

October 2021

## Athletic Trainers' Hand Hygiene Behaviors During the COVID-19 Pandemic

Olivia Jackson

*Indiana State University, ojackson6@indstate.edu*

Matthew J. Rivera

*Indiana State University, matthew.rivera@indstate.edu*

Kenneth E. Games

*Indiana State University, kenneth.games@indstate.edu*

Lindsey E. Eberman

*Indiana State University, lindsey.eberman@indstate.edu*

Follow this and additional works at: <https://nsuworks.nova.edu/ijahsp>

Digital part of the [Public Health Education and Promotion Commons](#)  
Commons

### Network Recommended Citation

Jackson O, Rivera MJ, Games KE, Eberman LE. Athletic Trainers' Hand Hygiene Behaviors During the COVID-19 Pandemic. *The Internet Journal of Allied Health Sciences and Practice*. 2021 Oct 01;19(4), Article 11.

This Manuscript is brought to you for free and open access by the College of Health Care Sciences at NSUWorks. It has been accepted for inclusion in *Internet Journal of Allied Health Sciences and Practice* by an authorized editor of NSUWorks. For more information, please contact [nsuworks@nova.edu](mailto:nsuworks@nova.edu).

---

# Athletic Trainers' Hand Hygiene Behaviors During the COVID-19 Pandemic

## Abstract

**Purpose:** Hand hygiene (HH) is a cost-effective public health intervention to prevent infectious disease transmission, including COVID-19. Health care professionals have shown poor adherence to HH best practices, and little is known about athletic trainer (AT) HH. ATs typically work in dynamic, unpredictable environments, creating barriers to HH compliance. The purpose of this study was to understand the self-reported behaviors and challenges with adherence to HH of secondary school ATs, particularly related to mitigating infection transmission during the COVID-19 pandemic. **Methods:** In this qualitative study, we conducted 11 semi-structured interviews with secondary school ATs actively engaged in direct patient care (age=31±9 years; experience=9±8 years). A 2-person data analysis team used a multi-phase inductive coding process to identify emerging domains and themes to create a codebook. Trustworthiness and credibility were established with member checking, multi-researcher analysis, and internal auditing. **Results:** We identified four themes: 1) best practices awareness, 2) impact of COVID-19, 3) resources, and 4) community-based prevention. Participants indicated HH training was included during on-boarding, but lacked contextual knowledge for HH in clinical practice, despite identifying ATs as health care providers. Participants expressed increased HH frequency due to the COVID-19 pandemic and concern for transmission. Participants noted an overall positive perception of access to physical resources, like hand sanitizer, sinks, and soap, as well as financial support to provide those resources. Participants noted decreased perceived risk and lack of formal policy or enforcement of HH expectations for facility users. **Conclusion:** ATs have general knowledge and resources but lack contextual knowledge and behaviors to employ HH best practices. The COVID-19 pandemic increased awareness, but HH by athletic training facility users remains poor. ATs should engage in HH based on best practice recommendations consistent with a traditional healthcare facility. Policies should be developed and enforced to limit disease transmission.

---

## Author Bio(s)

Olivia Jackson, DAT, LAT, ATC is an athletic trainer practicing with the Cleveland Clinic in Cleveland Ohio. She is a graduate of the DAT program from Indiana State University.

Matthew J. Rivera, DAT, LAT, ATC, is an Assistant Professor and athletic trainer and core faculty member in the Doctor of Athletic Training Program at Indiana State University.

Kenneth E. Games, PhD, LAT, ATC, is a Professor and Director of Clinical Education with the Doctor of Athletic Training program at Indiana State University.

Lindsey E Eberman, PhD, LAT, ATC, is a Professor and Program Director for the Doctor of Athletic Training Program at Indiana State University.



The Internet Journal of Allied Health Sciences and Practice

*Dedicated to allied health professional practice and education*

Vol. 19 No. 4 ISSN 1540-580X

---

## Athletic Trainers' Hand Hygiene Behaviors During the COVID-19 Pandemic

---

Olivia Jackson  
Matthew J. Rivera  
Kenneth E. Games  
Lindsey E. Eberman

Indiana State University

United States

---

### ABSTRACT

**Purpose:** Hand hygiene (HH) is a cost-effective public health intervention to prevent infectious disease transmission, including COVID-19. Health care professionals have shown poor adherence to HH best practices, and little is known about athletic trainer (AT) HH. ATs typically work in dynamic, unpredictable environments, creating barriers to HH compliance. The purpose of this study was to understand the self-reported behaviors and challenges with adherence to HH of secondary school ATs, particularly related to mitigating infection transmission during the COVID-19 pandemic. **Methods:** In this qualitative study, we conducted 11 semi-structured interviews with secondary school ATs actively engaged in direct patient care (age=31±9 years; experience=9±8 years). A 2-person data analysis team used a multi-phase inductive coding process to identify emerging domains and themes to create a codebook. Trustworthiness and credibility were established with member checking, multi-researcher analysis, and internal auditing. **Results:** We identified four themes: 1) best practices awareness, 2) impact of COVID-19, 3) resources, and 4) community-based prevention. Participants indicated HH training was included during on-boarding, but lacked contextual knowledge for HH in clinical practice, despite identifying ATs as health care providers. Participants expressed increased HH frequency due to the COVID-19 pandemic and concern for transmission. Participants noted an overall positive perception of access to physical resources, like hand sanitizer, sinks, and soap, as well as financial support to provide those resources. Participants noted decreased perceived risk and lack of formal policy or enforcement of HH expectations for facility users. **Conclusion:** ATs have general knowledge and resources but lack contextual knowledge and behaviors to employ HH best practices. The COVID-19 pandemic increased awareness, but HH by athletic training facility users remains poor. ATs should engage in HH based on best practice recommendations consistent with a traditional healthcare facility. Policies should be developed and enforced to limit disease transmission.

