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USMC Artemis Program: A Quantitative Analysis of Pregnancy and Postpartum Fitness and Recovery

June 2024

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Department of Defense Management

Naval Postgraduate School

Prepared for the Naval Postgraduate School, Monterey, CA 93943.

ACQUISITION RESEARCH PROGRAM
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ABSTRACT

Despite the expansion of fitness and body composition exemption periods, female Marines continue to face significant challenges in regaining pre-pregnancy fitness levels. Supportive resources and policies are crucial for aiding female Marines during their pregnancy and postpartum journeys and enhancing retention rates. Established in 2021 at the 1st Marine Logistics Group in Camp Pendleton, CA, the Artemis Program represents a command-endorsed, Navy Medicine-informed and evidence-based initiative aimed at improving the readiness and retention of pregnant and postpartum Marines and Sailors. This research seeks to evaluate the impact of the USMC Artemis Program on the fitness outcomes of mothers. The findings indicate that childbirth has a persistent negative effect on mothers' fitness outcomes, regardless of program participation. Additionally, a mother's Military Occupational Specialty influences the likelihood of participation. While there is considerable interest in expanding this program to other Marine Corps units and installations, successful implementation depends on improved accountability among participants. Enhanced record-keeping practices would facilitate more accurate data analysis on the program's effectiveness and support its potential expansion across the Marine Corps. These findings highlight the ongoing need for strong support systems and resources to help Marine mothers balance their military duties and parental responsibilities.

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To my son Cooper, thank you for filling my life with such joy and happiness. Being your mom will forever be my greatest accomplishment.

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LIST OF ACRONYMS AND ABBREVIATIONS

ACOG	American College of Obstetricians and Gynecologists
BCP	Body Composition Program
CDC	Child Development Center
CFT	Combat Fitness Test
CIP	Career Intermission Program
DACOWITS	Defense Advisory Committee on Women in the Services
EDIPI	Electronic Data Interchange Personal Identifier
FFI	Force Fitness Instructor
ITT	Intention to Treat
LD	Legitimate Daughter
LS	Legitimate Son
MAGTF	Marine Air Ground Task Force
MCC	Monitored Command Code
MCO	Marine Corps Order
MEF	Marine Expeditionary Force
MLG	Marine Logistics Group
MOS	Military Occupational Specialty
NPSP	New Parent Support Program
P3T	Pregnancy Postpartum Physical Training
PFA	Physical Fitness Assessment
PFT	Physical Fitness Test
PSWP	Pregnant Soldiers Wellness Program
TFDW	Total Force Data Warehouse
TM2030	Talent Management 2030

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I. INTRODUCTION

The efforts to improve the support and perception of parenthood within the Marine Corps have been at the forefront of leaders' concerns for several years. Some of the improvements include expansions of the parental leave and pregnancy and postpartum fitness policies. However, despite these policy changes, Marine mothers continue to face challenges returning to their pre-birth fitness outcomes. These challenges affect each mother differently, but the type of support and resources available to them should be the same. In February of 2021, the 1st Marine Logistics Group (MLG) at Camp Pendleton introduced the Artemis Program. This program aims to help its pregnant and postpartum Marines balance the newfound challenges of motherhood with the expectations of being a Marine. Currently, the implementation of the Artemis Program outside of the 1st MLG is entirely dependent on unit-level leaders. If this program is an effective support resource for mothers, the Marine Corps should consider implementing it at all major installations.

A. PURPOSE

The purpose of this thesis is to analyze how participation in the Artemis Program affects the motherhood penalty and provide results and recommendations on the further implementation of this program at installations across the Marine Corps. Recent expansion in the fitness testing and body composition exemption periods allows mothers more time to return to standards. This program, if implemented Marine Corps-wide, could further assist mothers in safely returning to their pre-pregnancy fitness levels.

B. SCOPE AND METHODOLOGY

The panel data used in this thesis is from the Marine Corps Total Force Data Warehouse (TFDW) and contains monthly observations of active-duty female Marines from January 2015 to August 2023. The data includes demographic information such as race, age, marital status, rank, physical fitness test (PFT) and combat fitness test (CFT) scores, education status, number of dependents, dependent date of birth, and Artemis Program participation status. These demographics combined with monthly observations of

PFT and CFT performance establish pre- and post-birth trends among mothers who participated in Artemis and those that did not.

C. RESULTS AND FINDINGS

This study explores the impact of the Artemis program on the fitness scores of Marine mothers. The fixed effect regression findings reveal that mothers continue to experience a significant decline in fitness scores post-birth. The logit model results show that certain Military Occupational Specialties (MOS) are more inclined to participate in the program. This is likely due to MOS-specific fitness requirements and expectations, or proximity to the program at the 1st Marine Logistics Group (MLG).

D. ORGANIZATION OF CHAPTERS

Chapter I provides an overview of the thesis. Chapter II provides a review of literature and research on the effects of parenthood and parenthood-related policy changes. Chapter III explores the data and methodology used to analyze the data. Chapter IV presents the results of the analysis. Chapter V provides the recommendations, future research, and a conclusion of the thesis.

