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**NAVAL
POSTGRADUATE
SCHOOL**

MONTEREY, CALIFORNIA

THESIS

**PARENTHOOD, COVID-19, AND WORK OUTCOMES
IN THE DOD**

by

Yuk W. Kwan

March 2022

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REPORT DOCUMENTATION PAGE			<i>Form Approved OMB No. 0704-0188</i>
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington, DC, 20503.			
1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE March 2022	3. REPORT TYPE AND DATES COVERED Master's thesis	
4. TITLE AND SUBTITLE PARENTHOOD, COVID-19, AND WORK OUTCOMES IN THE DOD		5. FUNDING NUMBERS	
6. AUTHOR(S) Yuk W. Kwan			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000		8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A		10. SPONSORING / MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.			
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release. Distribution is unlimited.		12b. DISTRIBUTION CODE A	
13. ABSTRACT (maximum 200 words) When the COVID-19 pandemic hit the United States around March 2020, it changed the landscape of the work environment, and there was a sudden shift from in-person office work to a substantial portion of the population conducting their jobs remotely. My study evaluates how these changes affected the Marine Corps' critical resource—their personnel. By combining Marine Corps demographic data with K-12 public school closures data across the United States at the county level, I used four separate performance metrics to estimate the effects that school closures had on productivity among Marines. When the Marine Corps allowed parents the time to take care of their children, I found that it had a positive relationship between remote work and performance when looking at proficiency scores. My study also concluded that the population that suffered from school closures when compared to their counterparts were female Marines with children, when examining the impact on Combat Fitness Test scores. I recommend that the Marine Corps continue allowing Marines with children the flexibility to maintain a healthy work-life balance and find ways to lessen the burden when unforeseen childcare requirements arise. My analysis demonstrates that policies that provide more freedom for Marines to maintain a healthy work-life balance do not negatively affect a Marine's performance. Creating new policies to continue the era of remote work in the Marine Corps can benefit the productivity of Marines.			
14. SUBJECT TERMS COVID-19, pandemics, work, performance, remote work, gender		15. NUMBER OF PAGES 51	
		16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UU

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PARENTHOOD, COVID-19, AND WORK OUTCOMES IN THE DOD

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MASTER OF SCIENCE IN MANAGEMENT

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**NAVAL POSTGRADUATE SCHOOL
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ABSTRACT

When the COVID-19 pandemic hit the United States around March 2020, it changed the landscape of the work environment, and there was a sudden shift from in-person office work to a substantial portion of the population conducting their jobs remotely. My study evaluates how these changes affected the Marine Corps' critical resource—their personnel. By combining Marine Corps demographic data with K-12 public school closures data across the United States at the county level, I used four separate performance metrics to estimate the effects that school closures had on productivity among Marines.

When the Marine Corps allowed parents the time to take care of their children, I found that it had a positive relationship between remote work and performance when looking at proficiency scores. My study also concluded that the population that suffered from school closures when compared to their counterparts were female Marines with children, when examining the impact on Combat Fitness Test scores. I recommend that the Marine Corps continue allowing Marines with children the flexibility to maintain a healthy work-life balance and find ways to lessen the burden when unforeseen childcare requirements arise. My analysis demonstrates that policies that provide more freedom for Marines to maintain a healthy work-life balance do not negatively affect a Marine's performance. Creating new policies to continue the era of remote work in the Marine Corps can benefit the productivity of Marines.

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LIST OF ACRONYMS AND ABBREVIATIONS

CFT	Combat Fitness Test
COVID-19	Coronavirus Disease 2019
FITREP	Fitness Report
MOS	Military Occupational Specialty
PROCON	Proficiency and Conduct Marks
RS	Reporting Senior
RV	Relative Values
TFDW	Total Force Data Warehouse

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ACKNOWLEDGMENTS

Most importantly, I want to thank my wife and daughter for their unwavering support. Also, my advisors have provided immeasurable support throughout this process. Lastly, the members of the MSA cohort, especially those in the Marine cohort, were critical to my success at NPS.

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I. INTRODUCTION

A. BACKGROUND

As General David H. Berger, 38th Commandant of the Marine Corps, stated in his Commandant's Planning Guidance (CPG), the individual Marine is the vital resource in the success of the Corps (Berger, 2019). The population of United States Marines ranges from Privates who recently graduated from high school to Generals who have served for over four decades. Depending on the military specialties, some Marines spend most of their workday out in the field, training for combat. Others might sit in front of the computer all day, supporting Marines conducting operations on the other side of the world. These two examples show a varying degree of work requirements needed to sustain combat power across the globe. Besides Marines in direct support of combat operations, Marines in other military occupational specialties drive vehicles, manage computer networks, stock supply warehouses, or process administrative paperwork. Regardless of the occupation, normal work conditions changed abruptly on 13 March 2020, when the Marine Corps placed strict "stop movement" restrictions across the force (United States Marine Corps, 2020d).

B. PURPOSE

When the Coronavirus Disease 2019 (COVID-19) pandemic hit the United States around March 2020, it changed the landscape of the work environment, and there was a sudden shift from all in-person office work to a substantial portion of the population conducting their jobs remotely. The practice of working from home in the Marine Corps was virtually nonexistent before the pandemic. Still, those in the Marine Corps who were able to work remotely took their computers home one day and expected to return to the office and business as usual in about two weeks. Those two weeks turned into several months for some and up to two years, on and off, for others. How did these changes affect the Marine Corps' critical resource—their personnel?

