

Telemedicine Experiences of Athletic Trainers and Orthopaedic Physicians for Patients With Musculoskeletal Conditions

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Context: Telemedicine is the delivery of medical care from a distance using technology. The integration of telemedicine as a supplement to musculoskeletal-based patient encounters may be feasible in sports medicine.

Objective: To investigate health care professionals' perceptions of and experiences with telemedicine.

Design: Cross-sectional explanatory sequential mixed-methods study.

Patients or Other Participants: A purposeful sample of 17 athletic trainers from a National Collegiate Athletic Association Division I institution and 5 orthopaedic physicians from a sports medicine clinic located 92 miles from the campus.

Intervention(s): Participants were trained on the telemedicine platform and used it over 5 months for initial, follow-up, and discharge patient encounters.

Main Outcome Measure(s): Participants completed a preintervention survey containing the Theory of Planned Behavior and Technology Acceptance Model tool. Responses were analyzed using descriptive statistics and an independent-samples *t* test. After the intervention period, participants completed individual semistructured interviews that we coded using the consensual qualitative research tradition.

Results: From the interviews, the clinicians were characterized as telemedicine adopters ($n = 14$) or nonadopters ($n = 8$). The adopters reported higher levels of agreement on the Theory of Planned Behavior and Technology Acceptance Model tool as compared with nonadopters for all constructs. When comparing adoption status, we identified a difference ($P < .01$), with nonadopters reporting a low level of agreement for the subjective norm construct. The interviews revealed 5 domains: integration challenges, integration opportunities, collaborative practice, anticipatory socialization to future use, and benefits of integration. The participants indicated that integration challenges centered on "buy in," whereas opportunities aligned with the patient's condition and technology ease of use. They reflected that the telemedicine encounters required more preparation and yet allowed for cooperative behaviors between clinicians. The benefits of telemedicine included convenience and scheduling preferences that encouraged future use.

Conclusions: The integration of telemedicine in sports medicine brought about both challenges and opportunities for collaboration among athletic trainers and physicians that were heavily predetermined by the social pressures of colleagues.

Key Words: telehealth, collaborative practice, technology

Key Points

- Stakeholders should consider using the Theory of Planned Behavior and Technology Acceptance Model tool to assess clinician adoption when exploring telemedicine integration.
- The social norms of athletic training influenced "buy in" to using telemedicine.
- Telemedicine allowed for collaborative practice between the orthopaedic physician and athletic trainer in real time to promote continuity of care in managing patients with musculoskeletal injuries.

Collaboration among physicians and athletic trainers (ATs) is not only a legal obligation but one that facilitates continuity of care and improved patient outcomes.^{1,2} Moreover, the core competencies of health care include providing patient-centered care through shared decision making; working in interdisciplinary teams; integrating evidence-informed practice, including clinical expertise and patient values; supporting decision making using informatics; and applying continuous quality improvement to change the processes and systems of care.³ To accomplish each of the core competencies, innovative strategies that challenge the norm in sports medicine practice are necessary. Although methods such as popula-

tion-health promotion,^{4,5} expansion of electronic health records,⁶ and interprofessional practice⁷ have been described in the athletic training literature by authors seeking to improve the work of ATs, these methods typically highlight the roles and responsibilities of the provider but limit the integration of the patient into shared health-related decision making.

Telemedicine is a method of clinician-patient consultation that could improve the patient-centered delivery of health care in sports medicine.^{8,9} Telemedicine is defined as the delivery of care and education to a patient through synchronous videoconferencing, asynchronous telephone calls and store-and-forward imaging, or remote monitor-

Table 1. Participant Demographics

Pseudonym	Age, y	Sex	Credentialed Experience, y	Provider Type	Patient Panel or Specialty Area	Telemedicine Adopter?
Abbie	22	Female	<1	AT	Cross-country, track and field	Yes
Benjamin	23	Male	1	AT	Football	Yes
Bill	22	Male	<1	AT	Basketball	No
Devin	39	Male	14	AT	Baseball, soccer	Yes
Dr Allen	43	Male	11	Orthopaedic physician	Spine	Yes
Dr Knight	58	Male	26	Orthopaedic physician	Knee	No
Dr Moreno	65	Male	34	Orthopaedic physician	Shoulder	No
Dr Reed	46	Male	12	Orthopaedic physician	Hand, wrist, and elbow	No
Dr Smith	45	Male	10	Orthopaedic physician	Foot and ankle	Yes
Farrah	47	Female	20	AT	Administrative	No
Jake	31	Male	7	AT	Cross-country, track and field	Yes
Jerry	23	Male	<1	AT	Cross-country, track and field	Yes
Jessica	23	Female	1	AT	Basketball	No
John	27	Male	5	AT	Football	Yes
Kylie	24	Female	2	AT	Baseball	No
Maurice	27	Male	4	AT	Cross-country, track and field	Yes
Megan	24	Female	<1	AT	Swimming and diving	Yes
Sally	24	Female	3	AT	Swimming and diving	Yes
Sam	23	Male	<1	AT	Softball	No
Shae	24	Female	2	AT	Football	Yes
Theodore	24	Male	1	AT	Volleyball	Yes
Vicky	25	Female	3	AT	Football, cheerleading	Yes

Abbreviation: AT, athletic trainer.

ing.¹⁰ Commonly, the terms *telehealth*, *telerehabilitation*, and *teleconcussion* are often used interchangeably to discuss specific mechanisms of care such as general patient education, therapeutic exercise, and neurocognitive assessment, respectively, rather than prevention, care, or evaluation.^{11–13} Telemedicine has been used mostly to bridge the quality gap in health care for patients in remote and rural areas or patients needing high-demand specialty care.^{14–16} Although telemedicine has emerged as a mechanism in many fields of medicine, such as emergency stroke assessment and dermatologic evaluation,^{17,18} limited evidence is available on its role in sports medicine.

