COVID-19 SPECIAL ISSUE II

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The Impact of the COVID-19 Pandemic on Older Adults Who Participate in Group Physical Exercise Program

Michiyo Tomioka PhD; Sarah Yuan PhD; Johnny Yago BA; Claudette Medeiros BA

https://www.doi.org/10.62547/MQXM6470

Abstract

The COVID pandemic exposed the vulnerability of older adults in myriad ways and social service organizations faced unprecedented challenges in safely providing support for older adults. Since 2007, Hawai‘i Healthy Aging Partnership (HHAP) has offered Enhance®Fitness, an evidence-based program to reduce the risk of falls and promote health among older adults. Due to the pandemic, all the Enhance®Fitness sites had to close and stop offering the program. The HHAP started to provide alternative activities remotely in May 2020. To explore the pandemic’s impact, the feasibility of online exercise programs, and the support needed among older adults to stay physically active, HHAP surveyed existing Enhance®Fitness participants and received 291 responses (59% response rate). The study used frequency distributions, comparison of means, and chi-square to analyze the survey data. Findings showed that the shutdown of the group exercise program during the pandemic led to a health status decline, a reduction in physical activities, and a shift from group to individual physical activities among older adult participants. Most respondents tried the remote exercise opportunities during the pandemic and would consider joining the remote programs in the future. However, about one-fourth of the respondents did not participate in remote exercise activities due to the lack of electronic devices, internet access, or interest in remote activity formats. To ensure equitable access to physical exercise programs for older adults in the post-pandemic era, it is critical to address the access challenges and resources needed for providing multiple programming options.

Keywords

Health promotion, older adults, evidence-based interventions, fall prevention, remote exercise classes, COVID-19

Abbreviations and Acronyms

ADRC = Aging and Disability Resource Center
BRFSS = Behavioral Risk Factor Surveillance System
HHAP = Hawai‘i Healthy Aging Partnership

Introduction

The benefits of physical activity among older adults are well documented. Physical activity research shows various positive outcomes in physical health, mental health, cognitive function, social engagement, and economic well-being.1-3 Hawai‘i Healthy Aging Partnership (HHAP), a collaborative endeavor led by the Executive Office on Aging, the Department of Health Chronic Disease Prevention & Health Promotion Division, and the University of Hawai‘i, has been offering Enhance®Fitness since 2007.4 It is an evidence-based physical exercise program that combines cardiovascular and balance exercises, stretching, and strength training to prevent functional decline in older adults. Classes consist of 3, one-hour weekly sessions conducted by certified fitness-specialized trainers. Enhance®Fitness improves the participants’ cardiovascular fitness, strength, flexibility, and balance and motivates regular attendance by creating a fun and friendly exercise environment that nurtures relationships among participants.5

The COVID-19 pandemic has affected older adults in numerous ways. In mid-March 2020 and through the early phase of the pandemic, the government ordered public and private organizations to postpone in-person gatherings and asked people to stay home to curtail the spreading of the virus. In addition, many locations and services providing physical activity opportunities were closed, including HHAP’s Enhance®Fitness sites.

Starting in April 2020, HHAP Enhance®Fitness instructors and program staff checked in with participants and reminded them about what they can do to keep active. The HHAP partners—the County of Kaua‘i Agency on Elderly Affairs and Maui County Office on Aging—soon noticed that the pandemic had caused social isolation, which triggered cognitive and physical decline, putting Enhance®Fitness participants at risk for falling and worsening health.

While waiting for the Enhance®Fitness developer to create a remote delivery protocol, the HHAP partners quickly organized themselves to offer remote physical activity opportunities for older adults in strict adherence to the COVID-19 safety guidelines. Maui and Kaua‘i Counties recruited participants from their existing Enhance®Fitness classes and beyond. To improve access to health promotion activities, Kaua‘i County launched virtual exercise classes via Zoom in mid-May 2020. Maui County produced physical exercise videos consisting of Enhance®Fitness components for airing on a local TV channel and posted them on the Aging and Disability Resource Center (ADRC) website in early June 2020. It was the first time HHAP offered physical activities in a remote format for older adults.

There was some uncertainty about whether older adults would accept the remote delivery of health promotion activities because most were unfamiliar with participating in activities remotely or using tablets.6 This study explored how the pandemic impacted...
older-adult participants who were part of the Enhance® Fitness in Hawai‘i, examined the longer-term feasibility of offering physical exercise programs remotely, and identified important factors related to designing accessible health promotion services and programs with cultural considerations for the future.

**Methods**

This study recruited participants from a pool of 493 Enhance® Fitness active members who enrolled in the program between April 2019 and March 2020. The instructors and program staff invited program members to participate in the survey during the regular check-in calls. Callers were trained by the program evaluator to use the study’s script for recruitment and to conduct the interview using the survey questionnaire. Member participation was voluntary, and no incentives were offered. After 2 months of data collection, the program staff decided to mail or email the survey questionnaire to the participants to speed up the process. From August to November 2020, a total of 291 Enhance® Fitness members completed the survey, representing a 59% response rate for the study.

The questionnaire design was a joint effort by HHAP Enhance® Fitness coordinators, instructors, and the program evaluation team. It was pilot tested with a few older adults before finalizing for data collection. The 20-question survey included 16 questions with precoded responses, 3 with short qualitative responses, and 1 open-ended question. It consisted of a demographic section, questions on current health status and physical activity engagement before and during the pandemic, questions on personal experience with the remote exercise programs, and questions on future directions of remote programming. The data examined in this study are listed below.

Demographic data included age, sex, race, living arrangements, and county of residence. Respondents were categorized into age groups (<70, 70–79, and 80+), racial groups (White, Japanese, Native Hawaiian/Pacific Islander, and “other” including Filipino, Chinese, Hispanic, African American, other Asians, and other non-Asians), household sizes (1 person, 2 persons, and 3+ persons), household composition (with or without children under 18), and county of residency (Kaua‘i and Maui). These characteristics were examined to see if they were associated with the key measures.

The health status of the respondents was measured by self-rated health. The impact of the pandemic on health was assessed by comparing the survey results to the pre-pandemic data collected from the Enhance® Fitness members as part of the regular assessment between April 2019 and March 2020. Self-reported impacts of COVID-19 on the respondent’s personal life were also examined. Physical activity status included the type and frequency of the activity, time spent per activity during the month before the pandemic (retrospective), and the direction of change in the amount of time spent for each activity in the past 30 days prior to the survey. The survey pre-listed 7 physical activity types (Enhance® Fitness, workout at home, gardening/yard work, household chores, walking, Hula or other dancing, golfing) and accepted other responses. The analysis categorized the physical activity types into group versus individual settings.

The questions on remote physical exercise opportunities included remote delivery methods, reasons for participation, and where they heard about the options. Future directions of the remote physical exercise programs asked the respondents what they would consider participating in the future, and the barriers and facilitators to their participation.

Each completed survey was assigned a unique number for data entry, and no personally identifiable information was entered into the database to ensure anonymity. Data were analyzed by frequency distributions, comparison of means, and Chi-square using the IBM SPSS Statistics, version 27 (IBM Corp., Armonk, NY). A statistically significant test result was set at \( P \leq .05 \). Institutional Review Board at the University of Hawai‘i approved this study (Protocol # 2-22-00905).

**Results**

The demographic characteristics of survey respondents (n=291) are shown in Table 1. The mean age was 74 years. Almost all were female (94%). The majority (66%) resided with 1 or more people, including some living in households with a minor (9%). Over one-third of respondents were White (35%), another one-third were Japanese (33%), 11% were Native Hawaiian and Pacific Islanders, and 20% were other. Over half (55%) resided in Maui County, and the rest (45%) lived in Kaua‘i County.

**The Pandemic’s Impact**

Almost all (95%) Enhance® Fitness participants who completed the survey indicated that the pandemic had changed their lives, either in a major way (59%) or a little bit (36%), and only 5% said their life stayed about the same. The majority of respondents (82%) rated their health status as “good,” “very good,” or “excellent,” and 18% said their health was “poor” or “fair” at the time of the survey. The “poor/fair” health percentage was 3 times higher than in the pre-pandemic period (6%).

Respondents were asked about their physical activity participation before and during the pandemic and how it had changed. On average, the respondents engaged in 3 to 4 different types of physical activities (including Enhance® Fitness) before the pandemic (mean=3.34), which decreased to 2 to 3 types during the pandemic (mean=2.87; \( P < .001 \)). The change in the number of physical activity types was not associated with the demographic characteristics examined in this study (data not shown).
The respondents recalled that, before the pandemic, they spent an average of 3.4 hours per week in group physical activities such as Enhance®Fitness, dancing, and golfing. During the pandemic, all but 1 of the respondents reported spending less time or no time in group physical activities, and 1 spent the same amount of time as in the pre-pandemic period (data not shown). For physical activities that can be done alone, such as walking, doing household chores, gardening, and working out at home, the average time spent was 10.2 hours per week before the pandemic broke out. At the time of the survey, over half (55%) of the respondents were able to spend the same amount of time on these individual physical activities, while the rest either did more (22%) or did less or none (23%) (Table 2).