II. BACKGROUND

> We should never ask our Marines to choose between being the best parent possible and the best Marine possible. These outcomes should never be in competition to the extent that success with one will come at the expense of the other.
>
> - General David H. Berger, 38th Commandant's Planning Guidance (Berger, 2019)

The 2022 Demographics of the Military Community reported that 9.4% of active-duty Marines are female and 7.5% of Marine parents are female (Department of Defense, 2022). In *Talent Management 2030* (*TM2030*), General Berger stated that "too many Marines starting families—especially female Marines—decide to leave service, fearing that parenthood will be incompatible with their careers" (Berger, 2021, p. 14). In response to the recruiting and retention crisis that has recently affected the Department of Defense, the Marine Corps focused its effort on retaining female Marines by reevaluating programs like the Career Intermission Program (CIP), the pregnancy and postpartum policy, and the parental leave policy. The CIP allows Marines to temporarily pause their active-duty service and resume their career without penalty to pursue other interests like graduate education, seminary, or starting a family. These *TM2030* initiatives are aimed at enabling career flexibility while encouraging the retention of experienced, talented Marines (Berger, 2023). *TM2030* has been the cornerstone of the Commandant's plan to modernize, develop, and grow the force. It emphasizes quality of life and Marine families as some of the priorities to rebalance recruitment and retention (Berger, 2023). This focus on families signals to Marines that their leadership and the institution itself are prioritizing the welfare of the family system. These new policies should lead to Marines having healthier family relationships while also executing their Marine Corps mission.

A. UNITED STATES MARINE CORPS POLICIES

1. Pregnancy and Parenthood

Even though the Marine Corps has a renewed focus on family and quality of life to retain highly talented Marines, the policies and culture surrounding parenthood have not always been as supportive of women. Until 1970, "any responsibility for children forced the separation of a woman Marine from service" (Stremlow, 1986, p. 151). Between 1971 and 1975, women who became pregnant were offered waivers to remain on active duty, if they had a good record and could prove they could care for a child (Stremlow, 1986). In 1975, Marine Corps Order (MCO) 5000.12 established that women Marines "who are pregnant may, upon request, be discharged or retained on active duty if otherwise qualified" (Stremlow, 1986, p. 153). This pregnancy and parenthood MCO has been updated throughout the last 50 years as new guidance has emerged regarding pregnancy, postpartum recovery, and return to fitness standard expectations. The most recent update, which occurred in 2021, expanded the exemption period from 9 to 12 months for mothers to deploy, meet weight standards, and take fitness tests.

The Department of the Navy has changed maternity leave duration three times in the past 10 years. In 2015, it increased maternity leave from 6 to 18 weeks, but in 2016, it reduced it to 12 weeks (Bacolod et al., 2022). In December 2022, the Department of Defense implemented a uniform 12-week parental leave policy for all parents, enhancing military families' well-being and work-life balance (Vergun, 2023). Prior to this most recent update, a 2022 study on maternity leave policy take-up found that most mothers took exactly 6 weeks of leave under the 6-week policy. During the shift from 6 to 18 weeks, those who received an unexpected additional 12 weeks of leave increased their take-up by 8.4 weeks while those who expected the additional 12 weeks averaged an additional 11.1 weeks of leave prior to returning to work (Bacolod et al., 2022). Upon shifting to the 12-week policy, mothers expected and took the full additional 6 weeks (Bacolod et al., 2022). These findings show that mothers are eager to use as much parental leave as they can and generally use most of the 12 weeks that are now provided.

Although there have been improvements in the policies that involve parenthood, there are still challenges that parents, particularly female parents, face every day. Childcare continues to be an issue due to maximum capacities, causing the wait lists for an opening at the Child Development Center (CDC) to last months. In a Defense Advisory Committee on Women in the Services (DACOWITS) Focus Group from 2023, respondents identified unavailable and unreliable childcare as an obstacle affecting servicewomen's ability to advance in their careers (Montgomery et al., 2023). Initiatives to address childcare issues were emphasized in *TM2030*. General Berger highlighted the necessity for sufficient childcare facilities, acknowledging the difficulties families face when fundamental requirements such as childcare are inaccessible.

2. Physical Fitness and Combat Fitness Test

Returning to pre-pregnancy fitness and weight standards is a very stressful task for many postpartum Marines. Healthy recovery post-birth takes time and historically female Marines were not given adequate time before they were required to pass the Physical Fitness Test (PFT) and Combat Fitness Test (CFT). The PFT, which is conducted from January through June, measures a Marine's strength and stamina through three separate events, while the CFT, conducted from July through December, measures agility, coordination, and anaerobic capacity through three separate events.

Initially, MCO P6100.12, which regulated the PFT and CFT evaluation standards, required postpartum Marines to pass a PFT within 6 months of returning to full duty and emphasized a moderate training pace upon clearance from a primary care provider (United States Marine Corps, 2002). In 2008, this order was replaced by MCO 6100.13, which specified that Marines would complete semi-annual fitness requirements no later than 6 months after returning to full duty (United States Marine Corps, 2008). Another update in 2019 extended the time to complete this requirement to no earlier than 9 months (United States Marine Corps, 2019). In 2021, the United States Marine Corps updated its policy regarding fitness and body composition standards, shifting from a nine-month exemption period to a 12-month exemption period (United States Marine Corps, 2021). This update

provides female Marines more time to recover and return to fitness and body composition standards during their postpartum period.

The Marine Corps also released the *Pregnancy and Postpartum Training Guidebook* which is readily available online and shared with units' Force Fitness Instructors (FFI). Such Instructors are Marines who are specifically trained to assist units with physical training programs and the Body Composition Program (BCP). Published in 2021, this guidebook features workout programs and guidance on maintaining fitness during pregnancy and getting back into shape after birth (Szoldra, 2021). Since returning to work, recovering, and returning to USMC fitness and weight standards is difficult for many Marine mothers, this guidebook is another tool that Marines can use during their pregnancy and postpartum time to aid in their fitness maintenance and recovery. Despite these updates, there are still barriers to exercise that many women face throughout pregnancy and the postpartum period.

