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Digital and Musculoskeletal Health Literacy of Collegiate Student-Athletes

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Abstract

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Keywords: health literacy, patient-centered care, sports medicine

INTRODUCTION

Health literacy is defined 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.[1-4] Through patient-centered care, clinicians provide information and education that eliminates confusion, helps individuals to comprehend their situation, and prepares the consumer to be engaged in preventative medicine behaviors through appropriate sources for healthy lifestyle choices.[5] There are several skills necessary for one to be considered to be health literate, such as the ability to read and interpret health information and charts, to properly apply the instructions on medication, and to understand health risks and implications enough to vote on environmental policies.[6] Individuals with lower health literacy averaged 6% more hospital visits and averaged 2 additional days of hospitalization when compared to adults with higher health literacy skills.[7,8]

According to the National Assessment of Adult Literacy (NAAL), only 12% of American adults have proficient health literacy, while 36% of adults had basic or below basic health literacy. This means that roughly 87 million U.S. adults have low health literacy.[9] One "at risk" adult population that may be overlooked is college and university students. The American College Health Association-National College Health Assessment identified significant proportions of undergraduate students feel they have not received information regarding specific health topics from their higher education institutions.[10] One study indicated college students reported the greatest weakness in their ability to feel understood and supported by healthcare providers and their ability to navigate the healthcare system, which may indicate an inability to engage with or a lack of access to health care providers, or issues with finding appropriate help using healthcare systems.[10]

In sports medicine, the increasing burden of musculoskeletal complaints warrants further examination into musculoskeletal health literacy (MHL), or the ability to know the anatomy, diagnosis, and conditions associated with orthopedic care.[11] Due to the general health-promoting environment of sport, athletics lends itself to be fertile grounds for promoting positive health behaviors, which may help to improve health literacy efforts; though the effects of college athletics on health literacy and health behaviors have not been evaluated.[12] In fact, there is minimal research into the health literacy of college students, and even less so regarding college student-athletes. Of the few studies that exist, contradicting findings have occurred, which the authors state is likely due to the difference in competition levels of their participants (DI, II, DIII etc.). Due to the nature of competitive sport, student-athletes face many unique stressors and engage in risky physical behaviors putting them at risk for negative health outcomes, specifically musculoskeletal injuries.[13] The process for communication and health promotion has changed drastically over the last decade.

Technology advancements in recent years has made the Internet into a primary telecommunications vessel.[14] With these advancements and widespread access to the Internet, electronic resources are beginning to play an increasingly major role in consumer health.[14] This was experienced first-hand during the covid-19 pandemic, where many individuals were on lockdown with the tv and internet being the most convenient way to receive information regarding the pandemic. The larger the role technology plays in our health care systems, the more important it becomes to also assess digital health literacy (DHL), or the skills needed to search, select, appraise, and apply online health information,[15] especially for college students who are highly connected to and feel comfortable with using the Internet particularly to find health information.

To meet the health literacy demands of our society, we must first understand the abilities and skills of our patient populations. Efforts to evaluate the health literacy of populations seeking care for musculoskeletal complaints is warranted given the substantial and increasing burden of musculoskeletal complaints, which account for 18% of all health-care visits in the U.S.[16,17] Of those with chronic musculoskeletal complaints, 7 to 42% demonstrate low health literacy.[16] This is concerning considering MHL is thought to require a more sophisticated set of skills than those deemed crucial for general health literacy.[17] By identifying those at risk of inadequate MHL and/or DHL, athletic trainers (ATs) and other health care professionals can be more aware of patients who may need additional help understanding their conditions.[17] Therefore, the purpose of this study was to measure the DHL and MHL levels of college student-athletes.

METHODS

Study Design

We used a cross-sectional survey to assess the health literacy levels of collegiate student-athletes. This study was part of a larger study of collegiate student-athletes' health literacy levels at all NCAA institutions and of student-athletes enrolled at Historically Black Colleges and Universities (HBCU) and Hispanic-Serving Institutions (HSI). Data extrapolated for this study was limited to data where participants completed the DHL and MHL instruments from the survey. This study was deemed exempt by the Institutional Review Board at University of South Carolina.