In orthopaedic care, telemedicine has been described as a method for initial evaluation,¹⁹ postsurgical follow-up,²⁰ and long-term rehabilitation²¹ of musculoskeletal conditions. Despite the positive findings and the continued expansion of state health laws and reimbursement patterns for telemedicine visits annually,²² we were unable to find any literature that examined user experiences relative to athletic training. Therefore, the purpose of our study was to investigate the perceptions and beliefs of ATs and physicians regarding the implementation of a telemedicine platform in a mixed rural-metropolitan collegiate athletic training facility for specialized orthopaedic physician consultations.

METHODS

This study used a cross-sectional explanatory sequential design with an online survey that addressed the empirical theories of planned behavior and technology acceptance paired with semistructured interviews. The Indiana State University Institutional Review Board approved this study.

Participants

We recruited a purposive sample cohort of 17 ATs (age = 27 ± 7 years, credentialed experience = 4 ± 5 years) from a midwestern National Collegiate Athletic Association

(NCAA) Division I institution and 5 orthopaedic team physicians (age = 59 ± 10 years, credentialed experience = 19 ± 11 years) from a sports medicine clinic located 92 miles from the institution. The institution was a medium-sized university that supported approximately 450 student-athletes on 16 NCAA Division I sport teams. Each of these student-athletes could have had a patient encounter through the telemedicine platform as part of the medical services rendered by either the ATs or orthopaedic team physicians if an injury that warranted care occurred. Moreover, the institution employed 5 full-time (year round, 40 hours per week) ATs and 12 part-time (academic year [August–May], 20 hours per week) ATs and had a formal agreement for patient care services with 5 orthopaedic physician specialists from a sports medicine clinic and surgery center. These 2 entities were selected because of a contractual agreement and previously defined relationship for student-athlete health care that had existed for more than 20 years at the time of the study. Each potential participant involved in the health care services at the university and sports medicine clinic was recruited via email to provide consent and navigate the preintervention online survey. Participant demographic information, including pseudonyms, is shown in Table 1.

Instrumentation

Participants completed the valid and reliable Theory of Planned Behavior and Technology Acceptance Model (TPB-TAM) tool.²³ The TPB-TAM tool contains 6 constructs that are scored on a 7-point Likert scale (1 = *strongly agree*, 7 = *strongly disagree*; a score of ≤ 3 indicates positive planned behavior).²³ The 6 constructs of the TPB-TAM are attitude, subjective norms, perceived behavioral control, perceived usefulness, perceived ease of use, and behavioral intention, which are predictors from each of the 2 theoretical concepts. The theory of planned behavior constructs center on social pressures related to the

Table 2. Interview Protocol^a

1. Please describe your experience over the past 5 months with telehealth.
 - a. Can you provide a couple of examples of when you used telehealth with your patients?
 - b. How did your patients respond to the consultation?
 - c. How did you measure the effectiveness of your consultation?
2. What benefits did you experience from the use of the telehealth platform?
3. Please describe how your patient care has changed, if at all, following the use of the telehealth platform.
4. Please describe any barriers you may have experienced when using the telehealth platform.
5. Describe how you perceive telehealth being used in athletic training in the future, if at all.
6. Additionally, responses from the survey tool per individual will be used to provide context for guided follow-up questions.
 - a. For example: "You stated that you strongly agree that using telemedicine technology in patient care and management is unpleasant before the start of this study. Can you explain why you agree with that? Can you explain if your viewpoint on telehealth has changed over the course of the 3 months?"

^a Instrument is reproduced in its original format.

behavior (subjective norms) and reflection of past experiences in conjunction with future expected barriers (perceived behavioral control).²⁴ Similarly, the technology acceptance model incorporates thoughts that a system would enhance one's job performance (perceived usefulness) and thoughts related to using a system that is free of effort (perceived ease of use).²⁴ Finally, both theories include the positive or negative assessment of a behavior (attitude) and the intention to execute a behavior (behavioral intention).²⁴ The TPB-TAM tool was administered through an email with a confidential survey link (Qualtrics, Inc, Provo, UT). The TPB-TAM tool has been used in previous research²³ related to health care professionals' use of telemedicine.

For the individual phone interviews, the 6-question, semistructured protocol (Table 2) was evaluated by a panel of qualitative researchers for content validity; no changes were required.

The interviews were performed after the 5-month intervention period.

Procedures

The study procedures spanned 7 months, with recruitment in July 2017, the telemedicine intervention from August to December 2017, and completion of the follow-up interviews in January 2018. After completion of the preintervention survey, the principal investigator (Z.K.W.), who is an AT with certification as a telehealth facilitator,²⁵ conducted the training and onboarding of the ATs and orthopaedic team physicians. The training consisted of a synchronous session to introduce the telemedicine platform, a troubleshooting help sheet, and answering of questions. The training sessions were completed in a large-group setting for the ATs in their athletic training facility and with the orthopaedic team physicians in their sports medicine clinic. For additional review after the initial training session, the participants were also provided with links to curated videos describing how to use the telemedicine platform via

smartphone or computer. The training addressed the background of telemedicine, how to facilitate and conduct telemedicine encounters, and how to track and document the encounters. At the end of the training, live use of the telemedicine platform was demonstrated. Over a 5-month intervention period, the participants used the telemedicine platform for orthopaedic-based initial, follow-up, and discharge patient encounters. During the intervention period, weekly emails were sent to all participants (ATs and orthopaedic team physicians) to remind them to consider using telemedicine, log their encounters, and contact the principal investigator for continued training on the telemedicine platform. The ongoing training was necessary and completed on an individual basis, either face to face or via asynchronous communication to show the provider the icons and buttons on the telemedicine platform. During a telemedicine encounter, the AT and patient met with an orthopaedic team physician with specialty training in foot and ankle; knee; hip and pelvis; shoulder; or elbow, wrist, and hand. To ensure patient privacy, the researchers were not present for any of the telemedicine-based encounters.