The USMC physical fitness exemption policy during pregnancy and postpartum is similar to the other services. The Air Force and Space Force implement an exemption for the Physical Fitness Test during pregnancy and require the test to be conducted by the 13th month postpartum (Department of the Air Force, 2022). The Army maintains an exemption from soldiers taking a recorded physical fitness test while pregnant and for one year after the conclusion of pregnancy and are automatically enrolled in the Pregnancy Postpartum Physical Training (P3T) program for 6 months after birth (Secretary of the Army, 2022). The Navy requires women to conduct a Physical Fitness Assessment (PFA) at the next regularly scheduled fitness test after 12 months postpartum (Department of the Navy, 2022).

B. THE ARTEMIS PROGRAM

A Marine Logistics Group (MLG) consists of more than 8,000 Marines and Sailors and it provides logistics support to the units within a Marine Expeditionary Force (MEF) and Marine Air Ground Task Force (MAGTF). It is primarily responsible for supply, maintenance, transportation, and other service support functions that facilitate operational

readiness and sustainability. There are three MLGs within the Marine Corps; 1st MLG in Camp Pendleton, CA; 2nd MLG in Camp Lejeune, NC; and 3rd MLG in Okinawa, Japan.

On February 4, 2021, Brigadier General Roberta Shea, former Commander of 1st MLG, announced the creation of the Artemis Program. The Artemis Program is a Navy-medicine and research-informed program that aims to increase the support and resource accessibility for pregnant and postpartum Marines and Sailors within 1st MLG (Marines TV, 2021, February 4). Artemis focuses on helping women sustain their fitness and health during pregnancy and assisting women during their recovery to increase individual and unit readiness. The Artemis Program is unique because it is a pregnancy- and postpartum-specific support program that offers mentorship between mothers and expectant mothers; access to resources, like the New Parent Support Program (NPSP), lactation consultation, and pelvic floor therapy; and weekly group workout sessions (Marines TV, 2021, February 18). The workout sessions are organized by the Semper Fit faculty, who are fitness instructors at the on-base gym. The workouts are tailored to meet the needs of both pregnant and postpartum women. This program encourages women to maintain their health and fitness while forming a supportive community of mothers. Other units in the Marine Corps have attempted to establish other Artemis Programs, but none have reached the extent of resources and support as the 1st MLG program.

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III. LITERATURE REVIEW

A. BARRIERS TO EXERCISE DURING PREGNANCY AND POSTPARTUM

The American College of Obstetricians and Gynecologists (ACOG) encourages women to exercise at least 150 minutes of moderate-intensity aerobic activity every week throughout pregnancy and recommends postpartum physical activity as soon as it is deemed medically safe (Birsner & Gyamfi-Bannerman, 2020). Recovery post-birth is entirely dependent on the type of delivery, the health of the mother and baby, and other individualized factors. Studies have shown that many women face certain barriers to exercise throughout pregnancy and the postpartum period. Pregnant women may experience a decrease in physical activity during pregnancy for several reasons, including concerns about injury or harming their baby, physical discomforts like nausea and fatigue, and lack of time, guidance, or knowledge of recommended practices (James et al., 2022). During the postpartum period, the primary barriers to exercise include fatigue or insufficient sleep, unpredictable schedule, or time due to the needs of the baby, lack of support from family and friends, and breastfeeding challenges (Edie et al., 2021). Marine mothers must balance these potential barriers and their responsibilities as Marines throughout their pregnancy and postpartum period.

1. Social Support

Another study found that both personal and environmental factors affect postpartum exercise participation, but found that social support, like mothers' groups and postnatal classes, increases the opportunities for mothers to be physically active while creating a community of women that can share their experiences with motherhood (Saligheh et al., 2016). To explore the role of perceived social support, Faleschini et al. (2019) found that mothers with social support from family and friends engaged in light-to-moderate physical activity and experienced decreased postpartum depression symptoms (Faleschini et al., 2019). The importance of a social community for mothers directly affects their motivation to participate in and their access to physical activity and overall mental health in the postpartum

period. The benefits of establishing such a community within the Marine Corps would likely increase fitness and mental health outcomes in many Marine mothers.

2. Mental Health

Pregnancy and the transition into motherhood introduce a plethora of physiological, psychological, and social changes for mothers (Edie et al., 2021). Pregnant women are more susceptible to developing mental health problems, like depression or anxiety (Bedaso et al., 2021). The challenges women face during pregnancy range from managing weight gain, the health of the baby considerations, emotional changes, childbirth preparation, and the actual act of childbirth, which all affect an expectant mother's mental health. Marine mothers are expected to manage these challenges while performing their military duties within the limits established by their pregnancy.

Approximately one in seven women experience postpartum depression in the year after giving birth (Mughal et al., 2024). Postpartum periods introduce the new responsibility of caring for a newborn while recovering from a life-altering event. This increase in responsibility, particularly for first-time mothers, can be overwhelming, and isolating, and cause mothers to prioritize the needs of others over their own (Edie et al., 2021). Marine mothers are experiencing these factors but under the added stress of returning to work and the requirement to return to weight standards and fitness levels.

B. PRIOR MILITARY RESEARCH

Marine families face challenges in all facets of life, including long working hours; separation from each other due to field exercises, duty, or deployments; and frequent Permanent Changes of Stations (PCS). Moreover, quality of life is one of the leading reasons Marines choose to depart the service (Berger, 2023). Pregnancy and childbirth are significant life events that affect both the primary and secondary caregivers. Existing studies suggest new parents struggle with maintaining physical standards as they recover from childbirth and face the demands of caring for a baby.