Participants
The participants for this study were collegiate student-athletes. To be included in the study, the student-athlete had to be active on an athletics team roster. There were no exclusionary criteria for participation.

Instruments
Demographic Questionnaire
The demographic questionnaire included questions pertaining to gender, age, race, college distinction (e.g., HBCU, HSI, predominately white institution, etc.), and types of health services/resources used by the student.

The survey also included four general questions, which allowed us to gain insight on an individual's internet use, means of internet access, frequency of Internet use, and self-rated Internet skills adopted from previous literature on DHL.[18] We also included two questions from the eHealth Literacy Scale, which asked how useful and important the individual felt it was to have health-related information be accessible on the Internet.[19]

Digital Health Literacy
Digital health literacy is defined as the skills needed to search, select, appraise, and apply online health information and health care related digital applications.[18] For the purpose of this study, DHL was measured using the Digital Health Literacy Instrument (DHLI). The DHLI has 21 self-reporting questions which asks its participants to answer questions with a rating on a four-point scale (very easy – very difficult; never – often). Overall scores are averaged resulting in an overall score of 0-4 with higher values indicating higher level of perceived DHL.[18] For our assessment, the 7 performance-based questions were omitted from our survey due to the online nature of the survey administration. The DHLI analyzes the participants' perception of their operational, navigational, information, and evaluation skills. Some examples of these skills include the ability to understand search results, ability to operate a computer or web browser and formulating effective search quarries.

Musculoskeletal Health Literacy
We used the Literacy in Musculoskeletal Problems (LiMP) questionnaire, a 9-item multiple choice questionnaire assessing MHL. The questionnaire explored questions across 3 domains: anatomy and terminology, musculoskeletal conditions, and diagnosis and treatment.[11] Each correct response is given 1 point and the incorrect responses get 0 points, for a total score of 9 points. The questionnaire is written at a Flesch-Kincaid grade level of 4.2, meaning anyone with a 4th grade reading level should be able to read this tool.[43] The LiMP overall scored is sorted into 3 literacy levels (inadequate=0-3, limited=4-5, adequate=6-9).[11] The LiMP questionnaire assesses musculoskeletal literacy through evaluation of several themes that cumulatively, not independently, determine one's musculoskeletal literacy. The LiMP questionnaire is a validated tool, which is sensitive (82.5%) and has a low false negative rate (17.5%) for detecting inadequate health literacy, suggesting that if an individual's LIMP score is above >6 that we can ascertain that they do not have limited musculoskeletal literacy.[11,20]

Procedures
The use of recruitment letters, snowball sampling, and indirect recruitment strategies were used for this study. Recruitment letters were emailed directly to compliances officers at all NCAA Division I (n=347), II (n=312), and III (n=442) colleges/universities (~53 HBCU and 40 HSI within the NCAA) and non-NCAA HBCU (n=30) and HSI (n=216). The recruitment letter provided a brief background of the study, and if approved by compliance officer, the compliance officer would then forward the study background and web-based link to all student-athletes inviting them to participate in the study.

The survey was computer based (Qualtrics, Inc., Provo, UT) and could be completed at a time convenient for the participant. The data collection period lasted 5 weeks in the Fall 2020 with reminders sent weekly. The participants who agreed to participate were first prompted to select if they preferred to complete the study in English or Spanish, regardless of their race or ethnicity. The tools were translated by a healthcare provider and native Spanish speaker to make a Spanish version available for those who prefer to respond the questionnaire in Spanish; however, no participants elected to use this option during data collection.

Statistical Analysis
We exported the data from Qualtrics to SPSS (IBM, Version 26, Armonk, NY) for all statistical analyses. We used G*Power 3 software to calculate a power estimate a posteriori. The a posteriori estimate was calculated using an α of 0.05 and a large effect size (0.6). The power analysis indicated that we needed a sample of 46 completed surveys to achieve an estimated power of 0.9.[21] We performed descriptive statistics (mean, mode, standard deviation) to analyze the demographics of the participants, general Internet use, as well as their DHL and MHL.