Two demographic characteristics—household composition ($P=.030$) and county of residence ($P=.010$)—were significantly associated with engagement in individual physical activities during the pandemic (Table 2). The proportion of respondents who reported spending “more”, “same” or “less/none” on individual physical activity during the pandemic was significantly different among those who lived in households with children under age 18 compared to those who did not. Respondents living with children under 18 were more likely than those in households without children to maintain the same amount of physical activity time (78% versus 51%); however, those in households without younger children were more likely to report increased time spent on individual physical activities (25% versus 4%). Of the 2 counties, Maui respondents were more likely to report spending the same amount of physical activity time (61% versus 46%), while Kaua’i respondents were more likely to spend increased time (30% versus 16%).

### Remote Physical Exercise Programs

Ninety percent of survey respondents ($n=262$) heard about the remote format of physical exercise programs offered by...
the HHAP partners and others. The most common source of information was Enhance® Fitness instructors or Area Agency of Aging staff (70%), followed by friends and family members (35%), ADRC (7%), and the HHAP website (3%) (data not shown). Of those who heard about it, nearly 70% (n=182) participated in the remote formats (Table 3). The most frequently cited reasons for participating in remote exercises were to keep exercising (89%), improve health (49%), and try something new (21%). Nearly half (46%) of the remote participants watched TV channels to exercise, 37% joined live virtual classes, 32% watched physical exercise videos online, and 15% tried multiple remote formats during the pandemic (data not shown).

As shown in Table 3, females were more likely than males to join the remote exercise activities (P=.003). Higher participation rate was also found among Japanese and Native Hawaiian/Pacific Islander respondents (versus White and “other” racial groups, P=.030), those who lived with children under 18 (versus those who did not, P=.045), and Maui residents (versus Kaua‘i residents, P=.037).

There were differences in remote physical activity formats by county. Kaua‘i residents were more likely than Maui residents to participate in the live or virtual physical activities (81% versus 8%, P<.001) and Maui residents were more likely to join the TV exercise programs (77% versus 4%, P<.001). This result reflects the availability of the HHAP remote activities in the respective counties. Some demographic characteristics were associated with a higher likelihood of joining a specific remote format. Respondents who did not live with children (versus those who did, P=.014) were more likely to participate in the live virtual exercise classes. Native Hawaiian/Pacific Islander and “other” racial groups (versus White and Japanese, P=.011), respondents living in a household of 3+ persons (versus in a 1- or 2-person household, P<.001), and those who lived with children (versus those who did not, P<.001) were more likely to watch TV channels for exercise. Respondents under 70 were more likely than their older counterparts to follow videos on the internet for exercises (P=.011).

**Considerations for Future Remote Program Deliveries**

When asked the respondents whether they would consider doing exercise online, along with a TV program, or both in the coming months, 75% indicated that they would. As shown in Table 4, those who accepted the TV format were more likely to be females than males (62% versus 29%, P=.007), living with children than without children (81% versus 59%, P=.028), and Maui than Kaua‘i residents (68% versus 51%, P=.004). Respondents who would consider doing exercise online tended to be those who lived in a 1-person or 2-person households than households of 3+ persons (53% and 57% versus 28%, P=.001), did not live with children than with children (52% versus 27%, P=.013), and resided in Kaua‘i County compared to Maui County (63% versus 39%, P<.001).

For those who considered joining TV exercise programs, 29% indicated they would not need any support or assistance. The most common help needed was program schedule and information (58%), followed by reminder calls to motivate them (23%), learning how to exercise safely (6%), and TV subscription (2%). Almost half of those who would join online exercise classes (46%) did not indicate any support or assistance needed. The most common support selected was program schedule and information (38%), followed by assistance for technology (18%), computer access (15%), reminder calls (15%), internet connectivity (13%), and learn how to exercise safely (6%) (data not shown).

Of the 72 respondents (25%) who would not consider joining any remote exercise programs, the common reasons given were not knowing how to use the technology (34%), already doing other exercises (34%), disliking the remote formats (27%), lack of access to computers (27%), and no or poor internet connectivity (23%) (data not shown).
<table>
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<td></td>
<td>34 (43.0%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>29 (36.7%)</td>
</tr>
<tr>
<td>3+ persons</td>
<td>18 (33.3%)</td>
<td>36 (66.7%)</td>
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<tr>
<td></td>
<td></td>
<td>9 (25.0%)</td>
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<td></td>
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<td>27 (75.0%)</td>
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<tr>
<td></td>
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<td>8 (22.2%)</td>
</tr>
<tr>
<td>Household Composition</td>
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<tr>
<td>With children &lt;18</td>
<td>5 (19.2%)</td>
<td>21 (80.8%)</td>
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<td></td>
<td>3 (14.3%)</td>
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<td>64 (42.1%)</td>
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<td></td>
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<td></td>
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<td>52 (34.4%)</td>
</tr>
<tr>
<td>County of Residence</td>
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<tr>
<td>Kaua‘i</td>
<td>58 (43.9%)</td>
<td>74 (56.1%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>60 (81.1%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 (4.1%)</td>
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<tr>
<td></td>
<td></td>
<td>21 (28.8%)</td>
</tr>
<tr>
<td>Maui</td>
<td>51 (32.1%)</td>
<td>108 (67.9%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8 (7.6%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>81 (77.1%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>37 (35.2%)</td>
</tr>
</tbody>
</table>
Prior research found that demographic characteristics such as educational attainment, living status, and neighborhood characteristics are associated with physical activity levels. This study’s findings showed that living with children under 18 may have influenced older adults’ engagement in physical activities during the pandemic. A study in Hong Kong found that grandparents’ childcare responsibilities increased due to school closure, reducing their time for physical activities. In this study, older adults living with minors tended to maintain the same amount of physical activity during the pandemic as before; however, those who did not live with minors were more likely to spend more time in physical activities. Interestingly, Hawaii’s Behavioral Risk Factor Surveillance System (BRFSS) data showed that older adults’ self-rated health and prevalence in physical activity participation improved from 2019 to 2021. This is the opposite of what this study found. Given that the survey participants were recruited from the Enhance®Fitness, their demographic characteristics and adjustments during the pandemic may not represent Hawaii’s general older adult population.

The pandemic also opened up opportunities for older adults to participate in physical exercise remotely. This study’s findings suggested the importance of considering older adults’ demographic characteristics when selecting the remote delivery mode. The online exercise programs, which included synchronized video conferencing and self-paced classes, were preferred by older adults in 1- or 2-person households, not living with minors, and younger than 70, who tended to have better access to online videos and programs. Watching exercise videos on TV was preferred by older adults living in households with 3+ persons, with minors, and among non-White and non-Japanese races. One hypothesis is that exercise with other household members is more enjoyable for older adults with specific cultural backgrounds. A previous study of Enhance®Fitness focus group with White, Chinese, Japanese, and Black participants indicated that family support and encouragement influenced their exercise adherence. In addition, 1 study reported that some ethnic groups value and choose group settings over individual settings. During the pandemic, older adults had limited social interaction with others, and family members were the most accessible social support. Many physical activity interventions are age-segmented, but recently some research has pointed to the benefits of developing intergenerational physical activity interventions.

This study identified needed support for the delivery of remote programs. Findings suggested that providers should post the program schedule and information where their clients can easily find them, and make reminder calls to encourage older adults to participate. One of the studies found that a reminder call is an effective strategy for continued participation in physical activity.

Some older adults may not be interested in the remote delivery of exercise programs, but this study also showed that some could not participate because of access barriers. Since the pandemic, the federal government or other organizations have started to

**Table 4. Intention to Join Remote Physical Activities in TV Versus Internet Formats by Demographic Characteristics**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>None (n=72)</th>
<th>TV format (n=174)</th>
<th>Internet format (n=144)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
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</tr>
<tr>
<td>Mean age</td>
<td>75.0</td>
<td>76.1</td>
<td>75.0</td>
</tr>
<tr>
<td>Age category</td>
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<td></td>
<td></td>
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<tr>
<td>&lt;70</td>
<td>15 (29.4%)</td>
<td>26 (51.0%)</td>
<td>32 (62.7%)</td>
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<tr>
<td>70-79</td>
<td>34 (27.9%)</td>
<td>69 (56.6%)</td>
<td>67 (54.9%)</td>
</tr>
<tr>
<td>80+</td>
<td>18 (25.4%)</td>
<td>39 (54.9%)</td>
<td>32 (45.1%)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>11 (64.7%)</td>
<td>5 (29.4%)</td>
<td>6 (35.3%)</td>
</tr>
<tr>
<td>Female</td>
<td>60 (22.2%)</td>
<td>168 (62.2%)</td>
<td>137 (50.7%)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>27 (26.7%)</td>
<td>57 (56.4%)</td>
<td>53 (52.5%)</td>
</tr>
<tr>
<td>Japanese</td>
<td>20 (20.8%)</td>
<td>62 (64.6%)</td>
<td>55 (57.3%)</td>
</tr>
<tr>
<td>Native Hawaiian &amp; Pacific Islander</td>
<td>6 (18.8%)</td>
<td>21 (65.6%)</td>
<td>13 (40.6%)</td>
</tr>
<tr>
<td>Other</td>
<td>18 (31.0%)</td>
<td>33 (56.9%)</td>
<td>22 (37.9%)</td>
</tr>
<tr>
<td>Household Size</td>
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<td></td>
</tr>
<tr>
<td>1 person</td>
<td>26 (27.4%)</td>
<td>57 (60.0%)</td>
<td>50 (52.6%)</td>
</tr>
<tr>
<td>2 persons</td>
<td>29 (22.1%)</td>
<td>77 (58.8%)</td>
<td>75 (57.3%)</td>
</tr>
<tr>
<td>3+ persons</td>
<td>14 (25.9%)</td>
<td>36 (66.7%)</td>
<td>15 (27.8%)</td>
</tr>
<tr>
<td>Household Composition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>With children &lt;18</td>
<td>4 (15.4%)</td>
<td>21 (80.8%)</td>
<td>7 (26.9%)</td>
</tr>
<tr>
<td>Without children &lt;18</td>
<td>65 (25.6%)</td>
<td>149 (58.7%)</td>
<td>133 (52.4%)</td>
</tr>
<tr>
<td>County of Residence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kauai</td>
<td>36 (27.5%)</td>
<td>67 (51.1%)</td>
<td>83 (63.4%)</td>
</tr>
<tr>
<td>Maui</td>
<td>36 (22.8%)</td>
<td>107 (67.7%)</td>
<td>61 (38.6%)</td>
</tr>
</tbody>
</table>