The telemedicine platform used in this study was Doxy.me (Doxy.me LLC, Rochester, NY). A commercially available platform, Doxy.me is compliant with the Health Insurance Portability and Accountability Act (HIPAA) and Health Information Technology for Economic and Clinical Health Act. The application is advertised as a free platform with an opportunity for upgrades related to the look, feel, and use of the site that would require a monthly or annual subscription. In addition, Doxy.me allows for photo capture for medical documentation, live chat, hosting of 3-way calls, screen sharing, secure file transfer, a virtual waiting room, and medical billing using a business associate agreement and National Provider Identifier number. For the purpose of our study, the orthopaedic team physicians did not bill for their services rendered through the telemedicine platform. The telemedicine platform did not require a download. The platform is considered simple to use for telemedicine encounters, as it does not require additional hardware or software beyond a video camera and microphone.²⁶ Doxy.me provides the clinician with a custom link that is connected to the clinician's telemedicine account and can be shared with the patient. Doxy.me was accessible via either a desktop (Macintosh or personal computer) or smartphone application (iOS or Android). We purchased and distributed 4 Chromebooks (Google LLC, Mountain View, CA) to the athletic training facility at the institution ($n = 2$) and the orthopaedic team physicians' sports medicine clinic ($n = 2$), but the patient encounters could be initiated using any accessible device.

After the 5-month intervention period, each participant was contacted by email to schedule a one-on-one, audio-only, Internet-based phone interview. The interviews were hosted through a commercially available videoconferencing program (Zoom, San Jose, CA) using a unique telephone number for each interview. Each semistructured interview lasted between 15 and 30 minutes. At the end of the interview, an MP4 audio file was transcribed by an artificial intelligence transcription company and its accuracy was verified by the research team.

Table 3. Theory of Planned Behavior and Technology Acceptance Model Tool Construct Means^a

Construct	Mean ± SD		
	Total Sample (N = 22)	Adopters (n = 14)	Nonadopters (n = 8)
Attitude	2.86 ± 0.99	2.57 ± 0.93	3.38 ± 0.93
Subjective norms	3.67 ± 1.00	3.31 ± 1.03	4.29 ± 0.58
Perceived behavioral control	3.00 ± 0.87	2.81 ± 0.98	3.33 ± 0.50
Perceived usefulness	2.85 ± 1.15	2.64 ± 1.17	3.21 ± 1.11
Perceived ease of use	3.18 ± 0.96	2.86 ± 1.02	3.75 ± 0.53
Behavioral intention	2.97 ± 1.12	2.73 ± 1.26	3.38 ± 1.03

^a Normative value = 3.0; 1–3 = positive behaviors, 3–7 = negative behaviors.

Data Analysis

Quantitative data from the TPB-TAM tool were downloaded and transferred to SPSS (version 25.0; IBM Corp, Armonk, NY). The data were analyzed using descriptive statistics (mean and standard deviation) for each construct with review based on the normative values of negative (≥ 3.0) and positive (≤ 3.0) planned behaviors. An independent-samples *t* test was completed for each construct of the TPB-TAM tool based on the adoption status as identified from the qualitative interview. Adoption status was determined by the first interview question based on the participant’s experience during the intervention period. Participants who self-reported using telemedicine at least once for patient care were characterized as *adopters*, and participants who stated they did not use it at all were categorized as *nonadopters*. The a priori α level of $P \leq .05$ was set for the comparative analysis.

We analyzed the qualitative data using the consensual qualitative research tradition,^{27,28} which has been used previously in athletic training research.⁶ After the audio-recorded interviews were completed, the qualitative analysis team, consisting of all 3 authors, met to discuss and agree on how to describe the meaning of the data and adoption status. To ensure the trustworthiness of the data, 2 external auditors assessed the coded transcripts and member checking was performed on participant feedback on coded responses.^{27,28} The qualitative data were further described using frequency classifications based on the number of participants who had coded statements in each category. The frequency classification followed the consensual qualitative research tradition, with *general* meaning a category was identified in all or all but 1 (21 or 22) of the participant transcripts, *typical* meaning the category was identified in at least 11 but fewer than 21 transcripts, *variant* meaning the category was present in 5 to 10 transcripts, and *rare* meaning the category was coded in 4 or fewer transcripts.^{27,28}

RESULTS

Among the clinicians, 72% (n = 16 of 22) had no previous experience with telemedicine. Based on the interviews, we characterized the clinicians as telemedicine adopters (n = 14) or nonadopters (n = 8). On the preintervention TPB-TAM, adopters reported higher levels of agreement than nonadopters for all constructs (Table 3). Whereas the subjective norm construct was the sole

Table 4. Qualitative Interview Domain and Category Counts (N = 22)

Domain and Category	Count	Frequency ^a
Integration challenges		
Buy in	21	General
Cases and conditions	17	Typical
Technology	20	Typical
Integration opportunities		
Buy in	18	Typical
Cases and conditions	16	Typical
Technology	17	Typical
Collaborative practice		
Encounter preparation	12	Typical
Cooperative behaviors	14	Typical
Anticipatory socialization to future use	22	General
Integration benefits		
Convenience and scheduling preferences	21	General
Enhanced patient care	7	Variant

^a *General* = the category was identified in all or all but 1 of the transcripts; *typical* = the category was identified in ≥ 11 but < 21 transcripts.

construct with a negative planned behavior for the adopters, nonadopters reported no positive planned behaviors. Additionally, a difference between adopters and nonadopters was identified for the subjective norm construct ($P < .01$), thereby demonstrating that the social norms of athletic training influenced buy in to using telemedicine.