RESULTS

A total of 271 college student-athletes initiated the survey with 260 consenting to participate. From this sample, 160 responses from student-athletes at various NCAA and non-NCAA institutions (age=20±4y) were used for analyses. The 160 student-athletes used in analyses were those who completed the demographic, general internet use and DHLI questions. Of these participants, 56 student-athletes completed the LiMP tool. All demographic information is reported in Table 1. Most participants (83.1%) reported utilizing their institution's athletic training services, with only 8.8% of participants reporting having never utilized any form of healthcare provider as a college/university student.

Table 1: Demographic characteristics of participants, n=160

Variable	Frequency N (%)
Gender	
Male	48 (30.0)
Female	111 (69.4)
Non-binary	0 (0.0)
Prefer not to report/prefer to self-describe	0 (0.0)
Missing	1 (0.6)
Race	
Black or African American	5 (3.1)
Hispanic, Latino or Spanish	4 (2.5)
White	133 (83.1)
Some Other Race or Ethnicity	1 (0.6)
Mixed/Multiracial	17 (10.6)
College/University Distinction	
Part B Institution (HBCU)	2 (1.3)
Predominately White Institution (PWI)	45 (28.1)
Unsure	71 (44.4)
Missing	42 (26.3)
Resources Utilized as a Student	
On-Campus Student Health (General Illness)	76 (47.5)
On-Campus Behavioral Health (Counseling, Therapy)	23 (14.4)
On-Campus Athletic Training Services (Sports Medicine)	133 (83.1)
Off-Campus Health Clinic (Hospital, Doctor Office)	81 (50.6)
Off-Campus Behavioral Health (Counseling, Therapy)	16 (10.0)
Off-Campus Sports Medicine (Physical Therapy)	40 (25.0)
None of the above – I have never visited a healthcare provider as a college/university student	14 (8.8)

General and Health-related Internet Use

Participants used smart phones to use the Internet and felt the Internet was both important and useful to their health. Most participants used the Internet to search for health/illness information (93.8%, n=150). Table 2 provides a full breakdown of Internet use by collegiate student-athletes. Participants were able to select more than 1 option in some sections, such as means of use and internet task use.

Table 2: General and health-related Internet use among collegiate student-athletes (n=160)

Item	N (%)
Frequency of Internet Use	
(Almost) every day	158 (98.8)
Several days a week	1 (0.6)
About 1 day a week	0 (0.0)
(Almost) never	0 (0.0)
Missing responses	1 (0.6)
Means of Internet Use	
Smart phone	158 (98.8)
Laptop	148 (92.5)
Personal computer	67 (41.9)
Tablet	30 (18.8)
Computer provided by work/school	27 (16.9)
Public computer	14 (8.8)
Self-rated Internet Skills	
Excellent	61 (38.1)
Good	74 (46.3)
Average	24 (15.0)
Reasonable	0 (0.0)
Poor	0 (0.0)
Missing responses	1 (0.6)
Internet Task Use	
Search for information on health or illness	150 (93.8)
Schedule an appointment with a healthcare provider	108 (67.5)
Read on health-related forums or social media websites	113 (70.6)
Read a healthcare provider or facility review	79 (49.4)
Use a health-related smart phone app	98 (61.3)
Ask a question of your healthcare provider	57 (35.6)
Monitor disease symptoms	70 (43.8)
Share personal medical information with others	34 (21.3)
Log on to review your electronic medical record	78 (48.8)
Post a health care review	15 (9.4)
Take a web-based self-assessment related to health/wellness	79 (49.4)
Engage in a telemedicine visit with a healthcare provider	40 (25.0)
Usefulness of the Internet in helping you make health decisions	
Not useful at all	4 (2.5)
Not useful	19 (11.9)
Unsure	38 (23.8)
Useful	78 (48.8)
Very useful	20 (12.5)
Missing response	1 (0.6)
Importance in being able to access health resources on the Internet	
Not important at all	2 (1.3)
Not important	13 (8.1)
Unsure	25 (15.6)
Important	85 (53.1)
Very important	35 (21.9)

Digital Health Literacy

The average DHLI score was 3.36±0.38 out of a total score of 4. Highest scores were reported for operational skills (mean=3.90±0.26) and protecting privacy (mean=3.67±0.48). The lowest subscale was evaluating reliability (mean=3.05±0.61). The information searching and determining relevance subcategories also scored rather low, with mean scores of 3.10 $\pm$ 0.61 and

3.12 ± 0.62, respectively. Navigation skills had a mean score of 3.37±0.57 and adding self-generated content had a mean score of 3.30 ± 0.68. Table 3 provides a breakdown of the DHL by question.