Prior research has shown that there is a prominent gender-differentiated impact of childbirth on physical fitness within the Marine Corps. Using a time series approach with

data on first-time USMC parents from 2013 to 2019, Larson found that combined fitness scores significantly decrease for both men and women immediately following childbirth (Larson, 2020). Fathers were 2.5 and 2.2 percentage points less likely to receive a first-class score on their PFT and CFT, respectively. Among mothers, the declines were 8.2 and 13.1 percentage points. While the initial drop in physical fitness occurs for both men and women, women continue to see a persistent drop in performance up to 24 months after birth (Larson, 2020).

Using a similar event-study methodology as Larson (2020), Henegar (2021) examined the effects of childbirth on performance among "dual military" parents, both parents are serving, and "other married" parents, who are active duty and civilian spouses. Being a dual military family adds an additional layer of complexity to the challenges that a family may face. The same challenges that exist in a single service-member household are doubled. There are two military careers that need to be managed, which adds stress and extra coordination efforts to ensure both servicemembers meet professional goals and standards. This study found that after birth, "other married" fathers' PFT and CFT scores dropped by 3 and 2 points, respectively. "Dual military" fathers experienced a larger decline with their PFT and CFT scores dropping by 6 and 4 points, respectively (Henegar, 2021). The study also found that mothers, both "dual military" and "other married," faced even larger reductions in fitness levels after birth when compared to fathers. "Dual military" mothers saw their PFT and CFT scores drop by 7 and 4 points, respectively, while "other married" mothers experienced drops in PFT and CFT scores of 8 and 5 points, respectively (Henegar, 2021). These results are consistent with Larson's first-time parent event study and highlight that mothers suffer larger drops in fitness following birth when compared to fathers.

Another study (Healy & Heissel, 2022) on the effect of pregnancy and childbirth on job performance, human capital accumulation, and career advancement found that both fathers and mothers experience a decline in health-related job performance immediately following birth. This study used an event study design on individual Marine data from 2010 to 2019. The results show that the impact on health-related job performance is less severe for fathers as they experience a 0.12 standard deviation drop in physical fitness scores

immediately post-birth, but this effect virtually disappears at 24 months post-birth (Healy & Heissel, 2022). On the other hand, mothers' physical performance drops by 0.49 standard deviations below their expected average at 8 months postpartum and remains below at 0.18 standard deviations 24 months post-birth (Healy & Heissel, 2022). These results emphasize the continued need for better support for Marine mothers, as they are more negatively affected by childbirth and parenthood.

C. OTHER MILITARY SUPPORT PROGRAMS

Previous research on a U.S. Army program like the Marine Corps' Artemis Program showed that participants valued having a pregnancy and postpartum program. The Army has maintained a Pregnancy/Postpartum Physical Training (P3T) Program since 2008. This program was created to "provide safe, standardized physical training and education" and "promote readiness through health by maintaining fitness levels of pregnant Soldiers, and successfully integrating postpartum Soldiers back into unit physical readiness training" (Wood, 2022, para. 2). In 2011, Kwolek et al. (2011) conducted a descriptive study to identify behaviors affecting participation in P3T. It focused on the Pregnant Soldiers Wellness Program (PSWP) that was established at Fort Bragg, North Carolina, the Army's largest U.S. base. The study consisted of 30 fixed-choice items including demographic information, baseline health, participation in PSWP, and factors affecting PSWP participation (Kwolek et al., 2011). Participation in the study was completely voluntary and only women who delivered a baby between May and December of 2008 were eligible. Out of the 316 eligible soldiers, only 74 participated (a 23.4% participation rate). There were multiple reasons identified for participating in PSWP. The most notable were fitness-related reasons: 46% to return to pre-pregnancy weight, 44.6% to limit overall weight gain, and 39.2% to return to prior physical fitness level or meet the AR 600-9 postpartum, which is the Army body composition program (Kwolek et al., 2011). Other reasons included having a healthier baby, a less difficult birth, improved psychological well-being, less injury before and after pregnancy, less discomfort, and less risk of preterm labor. The soldiers who participated in the survey reported positive benefits of exercising during pregnancy and postpartum. The study also reported that peer influence and camaraderie heavily influenced participation (Kwolek et al., 2011). This study did not

address any specific return to fitness metrics but addressed the reasons for or against participation in PSWP. This study shows that the participants strongly value a support program to help them reach their personal goals throughout pregnancy and during the postpartum period. The Army's P3T program provides a precedent that the Marine Corps can use to implement the Artemis Program service-wide.

D. CONCLUSION

The literature suggests that women's fitness is negatively affected by pregnancy and birth; although men experience some fitness challenges upon the arrival of a child, the effects are larger and more persistent for women. The Army established a pregnancy and postpartum support program that is more than just a guidebook; it provides fitness support, education, and community to women throughout their pregnancy and during their postpartum period. While updates in policy and fitness guidebooks are beneficial to Marine mothers, there are additional benefits that an organized support program offers. The Artemis Program is the first Marine Corps pregnancy and postpartum support program. This thesis aims to fill the gaps in the research on effective pregnancy and postpartum training programs in the Marine Corps by studying its effect on postpartum fitness. This will help identify its benefit to its participants and provide insight into the benefits of rolling out the Artemis Program at a service-wide scale.

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IV. DATA AND METHODOLOGY

A. DATA

This analysis uses a participation roster from the 1st MLG Artemis Program and comprehensive datasets from the Marine Corps Total Force Data Warehouse (TFDW), covering a variety of demographic and performance information on female Marines and their dependents. The roster of Artemis Program participants is a compiled list of individuals who attended weekly workouts between January 25, 2021, and March 15, 2021. The TFDW data tracks monthly observations of female Marines and their dependents from January 2015 to August 2023. The data includes demographics such as gender, race, age, marital status, education status, and military occupational specialty (MOS). The data on the Marines' dependents includes demographics such as date of birth, gender, and dependent relationship code. The data also includes PFT and CFT scores, which were standardized to create a combined fitness score variable.