**Discussion**

This study revealed some of the negative impacts the pandemic had on the health and physical activity level of Hawaii’s older adults who were active in a group exercise program—Enhance®Fitness—before the pandemic. Survey respondents who reported “fair” or “poor” health increased 3-fold compared to the program participants in the pre-pandemic period. Almost all stopped engaging in group physical activities due to the lockdown and its restrictions. Our findings agree with the majority of the recent literature on physical activity among older adults. For example, a review of 22 studies showed that 13 reported a decrease, and 9 reported no significant changes in physical activity among older adults.

Prior research found that demographic characteristics such as educational attainment, living status, and neighborhood characteristics are associated with physical activity levels. This study’s findings showed that living with children under 18 may have influenced older adults’ engagement in physical activities during the pandemic. A study in Hong Kong found that grandparents’ childcare responsibilities increased due to school closure, reducing their time for physical activities. In this study, older adults living with minors tended to maintain the same amount of physical activity during the pandemic as before; however, those who did not live with minors were more likely to spend more time in physical activities. Interestingly, Hawaii’s Behavioral Risk Factor Surveillance System (BRFSS) data showed that older adults’ self-rated health and prevalence in physical activity participation improved from 2019 to 2021. This is the opposite of what this study found. Given that the survey participants were recruited from the Enhance®Fitness, their demographic characteristics and adjustments during the pandemic may not represent Hawaii’s general older adult population.

The pandemic also opened up opportunities for older adults to participate in physical exercise remotely. This study’s findings suggested the importance of considering older adults’ demographic characteristics when selecting the remote delivery mode. The online exercise programs, which included synchronized video conferencing and self-paced classes, were preferred by older adults in 1- or 2-person households, not living with minors, and younger than 70, who tended to have better access to online videos and programs. Watching exercise videos on TV was preferred by older adults living in households with 3+ persons, with minors, and among non-White and non-Japanese races. One hypothesis is that exercise with other household members is more enjoyable for older adults with specific cultural backgrounds. A previous study of Enhance®Fitness focus group with White, Chinese, Japanese, and Black participants indicated that family support and encouragement influenced their exercise adherence. In addition, 1 study reported that some ethnic groups value and choose group settings over individual settings. During the pandemic, older adults had limited social interaction with others, and family members were the most accessible social support. Many physical activity interventions are age-segmented, but recently some research has pointed to the benefits of developing intergenerational physical activity interventions.

This study identified needed support for the delivery of remote programs. Findings suggested that providers should post the program schedule and information where their clients can easily find them, and make reminder calls to encourage older adults to participate. One of the studies found that a reminder call is an effective strategy for continued participation in physical activity.

Some older adults may not be interested in the remote delivery of exercise programs, but this study also showed that some could not participate because of access barriers. Since the pandemic, the federal government or other organizations have started to
offer device and internet connectivity for free or at minimum cost. Providers should assess clients’ comfort level with technology and provide appropriate assistance to those who need it.

The key to success in offering accessible physical activity for older adults is to provide options so individuals can choose a comfortable setting based on their situation. The aging network should consider offering a variety of modes of delivery for exercise programs or a range of physical exercise resources to meet the needs of seniors from different backgrounds. More staff training on remote programming and sharing resources among organizations would help the aging network more efficiently and effectively provide multiple remote and in-person program options.

One of the limitations of this study is its generalizability. The survey participants were recruited from the Enhance® Fitness, not the general population. The respondents were physically active, primarily female, and living in Kaua‘i and Maui Counties. Another limitation is the lack of data on older adults’ experience participating in remote exercise programs. The short questionnaire did not allow for in-depth questions on this topic. The third limitation was the data collection methods used. Compared to the self-administered survey via mail or email, the phone interview was better in reducing missing responses; however, it required more manpower to call and complete the interview, and might have increased social identification bias. Data collected via the mail or email method tended to have a higher percentage of missing responses, especially for the questions with complicated instructions, such as the frequency of participation in remote exercise programs. Further study with a larger and more diverse sample would help the aging network better understand the programs and resources needed to create equitable access to physical exercise programs for older adults in the post-pandemic era.

**Conclusion**

Overall, this study highlighted the impact of the pandemic and the unique needs among Hawai‘i’s older adults to stay physically active when the in-person group exercise program had to stop abruptly. Even during a pandemic, it is recommended that older adults remain active to delay the onset of chronic conditions and disabilities. This study highlighted that the pandemic negatively impacted Hawai‘i’s older adults, but many have sought remote options for physical activity and would consider joining remote programs even when the pandemic is over. Some barriers to participation can be reduced by finding existing public resources. The aging network can benefit from more training on remote programming and sharing programming resources to make more remote exercise options available for older adults.

**Conflict of Interest**

None of the authors identify a conflict of interest.

**Acknowledgments**

We acknowledge the Hawai‘i Healthy Aging Partnership (HHAP), a collaborative endeavor led by the Executive Office on Aging, the Department of Health Chronic Disease Prevention & Health Promotion Division, and the University of Hawai‘i, and service providers dedicated to expanding evidence-based health promotion options for older adults in Hawai‘i. HHAP has been supported by State and County appropriations.

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Kū Like Kākou: Utilizing a Community-led Model of Collaboration to Respond to the COVID-19 Pandemic

Sarah Momilani Marshall PhD; N. Ku‘uleimomi Tolentino BA; J. Ke‘alohilani Worthington MPH; Chantelle Eseta Matagi BA; Sharde K.M. Freitas JD, MPH; Kim Ku‘ulei Birnie; Mary-Frances Oneha PhD

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Abstract

The outbreak of COVID-19 in 2020 brought significant challenges for Native Hawaiians (NH), Pacific Islanders (PI), and other communities of color worldwide. Rapidly increasing rates of infection and transmission of the virus in Native Hawaiian and Pacific Islander (NHPI) communities and incomplete or unavailable data signaled to Hawai‘i’s leaders that advocacy and action needed to take place to minimize the impact of COVID-19. The Native Hawaiian and Pacific Islander Response, Recovery, and Resilience team (NHPI 3R Team) emerged from an effort to lead and fill gaps in response to COVID-19. Through the swift, intentional, and collaborative work of the team and its partners, NHPI communities and the entities that serve them were better equipped to navigate the pandemic, improve health outcomes, and contribute to a reduction in the number of infections, a rise in vaccination uptake, and an increase in NH and PI representation on various levels of government agencies. As the world shifts its focus from COVID-19 to broader health topics, the NHPI 3R Team will continue to serve as a hub for the exchange of resources and a model of community-led work that can be used to tackle issues like COVID-19 and beyond.

Keywords

Native Hawaiian/ Pacific Islander (NHPI) collaboration, COVID-19 response, community-led model, data disaggregation, NHPI health disparities

Abbreviations/Acronyms

CDC = Centers for Disease Control and Prevention
COVID-19 = Coronavirus Disease, otherwise known as SARS-CoV-2
HDOH = Hawai‘i State Department of Health
NH = Native Hawaiians
NHPI = Native Hawaiians and Pacific Islanders
NHPI 3R Team = Native Hawaiian & Pacific Islander Hawai‘i COVID-19 Response, Recovery, & Resilience Team
OMH = Office of Minority Health
PI = Pacific Islanders
POL = Papa Ola Lōkahi

Introduction

E lauhoe mai nā waʻa; i ke kā, i ka hoe, i ka hoe, i ke kā; e pae aku i ka ‘āina

“Everybody paddle the canoes together; bail and paddle; paddle and bail, and the shore will be reached.” If everyone pitches in, the work is quickly done.1

Native Hawaiians and Pacific Islanders (NHPI) experience adverse health, social, and economic disparities at higher rates than other racial and ethnic groups in Hawai‘i. Those disparities were laid bare as events of the COVID-19 pandemic unfolded across the world in early 2020. A rapid increase in COVID-19 infections in Hawai‘i and incomplete or unavailable disaggregated race and ethnicity data to guide an appropriate and meaningful public health response exposed the critical need for advocacy and action to minimize further impact on these communities. Leaders representing multiple NHPI communities came together to create the Native Hawaiian & Pacific Islander COVID-19 Response, Recovery, & Resilience Team (NHPI 3R Team).