Table 3: LiMP Questions Breakdown (n=160; some missing responses)

How easy or difficult is it for you to…	**Very Difficult**	**Difficult**	**Easy**	**Very Easy**
• Use the keyboard of a computer (e.g., to type words	0, 0	0,0	19, 11.9%	141, 88.1%
• Use the mouse (e.g., to put the cursor in the right field or to click)?	0,0	0,0	13, 8.1%	147, 91.9%
• Use the buttons or links and hyperlinks on websites?	0,0	0,0	18, 11.3%	142, 8.8%
When you search the Internet for information on health, how easy or difficult is it for you to …	**Very Difficult**	**Difficult**	**Easy**	**Very Easy**
• Make a choice from all the information you find?	1, 0.6%	29, 18.1%	91, 5.6.9%	39, 24.4%
• Use the proper words or search query to find the information you are looking for?	1, 0.6%	16, 10.0%	78, 48.8%	65, 40.6%
• Find the exact information you are looking for?	4, 2.5%	37, 23.1%	82, 51.2%	37, 23.1%
• Decide whether the information is reliable or not?	9, 5.6%	55, 34.4%	62,38.8%	34, 21.3%
• Decide whether the information is written with commercial interests (e.g., by people trying to sell a product)?	3, 1.9%	40, 25.0%	74, 46.3%	43, 26.92%
• Check different websites to see whether they provide the same information?	0,0	4, 2.5%	81, 50.9%	74, 46.5%
• Decide if the information you found is applicable to you?	1, 0.6%	28, 17.6%	82, 51.6%	48, 30.2%
• Apply the information you found in your daily life?	0, 0	25, 15.7%	84, 52.8%	50, 31.4%
• Use the information you found to make decisions about your health (e.g., on nutrition, medication or to decide whether to ask a doctor's opinion)?	7, 4.4%	23, 14.5%	80, 50.3%	49, 30.8%
When typing a message (e.g., to your doctor, on a forum, or on social media such as Facebook or Twitter) how easy or difficult is it for you to…	**Very Difficult**	**Difficult**	**Easy**	**Very Easy**
• Clearly formulate your question or health-related worry?	2, 1.3%	16, 10.5%	69, 45.4%	65, 42.8%
• Express your opinion, thoughts, or feelings in writing?	1, 0.7%	20, 13.2%	63, 41.4%	68, 44.7%
• Write your message as such, for people to understand exactly what you mean?	1, 0.7%	22, 14.5%	61, 40.1%	68, 44.7%
When you search the Internet for health information, how often does it happen that ...	**Never**	**Once**	**Several Times**	**Often**
• You lose track of where you are on a website or the Internet?	81, 51.6%	49, 31.2%	24, 15.3%	3, 1.9%
• You do not know how to return to a previous page?	126, 80.3%	24, 15.3%	6, 3.8%	1, 0.6%
• You click on something and get to see something different than you expected?	53, 34.2%	52, 33.5%	49, 31.6%	1, 0.6%
When you post a message on a public forum or social media, how often …	**Never**	**Once**	**Several Times**	**Often**

• Do you find it difficult to judge who can read along?	95, 62.5%	40, 26.3%	15, 9.9%	2, 1.3%
• Do you (intentionally or unintentionally) share your own private information (e.g., name or address)?	109, 58.9%	31, 20.4%	11, 7.2%	1, 0.7%
• Do you (intentionally or unintentionally) share someone else's private information?	136, 89.5%	14, 9.2%	0,0	2, 1.3%

Musculoskeletal Health Literacy

The overall average LiMP score was 6.29±1.36 (range 3-9) with a mode of 7. Of the 56 participants who completed this portion of the study, 26.8% (n=15/56) limited or inadequate MHL (scores of <6). Table 4 lists the content for each LiMP question and the percentage of participants that answered each question correctly regardless of complete the entire LiMP questionnaire.