**Key Words:** hand hygiene, infectious disease transmission, best practices

---

## INTRODUCTION

Hand hygiene is one of the most cost effective public health interventions, where previous investigations have claimed a one-percent increase in hand hygiene behaviors at one health care system could save \$40,000 in annual costs associated with methicillin-resistant *Staphylococcus aureus* (MRSA) alone.<sup>1</sup> In addition to financial advantages, proper hand hygiene has been shown to decrease virus transmission.<sup>1</sup> Since the onset of the COVID-19 pandemic in March of 2020, public health messaging has centered on non-pharmacological prevention measures, including mask wearing, physical distancing, and hand hygiene.<sup>2</sup> The SARS-CoV-2 virus can live on human skin for up to nine hours.<sup>3</sup> Additionally, alcohol-based hand rubs that meet World Health Organization (WHO) regulations have been shown to inactivate the virus in 30 seconds with proper use.<sup>4</sup> The extended lifetime of the virus on the skin, as well as the proven effectiveness of hand hygiene in its inactivation, makes hand hygiene essential to infection prevention, which alone has been shown to decrease COVID-19 transmission by 55%.<sup>2</sup> However, despite the known benefits of proper hand hygiene, health care professionals have shown poor adherence to hand hygiene behavior recommendations in the absence of interventions.<sup>5,6</sup>

Proper hand hygiene is particularly important in athletic training where a majority of athletic trainers practice in a dynamic environment with increased patient traffic and shared spaces.<sup>7,8</sup> In addition to the SARS-CoV-2 virus, other pathogens, including skin infections, respiratory illness, and food and water borne illnesses continue to pose health-related issues for athletic populations.<sup>9,10</sup> The WHO, Centers for Disease Control (CDC), and the National Athletic Trainers' Association (NATA) all recommend the use of proper hand hygiene by athletes and health care providers to prevent the spread of these types of infections.<sup>11-15</sup> In a study that focused on MRSA transmission in athletic training practice, the authors asked about self-reported hand washing behaviors of athletic trainers. Although not the primary purpose of this study, the authors concluded that only thirty percent of respondents washed their hands before treating a patient, and 35% "sometimes, occasionally, or never" washed their hands after treating a patient.<sup>14</sup> This is in direct contrast to the indications for performing hand hygiene as set forth by the WHO, CDC, and NATA.

Significant research has investigated the hand hygiene behaviors of other health care providers, including physicians, nurses, physical therapists, and paramedics.<sup>5,6,16</sup> However, the literature lacks significant investigation into the hand hygiene behaviors of athletic trainers.<sup>5,6,16</sup> There are many parallels between secondary school athletic training environments and emergency departments including unpredictable and unexpected patient volumes requiring immediate attention at a high level of perceived urgency.<sup>5,16</sup> The work settings of athletic trainers are not sterile environments and are often located in close proximity to areas shown to foster large amounts of infectious agents, including weight rooms, locker rooms, and other training facilities.<sup>17</sup> In addition to COVID-19 concerns, these factors present challenges for health care providers in these settings to maintain proper hand hygiene behaviors. As health care providers, it is essential for athletic trainers to understand and practice proper hand hygiene behaviors as directed by the WHO, CDC, NATA, and Board of Certification (BOC) to minimize the spread of infectious diseases. Indeed, hand hygiene education is included within several of the 2020 Standards of the Commission on Accreditation of Athletic Training Education (CAATE);<sup>18,19</sup> The purpose of this research was to understand the self-reported hand hygiene behaviors and challenges associated with adherence to proper hand hygiene behaviors of secondary school athletic trainers in clinical practice, particularly as it relates to mitigating infection transmission during the COVID-19 pandemic.

## METHODS

The study used a semi-structured interview consisting of questions regarding participant hand hygiene behaviors, resources, and knowledge of best practices. The qualitative design allows for open-ended questions and in-depth responses regarding individual experiences. This type of questioning helps to identify common themes across a group of individuals.

### Participants

Participants were certified athletic trainers who were actively engaged in direct patient care in the secondary school setting at the time of data collection. Exclusion criteria included athletic training students, retired athletic trainers, or certified athletic trainers who were not actively practicing direct patient care in the secondary school setting. Participants were recruited using criterion sampling from social media platforms, including Twitter and Facebook. Eleven participants (age=31±9 years; experience=9±8 years) that met the inclusion criteria completed the study.

### Procedures

Participants responded to the social media recruitment and affirmed that they met the inclusion criteria. An informed consent document was emailed to each individual who showed interest in participating in the study. After reviewing the informed consent, participants scheduled an individual time to meet with the primary investigator to complete an audio-only interview via Zoom® (San Jose, CA). Participants were sent a password-protected link to participate in the audio interview by the primary investigator.