The qualitative analysis revealed 5 domains: integration challenges, integration opportunities, collaborative practice, anticipatory socialization to future use, and benefits of integration. The frequency counts of coded domains and categories are provided in Table 4. Integration challenges centered on buy in, whereas opportunities aligned with the patient’s condition (eg, follow-up visits) and technology ease of use. Participants reflected that they prepared for the telemedicine encounters more and that the interaction allowed for cooperative behaviors between providers. The benefits of telemedicine included convenience and scheduling preferences that encouraged its use in future situations.

Domain 1: Integration Opportunities

Integration opportunities specific to buy in, cases and conditions, and technology emerged as a domain and categories, respectively, throughout the study. Participants remarked that the resources and training necessary for the platform prepared them to integrate telemedicine into their practice. Dr Allen, an orthopaedic team physician with a spine specialty, said: “I feel that the resources were sufficient. It is not a complicated platform to use. I think the training was appropriate.” The simple navigation of the platform and the ease of use of telemedicine promoted the integration of the delivery mechanism during the study. Theodore, an AT in the transition-to-practice phase of his career (certified for < 3 years), commented:

I really enjoyed using telemedicine. It was actually surprisingly easy to use, once you just figured it out. It did take just a minute to kind of figure out what the heck

I was doing, but it was really nice to be able to use [the platform].

Regardless of the integration and adoption status of the participant, most individuals noted the expansion of technology in their everyday lives, which could have flowed into their professional lives. Sam, a graduate assistant AT, stated:

I think most people have access to computers and smartphones now days. I think in this day and age, we have so much access to technology that it is not unreasonable for anyone to get on to this software and to start using telehealth.

The integration opportunities continued with buy in from the providers and patients. Jerry stated: “My direct supervisor was 100% on board. He dealt with most of the encounters. He loved it and thought it was [a] great alternative.”

Whereas some of the participants noted an immediate interest in using the telemedicine platform, others described a slower adoption over the 5-month intervention period. The peer-to-peer learning and conversations among the athletic training staff altered their perceptions of telemedicine during the study. Jessica, a second-year graduate assistant AT who was a nonadopter of telemedicine, explained:

I think [my perceptions] changed moderately in a positive aspect because I feel that as people have been using it and then there has been some positive talk about it, that our supervisors have become a little bit more receptive to it.

Jessica’s sentiments regarding supervisor buy in weighed heavily in the adoption and integration of telemedicine for her. A supervisor of the graduate assistant ATs, Farrah, noted how her attitude toward telemedicine changed over time from a state of unwillingness to a thoughtful judgment of the technology:

I think one of the things I hope that you learned from this as well with working with us is that I wasn’t really bought into it in the beginning, and I think with patience and education, you can steer some of us in the [right] direction.

Finally, the physicians and ATs shared how they used telemedicine to care for specific patients and conditions. Dr Smith stated, “Most of [the patients] were foot and ankle [postoperative] checks, really quick. Or just injury checks on something that was getting better.” The AT who worked closely with Dr Smith during the study felt the same: that most of the telemedicine encounters were follow-ups, yet they each had a different sense of what occurred during patient consultations. Jake highlighted:

I probably used it 8 to 10 times, ranging from follow-up visits to initial visits with our physicians. Overall, I think it worked well. Most of the follow-ups were all stress fracture–related in the tibia. I think I had one or two

initials [encounters], most of which were tibial stress fractures as well, and then I believe we had one patient, she was getting cleared for full return to play from a [spondylolysis] that she had been dealing with the prior 8 months, which went well.

Dr Moreno, a nonadopter of telemedicine, explored opportunities in which he could have integrated telemedicine:

It kind of depends on the time frame. There are some things, particularly early on, a suture removal for example, we can probably look at a wound by teleconference. Tell if it is okay and have someone at the school take out the stitches.

Interestingly, an AT communicated similar sentiments about how she could integrate telemedicine with the procedures and skills she could perform. Unaware of his remarks, the AT, Vicky, described an interaction with Dr Moreno that occurred during the intervention period:

We have a [postoperative] patient right now, and his visit up [at the sports medicine clinic] was basically making sure his incisions looked fine and that his range of motion was good. So, it was about a 15-minute conversation with that surgeon. That is something that we could have easily done [on telemedicine]. We know his incisions are clean and we measured his range of motion on [an] every-other-day basis, so these are things that we could have had a telemedicine [encounter] with him.

Domain 2: Integration Challenges

Whereas the participants noted opportunities for integration, the postintervention interviews also identified a domain related to challenges focused on buy in, cases and conditions, and technology categories. Regarding technology challenges, the participants expressed concerns regarding the platform and connection. Sally observed:

We had a few technological setbacks, whether that be losing the picture feed, which, for the physician, did not seem like a big deal; he was able to overcome that. And then on another encounter, we just had a connection problem, which we fixed by using another mode of video, but just to patch it in the situation and to be able to finish our consultation. In those 2 brief situations, we were able to adjust and fix it and still use the telemedicine.

The technology setbacks related to the wireless connection and computer updates were similar struggles expressed throughout the interviews. Megan expressed comparable sentiments:

We had some trouble with the system. Turns out it was more at the [sports medicine clinic]. It was not necessarily on our end or with the program, which I could tell the physician was a little bit frustrated with it. So we ended up switching up to just using FaceTime, which obviously is not HIPAA compliant. But we were already there, so that’s how we did it.

In both situations involving technology problems, Megan and Sally looked for solutions via nonsecure mechanisms. Finally, Jake, who was a supervisor in the athletic training facility, spoke to the bigger concerns with technology integration:

I think a downfall to it is that one of the frustrations for athletic training facilities on using [telemedicine] is that, at least to my knowledge, there are not many, if any, [electronic medical record systems] that have it integrated within. I know a personal preference, I hate having to use 3 or 4 different software companies or programs to do everything we need, and why there cannot be one [electronic medical record] that has everything integrated within it is beyond me.