1. Data Cleaning

The Artemis Program participation information existed in six rosters of participants' Electronic Data Interchange Personal Identifier (EDIPI), which I condensed into one master roster to capture everyone who participated in the program. The raw data from TFDW comes from four different files: CFT data, PFT data, dependent data, and Marine demographic data. I combined the CFT and PFT data and filtered it to include only passing scores. I limited the dependent data to include only dependents with a "Legitimate son (LD)" or "Legitimate daughter (LD)" designation code as these indicate births instead of other types of dependents like adopted children, stepchildren, or spouses. I merged the CFT, PFT, and dependent data by EDIPI into one combined data frame. Then I merged the Marine demographic data with the combined fitness tests and dependent data frame by EDIPI and PFT/CFT test month-year. I used an individual's most recent demographic information to fill in any missing demographic information from the month-year merge. Next, I combined TFDW and Artemis roster files into one master file and filtered it to include only those that were mothers. Then I created a participant variable to identify

Artemis Program participants and non-participants using a binary indicator for participant status. I also created categories for demographic variables like race, education, MOS, marital status, and grade. For example, in the MOS category, I specify an individual's MOS group type: Combat includes jobs like artillery, infantry, tanks, and combat engineers; Combat Service Support includes jobs like logistics, ground supply, and administration; and Aviation includes all aviation related jobs like pilot, aviation maintenance and supply, and air traffic controller. I further cleaned the data to keep the control and treatment groups as similar as possible. Since the earliest Artemis participants' dependent date of birth occurred in 2019, I retained only observations with a dependent date of birth after January 1, 2019. Additionally, I exclude any observations that might occur during the pregnancy (-3 quarters pre-birth to 4 quarters post-birth) and limit the observations to 12 quarters pre- and post-birth. This allows me to examine the specific trends associated directly with birth and reduces the impact of external factors on fitness outcomes.

2. Summary Statistics

Table 1 shows the summary statistics for mothers in the treatment and control groups. The treatment group in this table is mothers who participated in the Artemis Program; the control group is mothers who did not participate in the Artemis Program. Both groups were observed having a child during the observation period. There are 107 Artemis participants and 3,922 non-Artemis participants. To ensure that the treatment and control groups were as similar as possible, the dependent date of birth was limited to include only births after January 2019, as Artemis participants only had dependent dates of birth after that date. The table shows the counts of each demographic variable with the percentage in parentheses and means of the PFT and CFT.

The summary statistics demonstrate that the treatment and control groups are statistically different in three categories: marital status, grade, and MOS group. A *p*-value of 0.019 indicates that there is a statistically significant difference in the marital status distributions between the two groups. Non-participants have higher percentages in all marital status categories except where Artemis participants have a higher percentage of single Marines (41.1%). The *p*-value of 0.030 emphasizes the difference in grade between

the two groups as 370 non-participants are officers while there are only three officers in the participant group. This highlights that enlisted personnel may be more interested in participating than officers. The combat service support MOS makes up the majority of both groups' MOS types, but there are no aviation MOS types in the treatment group. This is likely due to the lack of organic aviation MOSs within the 1st MLG.

Table 1. Summary Statistics by Participation Status

Descriptives	Non-Participants	Participants	p-value of difference
n	3922	107	
Age (mean (SD))	25.66 (5.11)	24.95 (4.04)	0.154
Marital Status (%)			0.019
Divorced	269 (6.9)	5 (4.7)	
Married	2507 (63.9)	58 (54.2)	
Other	48 (1.2)	0 (0.0)	
Single	1098 (28.0)	44 (41.1)	
Race Category (%)			0.981
American Indian or Alaska Native	86 (2.2)	2 (1.9)	
Asian	116 (3.0)	2 (1.9)	
Black	597 (15.2)	15 (14.0)	
Declined to Respond	42 (1.1)	1 (0.9)	
Other	50 (1.3)	2 (1.9)	
Pacific Islander	54 (1.4)	1 (0.9)	
White	2977 (75.9)	84 (78.5)	
Grade = Officer (%)	370 (9.4)	3 (2.8)	0.03
MOS Group (%)			<0.001
Aviation	778 (19.8)	0 (0.0)	
Combat	199 (5.1)	18 (16.8)	
Combat Service Support	2945 (75.1)	89 (83.2)	
Education Level (%)			0.135
Bachelor's Degree	380 (9.7)	2 (1.9)	
Doctorate	16 (0.4)	0 (0.0)	
HS Diploma	3103 (79.1)	93 (86.9)	
Master's Degree	132 (3.4)	3 (2.8)	
No HS Diploma	21 (0.5)	1 (0.9)	
Some College	270 (6.9)	8 (7.5)	
Birth Order (%)			0.423
1	2629 (67.0)	79 (73.8)	
2	961 (24.5)	20 (18.7)	
3	241 (6.1)	8 (7.5)	
4	70 (1.8)	0 (0.0)	
5	20 (0.5)	0 (0.0)	
6	1 (0.0)	0 (0.0)	
PFT Score (mean (SD))	239.65 (30.24)	241.15 (28.13)	0.612
CFT Score (mean (SD))	269.22 (24.25)	272.27 (20.73)	0.2

3. Fitness Measurement

To increase the statistical power of my analysis, I combined the PFT and CFT scores. Both the PFT and CFT use a 300-point scale (100 maximum points for each event), as shown in Table 2. I took the raw PFT and CFT scores and calculated Z scores based on yearly performance. I used those Z scores to create a combined fitness Z score, where the mean=0, and SD=1. Using a combined fitness Z score accounts for changes in fitness standards that might affect how an individual performs overall. For instance, in 2017, the USMC changed the PFT to require women to perform pullups instead of the flexed arm hang (Schogol, 2017). The combined fitness Z score also increases the number of fitness observations for an individual per year, which provides a more accurate representation of an individual's fitness over time. The combined fitness score variable increases the statistical power of the analysis and makes the findings more reliable.