### Data Collection

A semi-structured interview approach was used to capture the perceptions of secondary school athletic trainers regarding hand hygiene in their clinical practice. The goal of the semi-structured interview was to thoroughly address the issue of hand hygiene in various aspects of the participants' clinical practice. The interview process was audio-only to improve confidentiality and recorded to ensure accurate transcription. Each participant met with the primary investigator individually, where the primary investigator reviewed the informed consent and participants were given the opportunity to ask any questions regarding the study and their participation. After verbal consent was obtained to participate, the participants answered basic demographic questions and seven questions, regarding their experience with hand hygiene in clinical practice. The semi-structured interview script was created by the research team and reviewed by an independent researcher. The questions centered on the participants' previous hand hygiene training and self-reported hand hygiene habits (Table 1). These questions accounted for potential changes since the beginning of the COVID-19 pandemic. Additional questions focused on participants' perceptions of hand hygiene resource availability (soap, sink, hand sanitizer, etc.) and the perceived adherence to hand hygiene of those within the athletic training facility including co-workers, athletic training student aides, patients, and school staff. At the end of the interview, participants were given the opportunity to elaborate or provide additional information regarding their experience with hand hygiene in clinical practice that they may not have yet expressed. All interviews were recorded digitally and transcribed verbatim by the primary investigator. Audio transcripts were de-identified and participants were given a pseudonym.

**Table 1.** Interview Questions

Interview Questions
1. What best describes your job setting?
2. How many years have you been at your place of current employment?
3. What is your age?
4. How many years of experience do you have as a credentialed AT?
5. What type of infection control training did you receive during onboarding at your current place of employment?
6. Can you please describe how hand hygiene fits into your current work routine? a. If the participant does not describe triggers: Tell me about any triggers or cues that are embedded into your practice that help you maintain this practice.
7. In what ways, if any, have your hand hygiene behaviors changed over the past 6 months? a. Do you think, as the fear of the pandemic dissipates, these changes will persist? Why or why not?
8. In your own words, describe hand hygiene best practices for health care providers.
9. In your own words, describe the importance of hand hygiene behaviors.
10. What physical resources, if any, are available in your immediate facility for implementation of hand hygiene behaviors? (Facility will be defined as where the participant provides a majority of their patient care day-to-day.) a. In what ways, if any, have these resources changed over the past 6 months? b. What concerns, if any, do you have about the availability of the physical resources for implementing hand hygiene in the future?
11. How would you describe the adherence of best practices for hand hygiene behaviors in general at your current place of employment? a. Are others expected to abide by hand hygiene expectations in the facility? Why or why not? b. What concerns, if any, do you have about the hand hygiene behaviors of others in your facility?

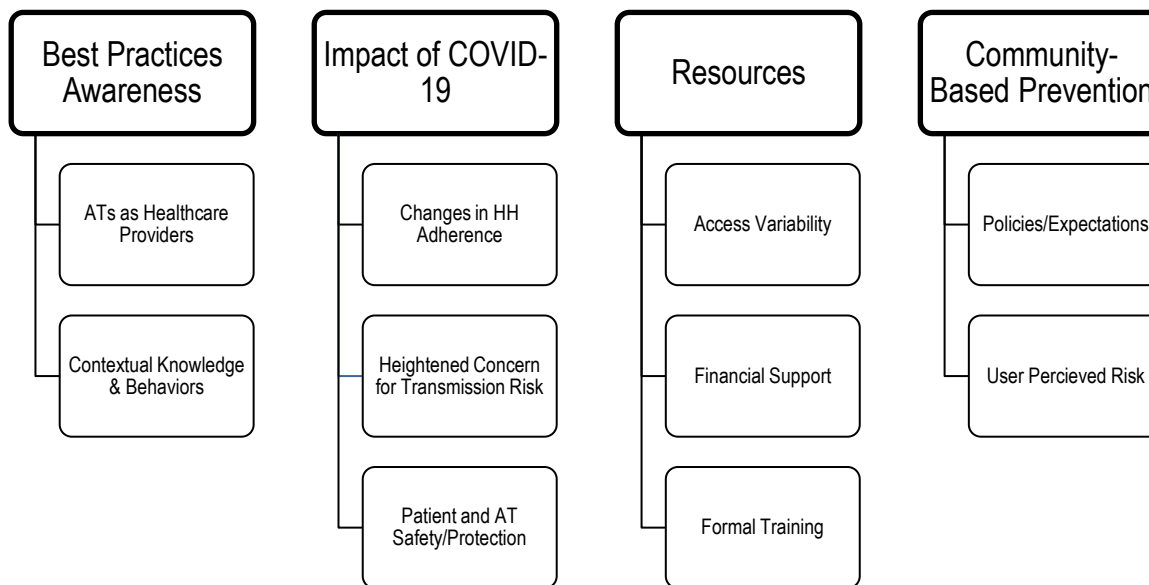
### Data Analysis

Member checking was used after transcription of the interviews to ensure accuracy of participant data. The data analysis process included multi-analyst coding using a multi-phase inductive coding process to identify emerging themes and categories to create a codebook. Each researcher reviewed the transcripts independently to develop a list of themes and categories reflected in the data through general statements. Researchers found consensus on the individual reviews to develop a codebook, which was applied to the remainder of the transcripts, analyzed by an individual researcher, and confirmed by another researcher. Trustworthiness and credibility were established with member checking, multi-researcher analysis, and internal auditing.