The challenges continued for the ATs, who described difficulties related to buy in from the physicians. To meet with the orthopaedic team physician, the ATs were required to transport each patient the 92 miles to the sports medicine clinic via school vehicle. Kylie, Abbie, and Shae commented on the physicians who would not consider telemedicine. Kylie shared,

If [the orthopaedic team physicians] were not comfortable to use [telemedicine] or they just were not willing to do it or not willing to learn, then that hindered us from doing [telemedicine]. And then we [have] to go into the [sports medicine clinic].

Abbie expressed similar frustration as she reflected on a patient encounter:

It was literally a 10-second interaction with the physician assistant one time, a 10- to 20-second interaction the second trip with the physician, and we have another one coming up. So, it was pretty frustrating just as me, for the clinician, to drive an hour and a half up there for a 10- to 20-second interaction. And it was very simple maneuvers that I could have done through a computer screen, and I feel that because my patient had to get out of classes, so he definitely had some issues there with the professors.

Challenges with buy in related to the physicians' unwillingness to explore telemedicine for quick encounters led to frustration for some of the ATs. Shae said:

I think that some of the physicians were just set in their ways and not as willing to try something new. Especially for some of our shoulder patients, I would say. We had, I think, 3 or 4 labral tear repairs, and in my opinion, [it] was not necessary to bring a patient for a doctor visit to just evaluate their range of motion and tell them what to expect for their upcoming surgery, when the same thing could be done via telehealth.

Finally, the ATs and physicians both identified certain hindrances in using telemedicine specific to the patient and condition. Dr Knight and Dr Moreno, both nonadopters during the intervention period, explained their rationale for lack of use. Dr Knight explained:

I did not use it and I know why. It would make it difficult for the problems that I deal with to use it. Because I'm doing knee exams, seeing people for knee problems, part of my exam, my ability to treat that patient is so dependent on the physical exam. Where are they tender? How tender are they? Stability exam and stability is a feel. I have got to know what they feel like. A new injury, a follow-up injury, made it hard to use it. Because my either initial evaluation or my follow-up evaluation is so dependent upon hands on, not witnessing but actual hands on, the feel of that, it makes it hard.

Dr Moreno conveyed a similar message of limitation related to not being able to physically touch the patient:

The biggest issue would be physical examination. Laying my hands to feel how a joint move[s], what the motion is, things like that. There is obviously no way we could do that with teleconferencing, effectively. So, I would have to be face to face, person to person to be able [to] lay on my hands and do an examination.

Jessica struggled as a nonadopter of telemedicine because of the lack of buy in from the physicians with whom she was collaborating on patient care. She had multiple patients with knee injuries that required multiple trips to the sports medicine clinic. Jessica elaborated on the situation:

Yes, I had so many [sports medicine clinic] trips just because I had one patient who had ACL [anterior cruciate ligament] reconstruction. Unfortunately, that was just a lot of [sports medicine clinic] trips just because she was not recovering very well. She just did not have great range of motion, and so he wanted to see her in person, so I ended up taking her up multiple times after her surgery. Her surgery was in November and then obviously, it is now end of January, and I think I took her up 3 separate times to be able to see him, but telemedicine was never an option. He wanted to see her in person. The other [patient] I saw [had] a grade 2 MCL [medial collateral ligament] injury, and I took her up at least twice for her injury. Within 6 to 8 weeks, I probably took her 3 different times up to [the sports medicine clinic]. That was just frustrating because he just wanted to check in with her and I think that could have been done over telemedicine.

Domain 3: Collaborative Practice

The third domain that emerged from the interviews was collaborative practice. From this domain, 2 categories described typical responses from the participants: encounter preparation and cooperative behaviors. *Encounter preparation* included the case review before the telemedicine consultation, and *cooperative behaviors* were interprofessional collaborations, peer-to-peer learning, and trusting relationships. Devin, an AT with 14 years of experience, communicated, "For some reason I feel like with the telemedicine versus when the doctor is here, the couple times we did it, I feel like for some reason we kind of prepared more for the telemedicine." These sentiments were echoed by Kylie:

It definitely makes you more aware of how you are proceeding with your evaluations and making sure that you are getting everything that your physician normally asks, so making sure that you are even more thorough than normal or maybe changing your evaluation a little bit to make sure that you are getting the proper things or doing it the way the physician wants versus the way you normally do it.

Although Kylie had the forethought to consider the orthopaedic physician's request for the encounter, other ATs prepared as they normally would for their clinical practice. Sally noted:

I was prepared for the communication and can look back on, "Okay, she was here with this range of motion, and now she is here," and there was 1 occasion, especially the first appointment, where [the orthopaedic team physician] said, "Here, I want [to] see this," even though I had given numbers, he wanted to see it for himself. So, I did a few [selective tissue] tests or a few measures with him on video, but for the most part I did it on my own and provided that information to the physician.

This idea of collecting information before the encounter versus demonstrating the outcome measures and reviewing the findings together led to the cooperative behavior category. John conveyed how telemedicine has improved and could continue to improve interprofessional collaborative relationships:

Personally, it helps out a lot as well, given a physician that you are working with and them being able to see your clinical skills. A lot of times, [the orthopaedic team physician] can only see clinical skills whether it is at a game or if they are in the athletic training [facility] or the clinic with you. Aside from that, they do not know exactly what you are doing or how efficient you are within your [rehabilitation] or your evaluation. That you can kind of show that physician where your strengths are at and how clinically competent you are via telehealth. That has been a positive aspect, especially from our graduate assistant standpoint that a physician can see, "Oh yeah, they know what they are doing evaluation wise," or, on the flip side to that, "This is what they could work on from an evaluation standpoint."