C. RESEARCH QUESTION

This paper uses a comprehensive dataset on Marines that provides a diverse workforce with a broad sampling of demographic groups and occupations to examine the changes in productivity before and after the shift to remote work using empirical data. Specifically, I studied the overall productivity consequences of the switch to remote work and the effects across genders and for people with children.

The onset of COVID-19 required the Marine Corps to suddenly adjust their policy on remote work to allow a majority of Marines to work from home at least part of the workweek. Additionally, COVID-19 impacted work-life balance with unforeseen changes to childcare during working hours when many schools and childcare centers ceased operations during the pandemic or shifted online as well. It is typically difficult to measure worker productivity changes because the data is either hard to obtain or does not exist. By exploring productivity using Marine Corps Total Force Data Warehouse (TFDW) data before and after the start of COVID-19 within the Marine Corps, one advantage of this study is that it will contribute to the growing literature on the impact of the pandemic.

D. LIMITATIONS

This section explains the limitations of this study due to unknowable conditions within my data.

1. Military Occupational Specialty

Every Marine has a billet military occupational specialty (MOS) associated with their assigned billet at that tour of duty. One limitation to this study is that billet MOS can vary within a specific MOS. For example, even though two motor transportation mechanics, MOS 3521, have the same MOS designation, they could have different job descriptions. If one mechanic works at a maintenance battalion, they are one mechanic of many within a platoon full of mechanics responsible for fixing a fleet of vehicles. In contrast, a Marine Expeditionary Unit Command Element mechanic would be one of three mechanics to manage roughly two dozen vehicles. The lack of variation within an MOS is a limitation because this study cannot compare these individuals' performances.

2. Dependents

The TFDW data provides each Marine's dependent's age. I used their dependent's age to determine if a Marine has children under 19 years old and corresponded the dependents' age with school grade levels. Furthermore, the data provides the duty location of each Marine. However, a second limitation of this study is the comprehensiveness of the dependent data. My study assumes that a Marine's dependent's location is the same as the Marine's location. It does not allow for flexibility if the dependent is not collocated with the Marine.

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II. BACKGROUND

A. CORONAVIRUS DISEASE 2019

COVID-19 is a respiratory virus originating from China around December 2019 (Centers for Disease Control and Prevention [CDC], 2020). It caused disruption socially, politically, and economically across the globe. The pandemic also caused travel, especially internationally, to slow drastically due to fear of the unknown and a desire to limit the spread of the disease. Moreover, it unexpectedly required many businesses and government agencies to close their offices or workplace and migrate to remote work from home for continuity of operations.

B. MARINE CORPS' MITIGATIONS

The Marine Corps published its first guidance regarding COVID-19 on 11 February 2020, instructing the Corps to make necessary preparations to protect the force (USMC, 2020a). Three weeks later, on 7 March 2020, the Commandant recognized the threat of COVID-19 on operations in the Marine Corps and ordered commanders to “take appropriate actions” (USMC, 2020b), such as maximizing teleconferences when possible. A few days later, on 11 March 2020, the Marine Corps published instructions on connecting to the Marine Corps computer network remotely because it was a new undertaking for most Marines (USMC, 2020c). On 13 March 2020, the Marine Corps ordered all Marines and their families to “stop movement” to “CDC Level 3” locations for two months (USMC, 2020d). This final week triggered Marines’ responses to the seriousness of COVID-19 and the start of an adjustment to a new work life.

Due to the need to work from home to slow the spread of COVID-19, many Marines who did not work on an individualized work computer could not perform their day-to-day responsibilities. Alternatively, many Marines could only accomplish what was required to maintain the basic requirements of their duty assignments by adjusting their schedules to minimize interactions with others. For example, a motor transport Marine could only go into their workstations on a limited time to perform the minimum, but mandatory, preventative maintenance checks and services on a particular vehicle. This period

amounted to a “new normal” on how the Marine Corps would function for the foreseeable future and how Marines needed to respond in their work performance.

C. PERFORMANCE MEASUREMENTS

This study utilizes four metrics to measure performance before and after COVID-19: leave usage, combat fitness test (CFT) scores, proficiency scores, and fitness report relative values.

(1) Leave

A Marine earns 2.5 days of leave each month while on active duty, equaling 30 days per year. Marines can take different types of leave for numerous reasons, but the most common types are annual leave or emergency leave. Leave usage is counted by whole days of leave, and the Marine Corps urges Marines to utilize their full leave allotment each year (USMC, 2009).

(2) Combat Fitness Test

In the Marine Corps, the CFT is one physical assessment conducted annually to measure a Marine’s fitness. The CFT is generally assessed between 1 July and 31 December of each calendar year and measures functional fitness in the form of an 880 yards run, ammunition can lifts, and a 300-yard agility course (USMC, 2021). Each event has a maximum possible score of 100 points, totaling a maximum CFT score of 300 points. CFT scores from 235 to 300 are classified as first-class; scores above 285 are exemplary and qualify for a “FITREP Section I directed comment” (USMC, 2021).

On 4 December 2020, due to an increase in COVID-19 cases in the United States, the Marine Corps “waived the annual requirement” (USMC, 2020e) for the remainder of the testing period of 2020. Therefore, Marines who had not completed their CFT assessments before that date were not required to conduct a test in 2020 and posted the same score from 2019. However, Marines who conducted their CFT before 4 December kept their scores as recorded (USMC, 2020e).