Table 4: LiMP Questions Breakdown

Question	Category Assessed	Percentage of Correct Answers
1	Musculoskeletal Conditions	50.7 (n=77/152)
2	Diagnosis and Treatment	15.2 (n=16/105)
3	Anatomy and Terminology	92.9 (n=130/140)
4	Anatomy and Terminology	85.4 (n=123/144)
5	Musculoskeletal Conditions	89.2 (n=83/93)
6	Anatomy and Terminology	83.6 (n=122/146)
7	Musculoskeletal Conditions	66.4 (n=97/146)
8	Musculoskeletal Conditions	70.4 (n=57/81)
9	Diagnosis and Treatment	34.7 (n=52/150)

DISCUSSION

According to the National Assessment of Adult Literacy (NAAL), only 12% of American adults have proficient health literacy.[1,9] To put this in perspective, 42% of those with limited health literacy did not understand directions on a pill bottle for taking medication on an empty stomach, 26% could not comprehend their appointment slips, and 60% could not process an informed consent document.[1] Now that "at-risk" populations are being discovered, strategies to reduce health literacy barriers for these groups have been a more central focus, encouraging creators of health care information outlets to consider culture, history, environment and literacy levels of the community.[22] Health care professionals play a significant role in aiding their patients in realizing the information available to them so they can maximize the benefits of health care, but in order to do so they must first understand the health literacy levels of their patient population.[23] Our study identified that most college student-athletes had adequate MHL and perceived themselves to be digitally health literate. There was still 26.8% of participants who scored below adequate for MHL.

General and Health-related Internet use

With technology advancements in recent years, the Internet has become the main information source worldwide, with approximately 2 billion people with access to it.[24] The proportion of American consumers using the Internet to seek health information has been steadily increasing as well, making health information one of the most investigated topics online, with more than 113 million American adults accessing nearly 70,000 health-related websites yearly.[14] In 2001 15.9% of individuals reported using the internet to seek health information, which rose to 72% in September of 2012.[25] Eight out of 10 Internet users admit they have looked online for health information, the third most popular web activity behind checking emails and using search engines.[14] Of consumers in the 18-30 year old range 38.6% reported obtaining health information from Internet search engines, 24.8% rely on popular Internet health websites and 32.7% utilize social media sites. Our study had much higher reported numbers with 93.8% of participants reporting utilizing the internet to find health information and 70.6% utilizing health forums and social media sites.

The high percentage of internet use in our study could be due to the expected increase in internet usage over time. In January 2020, news around the world was spreading around the new coronavirus strain (COVID-19) that was spreading fast, a more likely source of the increased internet usage seen in our study. An "infodemic" occurred in which COVID-19 became a trending topic, particularly after the World Health Organization declared COVID-19 a global health emergency on January 31, 2020.[24] Available statistics from Google trends confirmed that people worldwide were actively seeking COVID-19 related information online.[26] The

"infodemic" made it clear that consumption of health information occurs not only by persons with specific health conditions but also those with public health concerns.[25]

While people are sometimes unable to identify false information on social media, more than 2.9 billion individuals access social media, making it one of the most common, easily accessed form of information source, despite its credibility remaining in question.[27] When presented with an overload of information, exciting falsehoods begin to spread faster than boring truths on social media sites, causing large scale issues to public health outcomes and daily living. For example, misinformation on lockdowns and scarcity of supplies lead to the panic buying of supplies such as hand sanitizer, disinfecting wipes and toilet paper, inevitably causing scarcity of these products and inflated prices. Even with the government repeatedly asking them, through news channels, to stay calm as daily needs would be made available.[27,28] Another example of false information being spread rapidly is the misconception that taking a deep breath in and holding it for more than 10 seconds was a reliable method of coronavirus detection, when in reality it had nothing to do with coronavirus detection.[27] On the flip side, social media also has the potential to act as a method of dispersing reliable information to a large population quickly, especially during isolation. Social media trends in particular can help so that everyone will see the same messages on different platforms even if they forgo trusted sites like WHO website. A great example of this is the hand washing trend that was popular at the start of the pandemic, in which celebrities posted videos of them washing their hands according to WHO and CDC guidelines. Athletic trainers, like other healthcare professionals, need to aid the efforts to combat false information and be aware of the variety of medical information and communication formats on the Internet, since they may influence questions and decisions from their patients.[29,30]