The NHPI 3R Team was established in May 2020 in alignment with the national NHPI COVID-19 Response Team. Leaders and partners identified 3 overarching purposes: (1) improve the collection, analysis, and reporting of accurate data, (2) identify and lend support to initiatives across Hawai‘i working to respond to and address COVID-19 among NHPI, and (3) unify to establish a presence in the decision-making processes and policies that impact these communities. Four influential and recognized community leaders, 2 each from NH and PI communities, lead the team and are integral to ensuring that all activities and partnerships are in alignment with and fully represent the NHPI 3R Team’s mission and core values.

Papa Ola Lōkahi (POL), the federally appointed Native Hawaiian Health Board, serves as the organizing agency for the NHPI 3R Team. POL staff guides the development of agendas, discussions, and work products across committees, and ensures appropriate resources are mobilized to accomplish the team’s goals. POL has engaged members to advance shared goals and establish a standard of support, inclusion, and accountability on all levels.

In response to identified priorities, collaboration in committees address (1) data & research, (2) social support programs and recovery, (3) testing, contact tracing, isolation, and vaccinations, (4) communications & community engagement, and (5) public policy. Committees operate with appointed chairs who guide discussions and tasks in alignment with response priorities. In addition to ensuring adequate representation of the working committees, subcommittees create space for separate, relevant...
discussion of community priorities, attitudes, and character. As one collective unit, the team supports the tremendous COVID-19 response, recovery, and resilience-building efforts needed to address the disproportionate impact among NHPI. The NHPI 3R Team’s core organizational values and priorities align with the 5 conditions of the Collective Impact framework. ²

The ‘ōlelo no‘eau (Hawaiian proverb) above illustrates the importance of working together toward a common goal – a foundational characteristic of the NHPI 3R Team and Pacific worldview. Uniting the efforts of NHPI organizations improved the way the collective responded to the needs of the community. The purpose of this article is to showcase the achievements of the NHPI 3R Team specific to addressing the COVID-19 crisis and highlight a model of community-led collaboration and partnership that can be utilized to respond to future public health emergencies.

Efforts

Building a Network of NHPI Serving Partners

At the onset of COVID-19, NHPI-serving organizations looked to each other for new, relevant NHPI data and eventually joined forces to establish a more significant presence in seeking it. The NHPI 3R Team’s leadership then looked to engage additional partners with community rapport and a deep understanding of the disparities facing NHPI populations to navigate a response to the virus. It was essential to find partners actively immersed in community work to amplify efforts rather than replicating them. Partners from community-based organizations, health care centers, hospitals, insurance companies, trusted physicians, public health researchers, academia, finance, community action, government agencies, and others were sought to join the NHPI 3R Team’s effort. As the pandemic evolved and the impact of COVID-19 became clearer, additional partnerships, especially among service providers, evolved to help bridge gaps.

Conducting Environmental Analyses

Each committee conducted an environmental scan to identify what resources were available, where gaps existed, and where partnerships could be brokered to respond to COVID-19. Scans revealed there were significant gaps in data collection and reporting, reliable information on transmission and side effects of the virus, linguistic and culturally aligned public health messaging, and available programs and social services. Historical trauma and a lack of cultural competency were shown to be long-standing barriers in the distrust that underserved and marginalized communities feel toward the government and government-like agencies. With the continually evolving status of COVID-19, the NHPI 3R Team frequently assessed and reassessed its priorities and activities.

Newspapers and journal articles also illustrated the need for COVID-19 health information and messaging that was scientifically accurate, linguistically appropriate, and culturally aligned with NHPI knowledge, attitudes, beliefs, and practices. Partners were conscientious of longstanding trust issues between communities and the government agencies intended to serve them. In turn, they ensured that programs, events, and initiatives considered and integrated NHPI voices and histories. Regardless of the adversities that NHPI often face, their resilience and commitment to their cultural and historical foundations can be leveraged to reduce the impact of diseases like COVID-19.³

Understanding the Role of Data

In Hawai‘i, NHs represent 21% and PIs represent 4% of the state population.⁴ Though they are a minority of the population, historically the impact of disease has disproportionately affected these groups.⁵ Unfortunately, when health data are collected and reported on a state and national level, NH and PI or Asian American (AA) and PI data are reported in aggregate. In Hawai‘i, the Hawai‘i State Department of Health (HDOH) often fails to consistently report and collect disaggregated NHPI data. Additionally, the aggregate race group “Pacific Islander” clusters together many unique people throughout the Pacific. These discrepancies mask the disease burden, making it difficult to respond accurately and promptly.⁶

In the early stages of the pandemic, data were collected and reported by a few entities, 1 being the Hawai‘i Department of Health (HDOH). However, while the HDOH reported infection rates in accordance with the federal standard defined by the Office of Management and Budget (OMB), they failed to disaggregate NH data from PI data even though they possessed baseline data.⁷ The team leveraged the interconnectedness of the NHPI 3R Team network to partner with the HDOH to exchange information and solutions to respond to COVID-19. This partnership was instrumental in helping the HDOH’s Disease Outbreak Control Division (DOCD) navigate data disaggregation challenges and improve the reporting process to the public. It also opened doors to opportunities for further investigation into other gaps in data collection, reporting, and usage. Advocacy efforts for data disaggregation also took shape through testimony submitted to the Hawai‘i State legislature. Such efforts were pivotal to ensuring NHPI concerns related to COVID-19 and social determinants of health were heard. The team provided testimony for bills and resolutions that focused on addressing more immediate needs, such as timely, consistent, and disaggregated NH and PI COVID-19 data and the establishment of a PI contact tracing team. They also sought to prepare for future data needs, such as establishing protocols for more seamless data sharing and advocating for NHPI representation as part of the newly established data task force.
**Impacts**

**Partnerships and Collaboration**

The NHPI 3R Team’s network quickly became a hub for the exchange of resources, information, and expertise on newly surfacing topics during the COVID-19 pandemic. Partners looked to strengthen existing wraparound services and develop new programs to fill emergent gaps. Newsletters, flyers, and presentations provided updated data, testing and vaccination events, community surveys, resource kits, upcoming learning opportunities, and more were distributed weekly for partners to review and share with their networks. The production and planning of those communication products were coordinated through the NHPI 3R Team network. Today, more than 60 partners convene regularly to discuss issues surrounding COVID-19 and create community-aligned and data-informed solutions.

Bringing together partners in the NHPI 3R Team effort opened doors for engagement in national conversations and conferences to discuss the challenges facing NHPI communities before, during, and after COVID-19. This included presentations delivered to the Centers for Disease Control & Prevention (CDC), Administration for Native Americans (ANA), numerous national Asian American & Pacific Island-serving organizations, Office of Minority Health, Morehouse University, Office of Hawaiian Affairs trustees, Public Relations Society of America – Western Chapter, Hawai‘i Department of Health Vaccine Communications Hui, Hawai‘i Broadband Hui, Pacific Region Indigenous Doctors Congress (PRIDoC), American Public Health Association (APHA), Society for Prevention Research (SPR), International Union for Health Promotion and Education (IUHPE), and many more.

Exchanges between the NHPI 3R Team with other national and local efforts provided partners with opportunities for workforce and leadership development through networking. The NHPI 3R Team currently has partners involved on the Advisory Committee for the Office of Minority Health (OMH), the national NHPI COVID-19 Response team and its various committees, and the National Association of Pacific Organizations (NAOPO) and its working committees.

**Data-informed Solutions**

Through strong and persistent advocacy efforts by the NHPI 3R Team and other partners, Hawai‘i is now the only state to disaggregate NH and PI COVID-19 data. Once data were disaggregated, it was easier to identify the status of NHs and PIs at different points during the pandemic to provide adequate and timely solutions. Partners were recognized for their significant effort in advocating for improvements in the data collecting, analysis, and reporting process and were invited to co-author a *Morbidity and Mortality Weekly Report* (MMWR) article in collaboration with the CDC in late 2021.8

The disaggregation of NH and PI COVID-19 data and lived experiences confirmed the need for a PI contact tracing team (hereafter referred to as Team 6B) within HDOH that was grounded in trust-building and culturally relevant and effective outreach strategies. In response to the rapidly increasing NHPI COVID-19 caseload, the 26-member team, exclusively composed of and led by NHPI community members, provided culturally tailored and in-language wrap-around service referrals for NHs and PIs. Their effectiveness as a team was apparent in the proportion of cases they handled daily and the decreasing case rates of COVID-19 within the NH, PI, and Filipino communities. Data showed that NHPIs were 44% of cases and 32% of deaths from March 1, 2020 to February 28, 2021. The infection and mortality rates were 2501 cases per 100 000 population and 39 deaths per 100 000 population among NHPI communities, respectively. In comparison, Whites had an infection rate of 947 cases per 100 000 population and mortality rate of 9 per 100 000 population during the same time period.7,8

To help minimize the spread of COVID-19, testing sites were set up across Hawai‘i in zip codes with overall high infection rates. When clusters and new variants were identified throughout 2021, government response committees discussed ways to improve the current response to COVID-19 and the partnerships needed to succeed. One of the limitations identified was many of the initial testing and vaccination sites were set up in areas that were not easily accessible or considerably far from communities in need. Funding received through the NHPI 3R Team provided financial support for setting up over 300 testing and vaccination points of distribution across Hawai‘i in priority zip codes as well as communication and outreach activities that addressed misinformation and promoted vaccinations within NHPI communities.