### RESULTS

Four major themes emerged from the interviews with the participants: 1) impact of COVID-19, 2) best practices awareness, (3) resources, and (4) community-based prevention (Figure 1). The impact of COVID-19 was reflected in an increase in hand hygiene adherence, heightened concern for disease transmission risk, and increased awareness of the importance of patient and athletic trainer safety. Contextual knowledge and behaviors regarding hand hygiene was reflected in responses about best practices, as

was the distinction of ATs as health care providers. Participants addressed training, financial support, and access to hand hygiene supplies when discussing resources. The final theme of community-based prevention addressed facility policies and expectations, as well as the perceived user risk of participants. Each theme is detailed using participants' quotes.



**Figure 1.** Themes and Sub-themes

### Impact of COVID-19

The majority of participants described an increase in hand hygiene frequency as a result of the COVID-19 pandemic. Leslie reflected on the changes in her hand hygiene before and since the onset of the COVID-19 pandemic:

I looked at my hand hygiene practices once we got back on campus and started sports again and realized that I was definitely deficient in my hand hygiene around the athletes and how frequently I was washing my hands. Either between patients or between treatments or whatever. So, COVID has definitely made me more diligent and I'm hoping that my practice will continue to be more diligent about hand hygiene in the middle of our crazy busy time.

Ben acknowledged the impact the pandemic had on his hand hygiene behaviors. He stated, "I think it's been a really refreshing reminder of some of the behaviors that we have not been as disciplined on." Ben went on to explain:

I've definitely noticed myself more frequently in between every patient washing my hands ... It wasn't something I was doing in between every patient before, but especially [now] with the coronavirus.

Some participants who stated no increase in frequency perceived their hand hygiene behaviors as meeting best practices before the pandemic and therefore unchanged since the onset of COVID-19. Ann stated little change in her hand hygiene frequency, explaining:

I am a chronic hand washer/hand sanitizer user. So I wash my hands every day when I get to the school and then I use hand sanitizer before every patient encounter and then after every physical exam with that patient I'll hand sanitize again.

Tom affirmed:

I know others who tend to wash their hands more. But [my habits] have not changed. It's a general routine. It's not based on COVID, just based on me being a 'germophobe.'"

Participants expressed a strong sense of responsibility for preventing disease transmission within the athletic training facility. April emphasized how the simple task of hand washing can have an enormous impact, stating, "Something as simple as washing your hands and not touching your face could prevent cross contamination and it really helps keep me safe and my athletes safe." Donna explained that engaging in proper hand hygiene was important in "making sure that I'm taking care of myself and not spreading things around the athletic training room or to and from the athletes." This was echoed by Leslie:

It's especially important now to make sure we're not transferring germs from person to person and ... from an athlete to ourselves. We are the common denominator between all teams right now. So if we are getting COVID from an athlete that we are treating, we can potentially transfer that to all the other teams ... we're working with. So I think it's very important that we are continuing to stay consistent with washing our hands after every person, even though it can be really hard and challenging to remember to do that every single time.

Tammy's perspective embodied ownership of the prevention of transmission of disease, as she stated:

I can be that one little factor that doesn't help spread anything ... [Students] might not do it throughout the day, but at least when I'm in [the athletic training facility], I know that I'm doing what I need to do. I'm washing my hands and then I'm encouraging our students to do the same.

Chris echoed the essential role secondary school athletic trainers play in the prevention of disease transmission:

We see more patients per practitioner than probably the normal physician does. You know, I know there's days where I can look at my injury log and there's 75 people that I've seen within a three-hour time. If we're seeing that many people in such a short amount of time, we're not taking care of ourselves by doing simple things like washing our hands or doing hand sanitizer in between each patient. And those are things that we need to do to take care of ourselves that way we can continue to provide care but also be respected and viewed as health care professionals.

### **Best Practices Awareness**

Participants perceived hand hygiene as important to disease transmission prevention overall. Andy explained, "It's important to keep the transmission of viruses and bacteria down from one person to another." When asked what cues are used in clinical practice to initiate hand hygiene, Ann described, "Before I begin ... seeing patients and taking somebody's questions ... that is my cue [to] do something in the form of hand hygiene." Tammy described her perception of best practices for hand hygiene, including performing hand hygiene:

Before and after patient interaction [with] 20 seconds, soap and water ... washing the thumbs, taking the time to scrub under the fingernails. However, [soap and water] is not always accessible, like on the sideline. And then the next best practice would be to have hand sanitizer.

Chris described his daily routine and how he balances the use of soap and water with hand sanitizer: "If we don't get a chance to go from a patient to wash your hands, it's mandatory that we use hand sanitizer in between." He also shared timely perspective on the importance of hand hygiene beyond his individual clinical practice.

