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Original Article

# Analyzing and Addressing Telemedicine Barriers Among Lubbock Medicaid Patients

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## Abstract

There has been a widespread demand for virtual medicine since the COVID-19 pandemic. However, there are pertinent limitations, such as reliable internet, Zoom-capable technology, and technological literacy. Using retrospective chart review, a survey questionnaire was sent using Qualtrics Software to Medicaid patients seen at the Texas Tech Physicians Family Medicine Clinic from 2020 - 2022 with the goal of identifying potential barriers that may exist regarding telemedicine access in Lubbock, TX. More than half of the respondents (57%) reported never participating in a telemedicine visit, even though most respondents (76%) are semi-proficient with the use of technology. Almost half of respondents cited the COVID-19 pandemic as the reason why they began utilizing telemedicine (47%). Respondents did not use telemedicine because they were unaware that the service was an option or available for them specifically (43%). The underutilization of virtual medicine can, in large part, be attributed to a lack of publicity on the availability of telemedicine as a source of medical care. We sent virtual flyers to all Lubbock Medicaid patients to increase awareness and education on the benefits and practical uses of telemedicine in a wide variety of medical conditions. Additionally, we sent virtual flyers to physicians to help increase the number of practitioners offering telemedicine services. By increasing the usage of virtual medicine and diminishing the effects of associated barriers, telemedicine has the potential to create greater equity in access to health care.

**Keywords:** Telemedicine, Medicaid, West Texas, Survey

### Background

Teleservice is how one can receive a service remotely. In the context of health care delivery, teleservice can be further broken down into several subcategories: telehealth, telemonitoring, and telemedicine. Telehealth is the delivery of services to patients by nonmedical healthcare professionals, such as psychologists and social workers.[1] Home telemonitoring is the remote collection of data from patient monitoring devices, such as blood pressure cuffs and glucometers. Telemedicine is the delivery of remote medical care by healthcare professionals, such as physicians, nurse practitioners, and physician assistants.

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Telemedicine has many benefits that make it a favorable option for patients in contrast to in-person care. The ability to avoid the hassle of waiting rooms and the trouble of finding a parking spot at a busy medical facility makes telemedicine a convenient alternative. If a patient is forced to move to a different location, continuity of care with their long-time physician can continue with telemedicine. Even with limited time, patients are empowered to take command of their health by accessing their physician from any location with an internet connection. By reducing exposure to infectious microbes, telemedicine can reduce the transmission of communicable diseases, to which immunocompromised patients are susceptible. With the use of HIPPA (Health Insurance Portability and Accountability Act)-compliant technology, telemedicine can ensure the protection of private medical information in ways that are comparable to in-person encounters. Lastly, with transportation no longer being necessary, saving money on gas as well as time away from work makes telemedicine a more cost-effective option, which is especially important for low-income families.

Between 2019 and 2021, there was a 500% increase in the number of teleservices being offered to Texas Medicaid patients, as reported by the Texas Health and Human Services biannual report on Telemedicine, Telehealth, and Home Telemonitoring in Texas Medicaid.[2] This is likely a result of the COVID-19 pandemic and dedicated efforts at increasing funding and resources to telemedicine, such as the Texas House Bill 4 that passed unanimously in June of 2021. As a result, over 3.7 million telemedicine services were delivered to Texas Medicaid patients, with the most popular diagnoses being behavioral health (304,674), respiratory disease (211,770), and abnormal laboratory/clinical findings (206,761). With reimbursement being an early concern during the pandemic, an increase of over 100 million dollars was paid to Texas Medicaid telemedicine providers between 2020 and 2021.[2]

Of note, the number of Texas Medicaid telemedicine providers increased from 455 in 2019 to 7,505 in 2021, representing the drastic allocation of attention and assets to telemedicine during the pandemic. There was a slight decrease in the number of Texas Medicaid telemedicine providers from 2020 to 2021 across all county types (urban, suburban, and rural), likely reflecting a reduction in the pandemic response and a steady return to previous forms of healthcare delivery. However, the number of Texas Medicaid patients receiving telemedicine continued to increase by sizable margins between 2020 and 2021, possibly representing maintained efforts at avoiding COVID-19 transmissibility and a dedicated effort by healthcare providers to offer telemedicine services.

Even with there being a large influx of Texas Medicaid patients receiving telemedicine services in response to the pandemic, the question remains if healthcare disparities exist related to telemedicine access and usage. By addressing any inequities, the number of Medicaid patients receiving telemedicine services during the pandemic can be sustained or even possibly increased. Families of low socioeconomic status, particularly Lubbock Medicaid patients, were the focus of this project. Our goal was to determine if there are any identifiable barriers to access to

telemedicine services that could then be addressed with easy-to-implement interventions.

Potential barriers that have been suggested are as follows: 1. Access to reliable internet or cellular service may be difficult in certain circumstances, such as low-income families or residents of rural Texas. 2. Zoom-capable devices are expensive, making it a potential limiting factor for Medicaid patients in receiving telemedicine services. 3. Even if a Zoom-capable device is obtained, technological fluency is required to mediate the telemedicine encounter, which can be difficult for geriatric or disabled patients. 4. If the patient's condition requires a physical exam, laboratory orders, or imaging services, an in-person encounter is required. 5. Certain providers may not provide virtual medical services, limiting their patient pool only to in-person encounters. 6. Unawareness and poor public understanding of the functions and practical uses of telemedicine could be a reason why more Medicaid patients have not tried telemedicine.

## Methods

The studied demographic was Medicaid patients seen at Texas Tech Physicians Family Medicine Clinic from 2020 - 2022. A retrospective chart review was performed, and IRB approval was granted. A 15-item Qualtrics questionnaire was then sent to 6,585 Lubbock Medicaid patients through their email with options in both English and Spanish.

## Results

The 15-item survey had a 0.76% response rate with a total of 50 respondents that began the questionnaire. The majority of patients were English-speaking (98%) and one patient was Spanish-speaking only (2%). In terms of annual income, 69% of respondents reportedly earn less than $15,000, 18% earning between $15,000 - $24,999, 7% earning $25,000 - $34,999, 2% earning $35,000 - $49,999, and 4% earning over $75,000 annually. Over half of the patients (53%) consider themselves proficient in utilizing both a cell phone and a computer (Figure 1).

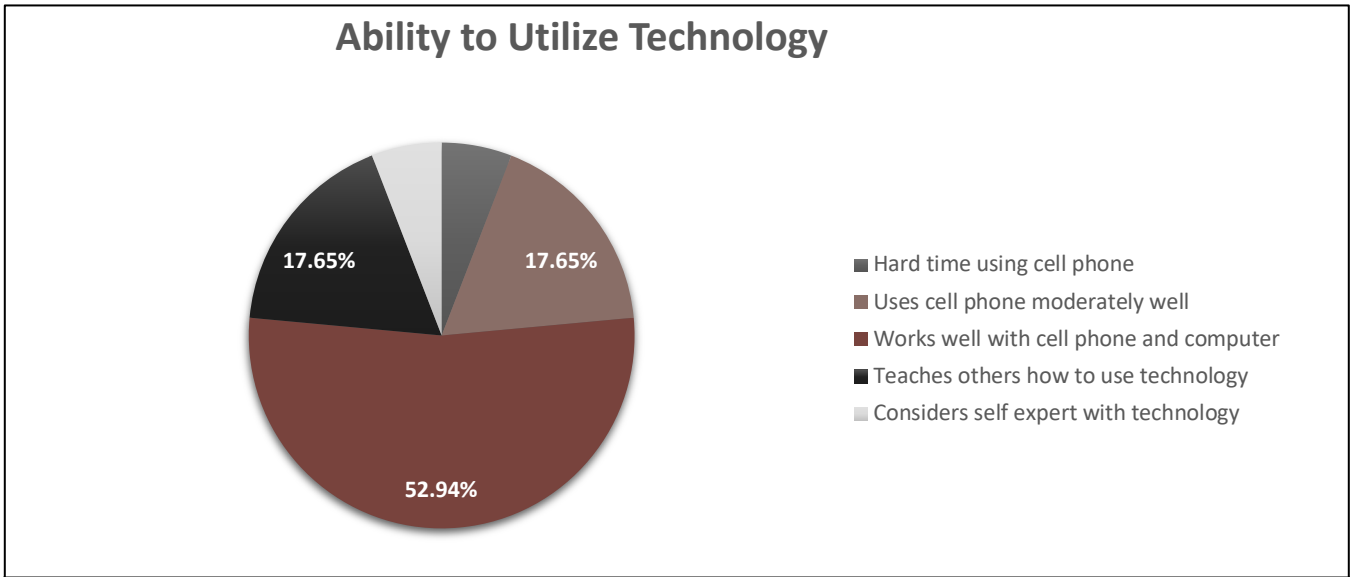


**Figure 1.** Patient reported confidence and ability to utilize technology reported by survey

A large majority of respondents have heard about telemedicine (94%). However, less than half of patients surveyed (43%) have participated in a telemedicine visit before. Reasons for telemedicine visits included: concerns regarding COVID-19 exposure, possible COVID-19 infection, psychiatry follow-up, ability to be seen quickly, and overall convenience. Interestingly, most responses declined that COVID-19 impacted their use of telemedicine when directly asked.