Dr Reed had a similar view regarding cooperative behaviors between the ATs and the orthopaedic team physician:

It is always good to establish a relationship with the [athletic] training staff and understand the level of experience of the [AT] prior to relying solely on the telemedicine. I do not think you have to have a several years' established relationship to consider telemedicine. I think that the telemedicine is probably a better tool when you are interfacing with [an AT] that has [a] broad level of experience and there is a confidence level [in the] physician-[AT] relationship.

The trusting relationship seemed to be a continued behavior that reinforced facilitation and the practice of each provider during the telemedicine encounter. Benjamin said:

The physician that I used telemedicine with twice before, I felt like we had a really good relationship. We communicated, not regularly of course, but whenever there was an incident, it was easier to communicate with him. He was easygoing to communicate already, prior to, and then even the first time we did telemedicine and we had a minor hiccup. He was very easy to communicate that, "Hey, there's a little issue on my end. Give me a minute."

Domain 4: Anticipatory Socialization to Future Use

During the interview, participants were asked to reflect on their experiences with telemedicine to explore if and how they could see themselves using it in the future. Regardless of adoption status, the general message from the participants was that they felt there would be a time and place for this technology within their clinical practice. In another example of the collective behaviors category, Shae explained how she would continue to use telemedicine as a means of establishing a relationship with the team physician:

I think it builds better relationships with your physicians because you are communicating on a different platform, not just in person. That holds a lot of accountability, as well. I think that this could help build, strengthen relationships with physicians, save time, and really just promote the newest technology to our patients and show how health care is evolving.

Beyond relationship development, many participants discussed a specific example of how they could see telemedicine as a benefit to their clinical practice. Dr Smith remarked, "[Telemedicine] is very good for taking care of athletes that you already know what is wrong with them and getting a checkup and see what is going on." A similar notion of completing follow-up care was provided by Dr Knight:

I would say more when an exam has returned to normal or near normal. It is more of a sign-off of a functional progression. So, somebody's got an MCL injury. I examine them, they are stable. Now it is really a matter of [the AT] putting them through a functional progression, but for them to go back, they got to get signed off by the team [doctor]. Well, you could say, "Hey, listen, I'm here with Joe today. Let me show you what he is doing." Almost like the video aspect of it, but do it live where you can ask, "Let me see him do this." I could see it more of when it gets more into the functional side of things.

Dr Knight was detailing how telemedicine could be used in the form of telerehabilitation, wherein the patient demonstrated therapeutic exercises using the videoconferencing platform rather than coming to the provider's clinic. Maurice suggested:

I think as we progress maybe more towards evaluations, if a physician's comfortable that way, maybe the mobile app or potentially an external webcam that you can maneuver more easily would be useful just to more easily position a camera or position between different areas or different things clearly.

Other participants followed this same line of thought, seeing themselves using the technology for telerehabilitation but also for other aspects of care in the domains of athletic training clinical practice. Bill considered:

I think on a daily basis of the things that I do, it might be evaluation or patient education or setting up therapeutic exercise or a rehabilitation program, I think a lot of those things, if you understand telemedicine and you have a good relationship with your patient, a lot of those things you can do through telehealth. Obviously, patient education would be just the same as talking to them on the phone. It just makes it a little bit more personable, when you can see your patient and the patient can see you. Then setting up a therapeutic exercise or [rehabilitation] program for them really would not be much different than taking them through something in the clinic. You have just got 2 computers between you and your patient, and you can kind of still walk them through everything that you would normally do.

Some of the participants reinforced the idea of “webside manner,” establishing and maintaining a rapport with patients despite the digital divide, which is essential in telemedicine care. Dr Allen viewed his future use of telemedicine from this angle:

Simple follow-up or going over lab results even in talking about regular labs or x-rays or MRIs [magnetic resonance imaging] or things where you typically would call someone or send them a letter. I think [telemedicine] gives it a more personal touch. I am more of a classic trained physician in the sense that I would like to always see my patients, have that face-to-face interaction, and talk [with] them and you cannot get that in today's world. And many times, we send faxes or emails or letters or we call them. Well, [telemedicine] is a step closer actually to what we would all like to have but we do not have the time for.

Domain 5: Integration Benefits

The fifth domain that emerged from the data was the benefits of integration. This domain highlighted 2 categories: the convenience and scheduling preferences of the patients and providers and enhanced patient care. The category *convenience and scheduling preferences* emphasized the time-saving aspect of telemedicine. Bill felt his patients “really liked the idea of having the option that [was] more feasible with their academic schedule and their athletic schedule.” Abbie added another potential benefit of telemedicine:

Although most patients live on campus, or near campus, it is not difficult for them to come into the clinic and see us. However, if it is over a break, which we just had a 3-

week break, and my postop patient was in their most critical stages, I think it would have been a huge benefit to have [telemedicine] available to the both of us.

Similarly, valuing one's time as a health care provider was a trickle-down effect of telemedicine. Sam addressed the general benefits of telemedicine:

Saving the money on gas and trips to [the sports medicine clinic], saving my time, because I value my time. So, not having to make trips to [the sports medicine clinic]. Also, providing me more time to provide care to my patients, so not having to go to [the sports medicine clinic] as much allows me to be more open with the patients getting back to health.

In terms of her longevity as an AT, Vicky predicted that telemedicine could improve her work-life balance:

With our [sports medicine] clinic being an hour and a half away, it takes it a minimum of 3 hours out of a clinician's day...takes 3 hours away from patient care. When you only have so many hours to work in a day, I think that is not a valuable use of our time. And the fact, you know, you think about the burnout rate in athletic trainers and if we are having to drive 3 hours to go to doctor's visits every single time, I think it kind of tacks on more time that you have to spend at your job that you're not doing other things because you are in a car for 3 hours. So, it is not like you are doing 3 hours of work, you are driving someplace for 3 hours, and that can take a toll on you after a while.