As Chris stated:

If athletic trainers want to be seen as healthcare providers [and] medical professionals, we need to uphold good standards and hand hygiene is one of those standards. [We] kind of fall into this gray area of people don't respect us as healthcare providers and it's little things like hand washing, hand sanitizing, being the person who sets the standard on wearing the mask. Those things are really important because they're the small things that add up to the big things... Or definitely recognize that we are health care providers, not just the person who's standing there in khakis or ... somebody that's going to be able to provide a band aid [and] we're there for a very strong purpose and those little things add up to the big things. And I know hand hygiene is one of them.

Tammy recognized her role as an essential healthcare provider on the school's campus, stating, "At the [secondary school setting], I am the only one that can provide some sort of healthcare, aside from our nurse on the other side of the campus." Donna echoed the importance of athletic trainers adopting quality hand hygiene practices as essential health care providers. She went on to explain that secondary school athletic trainers face particular challenges with respect to hand hygiene while detailing her perception of best practices:

For athletic trainers, I think it's harder than for other health care providers that are in a hospital or a clinic setting all the time. Where they're always inside, but for athletic trainers, when you're inside, you should be washing your hands after every person, after touching equipment other people have touched, after taping somebody, and then when you're outside and not able to wash your hands, I think that you should use hand sanitizer as a substitute until you can go back inside and wash your hands.

### Resources

All but one participant indicated they received some sort of infection prevention training during on-boarding for their current position. Of those who received training, all but one was done through passive, online education modules involving videos, reading text, and quiz questions required for successful completion of the training module. Mark described his on-boarding and annual training:

We do compliance trainings every year, like personal protective kind of trainings that we have to take and we get quizzed on ... to show understanding of that ... And it's basically just ... universal precautions ... washing your hands, wearing gloves whenever there's blood, what to do with needles and sharps.

Some participants noted their employer's trainings were directed toward other health care professionals, and perceived those recommendations as less than congruent with athletic training clinical practice. Tammy explained:

[The training was] more specific [to] nursing ... [including] washing hands between patients, and gloves, and making sure you [wash hands] before and after [patient contact]. So that one was a little bit more geared towards a different profession. But ... we wear gloves and we use hand sanitizer. We have sinks. So [the training] is still able to be used here in our setting, just has to be changed a little bit.

The overall message shared regarding participants' training with respect to hand hygiene was that the training was minimal and non-specific, completed independently in online modules. Andy simply stated his hand hygiene training was simply, "Computer based training. We went over hand washing and cleaning techniques [which] was about 15-20 minutes long."

Ten out of eleven participants stated they had access to a sink with soap, water, and paper towels within the athletic training facility where they provide care and perceived this access to aid in improvement in hand hygiene adherence for both clinicians and patients. April, who stated she did not have a sink in the athletic training facility where she provides care, perceived this lack of access and resources as a barrier to her hand hygiene frequency. She stated:

I should be washing my hands a lot more obviously, but given my current circumstances, I don't as much as I need to be. Ideally, if I had a sink in my [athletic training facility] I would be doing it between every patient. But because of the high volume of athletes I see, and just the timing ... It's not practical to run to the sink between every athlete.

A majority of participants stated an increase in the availability of physical resources for hand hygiene as a result of COVID-19, including soap, paper towels, hand sanitizer, and visual signs near sinks and in various places across the school. As Tom described, "There are hand sanitizer stations almost everywhere, and they do get changed out frequently ... those are the two changes that come to mind, and the hand sanitizer stations and the visual aid resources." Ben expressed the importance of administrative support in providing financial resources to promote hand hygiene:

[The administrators] do an absolute phenomenal job of making sure we have enough soap and paper towels, and we have a sink in our facility. All the sinks in the bathrooms are open for people to walk in and wash hands and there's been an abundance of sanitizers open and available since the onset of COVID.

Ann's experience echoed the availability of physical and financial resources to support hand hygiene in her clinical practice:

I have a sink with two soap dispensers in my athletic training facility. And then I have a full-size hand sanitizer on the gator that we bring outside, and I have a hand sanitizer in my pack, and I have a hand sanitizer in my room, so lots of hand sanitizers all around and then [the school] provides me with the soap and all those kinds of things that are needed for my facility.



### Community-Based Prevention

For some participants, hand hygiene was not considered a high priority for patients entering the athletic training facility. Tammy explained:

Unfortunately ... [the student-athletes] are not as concerned with the pandemic and hand hygiene. They haven't changed much or they've just added an extra hand sanitizer because of parents or other adults pushing them.

Leslie shared a similar experience, stating, "A lot of the students get cranky with us when we asked them to hand sanitize when they first come in [the athletic training facility]." April echoed that the secondary school where she practices, "[Hand hygiene] is not strictly enforced. No one really seems to care, unfortunately."

Participants described frustrations with enforcing hand hygiene with patients using the athletic training facility. Leslie disclosed, "I can only focus on the things I can control," and went on to explain:

I don't personally make athletes wash your hands when they come in, mainly because I am not touching their hands and I wipe down every surface after they leave, and I'm only allowing a few people at a time to come in to follow social distancing rules. In my personal athletic training room, I don't make other people wash their hands when they come in.

Ron also shared the approach of not requiring patients to perform hand hygiene when entering the athletic training facility. He stated:

If there's something that needs to be addressed ... that I need to touch their hands or something like that, I have them wash [their hands], or if they if they're bleeding ... they wash their hands ... I don't make them wash [their] hands when they come in ... there's no mandate, there's no rule that says you must hand sanitize before you come in the room.

