Tropical Diseases, Travel Medicine and Vaccines

RESEARCH

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Impact of COVID-19 on a medium-sized travel medicine clinic in eastern Pennsylvania, USA

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Abstract

Background The COVID-19 pandemic (COVID) disrupted international travel. We sought to determine the impact of the COVID-19 pandemic on patient volume, traveler demographics, and income of our medium-sized travel clinic in Pennsylvania, USA.

Methods We extracted de-identified pre-travel data on 3,510 pre-travel consultations for adults during: Pre-COVID-19 (January 2018-December 2019), Early COVID-19 (April 2020-March 2022) and Late COVID-19 (April 2022-March 2023). We compared traveler demographics, destinations, purpose of travel, medical conditions, and number of vaccinations administered over time, and our clinic's revenue obtained from our financial database (TruSource) for the Pre, Early and Late COVID-19 periods.

Results We observed 84% and 85% relative decreases in traveler volume and revenue respectively from the Pre-COVID-19 to the Early COVID-19 period. The decrease (16–11%) in volume was highest for travelers over 65 years of age. Of those that sought care during Early COVID-19, a fewer proportion of travelers had multiple co-morbid conditions and were taking chronic medications. Trip length increased and there was a significant increase in travel to Africa. Travel to visit friends or family and for service work also increased during Early-COVID-19 (32.9%) versus Pre-COVID-19 (19.8%). Clinic volume and revenue began to increase in Late COVID-19 but did not return to Pre-COVID levels.

Conclusions The COVID pandemic resulted in a large reduction in patient volume and revenue in our academic-based Pennsylvania travel clinic. We saw substantial changes in our traveler demographics, destinations, as well as reasons and durations of travel. Smaller travel clinics will need to have plans in place in order to survive the next pandemic and better serve their pre-travel populations.

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Introduction

In early 2020, COVID-19, also known as Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV-2), disrupted international travel for a variety of reasons. Governmental regulations contributed to this, and on March 19, 2020, the US instituted a Global Level 4 Health Advisory of "Do not travel" in an attempt to contain the pandemic and prevent its spread [1]. The degree of risk perception during pandemics varies among individuals possibly affecting their decision to travel, destinations for travel, as well as the duration of international trips [2].

The impact of the pandemic on international travel and the travel-related industry was enormous [3]. For example, The International Civil Aviation Organization (ICAO) reported in April 2023 a 60% drop in total world passengers in 2020 compared with the 2019 baseline, and a 49% overall drop for the year 2021 compared to 2019. The corresponding revenue loss to the airline industry during calendar year 2020 as compared to 2019 was estimated at 372 billion USD [4].

Prior to international travel, individuals may seek care and advice at a travel medicine clinic in order to mitigate health and safety risks at their destinations. These consultations typically include advice and education, vaccination, and the prescribing of chemoprophylaxis such as to prevent malaria [5, 6].

As a medium-sized travel clinic in the eastern part of Pennsylvania being at a higher financial risk than larger clinics, we sought to assess the impact of the pandemic on our travel clinic from multiple perspectives, including changes in the traveler demographics and the travel profile as well as the financial impact to the clinic.

Methods

Our travel clinic in Eastern Pennsylvania is located in the Lehigh Valley, serving the Valley population and some contiguous communities as the primary catchment base. This catchment base includes 910,000 local residents [7]. The travel clinic is embedded in a larger Infectious Diseases practice as part of a large tertiary-care health network of 13 hospitals of various sizes that include many specialty residency training programs. Staffing the travel clinic are ten board-certified Infectious Diseases physicians and two Physician Assistants, the majority of whom have a Certification of Travel Health [8]. During the two years preceding the COVID-19 pandemic, our travel clinic generated approximately 3.7% of all of the Infectious Disease practice revenue (counting outpatient and inpatient consultations).

Prior to the onset of COVID-19 our travel clinic performed on average 1,353 pre-travel visits/year. We submit our pre-travel data to the Global TravEpiNet (GTEN network), which is a de-identified national registry and database of travelers coordinated by Massachusetts General Hospital and supported by the U.S. Centers for Disease Control and Prevention (CDC) [9]. GTEN data include self-reported traveler demographics, medical history, medications, travel itinerary, duration and purpose of travel, and vaccination information [10]. Clinicians offering these consultations verify this information, add detailed immunization history, input vaccines administered, enter prescribed medications and document specific counseling provided.