Overall telemedicine experience was reported to be a mean of 9.14/10 with a standard deviation of 1.51. Most patients participated in telemedicine appointments via their cell phone devices (76%). Tablets (12%) and computers (12%) were also reportedly used. Disclosed Wi-Fi/cellular services used include Verizon, Suddenlink, Cricket Mobile, AT&T, Grande, Boost, and Sparklight.

Patients who have not utilized telemedicine before (57%) attributed their reasons to not having thought about it, not knowing it was an option, uninsured, or simply not wanting to talk on the phone. Despite this, most patients (74%) are open to using telemedicine in the future. Participants then ranked reasons to participate in telemedicine from highest priority to lowest priority. Saving transportation costs was the highest priority with 32% of respondents ranking first, followed by avoiding the waiting room (39%), avoiding the hassle of parking (39%), avoiding the hassle of finding a clinic location (26%), staying in a comfortable environment (23%), immunocompromised (32%), lack of transportation methods (39%), and unable to find childcare or miss work ranking last (68%). When asked what services patients would be willing to receive, most respondents preferred telemedicine appointments for prescription refills and follow-ups on lab work (Figure 2).

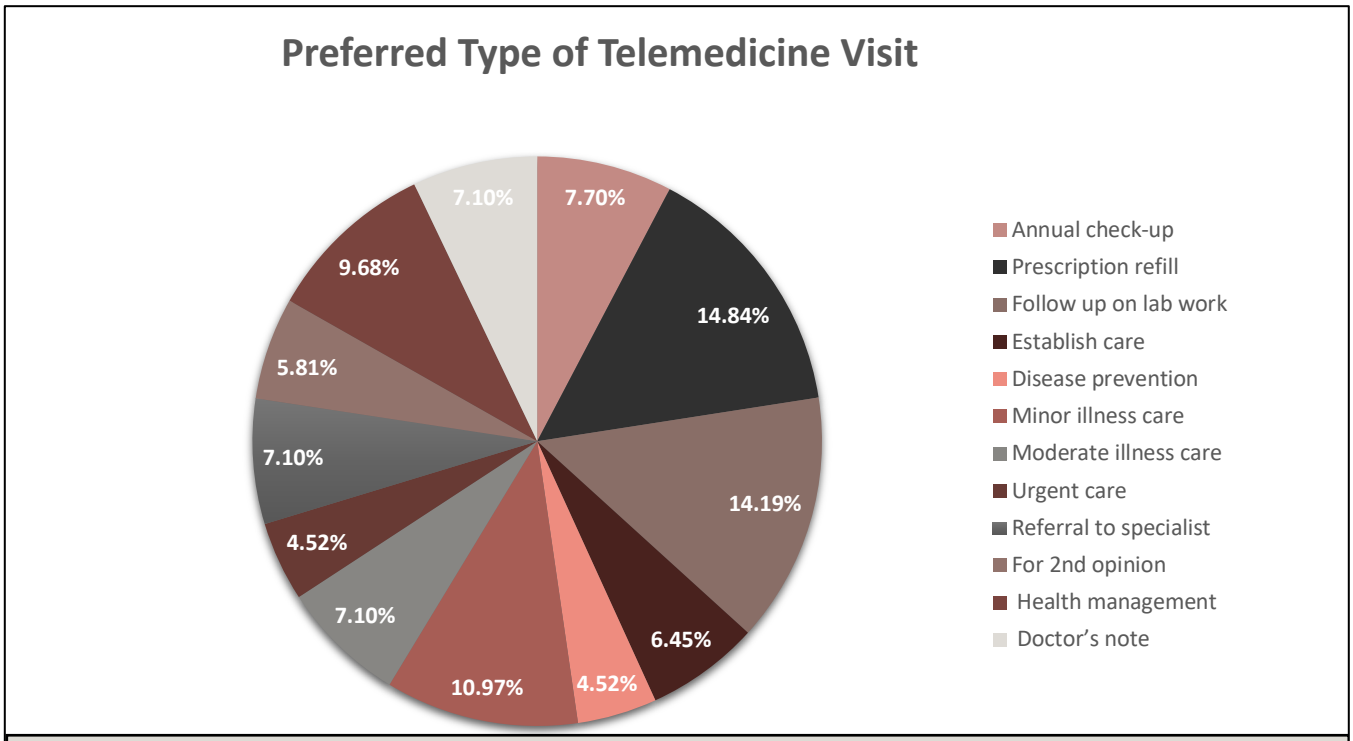


**Figure 2.** Types of Telemedicine visits preferred by the patient population reported by survey

There are several limitations present in this study. The results are unlikely to be generalizable to the entire target population due to a large non-response rate (99.24%). Additionally, there is potential for nonresponse bias in survey-based research, especially with a high non-response rate. Other limitations include the inability to reach patients in remote areas with no access to the internet and the potential lack of technological literacy to be able to access the survey and respond. In a study accessing technology while also utilizing technology as the means of distribution of a questionnaire, this introduces bias in responses. Patients may have changed their email addresses or do not regularly check their emails further contributing to a high non-response rate. Furthermore, questions were intentionally formulated to combat “survey fatigue” to encourage responses. The possibility of respondents “misreading” questions or selectively leaving questions unanswered also introduces the possibility of skewed results.

**Intervention**

A patient-targeted flyer (in both English and Spanish) was constructed to describe telemedicine, highlight the advantages of its use, and how to schedule a visit. A QR code was included on the flyer for patients to be able to efficiently schedule appointments. For patients not familiar with QR codes, both a phone number and a website link were included to schedule virtual appointments. The flyer was distributed digitally through email as well as physically displayed in patient rooms at Texas Tech Physicians Family Medicine clinic. Because there is a limit to the number of posters and flyers located in clinic rooms, this flyer was displayed centrally on its own to increase the chance of patients taking notice.

Due to a slight decrease in the number of physicians offering telemedicine services, we also sent a specialized virtual flyer to physicians outlining the benefits for their practice and their patient base.

**Conclusions**

Even though questionnaire results were limited by a high non-response rate, the information obtained is an important step to better understand Lubbock Medicaid patients' attitudes and understanding of telemedicine. Future construction of a brief in-clinic electronic survey displayed at check-in would increase the response rate and obtain data that is likely to be more representative of the target population.

The timing of the questionnaire distribution is beneficial as it was sent out during the Fall of 2022, nearly 2.5 years after the beginning of the COVID-19 pandemic. Telemedicine is widely known to have experienced a drastic increase in use during the pandemic, but there is limited knowledge about whether it will continue to be a desirable option for Lubbock Medicaid patients. This survey demonstrated that COVID-19 was a reason why many patients initially participated in telemedicine services. Reported data confirms that telemedicine appears to be a desirable option for patients even post-pandemic. Surveyed patients who have used telemedicine through the clinic before reported high satisfaction with their visit experience. It is evident that the system was working well for respondents. The most significant reason reported for patients not utilizing telemedicine services was due to a lack of awareness. Future steps involve increasing clinic advertising and focusing on patient education regarding the benefits of telemedicine and services that can be offered from the first clinic visit.

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Original Article

# Utility of Noncognitive Admission Variables in the Prediction of Academic Success

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## Abstract

**Background**

Physician Assistant (PA) programs commonly rely on cognitive measures such as grade point average for admission to their programs. Noncognitive measures are also collected at the time of application, with less information known about their utility in prediction of academic outcomes. This analysis observed the following noncognitive admission domains and their relationship with PA student academic success: employment hours, shadowing experience hours, research hours, hours spent in extracurricular activities, healthcare related activity hours, leadership experience, patient care experience hours, teaching hours, and volunteerism hours.