(3) Proficiency Scores

Another measurement of military performance in the Marine Corps is proficiency and conduct (PROCON) markings. This study focused solely on the proficiency scores portion of Marine's PROCON to measure their work performance. Commanders assign proficiency scores to Marines between the grade of Private through Corporal as one assessment of service while in the Marine Corps (USMC, 1997). The Marine Corps revamped the PROCON system to the Junior Enlisted Performance Evaluation System in January 2021, but this study only utilizes the difference in proficiency scores before 2021. The Marine Corps published the Individual Records Administration Manual to provide basic instructions on assigning PROCON scores which range from 0.0 for unacceptable to 5.0 for outstanding (USMC, 2000). In 2020, every Marine Private through Corporal should have received at least two PROCON markings for the semi-annual evaluation periods, one before the pandemic and one after the onset of COVID-19. It is also possible that an individual received more than these two mandatory observations due to different reporting occasions. For example, a Marine promoted to Corporal would rate an additional proficiency score marking on their promotion date (USMC, 2000).

Proficiency scores are informed by a Marine's performance and are essential to their career as it is used to determine promotions. Composite scores are a point system consisting of various elements from a Marine's record used to compare individuals for promotion. Proficiency scores are one input used to calculate a Marine's quarterly composite score. The Marine Corps then publishes the monthly cutting scores by rank and MOS to determine the eligible population for promotion for the following month. The averages of a Marine's proficiency marks since their last promotion are multiplied by one hundred points to add to their quarterly composite scores (USMC, 2012). For example, a Marine with 4.3 average proficiency score has 430 points calculated towards their composite score, whereas a Marine with 4.4 proficiency score averages has 440 points calculated towards their composite score.

(4) Fitness Report

Fitness report (FITREP) relative values (RV) are calculated from the numerical average gathered from 14 attribute markings. An RV is based on the individual's reporting senior (RS) and does not have any meaning as a stand-alone score. Its value is comparing different reports within the same RS for each rank (USMC, 2018). The RS RV scale ranges from 80 to 100, and is then binned into upper, middle, and lower thirds. An RS RV provides a numeric grade to compare different Marines within an RS's profile.

(5) Physical Fitness Test

Another physical evaluation conducted annually in the Marine Corps is the physical fitness test (PFT), generally assessed between 1 January and 30 June of each calendar year. The PFT consists of three events to measure upper body strength, core strength, and endurance in the form of "dead-hang, pull-ups, or push-ups; abdominal crunches or plank; and a three-mile run," respectively (USMC, 2021). On 22 April 2020, because of restrictions related to COVID-19 mitigation efforts, the Marine Corps canceled PFTs for the remainder of 2020 (USMC, 2020e). In the same way the CFT was waived as described above, the Marine Corps waived the PFT requirement for 2020 with an effective date of 22 April. Therefore, any Marines who had not taken the PFT before that date would carry the same score from 2019. Since there were no observations of PFTs after COVID-19 mitigations began with remote work, this study does not utilize PFT as a measurement of performance.

III. LITERATURE REVIEW

A. MARINE CORPS OR FAMILY

In his CPG, the Commandant focused a portion of his vision on the individual Marines and ways to “modernize the force” (Berger, 2019). He suggested that Marines should never have to decide between sacrificing work performance or spending time with their children. He proposed updating the Marine Corps parental and maternity leave policies to align with some private sectors. In accordance with his vision, the Marine Corps recently announced changes to increase secondary caregiver leave by one week to 21 days (USMC, 2022). By increasing secondary caregiver leave by 50 percent, the Marine Corps is demonstrating the willingness to support the Marines and their families. The Marine Corps understands the importance of family dynamics and the value of the family bond.

B. REMOTE WORK AND PERFORMANCE

The amount of literature related to COVID-19 and work performance has emerged in recent months as we get further from the onset of the pandemic. However, many of these studies generally used survey data from outside the United States. Nonetheless, they can be helpful indicators to identify different outcomes related to my research. For example, a paper analyzing how COVID-19 impacted productivity in the United Kingdom (UK) suggests that the COVID-19 reduced productivity in the U.K. private sector, compared to what would have happened if COVID-19 did not exist (Bloom et al., 2022). However, this decrease was mainly due to production costs. When only looking at “hourly labour productivity” (p. 1), the authors found that there was, on aggregate, a positive influence on production. Additionally, a study by Golden and Gajendran (2019) examined the amount of remote work to job performance. Their study found a positive correlation between these two factors and that an increase in remote work generates a positive return in their work performance.

My study examines the relationship between the extent of remote work due to different lockdown policies and productivity in the Marine Corps. A Romanian study found that individual factors and home/family factors are important predictors for employee

productivity and performance during COVID-19. However, contrary to the authors' hypothesis, they found that work-life balance issues did not affect work productivity, performance, and fulfillment from remote work (Mihalca et al., 2021). My study utilizes data to analyze the work-family conflict effect in the Marine Corps by schools and childcare services available during the lockdown.

C. COVID-19 AND WOMEN IN THE WORKPLACE

The pandemic has disproportionately affected women in the workplace. Within academia, two studies assess the decline in research and publications by female academics during COVID-19. In a study by Deryugina et al. (2021) examining the allocation of time by academics to spend on research and normal daily activities by using survey data, they found that "female academics with children" (p. 164) were more negatively affected by the pandemic. Deryugina et al. concluded this by decomposing the disruption caused by COVID-19 and calculating that female academics were unable to spend as much time on research compared to male academics. Squazzoni et al. (2020) analyzed the number of submissions and reviews in academic journals, finding that even though submission rate increased drastically during the beginning stages of COVID-19, females submitted comparably smaller number of manuscripts than their male counterpart.