When the first set of vaccines was available for a limited rollout, state leaders looked to follow the guidance put forth by the CDC’s Advisory Committee on Immunization Practices (ACIP). Recognizing the need to address community concerns, the NHPI 3R Team provided opportunities for community members to hear from trusted leaders and medical professionals about the COVID-19 vaccine. Communication materials such as public service announcements, toolkits, and infographics were distributed through webinars and social media to increase health literacy on vaccines in ways that resonate with NHPI communities. After the collective efforts of the NHPI 3R Team and its partners, vaccination uptake increased to be at 22% for the NHPI aggregate.8

In preparation for the legislative session each year, the NHPI 3R Team engaged community and partner expertise to better inform advocacy efforts. Throughout the 2022 State Legislative Session, the NHPI 3R Team submitted 13 testimonies on 10 unique bills introduced to benefit NHPI communities. Among those, the team submitted testimony urging the HDOH to continue to employ NHPIs, especially the NHPI contact tracing team.
The NHPI 3R Team provided a platform for community partners to cultivate effective collaborations and use them to forge solutions that improve NH and PI outcomes. The highest priority work areas for the team moving forward, as identified by partners, include: (1) increasing equity and representation for NHPI, (2) continuing collaboration across and within NH and PI communities, (3) working to de-silo all systems that serve communities and bring about systemic equity, (4) continuing to work in public health systems, (5) increasing communications internal and external to the NHPI 3R Team, and (6) developing leadership and resource opportunities.

The NHPI 3R Team’s living model of collaboration is highly effective and can be used and adapted to inform future work in NHPI communities and other communities of color. The model of the NHPI 3R Team is organic and adaptable. As the status of COVID-19 continuously evolved, partners recognized that there was no single method to tackling the challenges highlighted by the virus, and as the situation with COVID-19 evolved, so too did the response of the NHPI 3R Team.

Continued Work

The NHPI 3R Team and its partners continue to build on the foundations created since the beginning of the COVID-19 pandemic. It is thanks to fierce leaders and partners who possess the trust of their communities that the NHPI 3R Team was able to respond to the identified needs of the people. While there have been significant strides made for improving health outcomes among NHs and PIs and increasing representation on multiple levels, the effort must continue. Advocacy done within and external to the NHPI 3R Team will need to continue to benefit and raise the status of NHs and PIs. As the NHPI 3R Team prepares to shift its focus to tackle health disparities other than COVID-19, the collaboration demonstrated by this team will serve as a model for the work that lies ahead.

Conflict of Interest

None of the authors identify a conflict of interest.

Acknowledgments

Mahalo to the NHPI 3R Team, its partners, and leadership for continued service to Native Hawaiian and Pacific Islander communities. A special mahalo to our Native Hawaiian and Pacific Islander communities that inspire the work of the collective.

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References


Impact of the COVID-19 Pandemic on Inpatient Pediatric Medical Student Education in Hawai‘i

Alyssa S. Fujiwara BS; Jennifer R. Di Rocco DO, MEd; Travis K.F. Hong MD; Chieko Kimata PhD, MPH, MBA; Kyra A. Len MD

Abstract

The COVID-19 pandemic has had many effects on medical student education, ranging from safety measures limiting patient exposure to changes in patient diagnoses encountered by medical students in their clerkship experience. This study aimed to identify the impact of the pandemic on the inpatient experiences of third- and fourth-year medical students by assessing patient volumes and diagnoses seen by students. Frequency and types of notes written by medical students on hospital-based pediatric rotations at Kapi‘olani Medical Center for Women and Children as well as patient diagnoses and ages were compared between 2 time periods: pre-pandemic (July 2018-February 2020) and pandemic (May 2020-September 2021). On average, the number of patients seen by medical students was significantly reduced in the pandemic period from 112 patients/month to 88 patients/month (P=0.041). The proportion of patients with bronchiolitis or pneumonia were also significantly reduced in the pandemic period (P<0.001). Bronchiolitis was diagnosed in 1.3% of patients seen by medical students during the pandemic period, compared with 5.9% of patients pre-pandemic. Pneumonia was diagnosed in 1.0% of patients seen by medical students in the pandemic period compared with 4.6% pre-pandemic. There was no significant difference in patient age between the 2 groups (P=0.092). During the first 18 months of the COVID-19 pandemic, medical students in this institution had a remarkably different inpatient experience from that of their predecessors. They saw fewer patients, and those patients had fewer common pediatric respiratory diseases. These decreases suggest these students may require supplemental education to compensate for these gaps in direct pediatric clinical experience.

Keywords

COVID-19; pandemic; medical education; medical student; clerkship; pediatrics

Abbreviations and Acronyms

AAMC = Association of American Medical Colleges
ED = emergency department
EMR = electronic medical record
H&P = history and physical
ICD = International Classification of Diseases
JABSOM = University of Hawai‘i John A. Burns School of Medicine
OB/GYN = obstetrics and gynecology
PPE = personal protective equipment
RSV = respiratory syncytial virus

Introduction

On March 13, 2020, 2 days after COVID-19 was declared a global pandemic by the World Health Organization, the Association of American Medical Colleges (AAMC) released guidelines supporting the suspension of clinical activities due to concerns for student and patient safety as well as allowing hospitals to ensure they had adequate personal protective equipment (PPE) and COVID-19 testing capabilities.1,2 On March 16, 2020, all medical students at the University of Hawai‘i John A. Burns School of Medicine (JABSOM) were removed from the clinical environment for 7 weeks until May 4, 2020. This was a dramatic change for clinical education of medical students who sometimes spend 40 to 70 hours per week in the clinical environment and were suddenly expected to learn the same clinical skills at home.

The curriculum of the clinical clerkship was modified to include virtual lectures, online clinical reasoning exercises, online cases, and virtual meetings with faculty preceptors; students were provided limited in person clinical time. Since students were removed from clinical rotations for 7 weeks, their schedules were modified to spread their virtual learning among their remaining inpatient clerkships. For example, a student may have spent weeks 1-3 doing virtual internal medicine, weeks 4-5 virtual pediatrics, and weeks 6-7 virtual obstetrics and gynecology (OB/GYN). Once they were allowed back into the clinical environment, they spent the rest of their semester doing in person internal medicine, in person pediatrics, and in person OB/GYN. The clerkship curriculum changes aligned with changes that other national and international medical schools made to adapt to removing their medical students from clinical environments.3-6

In addition, the children’s hospital experienced decreased patient numbers, similar to other children’s hospitals across the nation.7 Therefore, students saw fewer patients in the hospital. While the effects of the COVID-19 pandemic have revealed concerns about medical student preparation and performance on exams or observed structural clinical exams (OSCE), there is a lack of literature on the effect of the COVID-19 pandemic on students’ patient encounters and diagnoses of patients examined during pre- and post-pandemic periods.8-11
The objective of the current study was to identify changes caused by the COVID-19 pandemic on the inpatient experiences of third- and fourth-year medical students by assessing the volume of patient encounters and diagnoses of patients seen by students. Because medical students typically enter a note into the electronic medical record (EMR) after each patient encounter, this study used students’ notes as a measure of their experiences with patients. The team hypothesized that the third- and fourth-year students whose clinical experience took place during the pandemic period wrote fewer notes compared to students in earlier cohorts. Additionally, the team hypothesized that students saw fewer patients with common respiratory conditions during the pandemic period because of public health measures that limited traditional routes of respiratory infection transmission.

Methods

Quantitative information on numbers and diagnoses of patients seen by students at a single medical school in Hawai‘i during their clinical rotations was collected from the notes that the students wrote and signed which were stored in patients’ EMR. All notes authored by medical students rotating in inpatient clinical areas from July 2018 to September 2021 were extracted from the EMR by the Information Technology team at Kapi‘olani Medical Center for Women and Children, which is the tertiary pediatric hospital where all JABSOM students complete their inpatient pediatric clerkship rotation. Protected health information was immediately re-coded and deleted, with each patient given a unique patient study identification number. Extracted data elements included type of note, date, timestamp, author name, patient age, clinical area to which the patient was admitted, and primary International Classification of Diseases (ICD) diagnosis code.

The number of patients students saw per month was measured because it shows the average volume of patients that medical students cared for during their inpatient pediatric rotation, which was suspected to have changed during the pandemic. Average number of patients seen was determined by the quantity of unique patient study identification numbers extracted from the EMR, divided by the number of students rotating through inpatient pediatrics that month.

As a diversity of experiences in learning to manage new patients and patients who continue to be admitted is desirable and was suspected to have changed during the pandemic, the types of notes were examined. The 2 types of notes measured in this study were history and physical notes (H&Ps) and progress notes. One H&P note is written upon a patient’s admission to the hospital; progress notes are written once daily while patients remain admitted. For the study, H&Ps were used as a measure of newly admitted patients seen by medical students. The number of new patients seen was divided by the total number of patients students saw per month to determine the percentage of total patient encounters that were new admissions. Because students write 1 note daily for each patient they are following, the number of notes per patient was calculated to represent students’ experiences in caring for a patient over multiple days. The primary ICD codes included in the notes were used to determine primary diagnoses.

In addition to gathering a history, performing a physical exam, and developing appropriate diagnostic and treatment plans, the AAMC states that documenting a clinical encounter in the EMR is a professional activity that medical school graduates should be prepared to perform without direct supervision at the start of residency. Thus, the number of notes authored by medical students per month was also measured to demonstrate the opportunities learners had to practice this core skill.

