Medical journals/publications • Internet
SOURCE: PHY	Mentioning of medical information sources from a physician	• Doctor tells me what I need to hear • Getting health information directly from doctor first (prioritized) • Mentioning physicians offering guidance or advice can be considered as a source of information
RS: PHY	Relationship with physician being a factor (whether it's short or long)	• Knowing them (the physician) for a long time is better than someone new • Seeing them for a long time makes talking about stuff easier • Mentioning being more comfortable with their doctor since they have known them for a long time or know more about them
PRO	Mention of physicians being 'professional' or being more knowledgeable	• They are the experts- they should know what I need to do • I use the internet for information, but they (the physician) know more accurate stuff

		• Seeing the physician as knowledgeable because of their occupation and/or education
+ ENCOURAGE	Physician offering positive encouragement for eHealth information	• They always tell me to look things up on my own • Physician encourages conversation about information gathered • eHealth information is shared without contest from physician
- ENCOURAGE	Physician offering negative encouragement for eHealth information	• They (the physician) don't tell me to look up information at home • Physician not mentioning or bringing up eHealth at all • Physician claiming they know more than online sources
COMFORT	Comfortability being a factor in information sharing or physician relationship	• I prefer someone I know instead of a new doctor • Sharing demographics with a physician – gender, race, age, etc.
INFO DOUBT	Mention of misinformation/inaccurate information from medical sources	• Not everything you look up is right • Not sure if the information I find is accurate • Mentioning need clarification or reassurance with information they gather