**Objective**

This archival analysis aims to determine if noncognitive admission variables are predictive of Physician Assistant National Certifying Examination (PANCE) failure or academic attrition at a West Texas PA Program.

Methods: A series of multiple logistic regression models were constructed to predict PANCE failure and attrition using applicant self-reported cumulative experience hours in the noncognitive admission domains. Five cohorts (n=235) were evaluated using R statistical software (version 4.1.2).

**Results**

Patient care experience hours demonstrated a positive association with PANCE failure, while healthcare experience had positive trends with attrition. High GPA was protective against attrition when controlled for employment, research, and shadowing experiences, and also when controlled for leadership and patient care experience. High GPA was not a protective factor for PANCE failures.

**Conclusion**

Contrary to our hypothesis, increased self-reported experiences did not show a protective effect against PANCE failure or attrition but were instead detrimental.

**Keywords:** admission, attrition, physician assistant, PANCE, West Texas, healthcare experience

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## Background

Attrition and Physician Assistant National Certifying Examination (PANCE) failure are significant challenges for physician assistant (PA) programs. In 2019, the Physician Assistant Education Association Program Report identified a 93% graduation rate and an attrition rate of 6.7%.[1] The National Commission on Certification of Physician Assistants (NCCPA) reported a 95% national first-time PANCE pass rate in 2020, and a 93% first-time PANCE pass rate in 2019.[2] Furthermore, success on the PANCE and graduation rates are vitally important to PA programs because it has implications for accreditation, overall student success, and for PA candidate recruitment.[3-4] Attrition can also place financial strain on PA programs because the vacated seat often remains unreplaced.[3]

Attrition and first-time PANCE failure not only affect PA programs but can also have a lasting psychological impact on the PA student with one study describing it as an "emotional upheaval." [3] A student who is unable to complete the program is often left with unpaid student loans, loss of time spent actively employed, and an unlikely chance of ever realizing their goal of becoming a PA.[3] To decrease PA program attrition and PANCE failure, admission committees are tasked with identifying any variables in their applicant pool that may be predictive of academic outcomes. There has been much research considering cognitive variables at admission predicting academic outcomes; however, less analysis has been performed considering noncognitive variables.[4-5] Cognitive variables that have been researched for their utility in predicting academic outcomes include undergraduate grade point average (GPA) and Graduate Record Examination (GRE) scores;[3] however, increasingly the importance of holistic admission processes and placing a larger emphasis on noncognitive variables is gaining attention.[6]

## Objective

Prior studies examining noncognitive variables before matriculation have focused on domains such as emotional intelligence[8-9] or prior healthcare experience.[6,10] PA programs often emphasize previous clinical experience before admission though there is little evidentary basis and at least one study specific to PA education found no association between previous clinical experience and academic outcomes.[12] There remains little research specific to PA students considering noncognitive variables and their utility in predicting academic outcomes. We hypothesize that noncognitive admissions variables in PA students could be predictive in reducing PA student attrition rates and first-time PANCE failure rates.

## Methods

Institutional Review Board exemption was obtained to examine five cohorts of PA students from graduating class years 2017 to 2021 from one West Texas PA Program using total hours for nine noncognitive variables self-reported through the Centralized Application Service for Physician Assistants (CASPA). The admission demographics of the PA students for the cohorts examined are depicted in Table 1.

**Table 1.** GPA of attrition and PANCE failure of students by age

| | |
|---|---|
| **Students <25yo** | |
| Total Attrition | 1 |
| Avg GPA Attrition | 3.37 |
| Total PANCE failures | 8 |
| Avg GOA PANCE failure | 3.61 |
| **Students 25-29yo** | |
| Total Attrition | 8 |
| Avg GPA Attrition | 3.31 |
| Total PANCE failures | 7 |
| Avg GOA PANCE failure | 3.46 |
| **Students 30-35yo** | |
| Total Attrition | 1 |
| Avg GPA Attrition | 3.46 |
| Total PANCE failures | 0 |
| Avg GOA PANCE failure | n/a |
| **Students >35yo** | |
| Total Attrition | 3 |
| Avg GPA Attrition | 3.5 |
| Total PANCE failures | 3 |
| Avg GOA PANCE failure | 3.25 |

Data was examined by total cohort (n=235) and by students with below the program acceptance average total GPA of 3.5 (n=108) defined as a low GPA. The following nine variables were analyzed for their potential utility in predicting either attrition from the PA program or PANCE failure: employment hours, shadowing experience hours, research hours, hours spent in extracurricular activities, healthcare-related activity hours, leadership experience, patient care experience hours, teaching hours, and volunteerism hours. Only attrition for academic reasons was included and did not include students who decelerated or had attrition for medical or personal reasons.

The data was cleaned and analyzed using R statistical software (version 4.1.2). A series of multiple logistic regression models were constructed to predict PANCE failures and attrition using self-reported total experience hours in each of the nine noncognitive variable categories. Cumulative GPA was examined in two categories: those with GPA above and below the program average acceptance GPA of 3.5 on a 4.0 scale at the time of matriculation. Additional exploratory multiple logistic regression models were constructed to predict Attrition or PANCE failures using each of the self-reported noncognitive variables, GPA (i.e. High vs. Low), and their interaction. These multiple logistic regression models allowed us to examine the differential effects of non-cognitive variables in predicting Attrition and PANCE failures among applicants with high vs. low GPAs.

## Results

With consideration of the full data set, self-reported cumulative healthcare experience hours positively predicted attrition ($\beta$ = 0.0001; OR = 1.0001, p = 0.048). This indicates that every additional hour of increase in healthcare experience increased the odds of attrition by approximately 0.01%. In addition, cumulative exposure to patient care and cumulative duration of employment had positive statistical trends in predicting PANCE failures and attrition respectively ($\beta$ = 0.0001, OR = 1.0001, p = 0.054 and $\beta$ = 0.0001, OR = 1.0001 = 0.098 respectively). All other univariate logistic regression models were not statistically significant.

The data was analyzed with consideration of students with low GPA only. The average total GPA at the time of application through CASPA for all five cohorts was 3.54 and the average total science GPA at the time of application was 3.46. Among students with low GPA (less than 3.5 on a 4.0 scale), self-reported patient care experiences showed a statistical trend of being positively associated with PANCE failures ($\beta$ = 0.0001; OR = 1.0001, p = 0.052). This data represented in Table 2 indicates that every additional hour of increase in patient experiences increased the odds of PANCE failure by 0.01%.

**Table 2.** Results of multiple logistic regression models predicting PANCE failures among students using self-reported cumulative experiences / exposures, pre-admission GPA and their interactions.