The pre-pandemic period was defined as July 2018 to February 2020, and the pandemic period was defined as May 2020 to September 2021. The months medical students were removed from direct patient care (March 2020 and April 2020) were excluded. The number of patient encounters and diagnoses in the periods both prior to and after the onset of the pandemic were analyzed and correlated with the medical student schedules.

Descriptive statistics were employed for raw numbers, ages of patients, and diagnoses. Medical student data were grouped by third or fourth year status and analyzed in pre-pandemic and pandemic periods using paired t-tests. Chi-square test/Fisher’s exact test was used for comparing categorical variables, and the Mann-Whitney test was used for comparing non-normal continuous variables between these 2 time periods. A Tukey-type multiple comparison method was also used for testing the difference in proportion of primary diagnoses during the pre-pandemic and pandemic periods. Institutional Review Board (IRB) exemption and a Health Insurance Portability and Accountability Act (HIPAA) waiver were obtained (Hawai‘i Pacific Health Research Institute Study Number: 2021-057).

Results

Notes from 251 medical students on 4566 patients hospitalized between July 2018 and September 2021 were included. Medical students in the pre-pandemic period (July 2018 to February 2020) comprised of 130 third-year and 29 fourth-year students, while the pandemic period (May 2020 to September 2021) included 121 third-year and 28 fourth-year students (P=1.00).

On average, the number of patients seen by third-year medical students was reduced in the pandemic period from 112 patients/month to 88 patients/month (P=.041), but remained unchanged among fourth-year students 30 patients/month to 29 patients/month (P=.72) (Figure 1). Additionally, as shown by the number of admission H&P notes written, the number of newly admitted patients seen by medical students significantly decreased from 581 H&P notes prior to the pandemic, compared
to 282 H&P notes during the pandemic ($P<.001$). The average monthly percentage of total patient encounters that were new admissions decreased from 21% to 15% ($P<.001$) (Figure 2).

Pediatric diagnoses seen by medical students in their clinical rotations were significantly different between the 2 periods (Table 1). Significant decreases in bronchiolitis were observed from 5.9% (161/2731) of patients seen by medical students in the pre-pandemic period compared to 1.3% (24/1835 patients) of patients during the pandemic period ($P<.001$). Pneumonia diagnoses decreased from 4.6% (127/2731 patients) of total diagnoses to 1.0% (18/1835 patients; $P<.001$). COVID-19 diagnoses decreased from 0% to 0.9% (17/1835 patients; $P<.001$). Poisonings, which included both intentional and non-intentional poisonings, also increased from 0.5% (13/2731 patients) to 1.4% (26/1835 patients; $P=.002$). The proportion of patients diagnosed with intentional poisoning seen by medical students increased from 0.4% (10/2731 patients) to 0.9% (16/1835 patients). Non-intentional poisoning diagnosis increased from 0.1% (3/2731 patients) to 0.5% (10/1835 patients).

There was no significant difference in the mean patient age between the 2 periods: 5.76±7.08 years old and 5.72±7.10 years old ($P=.092$; data not shown) in the pre-pandemic and pandemic periods, respectively.

The number of notes written by third-year medical students per patient significantly increased in the pandemic period (2.14 vs 2.33 notes per patient, $P=.001$) (Figure 3). However, there was no significant difference in the number of notes written by medical students per month (Figure 4).

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**Figure 1. Number of Pediatric Patients Seen by Month and Medical Student Year**

The average number of patients seen by third- and fourth-year medical students (MS3 and MS4, respectively) per month was reduced in the pandemic period from 112 patients/month to 88 patients/month ($P=.041$) and 30 patients/month to 29 patients/month ($P=.72$) respectively. The MS3 clerkship is scheduled from mid-June to mid-December and beginning of January throughout May. The MS4 subinternships are primarily scheduled from July to October.
The average percentage of total patient encounters that were new patients seen by third- and fourth-year medical students (MS3 and MS4, respectively) per month significantly decreased from 21% new patients/total patients to 15% new patients/total patients after the onset of the pandemic ($P < .001$). Number of new patients was determined from the number of history and physical (H&P) notes written by medical students per month.

### Table 1. Pediatric Diagnosis by Number of Patients Pre-pandemic and Pandemic

<table>
<thead>
<tr>
<th>Primary Diagnosis</th>
<th>Number of Patients Pre-Pandemic* (%) n=2731</th>
<th>Number of Patients Pandemic* (%) n=1835</th>
<th>$P$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bronchiolitis</td>
<td>161 (5.9%)</td>
<td>24 (1.3%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>COVID</td>
<td>0 (0%)</td>
<td>17 (0.9%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Diabetes</td>
<td>49 (1.8%)</td>
<td>54 (2.9%)</td>
<td>.014</td>
</tr>
<tr>
<td>MIS-C</td>
<td>0 (0%)</td>
<td>3 (0.2%)</td>
<td>.065</td>
</tr>
<tr>
<td>Neonatal Jaundice</td>
<td>55 (2.0%)</td>
<td>56 (3.1%)</td>
<td>.003</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>127 (4.6%)</td>
<td>18 (1.0%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Poisoning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intentional</td>
<td>10 (0.4%)</td>
<td>16 (0.9%)</td>
<td>.002</td>
</tr>
<tr>
<td>Non-Intentional</td>
<td>3 (0.1%)</td>
<td>10 (0.5%)</td>
<td>.40</td>
</tr>
<tr>
<td>Preterm Newborn</td>
<td>2 (0.07%)</td>
<td>3 (0.2%)</td>
<td>.099</td>
</tr>
<tr>
<td>Urinary tract infection</td>
<td>22 (0.8%)</td>
<td>24 (1.3%)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>2348 (84.5%)</td>
<td>1615 (87.5%)</td>
<td>--</td>
</tr>
</tbody>
</table>

* Pre-pandemic period defined as July 2018 to February 2020. Pandemic period defined as May 2020 to September 2021.
Figure 3. Number of Medical Student Notes per Patient by Month
The number of notes written by third-year medical students (MS3) per patient significantly increased in the pandemic period (2.14 vs 2.33 notes per patient, $P=0.001$). No significant difference was found in the number of notes written by fourth-year medical students (MS4) per patient.

Figure 4. Number of Medical Student Notes by Month
No significant difference in the number of notes written by third- and fourth-year medical students (MS3 and MS4, respectively) per month during the pre-pandemic period compared to the period after the onset of the pandemic.
Discussion

The COVID-19 pandemic has significantly impacted medical education, including altering crucial clinical experiences that occur during clerkships for third- and fourth-year medical students. In addition to time lost when students were removed from their clinical rotations, inadequate PPE supplies and public health safety measures limited students’ ability to see patients with common respiratory complaints and/or those with high risk of having COVID-19. Nationally, this change had significant implications for trainees’ confidence and preparedness and varying results in clerkship standardized exams.8-10 The current study shows students’ educational experience was also significantly affected.

Medical students saw significantly fewer patients after returning to the hospital after their mandated leave; in particular, third-year medical students saw an average of 88 patients/month compared to 122 patients/month prior to the pandemic. The decrease in the number of patient encounters is likely related to the drop in number of admissions after the onset of the pandemic. At this institution, the mean total number of pediatric inpatient days decreased in the pandemic period, consistent with trends seen in pediatric hospitals across the nation.8-13-14 This observed change in admission rates may be multifactorial, including decreased incidence of acute illness due to public health measures, recommendations against going to hospitals by health care professionals, or fear surrounding COVID-19.8 Responses to an inpatient survey conducted by Kadambare et al showed that more than one-third of parents delayed seeking medical attention for their child due to concern about COVID-19.9

Changes in patient volume can also explain the significant reduction in the number of new patients seen by third- and fourth-year medical students, which dropped from 23% to 17% and 16% to 9% of their total patient encounters, respectively. The decrease in the proportion of new patient encounters may also have been due to safety rules that prevented medical students from seeing patients who were admitted with respiratory complaints until a negative COVID-19 test was confirmed.

As hypothesized, the proportions of patients seen by medical students with bronchiolitis and pneumonia were significantly reduced in the pandemic period. This finding may be a result of hospital COVID-19 safety measures, which limited students’ exposure to patients with respiratory symptoms. However, this decrease may also have been due to fewer patients admitted for these common pediatric respiratory illnesses. Studies published in the first year of the pandemic observed a significant reduction in the number of hospitalizations for respiratory diseases in the pediatric population, with 1 study demonstrating 92.5% fewer bronchiolitis hospitalizations and >99% reduction in the number of respiratory syncytial virus (RSV) cases.15-16 These findings were attributable to public health safety measures that were intended to decrease the spread of COVID-19, and subsequently decreased the transmission of other respiratory viruses among children.14-17 Safety measures included remote learning at the beginning of the pandemic and mask/social distancing mandates when children returned to school.15,17 In August 2022, the majority of schools dropped their COVID-19 restrictions.18 As children were no longer required to wear masks or socially distance in school, it was anticipated that pediatric respiratory hospitalizations would return to pre-pandemic levels. In fact, in the summer and fall of 2022 both locally and nationally, there was an unprecedented surge of patients admitted to the hospital with acute non-COVID respiratory infections.19 Medical residents who had less exposure to these pediatric respiratory diseases during their medical student clerkships suddenly needed to adapt to caring for this high volume of significantly ill patients.