Most participants explained that patients were required to perform hand hygiene when entering the athletic training facility. Chris explained the process he uses to enforce hand hygiene in the facility where he practices:

It's the standard that my staff has set so that we ensure every single time we talk to somebody, we just ask, 'Did you hand sanitize?' ... The students know that as soon as they walk into my room what the expectation of them is, and it's not a big, long rule list.

Donna described a similar approach in the athletic training facility where she practices:

As of right now, we are enforcing hand sanitizer [or] hand washing before we do any treatment with the athlete." Tammy emphasized the importance of involving her athletic training student aides in the enforcement of hand hygiene compliance in the athletic training facility, explaining, "I firmly believe that my athletic training student aides are an extension of myself and ... the way the clinic functions. So just because they're high school students ... they have the same expectations.

### DISCUSSION

The purpose of this research was to understand the self-reported hand hygiene behaviors and challenges associated with adherence to proper hand hygiene behaviors of secondary school athletic trainers engaged in clinical practice. Additionally, this project aimed to investigate how well secondary school athletic trainers are being prepared to mitigate infection transmission during the COVID-19 pandemic. The project addresses a gap in the literature regarding hand hygiene in athletic training practice and to our knowledge is the first to address this topic in the context of the COVID-19 pandemic.

Hand hygiene has been repeatedly emphasized as an essential public health measure to prevent the transmission of COVID-19, along with mask wearing and physical distancing.<sup>20</sup> Participants' responses reflected the increased awareness of the role hand hygiene plays in disease transmission prevention. This is supported in one study where, despite use of full PPE when caring for COVID-19 patients, healthcare workers in China were at increased risk of COVID-19 transmission if hand hygiene was not performed.<sup>21</sup> Most participants described best practices as stated in the NATA position statement on skin diseases, though not all participants mentioned all of the recommendations.<sup>13</sup> Similar to the findings of Kahanov et al, despite knowledge of best practice recommendations, clinicians are not following best practices during clinical practice.<sup>14</sup> A majority of participants stated that best practices follow the current recommendations set forth by the CDC and WHO, including hand washing for 20 seconds and using at least 70% isopropyl alcohol-based hand sanitizer when hand washing with soap and water is not available.<sup>22</sup>

Despite some participants describing indications for the initiation of hand hygiene supported by current recommendations, some indications were missed by most participants. The indications that were absent included before and after eating food, after touching commonly touched surfaces, before putting on a mask, and after removing a mask.<sup>22</sup>

The majority of participants described the widespread availability of hand hygiene resources including sinks, soap, and hand sanitizer, which is supported in the literature to increase hand hygiene frequency by facility visitors.<sup>23</sup> Despite an increased availability of hand sanitizer, participants did not perceive an increased frequency in patient hand hygiene frequency. The contrast between resource availability and use makes apparent that clinician enforcement of patient hand hygiene adherence, rather than resource availability, may contribute to a lack of patient adherence to best practices. Athletic trainers should make dedicated efforts to enforce proper hand hygiene practices for patients as well as themselves. It is also possible that the location of the hand sanitizer played a role in patient hand hygiene practice, as location near the entrance of the room has been shown to increase patient hand hygiene practice in a clinical setting.<sup>24</sup> Patient hand hygiene has been identified as essential in mitigating infection transmission in other settings and encouragement by the clinician is beneficial to increase patient hand hygiene.<sup>25</sup> While participants noted most of the recommendations for health care providers, the recommendations for returning to sport during COVID-19 from the National Federation of State High School Associations (NFHS) only recommends that, "hand sanitizer should be plentiful and available to individuals as they transfer from place to place."<sup>26</sup> Previous NFHS recommendations for sports hygiene recommend athletes should, "clean hands with an alcohol-based gel or soap and water before and after every practice and contest to decrease bacterial load on the hands."<sup>27</sup> Despite these recommendations, participants reported an overall increase in hand hygiene frequency by patients, but many opportunities for hand hygiene from patients may still be missed.

Despite the self-reported increase in hand hygiene frequency, some participants indicated they were not always compliant with hand hygiene recommendations as they should be. The majority of participants described hand hygiene behaviors between each patient, which indicates an increase compared to the findings of Kahanov et al. who found only half of athletic trainers surveyed in their study washed their hands before and after each patient contact.<sup>14</sup> However, participants' responses align with self-reported data provided by other health care professionals with respect to hand hygiene and COVID-19, including identifying hand hygiene as an effective transmission prevention measure, reporting increased hand hygiene frequency, and indicating the need for soap and water use when performing hand hygiene whenever possible.<sup>28</sup> While the COVID-19 virus resulted in a heightened awareness of the importance of hand hygiene on a public health scale, some evidence has shown that health care professionals in hospital settings initially increased their hand hygiene performance at the onset of the pandemic, but performance decreased to pre-pandemic levels within two months.<sup>29</sup> Indeed, fear has been identified as the most common predictor of positive behavior change with respect to public health recommendations during COVID-19.<sup>30</sup> Most participants stated they hoped their increased hand hygiene frequency would continue, even as fear of the pandemic dissipates, noting its importance with respect to best practices.