| Model | Dependent Variable | Independent Variable | β | SE | z-statistic | p-value |
|---|---|---|---|---|---|---|
| 1 | PANCE Failures | Intercept | -3.1305 | 0.6687 | -4.6811 | <0.0001 |
| | | Employment | -0.0002 | 0.0003 | -0.5834 | 0.5596 |
| | | High GPA | -1.0389 | 1.0726 | -0.9685 | 0.3328 |
| | | Interaction | 0.0002 | 0.0003 | 0.6211 | 0.5245 |
| | | N = 215, AIC = 54.289, log likelihood (df=2) = -23.145 | | | | |
| 2 | PANCE Failures | Intercept | -2.2435 | 0.6254 | -3.5873 | 0.0003 |
| | | Extracurricular | -0.0039 | 0.0086 | -0.4592 | 0.6461 |
| | | High GPA | -1.1275 | 1.0098 | -1.1166 | 0.2642 |
| | | Interaction | 0.0038 | 0.0086 | 0.4431 | 0.6577 |
| | | N = 106, AIC = 45.932, log likelihood (df=2) = -18.966 | | | | |
| 3 | PANCE Failures | Intercept | -3.1511 | 0.6625 | -4.7561 | <0.0001 |
| | | Healthcare Experience | -0.0003 | 0.0005 | -0.5895 | 0.5555 |
| | | High GPA | 0.3593 | 1.0391 | 0.3458 | 0.7295 |
| | | Interaction | -0.0156 | 0.0183 | -0.8561 | 0.3919 |
| | | N = 215, AIC = 50.496, log likelihood (df=2) = -21.248 | | | | |
| 4 | PANCE Failures | Intercept | -1.9521 | 0.6910 | -2.8252 | 0.0047 |
| | | Leadership | -0.0041 | 0.0046 | -0.8936 | 0.3715 |
| | | High GPA | -1.5734 | 1.0758 | -1.4626 | 0.1436 |
| | | Interaction | 0.0042 | 0.0046 | 0.9219 | 0.3566 |
| | | N = 106, AIC = 45.424, log likelihood (df=2) = -18.712 | | | | |
| 5 | PANCE Failures | Intercept | -3.9911 | 0.7638 | -5.2254 | <0.0001 |
| | | **Patient Care Experience** | **0.0001** | **0.0001** | **1.9415** | **0.0522** |
| | | High GPA | 0.4321 | 1.1383 | 0.3796 | 0.7043 |
| | | Interaction | -0.0009 | 0.0011 | -0.8014 | 0.4229 |
| | | N = 215, AIC = 51.3, log likelihood (df=2) = -21.65 | | | | |
| 6 | PANCE Failures | Intercept | -2.9087 | 0.5929 | -4.9060 | <0.0001 |
| | | Research | -0.8431 | 137.7127 | -0.0061 | 0.9951 |
| | | High GPA | -0.7676 | 0.9296 | -0.8257 | 0.4090 |
| | | Interaction | -0.0140 | 193.2997 | -0.0001 | 0.9999 |
| | | N = 215, AIC = 50.368, log likelihood (df=2) = -21.184 | | | | |
| 7 | PANCE Failures | Intercept | -3.4590 | 0.6597 | -5.2428 | <0.0001 |
| | | Shadowing | 0.0001 | 0.0008 | 0.1264 | 0.8994 |
| | | High GPA | -0.0642 | 1.2198 | -0.0527 | 0.9580 |
| | | Interaction | -0.0042 | 0.0071 | -0.5920 | 0.5538 |
| | | N = 215, AIC= 54.458, log likelihood (df=2) = -23.229 | | | | |
| 8 | PANCE Failures | Intercept | 26.5661 | 90577.6039 | -.0003 | 0.9998 |
| | | Teaching | 0.0000 | 255.5565 | 0.0000 | 1.0000 |
| | | High GPA | 0.0000 | 110250.0742 | 0.0000 | 1.0000 |
| | | Interaction | 0.0000 | 353.5806 | 0.0000 | 1.0000 |
| | | N = 55, AIC = 8, log likelihood (df=2) = 0 | | | | |
| 9 | PANCE Failures | Intercept | -3.3964 | 0.6201 | -5.4773 | <0.0001 |
| | | Volunteerism | <0.0001 | 0.0003 | -0.1186 | 0.9056 |
| | | High GPA | -0.7397 | 1.0149 | -0.7289 | 0.4661 |
| | | Interaction | 0.0001 | 0.0006 | 0.2124 | 0.8318 |
| | | N = 215, AIC = 54.935, log likelihood (df=2) = -23.467 | | | | |

**Table 3.** Results of multiple logistic regression models predicting attrition among students using self-reported cumulative experiences / exposures, pre-admission GPA and their interactions.

| Model | Dependent Variable | Independent Variable | β | SE | z-statistic | p-value |
|---|---|---|---|---|---|---|
| 1 | Attrition | Intercept | -2.2317 | 0.4213 | -5.2973 | <0.0001 |
| | | Employment | -0.0001 | 0.0001 | -0.8762 | 0.3809 |
| | | **High GPA** | **-3.4674** | **1.3992** | **-2.4782** | **0.0132** |
| | | **Interaction** | **0.0003** | **0.0002** | **1.9068** | **0.0565** |
| | | N = 235, AIC = 74.156, log likelihood (df=2) = -33.078 | | | | |
| 2 | Attrition | Intercept | -2.2745 | 0.5557 | -4.0933 | <0.0001 |
| | | Extracurricular | -0.0003 | 0.0008 | -0.3919 | 0.6951 |
| | | High GPA | -2.0304 | 1.2719 | -1.15975 | 0.1102 |
| | | Interaction | 0.0004 | 0.0011 | 0.3655 | 0.7148 |
| | | N = 118, AIC = 45.635, log likelihood (df=2) = -18.817 | | | | |
| 3 | Attrition | Intercept | -2.7276 | 0.4129 | -6.6063 | <0.0001 |
| | | **Healthcare Experience** | **0.0001** | **0.0001** | **1.6472** | **0.0995** |
| | | High GPA | -1.4724 | 0.9079 | -1.6218 | 0.1048 |
| | | Interaction | -0.0001 | 0.0003 | -0.2194 | 0.8263 |
| | | N = 235, AIC = 82.552 log likelihood (df=2) = -37.276 | | | | |
| 4 | Attrition | Intercept | -2.1352 | 0.6046 | -3.5314 | 0.0004 |
| | | Leadership | -0.0010 | 0.0016 | -0.5910 | 0.5545 |
| | | **High GPA** | **-3.4178** | **1.9137** | **-1.7860** | **0.0741** |
| | | Interaction | 0.0020 | 0.0017 | 1.1383 | 0.2550 |
| | | N = 118, AIC = 42.896, log likelihood (df=2) = -17.448 | | | | |
| 5 | Attrition | Intercept | -2.5680 | 0.4318 | -5.9469 | <0.0001 |
| | | Patient Care Experience | 0.0000 | 0.0001 | 0.3481 | 0.7278 |
| | | **High GPA** | **-1.5977** | **0.9396** | **-1.7004** | **0.0890** |
| | | Interaction | 0.0000 | 0.0003 | -0.7047 | 0.9404 |
| | | N = 235, AIC = 85.124, log likelihood (df=2) = -38.562 | | | | |
| 6 | Attrition | Intercept | -2.4961 | 0.3818 | -6.5384 | <0.0001 |
| | | Research | 0.0000 | 0.0003 | 0.0085 | 0.9932 |
| | | **High GPA** | **-1.6576** | **0.8245** | **-2.0104** | **0.0444** |
| | | Interaction | <0.0001 | 0.0007 | -0.0310 | 0.9753 |
| | | N = 235, AIC = 85.232, log likelihood (df=2) = -38.616 | | | | |
| 7 | Attrition | Intercept | -2.3035 | 0.4473 | -5.1502 | <0.0001 |
| | | Shadowing | -0.0008 | 0.0014 | -0.5983 | 0.9932 |
| | | **High GPA** | **-1.6576** | **0.8245** | **-2.0104** | **0.0444** |
| | | **Interaction** | **0.0035** | **0.0021** | **1.7066** | **0.0879** |
| | | N = 235, AIC= 82.334, log likelihood (df=2) = -37.167 | | | | |
| 8 | Attrition | Intercept | -3.2243 | 1.1479 | -2.8088 | 0.0050 |
| | | **Teaching** | **0.0021** | **0.0013** | **1.6718** | **0.0946** |
| | | High GPA | -18.3418 | 4977.4328 | -0.0037 | 0.9971 |
| | | Interaction | -0.0021 | 2.7407 | -0.0008 | 0.9994 |
| | | N = 58, AIC = 18.547, log likelihood (df=2) = -5.274 | | | | |
| 9 | Attrition | Intercept | -2.4387 | 0.04014 | -6.0750 | <0.0001 |
| | | Volunteerism | -0.0001 | 0.0003 | -0.2963 | 0.7670 |
| | | High GPA | -1.2947 | 1.0084 | -1.2840 | 0.1992 |
| | | Interaction | -0.0011 | 0.0024 | -0.4713 | 0.6374 |
| | | N = 235, AIC = 84.588, log likelihood (df=2) = -38.294 | | | | |

Similarly, self-reported cumulative healthcare and teaching experiences had positive trends of being associated with attrition among students with low gpas (β = 0.0001; OR = 1.0001, p = 0.099 and β = 0.0021; OR = 1.0021, p = 0.095 respectively), indicating that per hour increase of health care and teaching experiences, the odds of failure among students with low gpas increased by 0.01% and 0.21% respectively. High GPA was a significant protective factor against attrition when controlled for employment, research, and shadowing experiences ($P < 0.05$) and also showed protective trends against attrition when controlled for leadership and patient care experiences ($P < 0.1$) but did not emerge as a protective factor for PANCE failures ($P > 0.1$). The attrition statistical analysis is listed in Table 3. None of the models revealed protective effects for self-reported experiences against PANCE failure or attrition.

## Conclusion

Contrary to our hypotheses, increased self-reported experiences prior to matriculation into a PA program did not show a protective effect against PANCE failures or attrition but were detrimental. Taken together, prior employment hours, healthcare experience, leadership experience, research experience hours, or teaching experience hours at the time of admission are unlikely to be of value in predicting attrition and PANCE failures among PA students. In addition, a high GPA and increased reported noncognitive experience showed negative trends. These suggested that increased experience hours in the various domains may increase the risk of attrition among high GPA students to a greater extent than low GPA students. This suggests that if a student has a high GPA, but has stayed out of an academic setting for a long while, though their experience hours have increased, their risk of attrition is higher. Table 4 shows attrition events grouped by age range.