Travelers who seek pre-travel counseling at our clinic are asked to pay the full consultation fee by cash or credit card at the time of the visit. The payment for any recommended vaccination is dependent on the traveler's insurance coverage. Our clinic accepts all insurance types present in our region: HMO, PPO, Medicare, State funded plans (Medicaid), Veterans' Administration, and private insurances. Patients without insurance coverage (self-pay) are expected to cover the costs of the vaccines themselves. Many insurances will cover certain vaccines, typically those in routine US Advisory Committee of Immunization Practice (ACIP) guidelines, for example measles-mumps-rubella (MMR), tetanus-diphtheria and acellular pertussis (Tdap), inactivated polio, and hepatitis A. However, many insurance plans do not include coverage for other vaccines including typhoid, yellow fever, rabies, Japanese Encephalitis, or cholera vaccines. For these latter vaccines, patients are expected to pay cash/credit card at the time of service. Many Medicare, state Medicaid, and HMO plans require that travelers receive some of their routine vaccines (e.g. hepatitis A, Tdap) at either their primary care provider, or at a retail pharmacy.

For this study, we considered only data pertaining to adult (>=18 years) travelers visiting our clinic between January 2018 through March 2023. We assessed changes in the distributions of traveler demographics, destinations (by WHO region and by country) [11], duration and reasons for travel, and overall health during the three periods defined as Pre-COVID-19 (January 2018-December 2019), Early COVID-19 (April 2020-March 2022) and Late COVID-19 (April 2022-March 2023). We created a variable to indicate reasons for travel with mutually exclusive categories: leisure, humanitarian service work, business, research and education, visiting family and relatives in a country of origin (VFR) and other reasons (e.g., adoption, military service, adventure, gatherings) indicating a hierarchy. For example, if someone traveled for leisure and any other purpose of travel, they were categorized as having traveled for leisure. We used data on the number of medical conditions and the number of medications taken to characterize the overall health of the traveler. The number of vaccines given per patient were tabulated for each of the three time periods.

The first confirmed case of COVID-19 seen in our network was in March of 2020. We censored January

Table 1 Traveler's demographics, destinations, and duration of travel across the three periods of COVID-19 of 3510 International travelers from our clinic

Characteristics	Pre- *N* = 2663 (75.9%)	Early Post- *N* = 429 (12.2%)	Late Post- *N* = 418 (11.9%)	*P*-Value*
		N (Col %)		
Gender	0.773			
Male	1159 (43.5)	194 (45.2)	186 (44.5)	
Female	1504 (56.5)	235 (54.8)	232 (55.5)	
Age				< 0.0001
18–49	1447 (54.3)	255 (59.4)	201 (48.1)	
50–65	789 (29.6)	127 (29.6)	118 (28.2)	
>65	427 (16.0)	47 (11.0)	99 (23.7)	
Duration of Travel				< 0.0001
<14 days	1354 (50.8)	162 (37.9)	192 (45.9)	
14–28 days	989 (37.1)	186 (43.6)	177 (42.3)	
>28 days	320 (12.0)	79 (18.5)	49 (11.7)	
Region of Travel**				
Africa	1267 (47.6)	331 (77.2)	200 (47.8)	< 0.0001
Americas	913 (34.3)	78 (18.2)	110 (26.3)	< 0.0001
Southeast Asia	313 (11.8)	16 (3.7)	67 (16.0)	< 0.0001
Western Pacific	271 (10.2)	19 (4.4)	36 (8.6)	< 0.001
Eastern Mediterranean	131 (4.9)	22 (5.1)	29 (6.9)	0.223
Europe	104 (3.9)	11 (2.6)	21 (5.0)	0.177
Reason for Travel				< 0.0001
Leisure	1525 (57.3)	218(50.8)	270 (64.6)	
Humanitarian Service Work	479 (18.0)	94 (21.9)	55 (13.2)	
Business	298 (11.2)	22 (5.1)	23 (5.5)	
Research/Education	250 (9.4)	31 (7.2)	33 (7.9)	
VFR	49 (1.8)	47 (11.0)	18 (4.3)	
Other	62 (2.3)	17 (4.0)	19 (4.5)	
Number of Pre-existing Medical Conditions				< = 0.0001
0	641 (24.1)	111 (25.9)	69 (16.5)	
1	720 (27.0)	124 (28.9)	94 (22.5)	
2	592 (22.2)	98 (22.8)	113 (27.0)	
>2	710 (26.7)	96 (22.4)	142 (34.0)	
Number of Current Medications Taken				< 0.0001
0	816 (30.6)	162 (37.8)	111 (26.6)	
1	617 (23.2)	87 (20.3)	68 (16.3)	
2	419 (15.7)	62 (14.5)	62 (14.8)	
>2	811 (30.5)	118 (27.5)	177 (42.3)	
Number of Vaccinations received				< 0.0001
0	174 (6.5)	63 (14.7)	87 (20.8)	
1	916 (34.4)	145 (33.8)	136 (32.5)	
2	832 (31.2)	119 (27.7)	124 (29.7)	
>2	741 (27.8)	102 (23.8)	71 (17.0)	

*Based on a two-sided Chi-square Test. **Not mutually exclusive

through March of 2020 as the pandemic had not yet arrived in our region. April 1, 2022 was set as the beginning of the Late COVID-19 period as this was the time when a second Omicron wave crossed much of the United States and overall COVID-19-related mortality began to decrease [12]. These same parameters were used to analyze the financial impact the clinic faced in terms of visit volumes and revenue during this period. To assess the impact on revenue, we reviewed data stored in our network's financial database, TruSource (WebFOCUS) [13]. This data was then compared with trends in the demographic data from travel consultations.