After the onset of the pandemic, an increase in number of notes per patient without significant change in the total number of notes written by medical students suggests that medical students in the pandemic period encountered more chronically ill patients during their inpatient pediatric rotation and fewer acute cases. This conclusion is supported by the comparison of diagnoses listed above, which indicated medical students saw less acuity of respiratory illnesses.

Although the proportion of pediatric patients with respiratory illnesses declined, the proportion of patients admitted into the institution for poisoning increased. Thus far, there have been conflicting findings on the effects of the pandemic on pediatric poisonings based on studies analyzing trends seen in emergency departments (ED) and intensive care units.20-22 Studies that showed a decrease in the proportion of poisoning diagnoses suggested that this decline was at a lesser degree than a broad range of other pediatric conditions.20-21 The current findings align with studies of calls to poison control and the Centers for Disease Control and Prevention’s Morbidity and Mortality Weekly Report. The National Poison Data System reported an increase in call volume in the beginning of March 2020, the time stay-at-home orders were issued, with the highest number of exposures occurring in children under 5.23 The Centers for Disease Control and Prevention reported an increase of 171 ED visits per week for drug poisoning in adolescents ages 12 to 17 years during 2021 compared with 2019 (38 462 ED visits in 2021 versus 29 581 ED visits in 2019).24 The similar increases in the proportion of intentional and non-intentional poisonings suggest that school closures may have effectively mitigated the spread of COVID-19 and pediatric respiratory illnesses, but also had consequences of accidental injury and mental health problems in children who were home with varying degrees of supervision. Poisonings are the third-leading cause of death in children in the US, and medical residents who completed their medical student clerkships during the pandemic period may be better practiced in caring for pediatric patients admitted with this uncommon but potentially high morbidity diagnosis.
one limitation to this study is the relatively small sample size of fourth-year medical students, which limited the power of this cohort and may have contributed to the non-significant results seen in their clerkship experience. The timing of the pandemic in relation to the fourth-year medical student schedule may have also had an impact on our findings. COVID-19 restrictions were enforced in March 2020, which fell outside the normal months of fourth-year inpatient sub-internships in July to October. In addition, even prior to the pandemic, admissions for respiratory conditions are generally not as prevalent in the early Fall. A study performed at a treatment facility on Oʻahu from 2014 to 2018 showed seasonality of pediatric acute respiratory infections caused by RSV and influenza A, with peaks from September to December and December to March, respectively.

Another limitation of the study is that it took place at a single tertiary pediatric hospital; these results may not be generalizable to other geographic locations. Also, the current study measured student exposure to inpatient pediatric diagnoses based on notes they authored but did not capture exposure to additional patients during rounds and other case discussions. In addition, this study does not account for other aspects of patient demographics medical students may have encountered during their clerkships, such as socioeconomic status, insurance status, ancestry, and religion.

During the first 18 months of the ongoing COVID-19 pandemic, medical students in the current institution had a remarkably different inpatient experience compared to their predecessors. They cared for fewer patients, and the frequency of certain primary diagnoses encountered were significantly different. Previous literature has established the crucial role of the clerkship experience in the development of clinical competence in health care trainees. Ericsson’s deliberate practice model describes that in medicine, and in most professional domains, expert performance is acquired by repetitive experiences accompanied by assessment and feedback. This premise is supported by multiple studies showing that clinical immersion, supervised training, and exposure to real patients during the clerkship years positively impact student learning. Rudaz et al showed that medical students who experienced caring for a diagnosis both in case-based tutorials and a real-life clinical setting collected more relevant patient information on H&P and wrote more accurate notes than medical students who were exposed only to case-based tutorials. While the current data show that medical students during the pandemic period may have had more exposure to some diagnoses such as poisonings, real-life experience with other conditions including common pediatric respiratory diseases were decreased. These decreases suggest that these students may require supplemental education to compensate for these gaps in direct pediatric clinical experience, especially in students who pursue pediatric residency training.

Future directions may include evaluating the effects of the pandemic on student perception of pediatrics and the impact of the changes to the clerkship curriculum on choosing a specialty. A cross-sectional study conducted early in the pandemic found that 1 in 5 medical students in the United States felt the disruption in their clinical education would affect their specialty choice. Of students who believed that the COVID-19 pandemic would affect their choice, the majority were concerned about obtaining letters of recommendation and not having enough time to explore specialties. In the 2021 AAMC Graduation Questionnaire, “personal fit” and “content of specialty” were indicated to be the top 2 strongest influences on choosing a specialty. Although the current study demonstrates how the pandemic affected medical students’ patient exposure, measuring lost time directly working and effects on relationships with professionals in a field may provide further insight into the pandemic’s effect on medical students’ specialty perceptions.

Conflict of Interest

None of the authors identify a conflict of interest.

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References


How COVID-19 Impacted Colonoscopy Utilization and Colorectal Cancer Detection in Hawai’i in 2020

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Abstract

The Coronavirus Disease of 2019 (COVID-19) pandemic had a profound impact on colorectal cancer (CRC) screening and diagnostic testing. During the initial months of the pandemic, there was a sharp decline in colonoscopies performed as many areas were on lockdown and elective procedures could not be performed. In later months, even when routine procedures started being scheduled again, some patients became fearful of contracting COVID during colonoscopy or lost their health insurance, leading to further delays in CRC diagnosis by colonoscopy. Previous studies have reported the dramatic decrease in colonoscopy rates and CRC detection at various institutions across the country, but no previous study has been performed to determine rates of colorectal screening by colonoscopy in Hawai’i where the demographics of CRC differ. The team investigated the pandemic’s impact on colonoscopy services and colorectal neoplasia detection at several large outpatient endoscopy centers in Hawai’i and also classified new CRC cases by patient demographics of age, sex, and ethnicity. There were fewer colonoscopies performed in these endoscopy centers in 2020 than in 2019 and a disproportionate decrease in CRC cases diagnosed. Elderly males as well as Native Hawaiians/Pacific Islanders were most impacted by this decrease in CRC detection. It is possible there will be an increase in later stage presentation of CRC and eventual CRC related mortality among these patients.

Keywords

COVID-19, pandemic, colorectal cancer, screening, colonoscopy, endoscopy centers

Abbreviations and Acronyms

COVID-19 = Coronavirus disease of 2019
CRC = colorectal cancer
GIQuIC = GI Quality Improvement Consortium
NCCRT = National Colorectal Cancer Roundtable
PPE = personal protective equipment

Introduction

The statewide lockdown instituted in Hawai’i in 2020 to help prevent the spread of Coronavirus disease of 2019 (COVID-19) and preserve valuable personal protective equipment (PPE) restricted elective procedures including colonoscopy. The purpose of this study was to determine the early impact of COVID-19 and the lockdown on colorectal cancer (CRC) detection by colonoscopy in Hawai’i. Colorectal cancer is the third most common cancer in the United States and second most common cause of cancer related deaths in men and women. Some patients who are at higher risk for CRC, including persons aged 65 years and older, smokers, and obese individuals, are also at higher risk for complications from COVID. CRC is treatable if detected early and CRC screening has been shown to save lives. Due to an alarming rise in early onset colon cancer, the United States Preventive Services Task Force now recommends that all patients begin screening at age 45, or sooner with other risk factors. Colonoscopy remains the gold standard for CRC detection and it is estimated that up to 80% of colon cancers can be prevented through the removal of pre-cancerous polyps during colonoscopy.

While the overall rates of CRC screening had been improving prior to 2020, elective colonoscopies were cancelled during the initial months of the pandemic and many patients have avoided procedures since then, resulting in a drastic decrease in colonoscopies performed. It is feared that this will result in CRC presenting at later stages and subsequently increased morbidity and mortality from the disease. A study by Sharaf and others reported that patients age 65+ were most severely impacted by screening delays. Certain ethnic disparities in screening have also been exacerbated by the pandemic, slowing the progress made in recent years. In a study by Nwankwo and others, there was a 55% reduction in screening colonoscopy for African Americans during the pandemic. Here in Hawai’i, Holcomb and others found that there was a 9.4-13.2% reduction in Native Hawaiians and Pacific Islanders undergoing CRC screening during the pandemic.

Methods

This is a retrospective study comparing the total number of colonoscopies performed and the number of CRC cases detected between January 1, 2019 - December 31, 2019 (pre-pandemic) and January 1, 2020 - December 31, 2020 (first year of the pandemic) at the 4 Hawai’i based outpatient endoscopy centers of Covenant Physician Partners: Hawai’i Endoscopy Center (HEC), Endoscopy Institute of Hawai’i (EIH), Pacific
Endoscopy Center (PEC), and The Endoscopy Center of Hilo (TEH). After receiving approval from Covenant’s Regional Vice President, de-identified information on the number of colonoscopies performed per month at each center, number of CRC cases detected, and demographics of newly diagnosed CRC cases (age, sex, and self-reported ethnicity) was extracted from Covenant’s research database and compiled into a spreadsheet for further analysis. No individual patient details were accessible to the researchers during data acquisition, storage, and comparison.