**Table 4.** Cumulative results of variables across multiple cohorts

| Year | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Students per Cohort | 55 | 58 | 58 | 58 | 60 |
| Age at Matriculation | 35.6 | 25.9 | 26.8 | 25.1 | 26.1 |
| Gender | 15(M) 40(F) | 16(M) 42(F) | 13(M) 45(F) | 5(M) 53(F) | 18(M) 42(F) |
| Average GPA | 3.56 | 3.5 | 3.53 | 3.55 | 3.56 |
| Average Science GPA | 3.43 | 3.46 | 3.47 | 3.43 | 3.46 |
| Average Patient Care Hours | 1805 | 1585 | 1530 | 1254 | 2892 |

Our study did demonstrate that GPA is a significant predictor of protection from both attrition and PANCE failure. The finding that GPA is a strong predictor of academic success has been demonstrated in other studies.[3,6,11] However, some of these same referenced studies' analyses revealed an opposite finding from this analysis that previous healthcare experience was positively associated with higher PANCE scores.[3,6] There are previous analyses that are consistent with our findings that healthcare experience prior to matriculation is unlikely to be a significant predictor of academic outcomes.[12] Due to the discrepancies in the literature, there is a clear need for continued research evaluating noncognitive variables at the time of admission such as healthcare experience while controlling for further variables such as age at admission and specifics of the type of prior healthcare experience rather than a total quantifiable amount.

This study has several limitations. First, the noncognitive variables are self-reported

experience hours by applicants and are not verified by CASPA. Additionally, the only outcome measures were attrition for academic reasons and PANCE failure. Further analyses could be performed to include variables such as decelerations and attrition for personal reasons. Our secondary analysis had a few limitations. Even though we detected significant associations between prior employment hours, healthcare experience, leadership experience, research experience hours, teaching experience hours, and PANCE failures, the observed odds ratios were very close to 1. Furthermore, due to the small sample size, we did not attempt to adjust for the false discovery rate despite testing multiple closely related hypotheses using the same dataset. A final limitation is that the reported healthcare experience hours were not examined separately for differing professions but rather analyzed as total hours spent in any patient contact role. Moreover, this analysis uses only hours to reflect the complex life experiences of students and presupposes the question of whether the way that information is collected for noncognitive variables at the time of application is the most effective means.

This analysis has the strength of having a larger sample size than many of the previous similar analyses examining noncognitive variables at the time of admission. Also, to the best of our knowledge, this study is unique in that it examines previously unexamined domains such as volunteer hours, leadership experience, extracurricular activity hours, and teaching experience. This study was free of bias as quantified variables in the form of hours were used to perform the data analysis to assess the basic outcome measures of PANCE failure and attrition with all students from five cohorts included in the data set.

While healthcare experience hours specifically have been anecdotally weighted as important for success in allied health programs, this analysis did not support that assertion. Nonetheless, noncognitive admission variables are an important part of the screening process for applicants to PA programs as they can be predictive of other important traits such as emotional intelligence[8-9] which are required for success in physician assistant programs and this archival data analysis is not suggestive of the need for elimination of these variables from the selection process.

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Original Article

# Impact of Personal Protective Equipment Usage and hand washing due to COVID-19 on the rate of HA-CDI

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## Abstract

**Background**

Clostridium difficile infection (CDI) is one of the most common healthcare-associated (HA) infections. Advanced age, use of proton pump inhibitors, concomitant antibiotics, steroids, prolonged hospital stay, and gastrointestinal surgeries are associated with increased incidence of disease. CDI is transmissible via the fecal-oral route by ingesting spores and is readily transmitted between patients and caregivers in the hospital. Strict contact precautions and handwashing are implemented in healthcare settings to prevent its transmission. The current pandemic of Coronavirus disease (COVID-19) has led to imposing restrictions on patient admission, visitations, and implementing extra measures on handwashing along with the use of personal protective equipment (PPE). Therefore, the main objective of this study is to identify if additional preventive measures for COVID-19 impact the HA-CDI rate.

**Methods:**

A retrospective study was conducted on patients diagnosed with HA-CDI during the COVID-19 year (2020) and compared with patients of the pre-COVID-19 year (2019) from March to October. Baseline characteristics, risk factors, and patient hospitalization were compared.

**Results:**

During the study period, a total of 148 cases were diagnosed with HA-CDI of which 75 cases were in the pre-COVID-19 and 73 cases in the COVID-19 year. The rate of HA-CDI was 5.03 vs. 5.33 per 10,000 hospitalized patients in the pre-COVID-19 year vs. COVID-19 year. A sub-analysis was done with 2020 data to identify if there are any contributing factors to the increased CDI rate. 21 cases were positive for COVID-19, of which 28.5% underwent GI surgery; 19% received steroids (Dexamethasone), 76.1% stayed in ICU with median LOS (16± 20.2) and 52.3% died.

**Conclusions:**

A slightly higher rate of symptomatic HA-CDI was observed during the COVID-19 year when compared with the pre-COVID-19 year. Implementation of measures to prevent the spread of COVID-19 e.g., use of PPE, handwashing, environmental cleaning, visitor restriction, etc. were expected to help decrease HA-CDI. Higher acuity patients and increased rate of these risk factors amongst patients admitted in the year 2020 might have offset the expected benefit of COVID-19 prevention strategies.

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## Background

The Coronavirus pandemic (COVID-19) has drastically changed the healthcare system with the implementation of strict infection prevention measures. To prevent the spread of Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2), patients were isolated, and healthcare workers were required to use personal protective equipment (PPE) like gowns, masks, gloves, and face shields. Moreover, hand hygiene was implemented as washing hands with soap and water or using alcohol-based sanitizers. Special attention was made to contact precautions with social distancing, limitation of visitors, and duration of visit time to hospitals. Disinfection and environmental cleaning were routine. Many studies have shown this infection prevention has limited the spread of many organisms especially those causing healthcare-associated infections, including Clostridium difficile.[1-3]

Clostridium difficile infection (CDI) is one of the most common healthcare-associated infections with an increase in morbidity, mortality, and prolonged hospitalization.[1] Healthcare-associated CDI (HA-CDI) is defined as any hospitalized patient with symptoms onset ≥ 72 hours after admission with a history of diarrhea (≥ 3 unformed stools in 24 hours with no other recognized cause) along with positive stool test - polymerase chain reaction (PCR) for toxigenic CD and positive PCR for CD toxin gene(s) or colonoscopic/ histopathologic findings of pseudomembranous colitis.[4,5] The risk factors for HA-CDI are advanced age, previous hospitalization, antibiotic exposure, presence of comorbidities, and use of antacids.[6,7] Several infection control measures are implemented to control the transmission of CD and its spores similar to COVID-19 prevention measures.[8]

## Objective

There have been studies with varying results in the rate of CDI during the COVID-19 period. Some studies had shown a decreased rate of CDI and others had no difference. There are only a few studies related to the HA-CDI rate. Therefore, this study aims to identify if these new changes have any effect on the rate of hospital-acquired Clostridium difficile infection.

## Methods

A retrospective study was performed using the data from two tertiary center hospitals on hospitalized patients who were diagnosed with an initial episode of HA-CDI during the COVID-19 year (2020) and compared with patients of the pre-COVID-19 year (2019) from March 1 to October 31. The HA CDI incidence was collected from the Infection Prevention team registry along with the compliance rate for preventive measures (hand hygiene) for CDI. The inpatient hospital bed days were collected for both hospitals from the daily census of the specified time period. The rates were calculated as the total number of HA CDI cases divided by the total number of hospital-patient-days over the study time period.

Data were collected by reviewing the medical records of patients. Inclusion criteria included all patients aged 18 years and above who tested positive for CDI after hospital admission. The patients who were diagnosed with community-acquired CDI, HA-CDI acquired in another hospital, Community Onset, and Indeterminate cases

were excluded from the study.