This study was deemed non-human subject research by the Institutional Review Board at Lehigh Valley Health Network.

Statistical analysis

Summary statistics (e.g., proportions) were obtained and bivariate analyses using a two-sided chi-square test were conducted to assess the significance of the difference in the distributions of the variables across the three time periods. All analyses were performed in SAS 9.4 (SAS Institute Inc., Cary, NC) and a two-sided $p<0.05$ was considered significant.

The revenue data were normally distributed as assessed by the Shapiro-Wilk test (p values of 0.63, 0.36, and 0.98 for Pre-, Early and Late COVID respectively). There was homogeneity of variances as assessed by Levene's test for equality of variances ($p=0.4856$). An omnibus one-way ANOVA was conducted to determine if quarterly revenue differed significantly across the three COVID periods defined as – Pre-COVID-19 (2018 and 2019, $n=8$), Early COVID-19 (April 2020-March 2022, $n=8$), and Late COVID-19 (April 2022-March 2023, $n=4$). Tukey post hoc analysis was conducted to determine specifically in which quarters revenue differed significantly.

Results

Early COVID Period

We reviewed 3,510 travel records. 2,663 from the 24 month Pre-COVID-19 period, 429 from the 24 month Early COVID-19 and 418 from the 12 month Late COVID-19 periods (Table 1). We observed an 84% decrease in travel clinic volume from 261,040 patients in the Pre-COVID-19 to 40,115 patients in the Early COVID-19 periods (Fig. 1). There was a decrease in the proportion of travelers over 65 years of age seen at the clinic (11%) in Early COVID-19 compared with Pre-COVID-19 (16%). The duration of travel increased during the Early COVID-19 period compared with Pre-COVID-19: 62% vs. 49% traveling for 14 days or longer; and 18.5% vs. 12% traveling for 28 days or longer. The most striking change in destination was to Africa, with 77.2% of all travelers seen during Early