My study includes the productivity change of women and parents during the lockdown in the Marine Corps to examine if this outcome is consistent in the military. This research is the first military study to my knowledge and one of the few U.S. studies in this area. By utilizing Marine Corps data before and after the onset of COVID-19, this study aims to further this subject area to analyze the effect remote work had on job performance due to COVID-19. I looked at labor input by using leave usage, work productivity with CFT scores, and supervisors' assessment of Marines' productivity through proficiency scores and FITREP RVs to examine their relationship

IV. DATA AND METHODOLOGY

A. DATA SOURCES

I used monthly data from the Marine Corps TFDW, which includes demographic, dependent, leave, PFT, CFT, PROCON, and FITREP data for all Marines from January 2013 to April 2021. The variables in these Marine Corps datasets formed the foundation for my study. Additionally, I used the School Closure and Distance Learning Database to track K-12 public school closures across the United States starting in 2020 (Parolin & Lee, 2020). This data identifies school closures by county zip codes using Global Positioning System (GPS) data from cell phones to examine foot traffic, comparing the year-over-year change in each school between the same months from 2019 to 2020. Parolin and Lee (2021) classified the school as being “closed or mostly closed” in 2020 and likely conducted distance learning if a school had at least a 50 percent decline between a specific month (e.g., October 2019 against October 2020). I use the same definition for my analysis.

B. DATA MANAGEMENT

Of the multiple data files obtained from TFDW, I used the “Marine Data” file, which includes service and demographic information for each Marine, as my main dataset. I then merged the remaining data files into the “Marine Data” and created a “Full Build” Marine dataset that provided monthly information for every Marine from January 2013 to April 2021. Lastly, I used Parolin & Lee’s closure data at the county level and merged that to the “Full Build” data by individual Marine location to create a full “School Closure” dataset.

C. DATA DESCRIPTION

The “Full Build” dataset contains 18,843,362 observations representing 457,821 individual Marines. With exactly 100 months of data, this equates to roughly 188,400 Marines per year, including Marines on active duty and active reserves components. The data includes variables on performance metrics on monthly leave usage, CFT scores, proficiency scores, and fitness report relative values.

These data includes information on gender (coded as 1 for female and 0 for male); family-related data on marital status (coded as 1 for married Marines and 0 otherwise); and interaction on gender and marital status (coded 1 for married female and 0 otherwise); an indicator variable for whether a Marine has a child or not (coded as 1 for Marines with at least one child and 0 otherwise); and counts of the number of toddlers (age 0–4), elementary-aged children (age 5–10), and middle and high school-aged children (age 11–18). Table 1 provides descriptive data for this group.

Table 1. Descriptive Statistics

	Observations	Mean	SD	Min	Max
Leave Used	18,843,362	2.13	5.01	0	156
CFT Scores	1,518,287	277.49	24.18	44	300
Proficiency Scores	1,271,985	43.16	2.12	0	50
RS Relative Values	761,317	91.97	6.26	80	100
Female	11,141,920	0.09	0.28	0	1
Married	11,141,920	0.55	0.50	0	1
Married Female	11,141,920	0.04	0.19	0	1
Has Children	11,141,920	0.79	0.40	0	1
Number of Toddlers-Aged	11,141,920	0.26	0.54	0	4
Number of Elementary-Aged	11,141,920	0.28	0.61	0	5
Number of Middle and High-Aged	11,141,920	0.20	0.56	0	6

Data from Total Force Data Warehouse (TFDW).

Of interest to this study, Marines take on average 2.13 days of leave per month, achieve an average CFT score of 277, receive an average proficiency score of 4.3 (for Corporals and below), and receive an average relative value of 91.97 on their fitness reports (for Sergeant and above). Furthermore, females represent 9 percent of the observations, 55 percent of Marines are married, 4 percent are married females, and 79 percent of Marines have children under 19 years old. The school-aged dependents are separated into age bins defined above to represent their school grade levels. For the number of children in each age bin, the mean represents the average number of children, and the maximum represents the highest number of children for the associated observations. For instance, looking at the number of elementary-aged children variable, there is about 1 child between the age of 5

to 10 years old for every 4 Marines in the observation period. In addition, at least one Marine has five children in this age group, as shown by the maximum.

Figure 1 replicates Parolin and Lee’s (2020; Figure 1) main findings on school closures. The figure shows the monthly percentage of school closures from January 2020 until April 2021 using their dataset collected from changes to cell phone traffic over the same period in 2019. It shows the significant increase in school closures across the United States in April 2020 after the onset of COVID-19 in March 2020, forcing many schools to conduct distance learning. The plot shows, for instance, that in May 2020, roughly ninety percent of schools were closed or mostly closed. There was also a drop in school closures in the summer months from June to August. At the start of the September 2020 school year, there was a mixture of in-person school and distance learning in the United States, with a decreasing number of school closures between January and April 2021.