To test for year over year (2020 vs. 2019) differences in colonoscopies, colorectal cancers, and colorectal cancer incidence, Poisson (count data) and logistic (proportion data) regression analyses were performed. Colonoscopies and colorectal cancers reported count data and incidence reported proportion data. Multilevel modeling (patients nested within health centers) was applied to account for multiple health centers. The SAS 9.4 software (SAS Institute Incorporated, Cary, NC) was used to perform all analyses.

Results

Colonoscopy counts declined by 61% from March through May 2020, from 4262 to 1645, compared with the same months in 2019 (Table 1). This was followed by a full recovery in subsequent months of 2020. Compared with 2019, overall colonoscopy counts decreased across all centers in 2020 from 16,013 to 13,522, which was a 16% decrease ($P < .001$) (Table 2). The number of CRC malignancies diagnosed by colonoscopy in 2020 was 40, down from 58 in 2019, which was a 31% decrease ($P = .20$) (Table 3-4). The incidence per 1000 procedures did not decrease significantly from 3.6 to 3.0 per 1000 ($P = .51$) (Table 4).

By demographics, there were several findings that were suggestive of differences but none of these reached the level of statistical significance. Among all age groups, there was a 70% decrease in colorectal malignancy diagnosed in the 80+ age range and a 41% decline in the 60-69 age range, but these were not significant ($P = .31$). Males had a 44% reduction in detection compared with a 4% decrease among females ($P = .30$). Among all ethnicities, Native Hawaiians and Pacific Islanders had the largest decrease in detection at 62%. Whites had the next highest reduction at 43% ($P = .71$) (Table 5).
Table 4. Total Number of and Incidence of Colorectal Cancers Detected at Each Endoscopy Center by Year, 2019 and 2020

<table>
<thead>
<tr>
<th>Year</th>
<th>HEC</th>
<th>EIH</th>
<th>PEC</th>
<th>TEH</th>
<th>Total</th>
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<td>2019</td>
<td>7</td>
<td>12</td>
<td>9</td>
<td>30</td>
<td>58</td>
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<tr>
<td>2020</td>
<td>0</td>
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<td>16</td>
<td>17</td>
<td>40</td>
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<td>Difference</td>
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<td>-13</td>
<td>-18</td>
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</table>

P-value* = .20

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<tr>
<th>Year</th>
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<th>EIH</th>
<th>PEC</th>
<th>TEH</th>
<th>Total</th>
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<td>1.8</td>
<td>10.9</td>
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<td>3.0</td>
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<tr>
<td>Difference</td>
<td>-1.7</td>
<td>-0.7</td>
<td>+2.1</td>
<td>-3.5</td>
<td>-0.6</td>
</tr>
</tbody>
</table>

P-value* = .51

HEC = Endoscopy Institute of Hawai‘i, EIH = Hawai‘i Endoscopy Center, PEC = Pacific Endoscopy Center, and TEH = Endoscopy Center of Hilo

Discussion

The Governor of Hawai‘i, David Ige, instituted statewide lockdown orders March 25, 2020 which extended to April 30, 2020. During this time, elective procedures were cancelled to help prevent the spread of COVID and preserve PPE; all endoscopies performed were largely restricted to urgent or emergent indications.

The reduction in procedures due to the initial lockdown as well as subsequent patient hesitancy had an immediate and profound effect on CRC detection in Hawai‘i. Although there was no statistically significant difference between 2019 and 2020, this may be due to the small sample size. Additionally, the CRC incidence per 1000 procedures was much higher in April 2020 compared with 2019 as only high-risk patients were undergoing colonoscopy at the time. In data from the GI Quality Improvement Consortium (GIQuIC) registry which includes information from more than 450 endoscopy sites across the United States, 30% fewer CRCs were detected in the first 7 months of the pandemic compared with the year before.

Here in Hawai‘i, the individuals who appear to have been most affected by the decline in CRC detection were those older than 80 (70% decrease) and Native Hawaiians/Pacific Islanders (62% decrease). These numbers did not reach statistical significance; however, other studies have also shown a COVID related decrease in CRC screening among Native Hawaiians and Pacific Islanders of up to 13.2%. Nwankwo and others hypothesized that the pandemic worsened screening disparities among minorities and other medically underserved populations by increasing psychosocial and economic barriers to health care including anxiety about contracting COVID and lack of appropriate insurance coverage.

The GIQuIC data also showed that the average monthly volume of colonoscopies decreased by almost 40% across the United States in the first 7 months of the pandemic. In Hawai‘i, there was a 16% overall decrease in colonoscopies performed in 2020 compared with 2019, which did reach statistical significance. Data on the number of hemoccult tests performed in Hawai‘i in 2020 could not be obtained. In further studies, it will be interesting to note if patients were also avoiding other methods of CRC screening, including hemoccult tests and imaging studies, since an abnormal alternate screening test necessitates a follow-up colonoscopy (2-step screening).

The number of colonoscopies performed returned to baseline in Hawai‘i a few months after the lockdown was lifted. Across the United States, there was a “ramp up period” after the initial months of COVID. As many patients returned to their gastroenterologists, a larger number of procedures were performed to try and clear the backlog until eventually plateauing and returning to pre-pandemic levels. There continue to be intermittent declines in number of colonoscopies during periods of

Table 5. Demographics of Colorectal Cancers Detected Across All Endoscopy Centers\(^a\) by Year, 2019 and 2020

<table>
<thead>
<tr>
<th>Age range</th>
<th>2019 (n=58)</th>
<th>2020 (n=40)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-39</td>
<td>1</td>
<td>0</td>
<td>-1</td>
</tr>
<tr>
<td>40-49</td>
<td>1</td>
<td>2</td>
<td>+1</td>
</tr>
<tr>
<td>50-59</td>
<td>13</td>
<td>8</td>
<td>-5</td>
</tr>
<tr>
<td>60-69</td>
<td>22</td>
<td>13</td>
<td>-9</td>
</tr>
<tr>
<td>70-79</td>
<td>11</td>
<td>14</td>
<td>+3</td>
</tr>
<tr>
<td>80+</td>
<td>10</td>
<td>3</td>
<td>-7</td>
</tr>
</tbody>
</table>

P-value* = .31

<table>
<thead>
<tr>
<th>Sex</th>
<th>2019</th>
<th>2020</th>
<th>Difference</th>
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</thead>
<tbody>
<tr>
<td>Male</td>
<td>36</td>
<td>20</td>
<td>-16</td>
</tr>
<tr>
<td>Female</td>
<td>22</td>
<td>20</td>
<td>-2</td>
</tr>
</tbody>
</table>

P-value* = .30

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>2019</th>
<th>2020</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asian</td>
<td>31</td>
<td>27</td>
<td>-4</td>
</tr>
<tr>
<td>White</td>
<td>14</td>
<td>8</td>
<td>-6</td>
</tr>
<tr>
<td>Native Hawaiian/Pacific Islander</td>
<td>8</td>
<td>3</td>
<td>-5</td>
</tr>
<tr>
<td>American Indian</td>
<td>1</td>
<td>0</td>
<td>-1</td>
</tr>
<tr>
<td>Undeclared</td>
<td>4</td>
<td>2</td>
<td>-2</td>
</tr>
</tbody>
</table>

P-value* = .71

\(^a\) Centers include the Endoscopy Institute of Hawai‘i, Hawai‘i Endoscopy Center, Pacific Endoscopy Center, and Endoscopy Center of Hilo.

\(^b\) Fisher’s exact test
COVID surges, however, and some individuals remain fearful about any invasive testing that potentially increases risk of contracting COVID-19 infection. In one study, overall colonoscopy numbers had improved since the start of COVID but were still 4% below historic baselines. Unfortunately, due to the decrease in colonoscopies performed during the COVID pandemic, there are likely many undiagnosed cases of colon cancer in the community which will present at later stages.

One strength of this study was the large number of baseline colonoscopies performed across all 4 endoscopy centers in 2019. Another strength is that it examines the impact of COVID on CRC screening here in Hawai‘i, which is unique in its demographics. The study was limited by the small sample size of total CRC cases detected. Additionally, there was a lack of data on alternative CRC screening studies performed during the time period which could be addressed by questionnaires indicating patient preferences.

In future studies, it would be helpful to determine if there was also a decrease in the number of advanced colon polyps (polyp greater than 1cm in size, polyp with high grade dysplasia, or with villous features) detected in 2020 as these carry a higher risk for malignancy than other colon polyps. Furthermore, it would be interesting to follow the results out further to determine number of CRC cases detected in 2021 and subsequent years, as well as the stages of these CRC cases on detection.

**Conclusion**

The pandemic resulted in far fewer colonoscopies performed in Hawai‘i in 2020 versus 2019; however, after the lifting of local lockdown orders, colonoscopy volumes nearly reached pre-pandemic levels. Overall, there was a 16% decrease in colonoscopies in 2020 but a 31% reduction in CRC cases diagnosed by colonoscopy. It remains to be seen whether patients were also avoiding other means of screening. It is likely that there will be an increase in later stage presentation of CRC and eventual CRC related mortality. Elderly males as well as Native Hawaiians/Pacific Islanders had the greatest decline in CRC detection during the pandemic and the development of targeted strategies for improving CRC screening and diagnostic testing is especially important for these patients.

**Conflict of Interest**

None of the authors identify a conflict of interest.

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**References**

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‘āina    Kaua‘i    O‘ahu
Hawai‘i  Lāna‘i   ʻohana
kūpuna  Mānoa   Wai‘anae

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