The ATs and orthopaedic team physicians both acknowledged potential benefits for their patients. Benjamin observed,

My patient, who has taken multiple trips to [the sports medicine clinic], he seemed very thankful that he did not have to make that trek when the meeting pretty much consisted of the same thing as the 5-minute evaluation he had through telemedicine.

Dr Moreno echoed similar thoughts:

Making it easier for [the patient] to get a conversation with me quickly. Because it's a distance...without that drive [the patients] might have been a little quicker to ask a few questions... from the [athletic] trainer's standpoint, of course, it is a time issue. It's a long drive. It takes a lot of effort to get athletes over here. So, a bigger advantage for them than it would have been for me.

A variant that emerged from the qualitative analysis was the category of *enhanced patient care*. Although only 7 participants viewed the benefits of telemedicine through this lens, the global aspect of communication and access to care was shared by the ATs in this study. Abbie asserted,

I think having these telehealth encounters in the clinic provides the patient autonomy because they can be in the

room, but that patient has the opportunity to still have that one on one with the physician before we step in, or need to step in at all.

This idea of being the “patient’s voice” during appointments for which the AT took the patient to the sports medicine clinic was also described by other participants. Sally commented:

My particular patient has an issue with communication, because she is from a foreign country, and so her English...she understands very well, but communicating back is pretty difficult for her. So even though it was telemedicine and there was the video components and some delays, things like that, she enjoyed it. It felt like there was less pressure on her to answer all the questions and be directed at. I feel like in an office everything is ... just being in person she feels more pressure to have an exact answer. And this way, we could even have a bit of a side conversation, I could help her communicate through this thing without it being awkward because of that telemedicine component and video component.

One AT would often drive patients from multiple sports to the clinic. This led to a patient having an AT as health care liaison who lacked familiarity with the patient’s case. Benjamin said:

I think [telemedicine] makes it easier for the patient-to-physician communication, specifically because I don’t know an instance where an athletic trainer was not there to help facilitate that communication. Sometimes, whenever we had patients go up [to the sports medicine clinic], their direct athletic trainer did not go with them, so sometimes that patient went into a doctor’s appointment without a health care provider and it was just the physician.

The idea of a facilitator in telemedicine emerged as an improved patient care topic. During the encounter, instead of serving as the provider from whom the patient was seeking care, the AT assisted the patient in the consultation with the physician. Maurice detailed this dynamic:

These might be some of the first physician visits that [the patients] are having without a parent or guardian present. So, it’s more nerve racking and now we are placing it in a mode of communication that they understand better and they have someone there to facilitate that visit. Whereas, like we mentioned before with going to [an] in-person physician visit, the physician is more used to leading that type of conversation and will take the reins and sometimes patients or even [AT] questions can fall to the wayside or get brushed aside in passing, just because like, “Yeah, I get what you’re asking, but it’s not really that pertinent,” versus in telemedicine, we are able to more directly ask those questions because you can’t get anywhere talking over one another in telemedicine, whereas you can do that in person. I think it facilitates more direct communication and almost more courtesy just because of the mechanisms of how it works.

Overall, the participants recognized the benefits of integration that met their own needs as well as those of their patients via convenience, scheduling preferences, and improving communications.

DISCUSSION

As defined previously, telemedicine is the practice of health care delivery over a distance using some type of technology device. Technology devices include telephone, email, and videoconferencing.²⁹ Overall, telemedicine is believed to play a critical role, which is only increasing with time, in the delivery of patient care.²⁹ Although cost-benefit analyses demonstrating how telemedicine affects patients and health care providers are currently lacking, given the nature of health care, we understand that this technology and delivery of services will affect the total structure of health care.³⁰ As a result, health care providers must consider how they will interact with a telemedicine system for patient care with respect to their knowledge, skills, and abilities. Our results showed that a purposeful sample of ATs and orthopaedic team physicians providing care to an NCAA Division 1 patient population both embraced the adoption of and perceived challenges to the integration of telemedicine for musculoskeletal-based patient encounters.

Adoption

The authors³¹ of a recent systematic review of musculoskeletal assessment via telemedicine by physical therapists indicated that these services were valid, reliable, and technically feasible for obtaining measures of pain, swelling, range of motion, muscle strength, balance, and gait. This information could create a paradigm shift in the delivery of health care services by ATs. In the telemedicine model, ATs can provide services and consultations without face-to-face interaction. However, it is important to reflect on how and with which patients telemedicine should be used. In our study, both the ATs and orthopaedic team physicians believed that telemedicine was useful for initial, follow-up, and discharge encounters; follow-up care after a diagnosis or intervention had been provided was cited most often. The adoption of telemedicine requires exposure time for the clinician to become comfortable. We suggest that clinicians begin to explore the adoption of telemedicine for follow-up care to improve buy in and select appropriate patients and conditions to ease the process for all parties. We did not limit exposure, which influenced integration challenges and opportunities alike.

The relationship between a physician and AT is typically dictated by contract, standing orders, and provider privileging. Although these documents create and define the relationship, the interaction and consultation are often dictated by the state practice act and daily schedules. As we continue to examine this contextual and contractual relationship, we must remember that the reason these individuals are working together in the first place is patient care. Their collaboration via telemedicine in this study was improved, which subsequently benefited the patient through quick and simple encounters. Our findings suggest that collaboration between the parties can be cooperative, whereby the physician’s trust in the AT may improve by watching the AT’s skills and abilities used in real time to

co-treat a patient. The AT was often in the room with the patient during the telemedicine call, which allowed the AT to perform selective tissue tests and functional assessments, including range-of-motion checks, as requested by the orthopaedic team physician. The interprofessional practice in action of clinicians collecting, sharing, and interpreting information may have enhanced patient care and the patient experience. Overall, telemedicine allowed for collaborative practice between the AT and orthopaedic physician in real time to promote continuity of care in managing patients with musculoskeletal injuries.