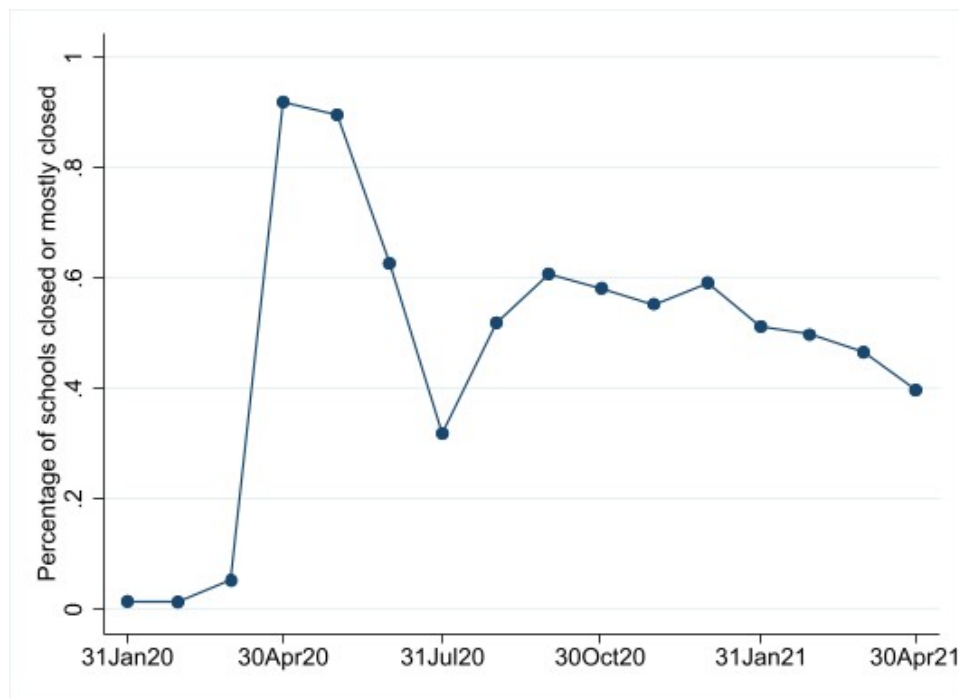


Figure 1. Percentage of School Closures from January 2020 to April 2021. Adapted from Parolin and Lee (2020).

Table 2 is a descriptive table that shows the mean and standard deviation for each variable for only 2019 and 2020 to focus the observations before and directly after the start COVID-19. The variables are similar to Table 1, with the mean and standard deviation displayed in the year columns. The last column calculates the difference from 2019 to 2020 and the p-value in parenthesis. There were fewer Marines in the Marine Corps in 2020 compared to 2019. This is based on the number of observations shown in the bottom of Table 2. There were 22,451 less observations in 2020 which equates to roughly 1,871 fewer Marines. This decrease in observations aligns with the planned force design decrease as outlined by the Commandant in Force Design 2030 (Berger, 2020). More importantly, the average amount of leave used dropped by over half a day per month due to lockdown restrictions between April and June 2020. CFT scores, proficiency scores, and RS RV increased slightly.

Table 2. Descriptive Table 2019 and 2020

Variables	2019	2020	Difference
Leave Used	2.485	1.821	-0.664***
	(5.258)	(4.908)	(0.000)
CFT Scores	266.883	267.998	1.116***
	(28.104)	(27.375)	(0.000)
Proficiency Scores	43.150	43.305	0.155***
	(2.315)	(2.250)	(0.000)
RS Relative Values	91.829	92.051	0.223***
	(6.332)	(6.313)	(0.000)
Female	0.089	0.090	0.001***
	(0.285)	(0.286)	(0.002)
Married	0.446	0.407	-0.039***
	(0.497)	(0.491)	(0.000)
Married Female	0.036	0.032	-0.004***
	(0.186)	(0.176)	(0.000)
Has Children	0.799	0.820	0.021***
	(0.401)	(0.384)	(0.000)
Number of Toddlers Aged	0.191	0.176	-0.015***
	(0.477)	(0.462)	(0.000)
Number of Elementary Aged	0.185	0.174	-0.011***
	(0.514)	(0.501)	(0.000)
Number of Middle and High Aged	0.131	0.122	-0.009***
	(0.467)	(0.451)	(0.000)

Variables	2019	2020	Difference
Observations	2,207,976	2,185,525	4,393,501

Data from Total Force Data Warehouse (TFDW) displaying variables of interest in 2019 and 2020

Figures next to variables depict the mean and standard deviation noted in parentheses

***Significant differences between 2019 and 2020 at $p < 0.001$

The table shows that the share of females increased slightly, from 8.9 to 9.0 percent. The “Has Children” variable indicates that 82.0 percent of Marines were parents in 2020, a 2.1 percentage point increase from 2019. This means a higher share of Marines were parents in 2020 compared to 2019. However, the average number of children dependents in each age bin was lower in 2020. For instance, in 2019, there was 1 toddler for every 5.2 Marines, but in 2020, there was 1 toddler for every 5.8 Marines. This could suggest that more non-parents departed the Marines Corps in 2020, but the parents who did leave had a greater number of dependents.

D. METHODOLOGY AND MODELS

I used four separate performance metrics as my dependent variables to estimate the effects that school closures had on productivity among Marines. The performance metrics are monthly leave usage, CFT scores, proficiency scores, and fitness report relative values. For the demographic-related data, the observations were restricted to only those Marines who were in the dataset on January 2020. By using multiple linear regression with person fixed effects and period fixed effects, I attempted to infer any differential changes in productivity after school closures.

Since the Marine data includes information on where each Marine is stationed and the school data identified county-level school closures over time, this location match allows for a generalized difference-in-differences approach, where the implicit comparison is between Marines who work in counties that are and are not under lockdown.

$$(1) Y_{it} = \alpha_i + \beta * Closure_{it} + \delta_t + \varepsilon_{it}$$

The dependent variable, Y_{it} , gives a productivity measure for person i in period t , α_i denotes person-fixed effects so that all specifications control for any fixed traits.

$Closure_{it}$ is an indicator variable; that is one if the person is in a county under lockdown, and δ_t denotes period fixed effects. The coefficient β captures the change in productivity that occurs under the lockdown period.

To examine the effects felt by female Marines and parents, I extended Equation 1 with an interaction indicator with gender and dependent children in Equation 2.