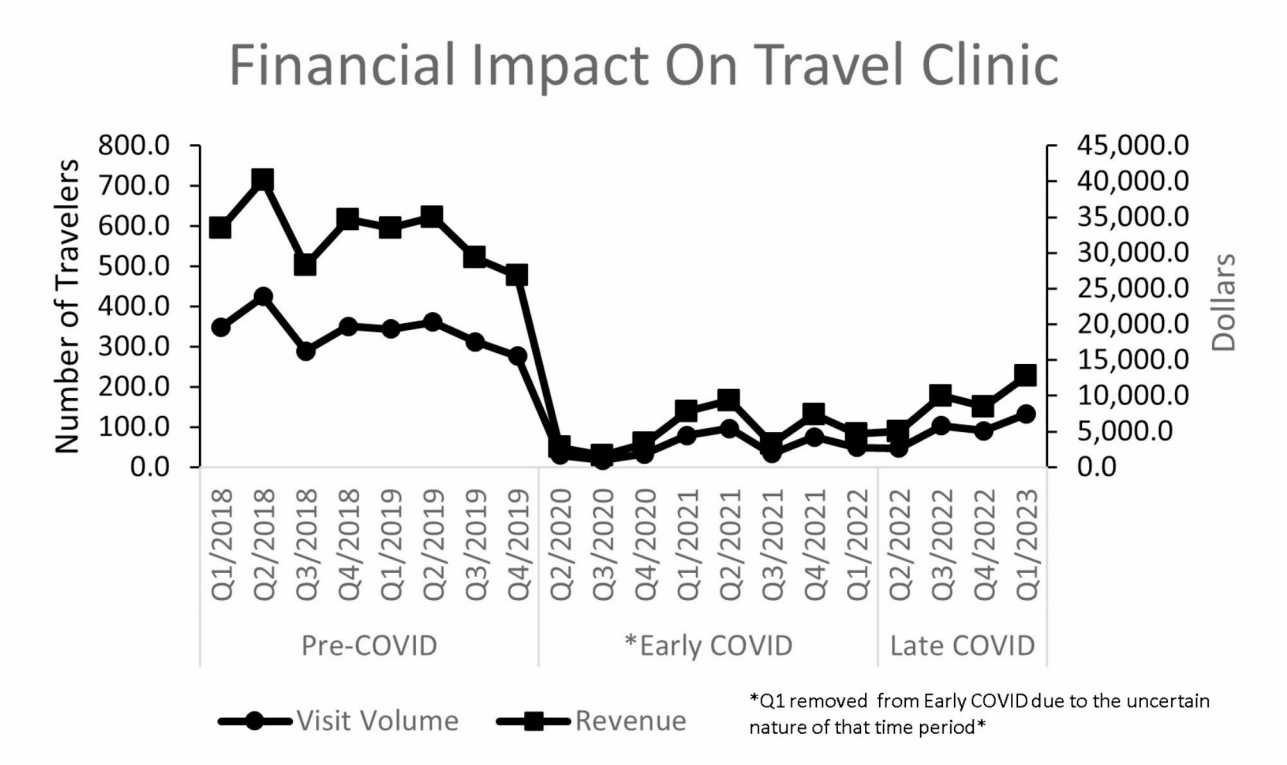

Fig. 1 Quarterly trends of traveler visit volume and revenue generated by the travel clinic across three periods

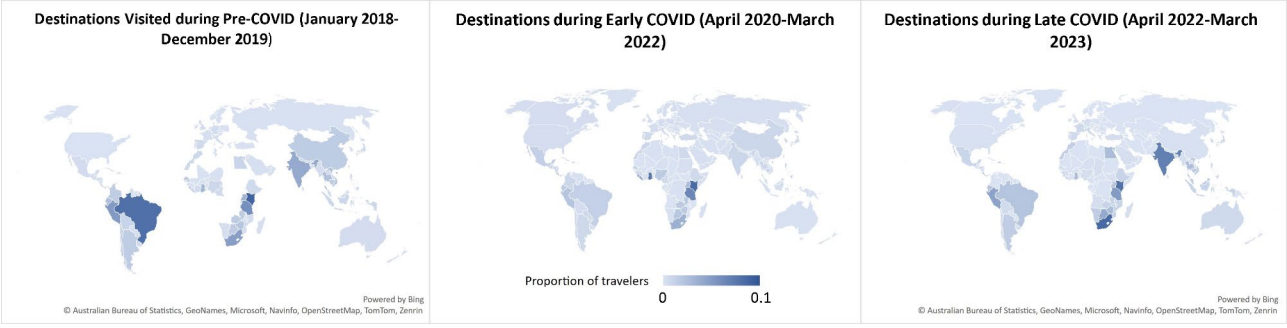

Fig. 2 Travel destinations during the Pre, Early and Late COVID-19 periods

COVID-19 traveling to Africa, in comparison to 47.6% pre-COVID-19 (Table 1; Fig. 2). The reason for travel changed over time ($p<0.0001$). We saw a 9.2% absolute increase (511% proportional increase; 1.8–11%) in VFR travel [14] and 3.9% absolute increase (21.7% proportional increase; 18.0–21.9%) in humanitarian service work from the Pre- to the Early COVID-19 period with a corresponding absolute 6.5% (57.3–50.8%) drop in leisure and 6.1% (11.2–5.1%) drop in business travel (Fig. 3).

Regarding traveler health, during the Early COVID-19, there was a 4.3% decrease (26.7–22.4%) in the number of travelers with >2 medical conditions (proportional 16% decrease) and a 4.3% absolute increase (53.8–58.1%) in number of travelers taking none or only one medication ($p<0.0001$). Vaccinations received per traveler during Early COVID-19 decreased from Pre-COVID-19 with 8.2% (6.5–14.7%) more travelers receiving zero vaccines and a 4% decline (proportional 14% decline; 27.8–23.8%) in travelers receiving >2 vaccines (Table 1). The change in proportions with zero vaccination was 7.8% for leisure, 2.9% for humanitarian workers, 5.4% for business, 10.9% for research and education, 10.9% for VFR, and 30.5% for other types of travelers. The number of travelers traveling for reasons other than leisure or humanitarian work was too small for us to make robust inferences. Also, our data is limited in that we cannot identify whether people were traveling back to places they had been to before or were traveling to new locations.