The antimicrobial agents that may induce CDI were referred from 2020 UpToDate, Graphic 55479 Version 13.0. The most frequently associated antibiotics are fluoroquinolones, clindamycin, broad-spectrum penicillin, 2nd- 4th generation cephalosporins, and carbapenems. Similarly, macrolides, narrow-spectrum penicillins, 1st generation cephalosporins, trimethoprim-sulfamethoxazole, and sulfonamides are occasionally associated with C. difficile infection. The severity of disease was classified as non-severe if white blood cell count <15,000 cells/ μL and serum creatinine <1.5 mg/dL; severe if white blood cell count ≥ 15,000 cells/μL and/or serum creatinine ≥ 1.5 mg/dL; and fulminant colitis if complicated by hypotension or shock, ileus or megacolon.

A comparison of baseline characteristics, risk factors and patient hospitalization were compared. All variables were analyzed using descriptive statistics (number, percentage, mean, and standard deviation) Categorical variables were compared using the chi-square or the Fisher Exact test where appropriate, and continuous variables were compared using t-test and Mann-Whitney-Wilcoxon test with significance set at $p<0.05$. All analysis was performed using RStudio version 4.1.2.

## Results

During the study period, a total of 148 cases were diagnosed with HA-CDI of which 75 cases were in the pre-COVID-19 and 73 cases in the COVID-19 year, accounting for a total of 149,092 and 136,982 inpatient bed days respectively. The rate of HA-CDI was 5.03 vs. 5.33 per 10,000 hospitalized patients in the pre-COVID-19 year vs. the COVID-19 year.

No statistically significant differences in baseline demographic characteristics, (age, sex, and BMI); comorbidities (diabetes, hypertension, and cancer), and risk factors like the presence of enteral tube were observed between the two groups. Patients in the pre-COVID year had more comorbidities than in the COVID year (Table 1). Factors associated with CDI like antibiotic use (p=0.001) and proton pump inhibitor use (p= 0.005) although significant were prescribed less frequently in patients during the COVID-19 year (Table 2).

**Table 1.** Demographics, Risk Factor and Hospital course

| | **Pre COVID 19 year - 2019 (n= 75)** | **COVID 19 year-2020 (n=73)** | **p-value** |
|---|---|---|---|
| Age (years, Mean ± SD) | 57.98 ± 17.16 | 60.56 ± 16.29 | 0.43 |
| Male (n, %) | 44 (58.66%) | 33 (45.20%) | 0.14 |
| Body mass index (BMI) ($kg/m^2$) ± SD | 30.18 ± 8.6 | 30.66 ± 8.3 | 0.85 |
| **Medical comorbidities** (n, %) | | | |
| Diabetes | 38 (50.66%) | 28 (38.35%) | 0.11 |
| Hypertension | 52 (69.33%) | 42 (57.53%) | 0.09 |
| Chronic Kidney Disease | 27 (36%) | 15 (20.5%) | **0.03** |
| Cancer | 13 (17.33%) | 10 (13.69%) | 0.7 |
| **Presence of risk factor** | 15 (20%) | 21 (28.76%) | |
| Enteral Tube | 6 (8%) | 4 (5.48%) | 0.52 |
| Gastrointestinal surgery | 5 (6.6%) | 17 (23.28%) | **0.01** |
| Both | 4 (5.4%) | 0 | |

**Table 2.** Medication used during hospital stay that are associated with HA-CDI

| Type of medication | Pre COVID 19 year-2019 (n=75) | COVID 19 year-2020 (n=73) | p-value |
|---|---|---|---|
| Steroid use | 32 (42.6%) | 22 (30.1%) | 0.15 |
| Antibiotic exposure | 67 (89.33%) | 51 (69.86%) | **0.001** |
| Frequently associated | 63 (94%) | 35 (68.6%) | |
| Proton pump inhibitor | 48 (64%) | 29 (39.7%) | **0.005** |

During the COVID-19 year, there was a significantly high number of patients that had undergone gastrointestinal (GI) surgery (22.6% vs. 6.6%, p=0.01). Almost half of the patients in each group stayed in the intensive care unit (ICU) and the mean length of ICU stay was significantly higher in the COVID-19 year (20.4± 34.3 days vs 11.6± 16.9 days, p= 0.03).

The mortality rate was higher (20.5% vs. 12%, p= 0.23) during the COVID-19 period.

**Table 3.** Hospital Outcome

| Characteristics | Pre COVID 19 year - 2019 (n= 75 | COVID 19 year-2020 (n=73) | p-value |
|---|---|---|---|
| Length of hospital stay (days, Mean ± SD) | 19.96 ± 14.66 | 23.32 ± 19.44 | 1 |
| Intensive care unit stay (n, %) | 40 (53.3%) | 37 (50.6%) | |
| Intensive care unit stay (days, Mean ± SD) | 11.6 ± 16.99 | 20.4 ± 34.37 | **0.033** |
| Mortality | 9 (12%) | 15 (20%) | 0.23 |

A sub-analysis was done with 2020 data to identify if there are any contributing factors to the increased CDI rate. 21 cases were positive for COVID-19, of which 28.5% underwent GI surgery; 19% received steroids (Dexamethasone), 76.1% stayed in ICU with median LOS (16± 20.2) and 52.3% died.

**Table 4.** Occurrence of Suspected COVID Variables in Patients During the COVID year

| COVID variables | |
|---|---|
| COVID positive cases | 21 (28.7%) |
| No of people stay in ICU | 16 (76.1%) |
| No of people with severe C. difficile | 7 (33.3%) |
| No of people with GI surgery | 6 (28.5%) |
| No of people with cancer | 19 (90.4%) |
| No of people exposed to frequently associated antibiotics | 9 (42.8%) |
| Mortality | 11 (52.3%) |

## Discussion

In this retrospective study, during the COVID-19 pandemic, we found no decline in HA-CDI despite additional strict control measures of hand hygiene and PPE usage for the prevention of COVID-19. The preventive measures of CDI included isolation of patients, using protective clothing as gowns, proper donning, and doffing of PPE to prevent self-contamination and proper hand hygiene. The adherence to this hand hygiene was strictly checked by secret shoppers for compliance and to prevent healthcare workers' hygiene errors that can lead to the spread of COVID-19. Compliance was high in the COVID-19 year compared to the pre-Covid year.

Many studies have shown the rate of CDI was low during the pandemic and concluded that maintaining the standard preventive measures would ultimately reduce the rate of CDI.[2,9-11] One study adjusted the rate with decreased CDI testing during the COVID period concluding the initial observance of increased rate adjusted for delayed diagnostics.[9] Our center already had

implemented the best standard method and despite all these measures, our study showed a static rate of HA-CDI same as some of the few studies that had shown no difference in CDI in 2020 versus 2019 concluding the extra precaution did not affect the incidence of HA CDI.[12] One study showed a higher rate of CDI during the COVID year however it accounted for all the CDI and not just HA-CDI.[13] Another study found a lower incidence of HA-CDI during the COVID-19 year compared to the past three years however when compared to COVID-19 wards versus COVID-free wards the incidence of HA-CDI was higher, suggesting SARS-COV2 can alter the gut microbiota and can be a possible risk factor CDI.[1]

We examined the factors responsible for the static rate at our centers during the pandemic. The administration of antibiotics during hospital stays, especially for those frequently associated with C. difficile, however, was surprisingly less during the COVID-19 period than the previous year. A study showed no difference in HA-CDI rate despite increased use of broad-spectrum antibiotics during the COVID-19 period.[2,12] Similarly, results shown in the studies done in a single center, offering the same standard of care were associated with advanced patient age, prolonged hospitalizations, and widespread antibiotic usage which are known risk factors for HA-CDI.[11-13] Our study found the increased length of hospital stay and prolonged ICU stay during the COVID-19 period can contribute to additional risk of getting hospital-acquired infection. Moreover, our study showed a higher rate of GI surgery among patients who had HA-CDI in the COVID-19 period which can be linked to some studies that interpreted intestinal surgery as causing intestinal dysbiosis which might lead to increased risk of CDI.[14]

There are limitations to this study as this is retrospective in nature, we were not able to obtain the patient-level risk factor who developed HA-CDI while admitted to the hospital. Identification of COVID-19 itself as a risk for CDI was not able to justify as no data were collected on co-infection of COVID-19 and HA CDI.

## Conclusion

Based on our observations, the HA-CDI rate remained static (or a slightly higher rate of symptomatic HA-CDI was observed) during the COVID-19 year when compared with the pre-COVID-19 year in two tertiary centers. Our institutions have already implemented a high level of preventive measures for CDI adherence, and implementation of measures to prevent the spread of COVID-19 which were expected to help decrease HA-CDI, which was not able to provide a significant impact on the rate of HA-CDI at our centers. We did observe longer ICU stays and a higher rate of GI surgery among patients who had HA-CDI in 2020. Higher acuity patients and increased rate of these risk factors amongst patients admitted in the year 2020 might have offset the expected benefit of COVID-19 prevention strategies.