Table 2. Fitness Test Events

Fitness Test Events		
	Physical Fitness Test	**Combat Fitness Test**
Event 1 (100 points)	Max Pull-Ups*	Movement to Contact (MTC): 880-yard run
Event 2 (100 points)	Max Plank	Max Ammo Can Lift in 2 minutes
Event 3 (100 points)	3 Mile Run **	Maneuver Under Fire (MANUF): 300-yard shuttle run
Alternatives	*Max Push-Ups in 2 minutes **Row if 46 years+ or medical waiver	No alternatives exist for this test

B. METHODOLOGY

This analysis aims to show the effect of Artemis Program participation on postpartum fitness outcomes by estimating the combined fitness outcomes of Artemis participants and non-Artemis Program participants. The treatment and control groups

include only mothers who have given birth after January 2019 and restrict the observation period to 12 quarters before and after birth. Only fitness scores that are considered passing, a score of 150 or above, and non-partial, meaning not missing any event, were included. The most complete model I use is:

$$Y_{it} = \beta_0 + \beta_1 After_t + \beta_2 After_t A_i + \gamma_i + \varepsilon_i,$$

where Y_{it} shows the outcomes for combined fitness scores of mothers *i* at time *t*, $After_t$ is a binary indicator for post-birth, where 1 is after birth and 0 is pre-birth, $After_t A_i$ is a binary for both being an Artemis participant and post-birth, and ε_{it} is the error term that captures any unobserved factors that may affect combined fitness scores of mothers. To account for individual characteristics like age, race, MOS, and marital status, γ_i represents individual fixed effects that allow me to compare changes within the individual before and after birth. The individual fixed effects control for any time-invariant characteristics, like genetic factors, baseline health conditions, motivation levels, or other personal attributes that may impact fitness levels. Including fixed effects ensures that the model focuses only on the effects of the variables that change over time. The coefficient β_1 represents the effect of birth on an individual's combined fitness score regardless of participant status, and the coefficient β_2 represents the additional impact of being an Artemis participant and post-birth on combined fitness score when compared to non-participants during the post-birth period.

To further investigate the effect of the Artemis Program, I employ two logistic regression models to predict participation in the program. The results of these regressions can provide further insight into what influences a mother to participate in the program. Both models use participation as the dependent variable, where 1 indicates participation and 0 indicates non-participation. I use the same analytical sample from the first two models but limit the data to one observation per EDIPI based on the closest pre-birth fitness test before the Artemis Program start date. This allows me to use the closest pre-birth characteristics that would influence a mother's decision to participate. The first model incrementally adds binary indicator predictor variables like MOS type, demographics, education, and rank in a block-by-block regression, whereas the final model only includes

the statistically significant indicators. MOS types are categorized by the first two digits of the primary MOS code. For example, MOS codes like 0100, 0101, 0102, 0111, 0160, 1061, and 1070 are categorized by the first two digits 01 and are labeled Administration. The other MOS categories are Aviation Support, Air Crew, Artillery, Combat Engineer, Communications, COMSTRAT, Cyber, Finance, Ground Supply, Infantry, Intelligence, Legal, Logistics, Military Police, and Other. The most complete logit model that I use is:

$$prob(Y_i = 1) = \frac{e^{b_0 + b_1 MOS_i + b_2 Educ_i + b_3 Dem_i + b_4 Grade_i}}{1 + e^{b_0 + b_1 MOS_i + b_2 Educ_i + b_3 Dem_i + b_4 Grade_i}},$$

where Y_i is equal to 1 if individual is an Artemis participant and 0 otherwise, MOS_i represents the vector of MOS categories, $Educ_i$ represents the vector for the levels of education, Dem_i is the vector for demographic variables, and $Grade_i$ is the vector for an individual's grade. These vector categories only include the statistically significant MOS, education, demographics, and grade variables from the block-by-block regressions.

The second model uses an individual's End of Active Service (EAS) date as the predictor variable. EAS is separated into four categories: Indefinite, which indicates an officer that has accepted Career Designation, 1–4 years, more than 4 years, and already EAS'd. The most complete logit model that I use is:

$$prob(Y_i = 1) = \frac{e^{b_0 + b_1 EAS_i}}{1 + e^{b_0 + b_1 EAS_i}},$$

where Y_i is equal to 1 if the individual is an Artemis participant and 0 otherwise and EAS_i represents the vector for the EAS categories. This method attempts to find any relationship between the time a mother has left on their contract and participation status.

C. SCOPE AND LIMITATIONS

While the current Marine Corps policy requires new mothers to take a PFT or CFT 12 months post-birth, the data contains observations that occurred under the previous 6- and 9-month post-birth policies. The use of combined fitness scores depends on Z scores that are scaled to the mean and standard deviation of each year's score, which inherently adjusts for year-to-year changes in performance levels that may be caused by changes in

policies or standards. To control for fitness observations that might have occurred during the pregnancy or the 12-month exemption period, any observations between -3 quarters pre-birth to 4 quarters post-birth were excluded from the sample. To ensure that the treatment and control groups were comparable, only births that occurred after January 2019 were included.