In terms of volume and revenue, COVID-19 resulted in an 84% drop (from an average 338 visits per quarter to 52

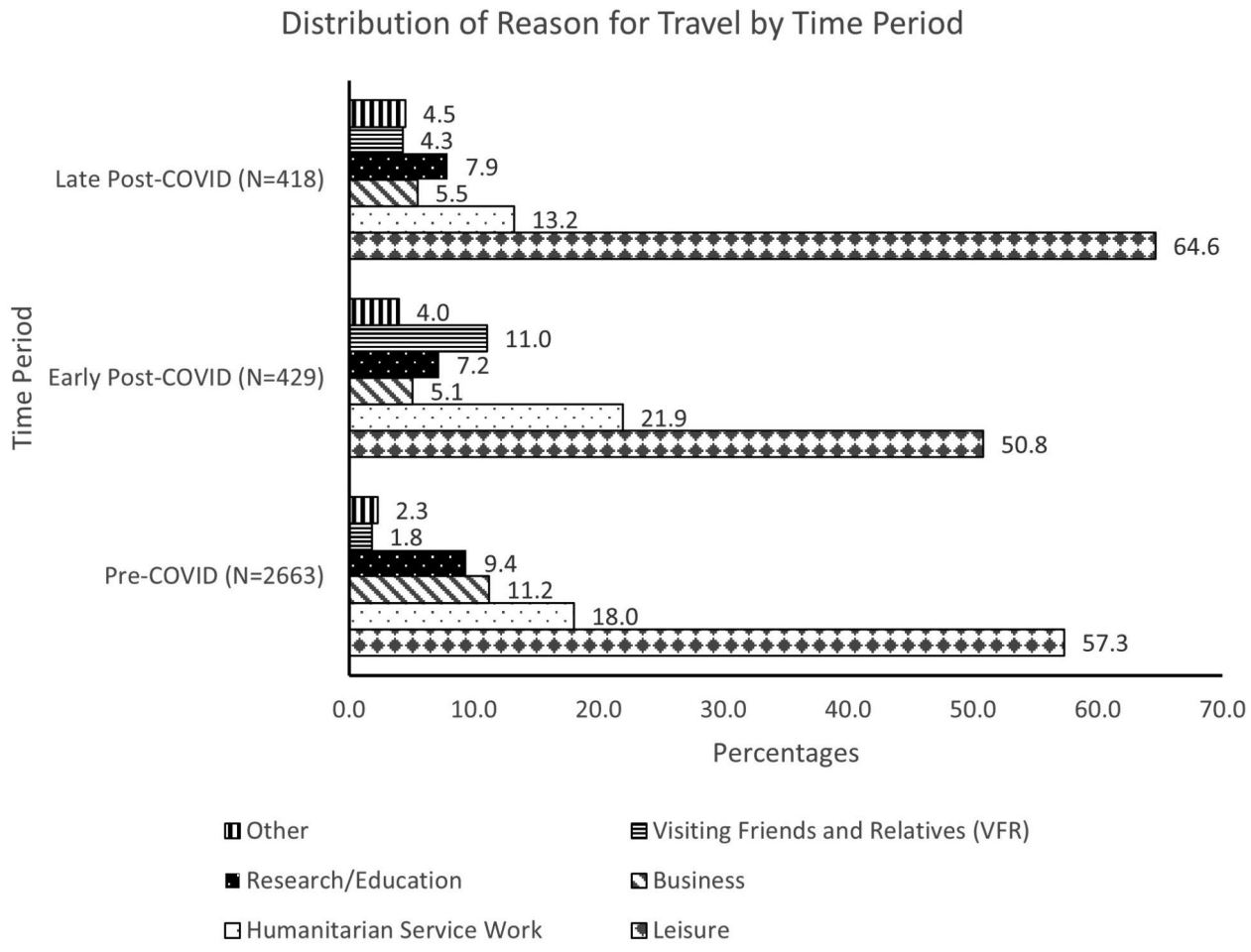

Fig. 3 Reason for Travel Change Over Time

visits per quarter) in travel patient volumes, and a corresponding 85% proportional revenue drop for the travel clinic per quarter in the Early COVID-19 period from the Pre-COVID-19 period (Fig. 1, S1). The travel clinic's share of revenue in the Infectious Diseases practice dropped to <1% during the COVID-19 pandemic and had not recovered to the Pre-COVID-19 levels by March 2023. By March 2023, quarterly clinic revenue [mean±standard deviation] was still at only 28% of Pre-COVID-19 values, (Pre-COVID-19 [$32,630.00±$4,356.58]; Early COVID-19 period [$5,014.38±$2,796.09]; and Late-COVID-19 period [$9,044.00±$3,217.58] ($p<0.001$). All individuals in this assessment paid for their pre-travel consultation aspect of the bill at the time of service throughout the three periods. Review of the traveler's insurance coverage for vaccinations indicated a significant increase in self-pay (uninsured) individuals from the Pre- to Early COVID-19 periods (20.6% and 32.2% respectively) ($p<0.001$), while those with commercial insurance showed a significant decrease from Pre- to Early COVID-19 (55.5% and 45.4% respectively) (S3).