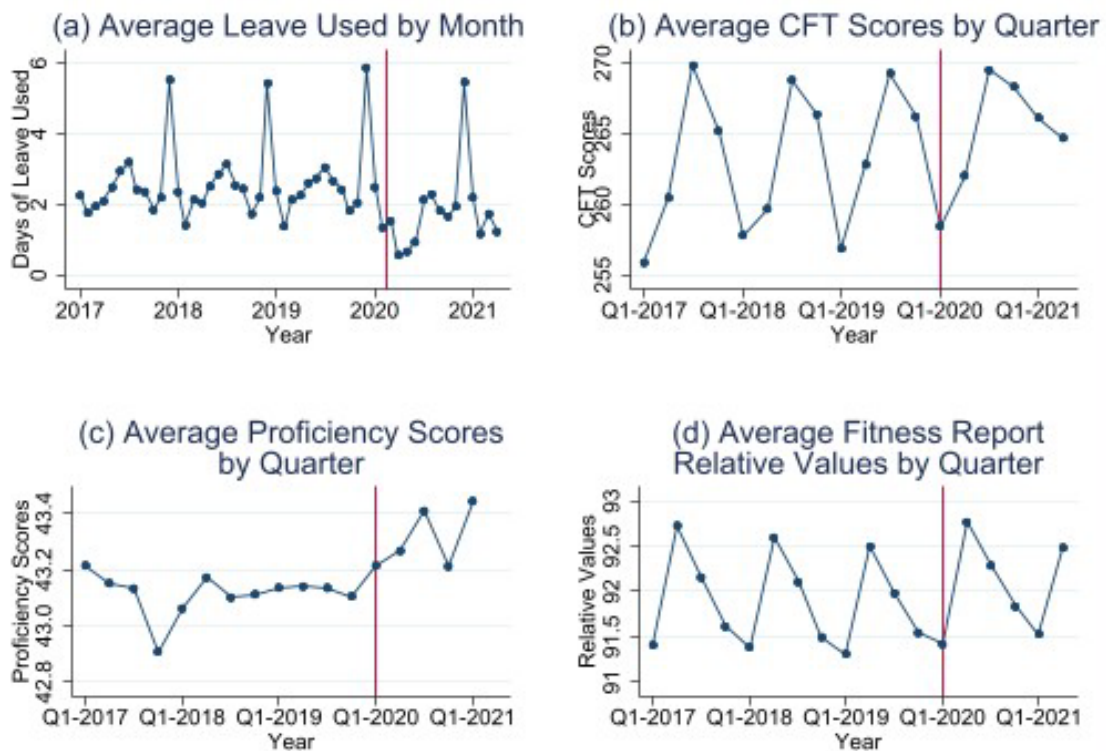
$$(2) Y_{it} = \alpha_i + \beta_0 * Closure_{it} + \beta_1 * Closure_{it} * Interaction_{it} + \delta_t + \varepsilon_{it}$$

$Interaction_{it}$ is an indicator for parents, female Marines, and female parents. The coefficient β_1 in this setup would capture any differential changes in productivity experienced by each interaction.

V. RESULTS

A. DESCRIPTIVE RESULTS

I first looked at how each performance variable changed prior to estimating the effects. Figure 2 from top left to bottom right shows the average days of leave used by Marines per month, the average CFT scores by quarters, the average proficiency scores by quarters, and the average FITREP RV by quarters from January 2017 to April 2021. The red line illustrates 15 March 2020 to denote the start of COVID-19 restrictions.



The panels display averages from Q1, 2017 to Q1, 2021 for each performance metrics.

Figure 2. Average Performance Metrics from 2017–2021. Data from Total Force Data Warehouse (TFDW).

Panel (a) shows that the use of leave is seasonal, with Marines taking more leave in the summer months and also a spike in December. This pattern changed in 2020 with a

drop in leave usage from April to June due to movement restrictions in the Marine Corps. Marines were still not taking much leave throughout the summer and fall of 2020 compared to previous years. However, December was similar to the years before COVID-19, with a considerable increase in leave during the holidays.

Marines conduct CFTs during the second half of each year, which comprises quarters three and four. Therefore, the average scores are higher during those periods each year because Marines are training for their tests, unlike Marines who run CFT in the first half of the year due to make-up tests from injury or as needed for additional assessment due to required screenings. As displayed in Panel (b), the CFT average was higher after COVID-19 than in previous years. In Panel (c), the increase in the proficiency scores' average to the right of the red line shows that scores were higher after COVID-19 than in preceding years. The scores during Q2 and Q3, 2020 reflected remote work periods. Lastly, Panel (d) shows that the FITREP RVs were similar to preceding years in Q2, 2020 but marginally higher during Q3 and Q4, 2020, after the onset of COVID-19 and remote work.

The different panels from Figure 2 might show a trend before and after COVID-19 lockdown, but by and large, they do not suggest an effect on productivity. The panels also highlight the importance of accounting for seasonality in my analysis: for instance, I should not compare CFT scores between Q1/Q2 with Q3/Q4, because I would expect differences in outcomes regardless of COVID-19. However, a regression framework will provide a more precise measurement and allow me to separate out potential effects from any shift in the composition of the Marines.

B. REGRESSIONS OUTCOME

1. Leave

Table 3 shows the regression outputs for the effects on leave due to school closures. Column (1) shows the effect on leave for Marines from locations where the local school district was closed for in-person learning. It indicates a negative effect; however, the result is not statistically significant. Since the school closure variable measures the share of schools with drastically decreased foot traffic, the coefficient on school closure suggests Marines took 0.28 fewer days of leave per month when the surrounding school district went

from zero to one hundred percent closed. Since a Marine takes an average of 2 days of leave per month as shown by the outcome mean at the bottom of the table, the 0.28 days decrease equates to a 14 percent drop. When I add the interaction between parents and school closures in Column (2), I find no differential effects on leave for these Marines who are and are not parents.