There are several implications for clinical practice that can be derived from the findings of this study. First, athletic trainers are health care professionals and should identify as such, both intrinsically and within the healthcare community and broader community. Athletic trainers and school nurses are the primary health care providers in the secondary school setting, who play a crucial role in advocating for public health initiatives to support the health and safety of students and staff within the school to promote a safe, healthy environment. The literature supports the use of interventions, including educational sessions, verbal, and visual cues, as well as the implementation of policy to support improved hand hygiene frequency among facility users.<sup>23</sup> Athletic trainers would benefit from additional targeted educational training regarding hand hygiene to promote widespread adherence to best practices across all settings. Education must begin at the student level, with adequate emphasis placed on the importance of hand hygiene in professional programs, including the reinforcement of proper hand hygiene modeled by faculty and preceptors during students' clinical experiences.<sup>31</sup> Despite the integration of hand hygiene in the 2020 CAATE Standards, many actively practicing athletic trainers may not have received formal education regarding hand hygiene in their professional education. Indeed, the burden of proper hand hygiene should not be left to professional level programs alone and should be included and emphasized in employee workplace training universally.<sup>19</sup> As athletic training continues to advocate for a stronger presence as a healthcare profession, clinicians must prioritize the skills that may feel elementary, but are essential to healthcare. The findings of this study support the creation and enforcement of a facility policy and procedures document to include infection prevention and control, which has been supported by the BOC in its most recently updated guide for athletic training policy and procedure development.<sup>32</sup> Athletic trainers may also use the BOC Facility Principles document to advocate for proper hand hygiene resources in the athletic training facility, as directed by the document.<sup>33</sup>

### Limitations

The interviews for this study were done as secondary schools were returning to activity during the COVID-19 pandemic (September – November 2020), which likely created a heightened sense of importance regarding hand hygiene. Additionally, the behaviors are self-reported, which could limit accuracy compared to behaviors assessed with direct observation. The hand hygiene literature

specific to athletic training is minimal, requiring comparisons to be made to other health care professions. Future research should include a wider sample, as well as investigation into other athletic training practice settings beyond the secondary school. Research would also benefit from exploring the education athletic training students receive in their professional level programs with respect to hand hygiene best practices. Considering the lack of hand hygiene research in the athletic training profession, additional investigation in this area would be invaluable to the profession. Specific research interests could include investigating adherence to hand hygiene recommendations through direct observation, exploring setting-specific barriers to hand hygiene compliance, and examining athletic trainers' perception of the role of hand hygiene in their clinical practice. Research in this area aims to improve clinical practice and patient safety while also distinguishing athletic trainers as health care professionals capable of providing high quality patient care in a myriad of settings.

## CONCLUSION

Athletic trainers reported increased frequency of hand hygiene behaviors as a result of the COVID-19 pandemic. Despite an increase in resource availability, athletic trainers still report missed hand hygiene opportunities in the workplace. Athletic trainers would benefit from educational interventions to reinforce hand hygiene best practice implementation. It is essential for clinicians to take responsibility not only for their own hand hygiene behaviors, but also those of the patients and users of their athletic training facilities to ensure the best possible mitigation of disease transmission within the athletic training facility.