Late-COVID-19 period

During the Late COVID-19 period, there was an increase in travelers over 65 years of age (24%) versus Early COVID-19 (11%) and Pre-COVID (16%), and a reduction in trips longer than 28 days (11.7%) versus Early COVID-19 (18.5%) and Pre-COVID-19 (12%) (Table 1). Travel to Africa as a proportion of clinic visits also fell appreciably (47.8%) versus Early COVID-19 (77.2%) returning to Pre-COVID-19 proportion (47.6%). Using fewer medical conditions and fewer medications as a surrogate for healthier travelers, we saw generally healthier travelers in the Early COVID-19 period as compared to the Pre-COVID-19 period, however that trend reversed through the Late COVID-19 period (Table 1 and S4, S5, S6). Vaccination uptake also changed significantly as there was an increase in the proportion of travelers who took no vaccinations from the Pre-COVID-19 period through the Late-COVID-19 period (6.5–20.8%) continuing on an upwards trend, while the proportion of individuals taking over 2 vaccines dropped significantly across the three periods from 27.8 to 17% ($p<0.0001$) (Table 1; Fig. 4). During

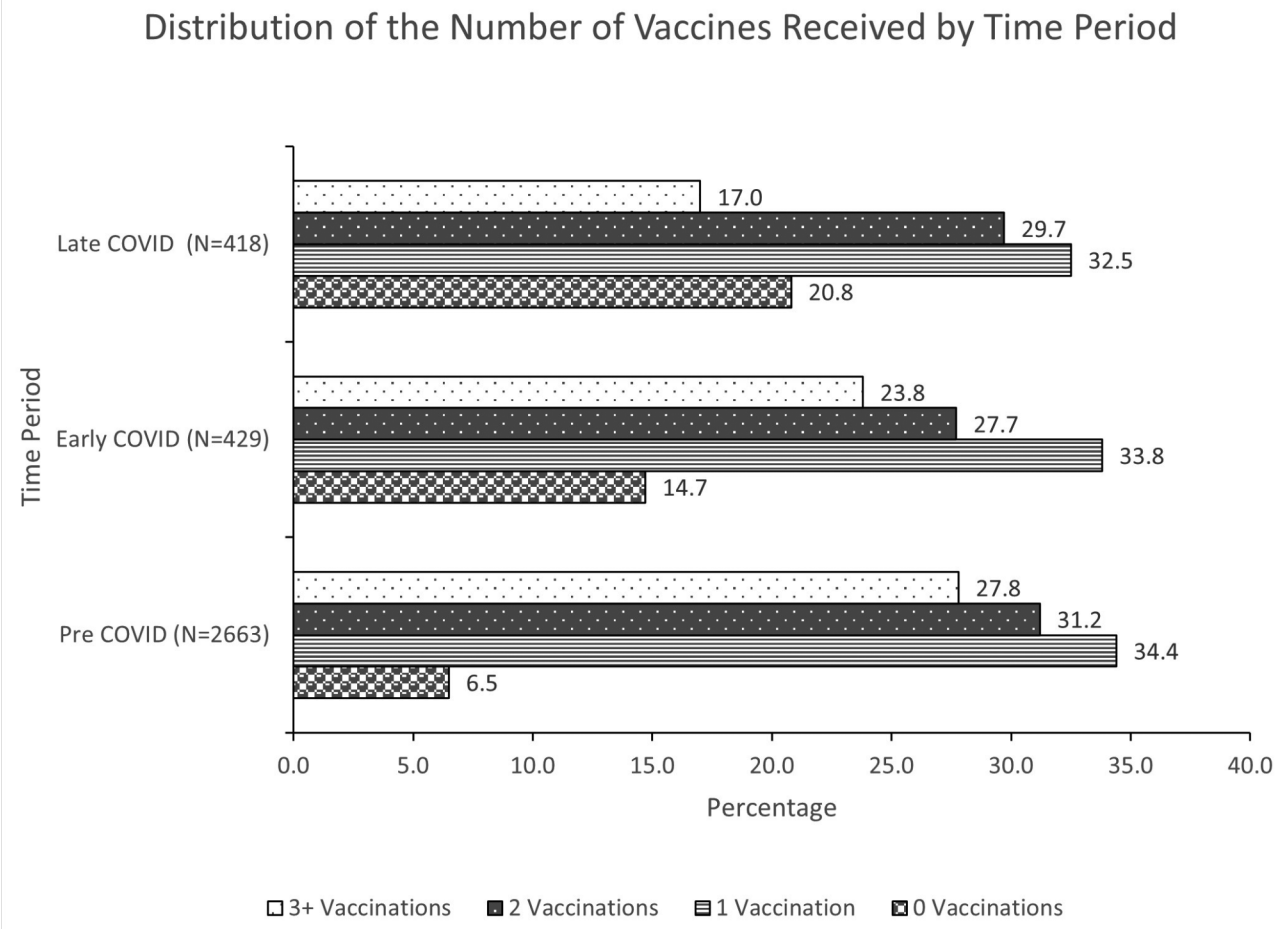

Fig. 4 Percentage of Travelers Who Received Vaccinations

both COVID-19 time periods, inpatient Infectious Diseases consultation requests increased dramatically (absolute increase of 57.4% from calendar year 2019 to 2020 and 7.9% from 2020 to 2021). Throughout these periods, our providers maintained their International Society of Travel Medicine (ISTM) memberships however, travel medicine conference attendance was curtailed due to COVID-19 travel restrictions and prohibitions against larger gatherings.