A limitation of this analysis is that the sample size for the treatment group is significantly smaller than the control group. The Artemis Program initially recorded participation at the weekly workout sessions but stopped taking attendance after the first 3 months. There is likely a larger treatment group sample size, but this could not be determined based on the rosters that were provided for this analysis. Those who were not identified as part of the treatment group based on the provided rosters are instead part of the control group, which could impact the differences found between the two groups. A larger sample size would also increase the statistical power of the study. Additionally, the provided rosters do not account for how involved the participants were in the program, as there is no specification on how often a participant attended the weekly workouts. This makes it difficult to measure the true effect of the program. Since the Artemis Program was voluntary, there could be selection bias in those who participated as individuals who are more interested in fitness or returning to pre-pregnancy fitness standards are more likely to volunteer for the program. A randomized assignment to the Artemis Program would eliminate this selection bias and balance any other confounding variables between the treatment and control groups. Lastly, since the Artemis Program has only existed since 2021, there is limited post-intervention data available which restricts the assessment of long-term postpartum fitness outcomes.

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V. RESULTS

A. COMBINED FITNESS SCORES

I first explore the quarterly means of the combined fitness scores between Artemis participants and non-participants, as shown in Figure 1. The vertical axis indicates how many standard deviations the score is away from the mean. Artemis participants have an average combined fitness score that is above the mean when compared to non-participants. Both the treatment and control groups experienced a decrease in combined fitness scores post-birth. For participants, the average combined scores at -3 quarters and 4 quarters are 0.102 and -0.002 standard deviations away from the mean, respectively. Conversely, the average combined scores for non-participants are -0.075 and -0.210 standard deviations away from the mean, respectively. These scores are immediately prior to pregnancy and the first score at 12 months postpartum.

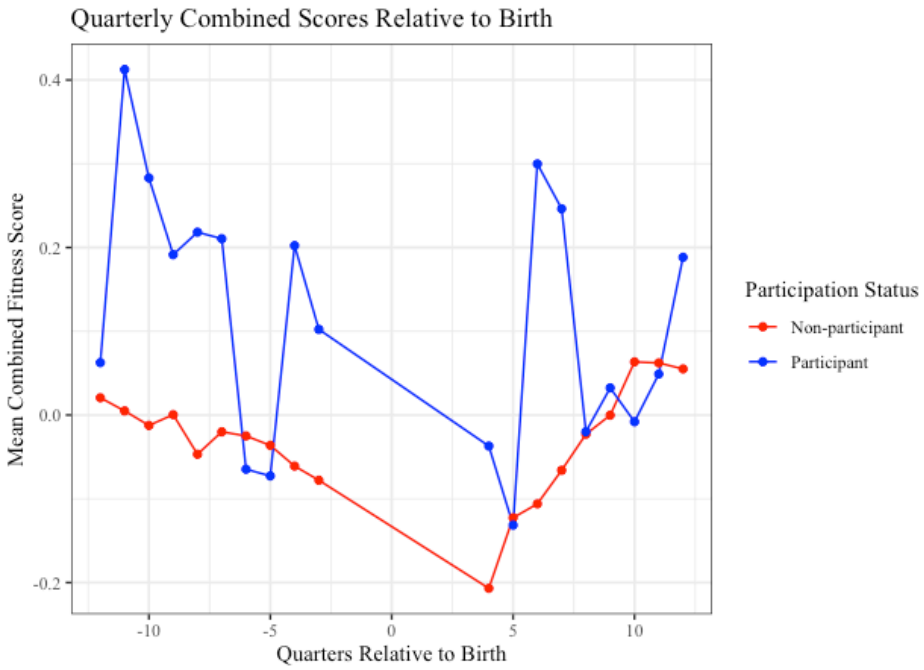

Figure 1. Quarterly Combined Scores

The results from the event study regression show the effect of Artemis participation on combined fitness scores, as displayed in Table 3. All three regressions use combined fitness scores as the outcome variable. Column (1) shows the basic interaction of participation and combined fitness scores. Column (2) includes demographic controls like age, race, MOS, marital status and rank. Column (3) is the most complete model as it controls for individual-level fixed effects. The fixed effects account for any time-invariant individual characteristics. Table 3 shows that both participants and non-participants experience a decrease in fitness immediately following birth. Column (3) shows that after birth, non-participant mothers experience a 0.113 standard deviation decrease in their combined fitness scores, which is statistically significant. Mothers who participate in the Artemis program experience an additional 0.015 decrease in their combined fitness scores, though the difference between Artemis participants and non-participants is not statistically significant. Additionally, the results indicate a level of uncertainty in the estimated effect of Artemis participation on post-birth fitness outcomes. The 95% confidence interval for this coefficient ranges from -0.157 to 0.127. This wide range of the confidence interval suggests that the estimate is noisy, and it cannot provide definitive evidence about the program's overall impact on post-birth fitness outcomes. However, this model reinforces that mothers, regardless of participation status, experience a statistically significant decrease in fitness post-birth. This result further highlights that Marine mothers continue to face challenges returning to pre-birth fitness outcomes. This is consistent with previous research on postpartum fitness outcomes.

An intention-to-treat (ITT) approach was used to investigate the effect of being located at Camp Pendleton while the Artemis Program was available during the post-birth period, relative to the outcome of the combined fitness score. This ITT model attempted to address the potential self-selection bias that may be present in the previous model because assignment to Camp Pendleton is random for individual Marines, whereas in the prior model, individual Marines self-select into the treatment group. The key takeaway of this model, which can be found in Appendix A, reinforces the results of the previous model that shows mothers experience decreased fitness outcomes post-birth.