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West Texas Journal *of* Medicine

Case Report

# Koilonychia in a Patient with Severe Iron Deficiency Anemia

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## Abstract

Koilonychia is a known sequela of chronic and severe iron deficiency anemia. The pathogenesis is not well understood but is postulated to be attributed to weakening of the underlying nail connective tissue secondary to poor oxygenation of the distal extremities. Because of the lower prevalence of koilonychia in developed nations, its clinical presentation in the U.S. is of particular significance. In the following case, a female patient presented with angina and heart palpitations of four months duration as well as severe anemia of unknown origin. Physical exam was notable for koilonychia, most prominent in the 1st - 4th digits of the right hand as well as the 1st and 2nd digits of the right foot.

**Keywords:** koilonychia, iron deficiency anemia, Plummer-Vinson syndrome, esophageal squamous cell carcinoma, esophageal adenocarcinoma.

### Introduction

Iron deficiency anemia is a common condition in North America, with a prevalence of 3.4% [1]. Causes include vegetarian diet, gastrointestinal cancer, celiac disease, benign hamartomatous polyps, erosive gastritis, gastric ulcers, chronic atrophic gastritis, *Helicobacter pylori* gastritis, autoimmune gastritis, hookworms and whipworms, celiac disease, and more. Iron deficiency anemia can cause many different signs and symptoms, such as fatigue, weakness, pallor of the skin and conjunctiva, pagophagia, atrophic glossitis, angular cheilitis, and a hyperdynamic state (e.g., tachycardia and heart palpitations).
Another clinical manifestation of severe iron deficiency anemia is koilonychia ("spoon nails"), which are thin and brittle nails that have a spoon-shaped divot on the dorsal surface. Because the most common cause of iron deficiency is malnutrition, koilonychia is found to be more prevalent in developing countries (36% of the population) in comparison to developed countries (8% of the population) [2]. The proposed pathomechanism of koilonychia is not well understood, but it is thought to be due to decreased oxygen delivery to the nail bed, resulting in weakening of the underlying nail connective tissue that causes an upward deviation of the distal portion of the nail [3].

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## Case presentation

The patient is a 43-year-old female presenting with angina, palpitations, chronic fatigue, weakness, pale skin, chest pain, shortness of breath, dizziness, cold extremities, brittle nails, and poor appetite for four months. She endorses left-sided chest pain and epigastric pain of cramping quality. Her chest pain occurs roughly three times per week, with a duration of up to fifteen minutes. Her heart palpitations occur daily, with associated dizziness during the episodes. The patient's social history is remarkable for tobacco smoking, one pack per day. She has a history of COVID-19 infection, once during the year 2019 and a recent episode in November 2022. On physical examination, the patient was noted to have koilonychia on the right upper and lower extremities, with visible longitudinal bands and flaking of the superficial layer of the nail.

## Discussion

Koilonychia is described as a "spoon-shaped" nail abnormality characterized by brittle, thin, concave nail dystrophy. It can be found in any age group, and it is often associated with severe, chronic iron deficiency that can be attributed to a myriad of causes, such as malnutrition, parasitic infections, malignancies, and more.

Treatment depends on the underlying source of the iron deficiency anemia and should resolve once the causative pathology is adequately addressed. With the relative rarity of koilonychia in developed nations, a thorough physical examination and clinical workup of patients is advised, as its presence may be an indication of a significant underlying pathology.

**Figure 1.** Top row of images illustrates central nail depression of the 1st - 4th digits of the right hand. Bottom row of images illustrates central nail depression in the 1st and 2nd digit of the right foot.

In the presented case, the patient endorsed frequent heartburn as well as difficulty with swallowing medications and food products, which warrants further workup for esophageal abnormalities. Barret esophagus from chronic esophageal reflux can lead to esophageal adenocarcinoma with possible secondary achalasia as a potential explanation of both dysphagia and chronic occult bleeding. Another possible alternative may be Plummer-Vinson syndrome, which presents with iron deficiency anemia and esophageal webs that results in dysphagia. Coupled with the patient's history of tobacco smoking, esophageal squamous cell carcinoma could also serve as an alternative explanation for her symptom manifestation. Because koilonychia is significantly more prevalent in developing nations compared to developed nations, this patient's presentation is noteworthy both in its geographical location as well as its coincident symptomatology.

## Conclusion

Koilonychia is a concave nail dystrophy that occurs as a sequela of chronic, severe iron deficiency anemia. Manifestation of this disease is relatively infrequent in developed countries due to the accessibility and availability of iron in everyday dietary food options. Because of this, the presence of koilonychia in developed countries likely represents a more serious underlying pathology, warranting a more extensive and time-sensitive clinical evaluation.

## Teaching point

Patients presenting with koilonychia in developed nations should be evaluated for both nutritional and non-nutritional sources of chronic and severe iron deficiency anemia.

## Next steps

The patient will undergo esophagogastroduodenoscopy and esophagogram to rule out Plummer-Vinson syndrome, esophageal squamous cell carcinoma, and esophageal adenocarcinoma.

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Case Report

# The Cat's Meow: A Triad of Optic Neuritis, Iritis, and a Parotid Mass

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## Abstract

Cat Scratch Disease is an infectious process caused by the bacteria *Bartonella henselae*. It classically presents as a self-limited lymphadenopathy after inoculation through a cat scratch. This case details an atypical presentation of optic neuritis, iritis, and a parotid mass. The purpose of this discussion is to promote the inclusion of Cat Scratch Disease in the diagnostic workup of a pediatric patient presenting with these symptoms.

**Keywords:** Bartonella henselae, Cat Scratch Disease, Parotid mass, Optic neuritis, Iritis

### The Condition

In most pediatric patients, cat scratch disease (CSD) presents as a localized cutaneous and lymph node disorder around where the causative organism, *Bartonella henselae,* was introduced. CSD begins with a primary lesion at the site of inoculation 3 to 10 days after the organism enters the skin and then goes through vesicular, erythematous, and papular phases.[1] The hallmark of the disease is lymphadenopathy near the location where the organism entered the skin around 1-2 weeks later. Usually, CSD is self-limited, but in some patients, it can spread to infect the liver, spleen, eye, or central nervous system. The direct mechanism of neurological involvement is unknown. It is thought that *Bartonella henselae* produces a neurotoxin that causes direct damage to cells in the nervous system, or it may induce an autoimmune response.

The different neurological manifestations are neuroretinitis, encephalopathy, and seizures. The less common neurological symptoms include paresthesias, meningomyeloradiculopathy, sphincter dysfunction, facial nerve palsy, cerebral arteritis, transverse myelitis, acute hemiplegia, and Guillain-Barre syndrome.[2] Bartonella, when associated with neuroretinitis, presents with optic disk edema, retinal detachment, and exudates that arrange in the pattern of a macular star. The absence of a macular star suggests a less common ocular neuropathy such as optic neuritis instead of neuroretinitis.[3] Cat-scratch disease rarely manifests with ocular or parotid involvement. Only 1-2% of patients with this disease have ocular involvement.[4] Ocular involvement can result in acute left eye vision loss due to papillitis/optic neuritis and iritis.

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Lymphadenitis can result in swelling of the parotid tissue producing a tumor-like mass.[5] This can precipitate a painful mobile swelling over the left parotid area with no other lymphadenopathy.

## Case Presentation

A 14-year-old girl presents to the emergency department with a tender nodule over her left parotid gland. The onset of the nodule was six days prior to admission. Two days after the onset of the nodule her vision became blurry, she developed blind spots in her visual fields, and had eye pain with ocular motion. A maxillofacial CT of the nodule in the emergency department was concerning for a parotid adenoma. She was referred to outpatient ophthalmology for evaluation of her visual changes. At the ophthalmology appointment, she was noted to have acute left optic neuritis and bilateral iritis and was referred for admission to the hospital.

Further history on admission reveals that she is sexually active, has no recent travel history, and has regular contact with cats. On admission, her visual acuity is 20/20 in the right eye and 20/50 in the left. An afferent pupillary defect is noted in the left eye with a round pupil of 4.0 mm and 2+ reactive. Her visual fields are full. The nerve margins of the left optic nerve are blurred and have two small hemorrhages. A 2 cm nodule is noted over the left parotid gland and is tender to palpation, mobile, and firm.