Table 3. Effects on Leave for Marines with School-Age Dependents Due to School Closure

	(1) Leave	(2) Leave	(3) Leave
Schools Closure	-0.275 (0.173)	-0.270 (0.148)	-0.337* (0.152)
Parents # Schools Closure		-0.006 (0.070)	0.063 (0.064)
Female # Schools Closure			0.591*** (0.097)
Female # Parents # Schools Closure			-0.631*** (0.103)
Outcome mean	2.00	2.00	2.00
R-squared	0.115	0.115	0.115
N	2,922,429	2,922,429	2,922,429

Data from Total Force Data Warehouse (TFDW) and U.S. School Closure & Distance Learning Database

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Parents is an indicator variable indicating a Marine with at least one child under 19 years of age.

Female is an indicator variable indicating female Marines.

Lastly, Column (3) further parcels out the interaction between a Marine's gender and dependents' status. In this regression, the coefficient on school closures captures the effects on male Marines without children, who took 0.34 less days of leave per month in response to school closure. The interaction in the second row for male Marines with children suggests they took roughly 0.27 $(-0.337+0.063)$ less days of leave than male Marines who did not experience school closures. Female Marines with children took about the same amount of leave at 0.31 (the sum of all four coefficients) less days of leave.

However, interestingly, female Marines without children had a positive effect at 0.25 (-0.337+0.591) more days of leave per month. This last group took almost 13 percent more leave than the Marines who did not reside at a district with school closures.

Essentially, the impacts on leave are the same for female Marines with children and male Marines with or without children. However, female Marines without children saw an increase in leave usage. Since remote work policies during COVID-19 was at the discretion of the local commands, it is possible that many commanders understood the difficulties of work-life balance between juggling work requirements and sustaining viable childcare. Therefore, commanders generally afforded Marines the opportunities to take care of their dependents without the need to take leave. This extra load was not necessary for female Marines without children since they did not have to worry about their children staying home from school.

2. Combat Fitness Test

I used exemplary CFT scores, above 285, to examine the impact from school closures on CFT, as depicted in Table 4. Exemplary CFT is a binary variable with 1 representing CFT scores above 285 and 0 otherwise. Overall, there are no sizeable differences in achieving exemplary CFT scores for Marines who lived in a location that experienced school closures compared to Marines who did not experience school closures. For example, the estimate in Column (1) suggests just a 0.2 percentage points decrease in exemplary CFT scores and is not statistically significant. Column (2) similarly suggests negligible effects with only a 0.2 percentage points increase in reaching a 285 plus CFT scores for Marines with children. When differentiating the outcomes between male and female Marines with children, there are opposing effects with a positive result for male Marines with children but a negative result for female Marines with children. As Column (3) shows, when the surrounding school district went from zero to one hundred percent closed, the probability of male Marines with children running an exemplary CFT increased by 0.3 percentage points $((-.016+.019)*100)$ whereas female Marines with children decreased by 1.7 percentage points (found by summing the four coefficients and

multiplying by 100). In percentage terms, this effect is a five percent penalty on mothers in earning a high first class CFT.

Table 4. Effects on Exemplary CFT for Marines with School-Age Dependents Due to School Closure

	(1) Exemplary CFT	(2) Exemplary CFT	(3) Exemplary CFT
Schools Closure	-0.002 (0.012)	-0.014 (0.012)	-0.016 (0.013)
Parents # Schools Closure		0.016*** (0.003)	0.019*** (0.004)
Female # Schools Closure			0.017 (0.014)
Female # Parents # Schools Closure			-0.037* (0.014)
Outcome mean	0.34	0.34	0.34
R-squared	0.825	0.825	0.825
N	219,009	219,009	219,009

Data from Total Force Data Warehouse (TFDW) and U.S. School Closure & Distance Learning Database

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Parents is an indicator variable indicating a Marine with at least one child under 19 years of age.

Female is an indicator variable indicating female Marines.

One plausible reason for the opposing effects on parents is that the preponderance of childcare fell to the mothers during the pandemic. Generally, Marines are health conscience, and most Marines, in pre-pandemic era, spend time during the week to work out and improve their physical fitness. During the lockdown, since Marines gained extra time from lack of activities such as their work commute or going out socializing, they were able to allocate more of their time during the week on fitness. In fact, Marine Corps Community Services put effort into opening base fitness facilities with modified

restrictions to allow Marines back into the gym as soon as possible during the lockdown. This opportunity was available to all Marines regardless of gender or parental status, hence the lack of evidence on an effect on exemplary CFT scores between school closures and open locations. However, I speculate that since parental care burden was often on the onus of mothers. Female Marines with children were the one group that experienced a negative effect, and they did not have the time to conduct physical training activities or workout to attain the higher CFT scores, as opposed to fathers who had the contrary effects.

3. Proficiency Scores

Table 5 indicates a positive effect on proficiency scores that can be attributed to school closures. Column (1) shows that proficiency scores increased by 0.21 points or a 0.48 percent for Marines who reside in a school district that experienced school closures compared to those Marines who did not. This result is statistically significant and equals a 2.1 points increase in composite scores, which affects promotion to the next rank. For Marines with children in Column (2), there is a further increase of 0.03 points in proficiency scores totaling to an increase of 0.24 points compared to Marines who did not experience school closures. This amount to an increase of 2.4 points in composite scores and a 0.55 percent increase in percent terms.