Discussion

Our retrospective record review revealed that the COVID-19 pandemic resulted in a large drop in travel clinic volumes and associated revenue from the Pre-COVID period and that these decreases were still present in the Late COVID-19 period although increases were occurring. This corresponds to the large decrease in international travel numbers due to travel restrictions and concerns about contracting COVID. Although our volume of inpatient Infectious Diseases consultation requests increased dramatically throughout both COVID periods, the corresponding drop in our travel and outpatient patient volumes created the effect of only minimal revenue increases, if any, despite the added time efforts noted by our providers (S1, S2). This loss in practice revenue owing to loss of Travel Clinic volumes had not yet recovered to the pre-pandemic levels by the end of Late COVID.

The drop in pre-travel consultation numbers and revenue seen in our clinic were also seen in other travel clinics in the US and in other countries. An International Society of Travel Medicine survey performed in April and May of 2021, revealed that 70% of respondents reported substantial reductions in travel clinic volumes [15]. A report on the impact in Southern Europe showed an overall drop of 75–90% for pre-travel assessments [16]. Such reductions in travel clinic volumes could have a devastating impact on free-standing travel clinics or sites that cannot easily shift personnel and resources elsewhere [17]. This could result in a reduction in public health benefits that travel medicine services can provide. Also impacting the revenue decline would be the loss in income attributable to fewer vaccinations administered during COVID.

Traveler demographics themselves changed significantly, with younger travelers consulting pre-travel services more during the Early-COVID-19 period and overall, the travelers were healthier, when looking at the number of pre-existing medical conditions and the number of current medications. Interestingly, most of these demographic features were recalibrating back toward baseline during the Late-COVID-19 period, particularly a much higher proportion of senior travelers and corresponding shorter trip durations.

VFR travel proportions rose dramatically during Early COVID-19, while travel for leisure and business decreased significantly. In addition to an increase in VFR travel, we also noted a significant surge in the proportion of travelers leaving for humanitarian work. Most of the changes in reason for travel seem to re-calibrate quickly in the Late COVID period.

We also found a significant increase in the proportion of travel to Africa, especially by VFR travelers, and especially for longer durations. This may reflect individuals traveling back to countries of origin during pandemic, perhaps either for family or financial reasons. The increase in the proportion of travelers to Africa may in part reflect the desire or need to obtain yellow fever vaccination to assist country entry. VFR travel has been a main driver in more recent returns to higher international travel volume with some forecasts suggesting a 17% compounded annual growth rate from 2021−25.[18] This trend is likely to continue.

Along with the improved health of travelers noted in the Early COVID-19 period, there were fewer vaccines given to patients during this period and throughout the Late COVID-19 period. It was not clear if the reduction in vaccines administered during Early/Late COVID-19, reflected increased declination or provider assessment of vaccine need. Perhaps some of the reduction in vaccination we saw during Early COVID-19 may have been in part due to a significant increase in the proportion of self-pay travelers (not insured) who may have opted to forgo some of the recommended immunizations due to cost concerns. Alternatively, considering the corresponding increase in VFR travel, fewer vaccines were ordered. It is well documented that VFR travelers are often under-vaccinated for similar destinations as other travelers and more often may decline recommended vaccinations for many potential reasons [19]. Our data does confirm that VFR travelers increased in significant proportions relative to other traveler types and a had much higher likelihood of receiving zero vaccines at their visit. Lastly, we showed that travelers during Early and Late COVID-19 were younger and healthier by our measures. This likely also contributed to lower update in vaccination. Whether less insurance coverage, younger age, better health, or increase in VFR and humanitarian service work contributed most to our observed decline in vaccination throughout both COVID-19 periods, cannot be determined from our data. It is certainly possible that the combination of our traveler characteristics and trip profiles all contributed significantly.

Certain vaccinations did show high acceptance rates during the Early COVID-19, including Yellow Fever, hepatitis A, and typhoid vaccines. Vaccine hesitancy was not formally assessed as a part of this study, however, there did not appear to be broad hesitancy as many of these travelers did readily seek advice and usually accepted the immunizations that were required by the destination countries.