Digital Health Literacy

One's ability to access and use the Internet has become easier in our modern society. In fact, the Internet is the favorite resource of millennial generations, often acting as their preferred source for information.[31] Because of the increase of Internet usage, it is key healthcare providers evaluate their patients' comfort and skills with the computer and web-based resources. College students' digital health literacy (DHL) is of particular interest to us due to the widespread access to Internet on college campuses, and the exposure to Internet and electronic resources that millennial and younger generations have had in their lives.[14]

Ivanitskaya et al found that 84% college students surveyed perceived their DHL skills as "good," "very good," or "excellent," yet students' actual eHealth literacy skills, according to their scores on a 56-item tool, were very poor.[31,32] Our study found that nearly all participants use the Internet daily (98%), with over 90% of participants reporting having used the Internet to search for health related information, schedule appointments and access medical records. The incredible accessibility of the Internet has potential to act as a quick way for individuals to obtain relevant health information. These online resources provide little value if the intended users lack the skills to effectively engage them.[15] Arguably, the greatest problem of the internet health information is finding valid and reliable information. An idea that is emphasized in our studies' DHLI results, which identified information searching and evaluating reliability as the worst categories for out participants (3.10 ± 0.61 and 3.05 ± 0.61). More specifically, misinformation has become an important problem, since people generally don't critically assess the information they read when making important decisions regarding their health.[24] This is concerning, since most of the information on the internet is unregulated, and its quality remains questionable.[24] For example, Eysenbach et al reported that 70% of websites presenting care information had significant quality issues.[33]

When individuals are unable to discern between real and fake news, unreliable sources may amplify risk perceptions and fear or risk of information overload. Information overload has been linked to increased stress and information avoidance, which in turn limits the reach that quality health information has on consumers. Big organizations improved at communicating online and people got better at identifying truth from fiction after the misinformation campaigns of 2016, at a large scale.[27] The Center for Disease Control and Prevention, the World Health Organization (WHO), a large number of healthcare organizations and journals are regularly posting and updating awareness and guidance across a host of online platforms. Social media sites like Facebook, Google and Twitter have begun pointing individuals who search for covid info to trusted sources, by offering priority to content from reliable accounts, while scrutinizing and fact checking for non-professional claims.[27]

While social media site are doing what they can to prevent the spread of misinformation, sometimes information spreads so quickly that millions have seen it before it can even be analyzed for credibility.[27] Individuals have different preferred sources of information and standards for sharing information to their following. In the end, users need to do their part in reporting false information they come across on social media and the Internet and fact checking information they do come across before sharing it to others. By helping to identify ways to ensure information is reliable and factual, we as athletic trainers can intervene before our patients end up in the information avoidance mindset.[26] Overall, additional research regarding the quality of the health information on various social media platforms should be conducted so we can better direct our patients to reliable information sources.[25] While we cannot

control how individuals use the Internet and all the available information that comes with it, we can help to educate our patients on how to find reliable sources and spot fraud.

There have been tools created to help identify reliable information already. Three major tools include the HONcode, the JAMA benchmarks and the DISCERN instrument. The HONcode consists of a minimum mechanism to provide quality, objective, and transparent medical information to Internet users. Websites agreeing to comply with standards and be subject to random audits may display the HONcode seal.[24] The JAMA benchmarks is a set of four criteria designed to assess and evaluate the quality of health information on the internet, and allows the consumer to easily decide if the site has basic components like transparency and reliability.[24] Finally, the DISCERN instrument is a valid and reliable 16-point questionnaire to aid health consumers and information providers in evaluating the quality of health information on any website.[24] Figure 1 provides helpful tips and reminders about finding reliable information in the digital market.