Additionally, patient preference for telemedicine has been related to reduced time and cost, with authors^{9,32} reporting that telemedicine encounters saved their sample of patients an average of 46 hours of driving time and \$1150 in travel-associated costs. Our results echoed these findings regarding telemedicine's ability to eliminate the time needed to travel to and from the clinic. Among the benefits of telemedicine we identified were efficiency for clinicians, including access to the physicians and more time in the clinic providing patient care rather than transporting patients to an appointment. Improved efficiency as a result of telemedicine integration has been a cited benefit in other health care professions.³³ Previous researchers²⁰ who evaluated telemedicine for postoperative orthopaedic care highlighted its convenience and access to care, including patient education regarding surgical complications, as the patients' caregivers did not have to drive the estimated 35 miles for a follow-up examination. Because ATs strive to be patient-centered providers, we should consider the scheduling preferences of our patients. Although our results indicated that one of the most frequent benefits of telemedicine was its convenience for the providers, it also helped student-athletes avoid missing class time. When considering traditional athletic training services, providers often ask their patients to report for follow-up care after a surgical intervention. However, if a patient is heavily medicated with opioids, the subsequent altered mental state can affect the ability to operate a motor vehicle. Thus, asking a patient to drive to a location for follow-up may be counterintuitive to healing.³⁴ Telemedicine may be a route for promoting patient safety when follow-up care is necessary, thereby improving social justice in the health care system.³⁵ Social justice can be achieved through improved access, quality, and cost effectiveness for patient education, evaluation, and care for a range of conditions and procedures.^{35,36}

Perceived Challenges

Previous investigators⁹ found that improved outcomes, ease of use, low cost, better communication, and decreased travel time accounted for most factors influencing patient satisfaction. Despite its positive attributes that can enhance the clinician-patient relationship, the adoption of telemedicine in clinical practice is affected by its usefulness, ease of use, design, technical concerns, time, and interactions with coworkers and patients.³⁷ To comprehend the acceptance of technology and telemedicine platforms in health care from a theoretical perspective, we must understand when, how, and why clinicians may embrace the potential of this delivery method for patient care. Under the theory of planned behavior, the intention to use

technology and telemedicine has been directly linked to the attitudes, subjective norms, and behavioral control of the individual.²³ In the technology acceptance model, attitudes and perceived usefulness often influence an individual's intentions to use.²³ The most important factor in physicians' acceptance of telemedicine platforms was their perceived usefulness.³⁸ In our study, subjective norms were the single most important construct that identified a negative planned behavior toward future adoption. *Subjective norms*, or the social pressures of colleagues, especially a supervisor, in support of a behavior, influenced the preintervention outcomes on the TPB-TAM tool. This means that the perceived notion of how telemedicine fits into everyday practice, which is typically rooted in the expected behaviors of an individual or group, was the area of most concern. This barrier to adoption is rooted in the belief that a person must perform in an expected manner. The aspects influencing clinicians' acceptance of telemedicine must be gauged before a new technology or innovative solution is implemented. If the learner or clinician does not want to accept the technology because of the subjective norms of the athletic training facility or colleagues, the implementation in long-term patient care will not be successful. We suggest that stakeholders explore the use of the TPB-TAM tool before training their staffs (other ATs and team physicians) on new technology such as telemedicine, as future buy in is heavily influenced pre-exposure by the perceived pressure to work in a similar manner to those around them.

The high rate of long-term telemedicine adoption relies on the promotion and willingness of the provider. Previous researchers³⁹ described a lack of clinician acceptance as leading to the failure of telemedicine; yet when the clinician accepted and supported the technology, patients followed suit. According to the acceptance model, challenges, whether preconceived, perceived, or lived, will ultimately dictate how sports medicine practitioners begin to use the service in daily patient care. It is also critical that ATs seeking to implement telemedicine determine the digital literacy of their patients and supervising team physician. Our participants perceived that the platform was simple to use and that practice increased their ease of use. Future authors should explore the digital health literacy of patients and ATs alike to better understand where educational efforts should be directed to promote technology solutions such as telemedicine across the profession.

Limitations and Future Research

This study was limited by a purposeful sample. As the profession begins to explore the introduction of telemedicine into routine athletic training services, we must have more small-scale studies of different patient care settings. Our findings may not be representative of ATs in other job settings, such as secondary schools, as the subjective norms related to adoption may be related to ATs who typically work as sole providers. The expansion of telemedicine across the profession could improve the access to ATs for rural and remote communities and bring skilled health care professionals to underserved populations. Future research should explore how the Sports Medicine Licensure Clarity Act, which extends liability insurance coverage for medical professionals who practice sports medicine across state

lines, may affect telemedicine encounters in athletic training. In the 2018 law, medical services are vaguely defined as services rendered to athletic teams and athletes. As such, the new law may serve as the basis by which athletic training practitioners can begin incorporating telemedicine across the profession.

Moreover, the focus of our work was on the provider's perspective relative to telemedicine integration. One of the fundamental pillars to evidence-based practice in health care is the patient's values and preferences. During data collection, we aimed to evaluate the patient's satisfaction at the end of the telemedicine encounter and complement that with follow-up interviews about the patient's experience. Unfortunately, returned patient assessments were few, and no follow-up interviews occurred. We encourage investigators to continue to assess the patient's view of telemedicine to see if the improved aspects of patient care from the provider's perspective mirror the patient's perception.

CONCLUSIONS

The integration of telemedicine in athletic training brought both challenges and opportunities for collaboration among ATs and physicians that were predetermined by the social pressures of colleagues. The main advantages were enhanced patient care, scheduling convenience, and cooperative relationship building. Buy in to technology and identifying the appropriate patient or condition for a telemedicine encounter brought challenges. Stakeholders should consider the TPB-TAM tool for assessing provider adoption when exploring telemedicine integration to reduce buy-in concerns and guide training and educational seminars.

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