The broader implications of the reduction in vaccination during both COVID-19 periods would be increased risk in vaccine preventable diseases both during travel and after return home (decreased acceptance for routine vaccines). This might disproportionately affect VFR travelers, who receive fewer vaccines, travel longer, and have historically had higher rates of vaccine preventable diseases such as hepatitis A and typhoid fever [20]. Self-pay travelers might also be disproportionately affected during such times. Consistent with other data, travel durations were longer with more travelers going for over 4 weeks. The destinations changed significantly as well with more trips to the African continent and correspondingly fewer trips to South America and Southeast Asia. We believe that destination changes were a result of global travel restrictions as well as destinations to which VFR travelers returned [18, 19, 21]. It is possible that many VFR travelers decided to isolate themselves and work remotely for their jobs, from their countries of origin and to be with family members, in association, perhaps with a lower cost of living.

The changes in our traveler demographics were similar to a prior analysis of the larger GTEN database, reviewing over 18,000 consultations which showed significant differences among international travelers during COVID-19, with longer durations of travel, an increase in proportions of younger travelers and an increase in VFR travel [6]. Travel to Africa increased significantly in this larger study, with a reduction in travel to Asia, similar to our findings. That review included a large pediatric population, showing a 263% relative increase through the COVID-19 period. It is likely that this was a consistent theme across the US, particularly during Early COVID-19.

The data presented here can serve as a valuable resource for planning for future pandemics or during global travel restrictions. Our 85% drop in travel-revenue through Early COVID-19 was substantial and can add to the stress of an already overburdened Infectious Diseases or other medical practice. Practices that rely heavily on Travel Medicine as part of their revenue stream will need

to consider having remediation plans in place to weather future restrictions should they occur.

Most travel clinics that are embedded within larger medical practices should be able to survive future pandemics by adding volumes in other domains of their practices, such as increasing inpatient consultation availability as we did in our practices. Practice managers can develop staffing plans in advance that would allow for more flexible rotations to fill voids in other areas of both outpatient and hospital rotations.

Smaller travel clinics will have to consider protocols in advance that allow them to reach out to those who may still travel during the pandemics such as VFR travelers and humanitarian workers. Reaching these groups in advance of global shutdowns by messaging and alerts via the health systems EMR, may still allow travel medicine providers to provide preventative care to these groups ahead of (and during) travel, albeit in a slightly different format. Additionally, one review has suggested that travel clinics might weather future pandemics by expanding services offered including adding pre-travel testing, and stand-by point of care diagnostics and self-treatment medication packs to those who do travel as well as considering implementing use of mobile devices with GPS capability to allow for contact tracing and/or disease surveillance in order to help mitigate spread in other countries [22]. How much of these activities might be reimbursed is unknown. Furthermore, addressing the particular needs of younger, particularly VFR travelers, would be important going forward, realizing that many do not seek pre-travel consultation and may be at higher risk for preventable adverse outcomes including, malaria typhoid fever, and hepatitis [20].

There are a few limitations to our analysis:

Data collected by the GTEN are limited to travelers who seek pre-travel advice from a GTEN site and hence these results cannot be generalized to a broader pre-travel population, many of whom might not seek pre-travel consultation and have been shown to differ from GTEN travelers [9].

Second, in the GTEN, the travelers self-report their medical conditions, medications, and reason for travel. This can be corrected at the pre-travel visit by the provider onsite, but there is the potential for travelers to omit or overstate the number of potential health problems as compared with a detailed provider history. As such, the traveler's overall health cannot always be accurately gauged by the results of the pre-travel survey.

Lastly, this study was from a single site within a specific type of healthcare network. Our findings may not be generalizable to other travel clinics or to the healthcare networks that support them but might still be able to create awareness and provide guidance to other similar clinics.

Conclusions

This study shows that the financial impact of COVID-19 on an academic-based, medium-sized travel medicine clinic was substantial. Major revenue loss was sustained over three years. Such losses could be devastating to stand-alone travel medicine clinics. Travelers during Early COVID-19 were younger, healthier, traveled to Africa, traveled for longer periods of time, and received fewer vaccinations as compared with the Pre-COVID-19 period. Enhanced education and messaging on ways to mitigate illness may be indicated for such travelers in the future. Recovery began in Late COVID-19 but has not yet returned to Pre-COVID levels.

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

Supplementary Material 3

Supplementary Material 4

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Author contributions

MK and MG: creation of original concept and protocol. SR provided access to the GTEN database. SR did the data searches and provided statistical analysis. PP, MK, MG and SR did the initial manuscript writing and revisions. All authors contributed to formal review and approval of this manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Competing interests

The authors declare no competing interests.

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