Table 5. Effects on Proficiency Scores for Marines with School-Age Dependents Due to School Closure

	(1) Proficiency Scores	(2) Proficiency Scores	(3) Proficiency Scores
Schools Closure	0.214** (0.078)	0.085 (0.088)	0.058 (0.092)
Parents # Schools Closure		0.154** (0.049)	0.171** (0.054)
Female # Schools Closure			0.205*** (0.054)
Female # Parents # Schools Closure			-0.093 (0.062)
Outcome mean	43.40	43.40	43.40
R-squared	0.536	0.536	0.536
N	317,112	317,112	317,112

Data from Total Force Data Warehouse (TFDW) and U.S. School Closure & Distance Learning Database

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Parents is an indicator variable indicating a Marine with at least one child under 19 years of age.

Female is an indicator variable indicating female Marines.

Column (3) portrays the interactions between male and female Marines and those with and without children. For a male Marine with children, proficiency scores increased by 0.23 points from the average score. There was a 0.26-point increase for female Marines without children which equals a 2.6-point increase in composite scores. Lastly, the effects of proficiency scores due to school closures were the highest for female Marines with children with a total increase of 0.34 points compared to Marines who lived in more in-person classroom instructions locations. This amounts to a 0.8 percent increase to the proficiency scores and a 3.4-point increase in the composite scores. In percent terms, this equates to a 1.84 percent increase in proficiency scores.

In my estimation, a higher rate of school closure is a proxy for a higher rate of remote work. It is likely that Marines who experienced a higher rate of remote work also had less direct supervision for their day-to-day work responsibilities. I think it is a

reasonable assumption that supervisors who evaluate proficiency scores understood that Marines had to balance work and childcare as discussed earlier, and therefore, gave more leeway in scoring Marines during remote work. Those supervisors assigning scores tended to be older Marines who, in many cases, have children themselves. Therefore, it is likely they understood the stress and burden added during the pandemic and could commiserate more with junior Marines undergoing the same hardship. Those marking proficiency scores could identify and associate by what they are experiencing at home. Proficiency score markings are subjective with different nuances, and I think it is feasible that these subtle insights caused an overall positive effect on proficiency scores for Marines who experienced lockdown.

4. Fitness Report

The effects on FITREP RV due to school closures are quite small and not statistically significant. Specifically, as shown in Table 6, there are no sizeable differences in FITREP RV for Marines who lived in a location that experienced school closures compared to Marines who did not experience school closures, regardless of gender or dependent status. For example, the estimate in Column (1) suggests that there is less than a 0.47 percent decrease in relative values and is insignificant when school districts closed to in-person learning.

Table 6. Effects on FITREP for Marines with School-Age Dependents Due to School Closure

	(1) FitRep Relative Values	(2) FitRep Relative Values	(3) FitRep Relative Values
Schools Closure	-0.047 (0.305)	0.060 (0.282)	0.070 (0.276)
Parents # Schools Closure		-0.144 (0.104)	-0.152 (0.105)
Female # Schools Closure			-0.100 (0.236)
Female # Parents # Schools Closure			0.071 (0.268)
Outcome mean	92.21	92.21	92.21
R-squared	0.568	0.568	0.568
N	109,549	109,549	109,549

Data from Total Force Data Warehouse (TFDW) and U.S. School Closure & Distance Learning Database

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Parents is an indicator variable indicating a Marine with at least one child under 19 years of age.

Female is an indicator variable indicating female Marines.

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VI. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

The coronavirus swept through the United States in the spring of 2020, causing significant uncertainty and fear across the country. The Marine Corps provided Corps-level guidance and instructed local commanders to implement localized measures to preserve the force. Commanders restricted movements and allowed unprecedented wholesale remote work for much of the non-deployed force.

When only looking at the performance results in the previous chapter individually, it does not clearly show how lockdown and school closures affected Marines' performance. There were some measures showing increases and others showing decreases without a clear connection. In all cases the effects were small. However, combining the results and summarizing the impact holistically shows a better picture of the effects on how Marines, especially parents, performed during these trying times.

When the Marine Corps allowed parents the time to take care of their children, as displayed by the negative effects on leave for both male and female Marines, it did not affect their performance in terms of FITREP relative values and even had a positive effect on proficiency scores. I consider this to mean that Marines performed at least to their normal abilities, if not better, during lockdown. Like other studies, there is a positive relationship between remote work and performance.

Also similar to previous studies, the population that suffered from school closures when compared to their counterparts were female Marines with children. It is important to note that my study only found a negative effect on the likelihood of mothers receiving a higher CFT score and not an overall negative effect on the passage of CFT itself. Nonetheless, mothers were disproportionately affected during the pandemic.

B. RECOMMENDATIONS

I recommend that the Marine Corps continue allowing Marines with children the flexibility to maintain a healthy work-life balance and find ways to lessen the burden when

unforeseen childcare requirements arise. Creating new policies to continue the era of remote work in the Marine Corps can benefit the productivity of Marines vice a negative effect. Additionally, the Marine Corps can continue the trend set by the new secondary caregiver leave increase and investigate the benefits of additional flexibility for childcare. Per the Commandant's guidance, manpower policymakers should pursue policies to allow extra leave after the birth of a child to include additional maternity leave for mothers to bond with their newborns. The analysis demonstrates that policies that provide more freedom for Marines to maintain a healthy work-life balance do not negatively affect a Marine's performance.

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