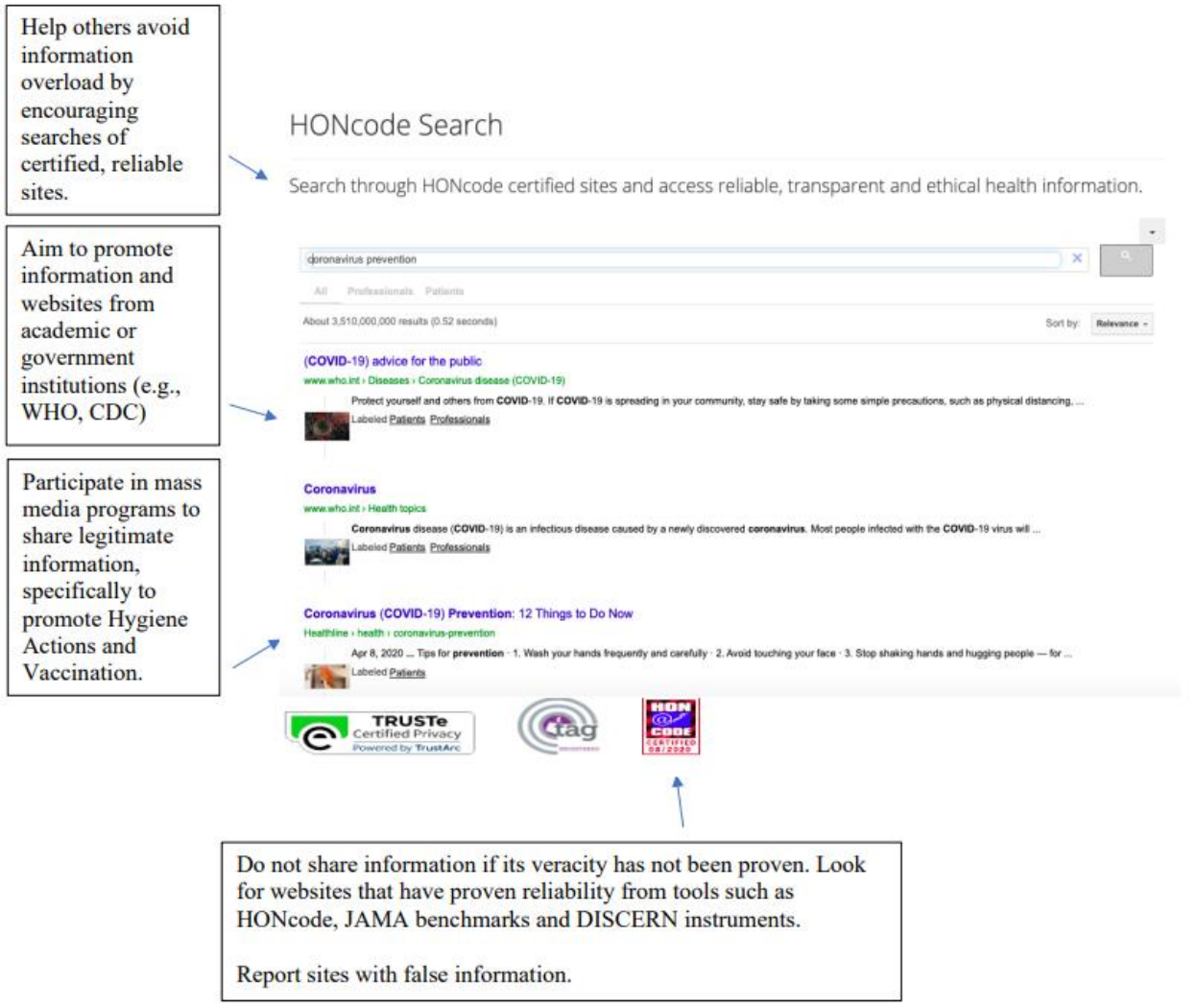

Figure: Tips for Accessing Reliable Information

Additionally, there is published research, which has identified clues to detecting factitious Internet claims, found in Table 4, which may be useful to share with patients to aid them in their online search for reliable information.[29,30] It is important to continue to practice patient centered care, listening to all of the patients complaints and debunking any myths they may have heard or seen with evidence based facts, rather than just telling them they are wrong.[29] If an individual is consistently "self-diagnosing" it may be more beneficial to identify any potential environmental or mental health factors that may be leading to this behavior. Finally,

encourage everyone to seek help from their trusted healthcare team, and not rely solely on the Internet. By having patients be open with you regarding where they are getting their information, you can identify common websites or forums that your patients may be using, and determine if those sources are reliable, while addressing any misinformation they came across.