## Discussion

### *Differential Diagnosis*

The differential diagnosis for the patient's optic neuritis, iritis, and parotitis included malignant, infectious, and autoimmune processes. A mass in the parotid gland in combination with abnormal neurologic symptoms raised suspicion for a malignant process. Many infectious agents, such as Cytomegalovirus (CMV), Epstein-Barr Virus (EBV), Human Immunodeficiency Virus (HIV), Bartonella, and Toxoplasma may present with reactive lymphadenopathy which can lead to an enlarged parotid gland depending on the location of the inflamed node. Although the patient did not have classic signs of bacterial meningitis such as headache or meningismus, her abnormal neurologic findings should prompt the consideration of bacterial meningitis or aseptic meningitis as the underlying etiology.

The sexual history of the patient also indicated the possibility of sexually transmitted infections (STIs) such as chlamydia, gonorrhea, and syphilis. The patient's presentation with optic neuritis and iritis prompted the consideration of a variety of autoimmune diseases such as juvenile idiopathic arthritis (JIA), multiple sclerosis, systemic lupus erythematosus (SLE), and sarcoidosis. Optic neuritis is typically secondary to demyelination, such as is seen in multiple sclerosis.[6] Ocular findings alone would not be sufficient for the diagnosis of SLE but should prompt a thorough history and physical exam for the evaluation of other underlying symptoms. Lymph node involvement with the presence of ocular symptoms may lead to a concern of sarcoidosis. Autoimmune diseases such as rheumatoid arthritis and systemic lupus erythematosus can be a cause of aseptic meningitis.[7,8]

***Actual Diagnosis***

To evaluate the diagnosis, imaging of the head and neck were obtained, sexually transmitted infection (STI) tests were done, and a lumbar puncture was performed. CSF cell count revealed pleocytosis consistent with aseptic meningitis.

The MRI showed that the nodule over the parotid gland was a reactive lymph node. This along with the visual changes due to optic neuritis and iritis indicated that the patient had an infection rather than a parotid adenoma. With STIs such as chlamydia, gonorrhea, and syphilis, the patient would be expected to present with genitourinary symptoms. The negative tests with the absence of normal STI presentation lowered the suspicion of these infectious agents. Laboratory tests for toxoplasma, CMV, EBV, and HIV were all negative. CSF culture x 24 hours was negative. These results decreased the likelihood of viral or bacterial meningitis. Negative anti-neutrophil antibody (ANA), rheumatoid factor (RF), and erythrocyte sedimentation rate (ESR) tests and no evidence of demyelination on imaging lowered the possibility of optic neuritis due to an autoimmune disease.

The MRI indicative of an infectious etiology, history of cat scratches, lymphadenopathy, and ocular involvement suggested the possibility of infection with *Bartonella henselae*. Cat scratch disease is characteristically diagnosed by meeting 3 out of 4 criteria including recent cat exposure, a positive test for *Bartonella henselae* antibodies, lymph node lesions, and lymphadenopathy with negative lab results for other causes [4]. The diagnosis was confirmed as cat-scratch disease post-discharge by elevated *Bartonella henselae* IgG titers at 1:128 (Reference Range: < 1:64) on 10/15/2018.

In most patients, Bartonella infection is self-limited, and treatments are supportive. In vitro testing has shown that various antibiotics are effective for the treatment of Bartonella. The indication for treatment with antibiotics is lymphadenitis to prevent the dissemination of infection. In CSD with lymphadenitis, azithromycin is the preferred treatment with clarithromycin, rifampin, and trimethoprim-sulfamethoxazole as alternative options. There is limited evidence for the specific treatment of cat scratch disease with neurological involvement.[9] The combination of doxycycline and rifampin is recommended for children over 8 years of age and has shown to promote the resolution of neurological presentations. The addition of systemic corticosteroids can also aid the resolution of the symptoms especially in patients with severe or persistent disease.[10]

The suspicion of cat-scratch disease in this patient led to empiric treatment with azithromycin, but the patient was transitioned to a regimen of doxycycline, rifampin, and prednisone with recognition of neurologic extension. Following medical treatment, the patient's bilateral iritis resolved, and optic neuritis improved. The lymph node enlargement gradually subsided. The patient's symptoms continued to improve on empiric therapy for Bartonella infection and she was discharged. The patient made full recovery with completion of antibiotic regimen.

**Conclusion**

Consider *Bartonella henselae* infection with the presentation of optic neuritis, iritis, and a parotid mass. In addition, Bartonella antibody testing is recommended to avoid unnecessary biopsy of a parotid mass or prior to beginning therapy for optic neuritis or neuroretinitis.

Optic neuritis secondary to infection can be misdiagnosed as demyelinating optic neuritis in young patients. To help avoid a misdiagnosis, providers should obtain a full and complete history including contact with pets or other animals because it is important to rule out bacterial infection prior to a diagnosis and treatment.

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Image Challenge

# Spinal Injury Following Motor Vehicle Accident

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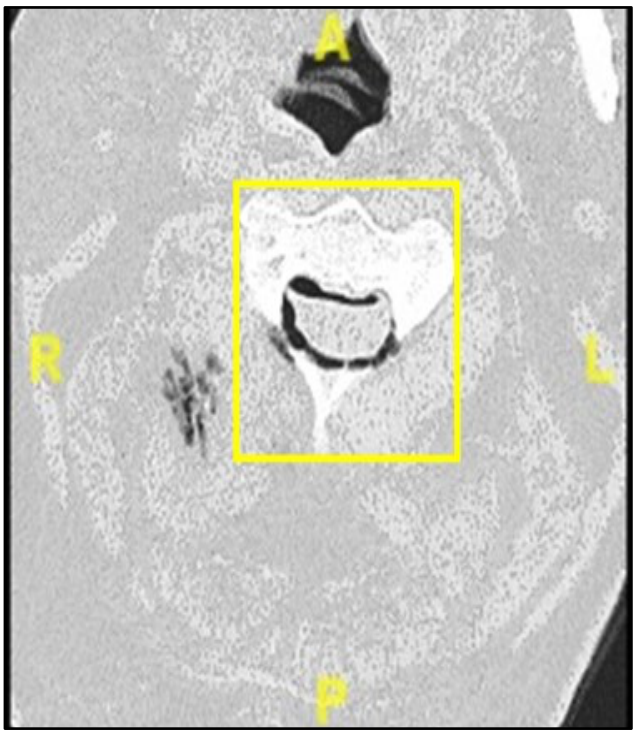
## Case

The patient is a 62-year-old male who presented to the emergency department (Level 2) status-post motor vehicle collision (MVC) as a restrained driver. Per the patient's report, his vehicle was at a standstill on the interstate highway when he was rear-ended by a semi-trailer truck traveling at 60 miles per hour.

## History of Present Illness

Upon arrival, the patient was alert and oriented to time, place, and situation. On physical examination, he had multiple lacerations of the scalp, lower lip, and tongue. He had chest wall tenderness and crepitus bilaterally upon palpation. Computed tomography (CT) of the cervical spine without contrast was performed as part of his trauma evaluation.




## Challenge

Identify the pathology demonstrated within the yellow box of the longitudinal CT shown above.

## Differential Diagnoses

- Paraspinal hematoma
- Pneumorrhachis
- Spinal epidural abscess
- Spontaneous spinal epidural hematoma

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**Answer**
Pneumorrhachis

**Discussion**

The image above demonstrates pneumorrhachis, or air within the cervical spinal canal, suggested by the hypodense region surrounding the spinal cord (See yellow asterisks). Specifically, this patient had gas within the cervical and thoracic spinal canal, most significantly within the C2-C6 spinal epidural spaces. Of note, there is gas within the paraspinal musculature seen on the right of the CT (See red circle).

Pneumorrhachis is a rare phenomenon commonly caused by gas entering the spinal canal secondary to pneumomediastinum, pneumothoraces, or subcutaneous emphysema. It can also result from penetrating spinal injuries, traumatic brain injuries, or infection.[1,2] In most cases, this condition is managed conservatively by treating the underlying pathology. Pneumorrhachis rarely results in spinal cord compression symptoms, which can be managed through surgical decompression surgery.[3]

In this case, the patient had bilateral pneumothoraces, bilateral rib fractures, traumatic subcutaneous emphysema, and vertebral fractures of the cervical and thoracic spinal regions. Fortunately, the patient did not develop complications via the pneumorrhachis, and his condition was managed with thoracostomy tube placement and posterior fusion of T2-T7 with allograft bone.

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