## REFERENCES

1. Evidence of hand hygiene to reduce transmission and infections by multi-drug resistant organisms in health-care settings. [https://www.who.int/gpsc/5may/MDRO\\_literature-review.pdf](https://www.who.int/gpsc/5may/MDRO_literature-review.pdf).
2. Chen X, Ran L, Liu Q, Hu Q, Du X, Tan X. Hand hygiene, mask-wearing behaviors and its associated factors during the COVID-19 epidemic: A cross-sectional study among primary school students in Wuhan, China. *Int J Environ Res Public Health*. 2020;17(8):2893. Published 2020 Apr 22.
3. Hirose R, Ikegaya H, Naito Y, et al. Survival of SARS-CoV-2 and influenza virus on the human skin: Importance of hand hygiene in COVID-19 [published online ahead of print, 2020 Oct 3]. *Clin Infect Dis*. 2020;ciaa1517.
4. Kratzel A, Todt D, V'kovski P, Steiner S, Gultom M, Thao TTN, Ebert N, Holwerda M, Steinmann J, Niemeyer D, Dijkman R, Kampf G, Drosten C, Steinmann E, Thiel V, Pfaender S. Inactivation of severe acute respiratory syndrome coronavirus 2 by WHO-recommended hand rub formulations and alcohols. *Emerg Infect Dis*. 2020 Jul;26(7):1592-1595.
5. Barr N, Holmes M, Roiko A, Dunn P, Lord B. Self-reported behaviors and perceptions of Australian paramedics in relation to hand hygiene and gloving practices in paramedic-led health care. *Am J Infect Control*. 2017;45(7):771-778.
6. Kingston L, O'Connell NH, Dunne CP. Hand hygiene-related clinical trials reported since 2010: A systematic review. *J Hosp Infect*. 2016;92(4):309-320.
7. Peterson AR, Nash E, Anderson BJ. Infectious disease in contact sports. *Sports Health*. 2019;11(1):47-58.
8. Gleeson M, Pyne DB. Respiratory inflammation and infections in high-performance athletes. *Immunol Cell Biol*. 2016;94(2):124-131.
9. Pärn T, Dahl V, Lienemann T, Perevosčikovs J, De Jong B. Multi-country outbreak of *Salmonella enteritidis* infection linked to the international ice hockey tournament. *Epidemiol Infect*. 2017;145(11):2221-2230.
10. Tillett E, Loosemore M. Setting standards for the prevention and management of travellers' diarrhea in elite athletes: An audit of one team during the Youth Commonwealth Games in India. *Br J Sports Med*. 2009;43(13):1045-1048.
11. World Health Organization. *WHO Guidelines on Hand Hygiene in Health Care: A Summary*. Geneva, Switzerland; 2009.
12. Centers for Disease Control. *Core Infection Prevention and Control Practices for Safe Healthcare Delivery in All Settings – Recommendations of the Healthcare Infection Control Practices Advisory Committee*. Atlanta, GA; March 15, 2017.
13. Zinder SM, Basler RSW, Foley J, Scarlata C, Vasily DB. National athletic trainers' association position statement: Skin diseases. *J Athl Train*. 2010;45(4):411-428.
14. Kahanov L, Gilmore EJ, Eberman LE, Roberts J, Semerjian T, Baldwin L. Certified athletic trainers' knowledge of methicillin-resistant *Staphylococcus aureus* and common disinfectants. *J Athl Train*. 2011;46(4):415-423.
15. Young LM, Motz VA, Markey ER, Young SC, Beaschler RE. Recommendations for best disinfectant practices to reduce the spread of infection via wrestling mats. *J Athl Train*. 2017;52(2):82-88.
16. Muller MP, Carter E, Siddiqui N, Larson E. Hand hygiene compliance in an emergency department: The effect of crowding. Merchant R, ed. *Acad Emerg Med*. 2015;22(10):1218-1221.
17. Jastifer JR, McNitt AS, Mack CD, et al. Synthetic turf: History, design, maintenance, and athlete safety. *Sports Health*. 2019;11(1):84-90.
18. BOC Standards of Professional Practice. Board of Certification website. [www.bocatc.org/system/document\\_versions/versions/69/original/boc-standards-of-professional-practice-2018-20171113.pdf?1510606441](http://www.bocatc.org/system/document_versions/versions/69/original/boc-standards-of-professional-practice-2018-20171113.pdf?1510606441). Published October 2017.

- 
19. 2020 Standards for Accreditation of Professional Athletic Training Programs. Caate.net. <https://caate.net/wp-content/uploads/2018/09/2020-Standards-for-Professional-Programs-copyedited-clean.pdf>. Accessed June 7, 2020.
  20. Lerner AM, Folkers GK, Fauci AS. Preventing the spread of SARS-CoV-2 with masks and other “low-tech” interventions. *JAMA*. 2020;324(19):1935-1936.
  21. Jefferson T, Del Mar CB, Dooley L, et al. Physical interventions to interrupt or reduce the spread of respiratory viruses. *Cochrane Database Syst Rev*. 2020;11:CD006207. Published 2020 Nov 20.
  22. Jindal R, Pandhi D. Hand hygiene practices and risk and prevention of hand eczema during the COVID-19 pandemic. *Indian Dermatol Online J*. 2020;11(4):540-543.
  23. Wichaidit W, Naknual S, Kleangkert N, Liabsuetrakul T. Installation of pedal-operated alcohol gel dispensers with behavioral nudges and changes in hand hygiene behaviors during the COVID-19 pandemic: A hospital-based quasi-experimental study. *J Public Health Res*. 2020;9(4):423-427.
  24. Cure L, Van Enk R. Effect of hand sanitizer location on hand hygiene compliance. *Am J Infect Control*. 2015;43(9):917-921.
  25. Haverstick S, Goodrich C, Freeman R, James S, Kullar R, Ahrens M. Patients' hand washing and reducing hospital-acquired infection. *Crit Care Nurse*. 2017;37(3):e1-e8.
  26. National Federation of State High School Associations. *Guidance for Opening up High School Athletics and Activities*. Indianapolis, IN: April 2020.
  27. National Federation of State High School Associations. *General Guidelines for Sports Hygiene, Skin Infections and Communicable Diseases*. Indianapolis, IN: October 2018.
  28. Sharma A, Aswal MR, Gupta R. Assessment of knowledge, attitude and practice regarding COVID-19 pandemic among health care professionals: A cross-sectional study. *J Clin Diagn Res*. 2020;14(9):5-10.
  29. Moore LD, Robbins G, Quinn J, Arbogast JW. The impact of COVID-19 pandemic on hand hygiene performance in hospitals. *Am J Infect Control*. 2021;49(1):30-33.
  30. Harper CA, Satchell LP, Fido D, Latzman RD. Functional fear predicts public health compliance in the COVID-19 pandemic [published online ahead of print, 2020 Apr 27]. *Int J Ment Health Addict*. 2020;1-14.
  31. Birnbach DJ, Rosen LF, Fitzpatrick M, Arheart KL, Everett-Thomas R. Current hand hygiene education is suboptimal. *Clin Teach*. 2019;16(6):589-592.
  32. Board of Certification. *BOC Guiding Principles for AT Policy and Procedure Development*. Omaha, NE: September 2020.
  33. Board of Certification. *BOC Facility Principles*. Omaha, NE: July 2020.
-