Table 4: Methods of Detecting Munchausen by Internet:[29,30]

Observations from the Athletic Trainer may include….
1. Posts by the patient that consistently duplicate material in other posts, books, or health-related websites
2. The patient displaying characteristics of the supposed illness emerging as caricatures
3. The patient experiencing near-fatal bouts of illness alternating with miraculous recoveries
4. The patient expressing fantastical claims, contradicted by subsequent posts, or flatly disproved
5. Continual dramatic events in the patient's life, especially when other group members have become the focus of attention
6. The patient having contrived cheerfulness about crises that will predictably attract immediate attention
7. Others apparently posting on behalf of the patient having identical patterns of writing

Musculoskeletal Health Literacy

One study found college athletes had significantly more knowledge on nutrition, health and injury recovery than non-athletes, though their correct response percentage was still low (45.7%).[12] This same study emphasized differences in health literacy, with athletes having better health literacy than non-athletes.[12] Despite a lack of formal courses, education through simple concrete experience is occurring in the athletic participation.[12] Additionally, ATs are taught to be advocates for the patient, guiding them through their treatment pathway from initial injury to return to play, and educating and helping them to make informed decisions, so additional education through experience in athletics could be related to the access of athletic training services. While our study found a majority of participants to have adequate MHL, there were still 26.8% who were not considered to have adequate MHL.

Additionally, the two questions related to diagnosis and treatment had the lowest success rate (15.2% and 34.7%), with the question regarding x-rays proving the most difficult for participants. The lack of correct responses on the x-ray and imaging question raises some concerns since radiographs are often used to confirm a diagnosis or reassess an injury. It is estimated that there is an average of 2.6 million emergency department visits for sports related injuries per year for individuals aged 5-24 years.[34] More specifically, 1 in 7 emergency department patients receive a CT scan so it is imperative that patients are fully aware of their radiation risks when undergoing the test. In fact, only 22.5% of patients believed that there was any risk of future cancer associated with a single CT scan/x-ray.[35] Despite this, 86-95% of patients believed physicians should explain the risks and benefits of CT scans and plain film radiographs, and 73-77% believe an informed consent should be signed.[35,36] It is evident that patients feel are not provided adequate education regarding imaging and wish to be informed of the risks in more detail before making a decision, yet 71% of physicians reported educating their patients less than one-fourth of the time when ordering scans.[37] This could be in part due to a lack of perceived need, but there is also room for physicians to become better educated as well. For example, in one study 20% of practitioners reported that they received no formal training about radiation-exposure risks, and only 27% feeling comfortable educating patients about the risks of radiation.[37]

The benefits of scans likely outweigh the risks of not performing scans, with medical imaging techniques attributed with increasing life expectancy by 0.62-0.71 years over a 14 year period.[38] Because of its benefits, it is unlikely imaging will go away but rather eventually improve. Therefore, it is imperative that we as athletic trainers educate our patients on the risk and benefits of all treatments and diagnostic tests prescribed to our patients, regardless of how basic it may seem. It is a fine line between patient advocacy and patients becoming dependent on ATs for health care access and understanding. Athletic trainers need to ensure that the individual is not just doing what we told them without an understanding the purpose of the treatment.

Future Research and Limitations

Most participants in this study identified as white and female. Less than 20% of participants in this study identified themselves as non-white and only 30% of participants identified themselves as male, therefore generalizations to all races, ethnicities and genders cannot accurately be made based on this study alone. Similarly, this study focused only on collegiate student-athletes, so further investigation is needed before generalizations can be made to broader populations, such as physically active individuals. Though the option was available, none of the participants elected to take the survey in Spanish. Therefore, there could be a potential for future research to identify any differences in DHL and MHL between native and non-native English speakers.

CONCLUSION

Most student-athletes possess adequate MHL. The findings directly impact patient education, as student-athletes are often using their phones to access health related information, which they feel comfortable with, but may not know if the source is trustworthy. Athletic trainers can further help with patient education by informing patients of tools to find credible sites, monitoring for Munchausen or individuals receiving inaccurate information, as well as answering questions, since they tend to interact with their patients as often as daily. As health information technology continues to expand in athletic training, the data hints at the potential to create patient education materials for all regardless of race or gender, though more research should be done into racial minorities and males, since our patient population was mainly Caucasian females.

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