Table 3. Combined Fitness Score Results

Analysis of Combined Fitness Scores

	Dependent Variable		
	Combined Fitness Score		
	Model 1	Model 2	Individual Fixed Effects
	(1)	(2)	(3)
Artemis Participant	0.167***	0.209***	
	(0.054)	(0.053)	
After Birth	-0.058***	-0.117***	-0.113***
	(0.017)	(0.017)	(0.014)
After Birth: Participant	-0.021	-0.002	-0.015
	(0.091)	(0.088)	(0.071)
Age		0.016***	
		(0.002)	
Race: Asian		0.051	
		(0.061)	
Race: Black		0.045	
		(0.049)	
Race: Declined to Answer		0.088	
		(0.075)	
Race: Other		0.081	
		(0.073)	
Race: Pacific Islander		0.118	
		(0.072)	
Race: White		0.053	
		(0.047)	
MOS: Combat Arms		0.152***	
		(0.036)	
MOS: Combat Service Support		0.077***	
		(0.018)	
Marital Status: Married		-0.143***	
		(0.025)	
Marital Status: Other		-0.128**	
		(0.060)	
Marital Status: Single		-0.206***	
		(0.029)	
Grade: Officer		0.662***	
		(0.026)	
Constant	-0.023***	-0.483***	
	(0.008)	(0.069)	
Observations	19,677	19,590	19,677

Notes: Data is from Total Force Data Warehouse
Reference Categories: Race: American Indian or Alaska Native
MOS: Aviation, Marital Status: Divorced, Grade: Enlisted
*p<0.1, **p<0.05, ***p<0.01

B. PREDICTING PARTICIPATION

Table 4 displays the results from the logit regression model where the dependent variable is whether a Marine mother was an Artemis participant. This table shows a block-by-block regression of specific categorical variables. Positive coefficients indicate an increase in participation likelihood, while negative coefficients indicate a decrease in participation likelihood. Column (1) shows the participation likelihood based on MOS. Column (2) shows participation likelihood based on demographic variables. Column (3) shows the participation likelihood based on the human capital factor of education. Finally, column (4) shows the participation likelihood based on grade. Notably, the block-by-block regressions indicate statistically significant factors that influence a mother's likelihood to participate based on specific reference groups. The statistically significant indicators include MOS categories "Combat Engineer," "Communications," "EOD/Ammunition," "Ground Supply" and "Logistics," education level "High School," and grade of "Officer."

These results suggest that mothers within the significant MOS categories are more likely to participate in the Artemis Program compared to mothers with Administration MOSs. This higher likelihood is due to the larger density of these MOSs within an MLG and access to the program. For instance, there are no organic aviation-related MOSs within an MLG, so I would expect the likelihood of participation for these MOSs to be lower. The results also indicate that mothers with a high school level education are more likely to participate than those with college-level education. This corresponds with the last significant indicator which shows that mothers who are officers are significantly less likely to participate compared to enlisted mothers. Officers make up a smaller portion of the Marine Corps than enlisted personnel and this population is further reduced when considering officers that are mothers. Additionally, their lower likelihood to participate may be due to other administrative or leadership responsibilities, possible stigma associated with participation among other officers, or a perceived lack of need to participate in Artemis.

Table 4. Block Logit Regression Models

Analysis of Participation Likelihood

	Dependent Variable			
	Participant			
	MOS	Demographics	Human Capital	Grade
	(1)	(2)	(3)	(4)
MOS: Air Crew	-15.453			
	(1,773.037)			
MOS: Artillery	-15.453			
	(4,738.641)			
MOS: Aviation Support	-15.453			
	(716.123)			
MOS: Combat Engineer	1.908**			
	(0.774)			
MOS: Communications	1.369**			
	(0.631)			
MOS: COMSTRAT	-15.453			
	(2,089.544)			
MOS: Cyber	-15.453			
	(4,738.641)			
MOS: EOD/Ammunition	3.263***			
	(0.597)			
MOS: Finance	1.088			
	(1.127)			
MOS: Ground Supply	2.152***			
	(0.538)			
MOS: Infantry	-15.453			
	(4,738.641)			
MOS: Intelligence	-0.107			
	(1.121)			
MOS: Legal	-15.453			
	(2,390.763)			
MOS: Logistics	2.617***			
	(0.524)			
MOS: Military Police	-15.453			
	(2,251.759)			
MOS: Other	-15.453			
	(1,911.915)			

Analysis of Participation Likelihood

	Dependent Variable			
		Participant		
	MOS	Demographics	Human Capital	Grade
	(1)	(2)	(3)	(4)
Race: Other		-0.021		
		(0.429)		
Race: White		0.017		
		(0.288)		
Marital Status: Married		-0.054		
		(0.405)		
Marital Status: Other		-14.900		
		(864.814)		
Marital Status: Single		0.518		
		(0.435)		
2nd Child		-0.223		
		(0.267)		
3rd Child		0.249		
		(0.434)		
4th-6th Child		-14.679		
		(690.382)		
Age		-0.032		
		(0.025)		
Education: High School			0.808**	
			(0.322)	
Grade: Officer				-1.280**
				(0.589)
Constant	-5.113***	-2.753***	-4.209***	-3.453***
	(0.502)	(0.806)	(0.304)	(0.102)
Observations	3,603	3,586	3,603	3,603

Notes: Data is from Total Force Data Warehouse
Reference Categories: MOS: Administration, Race: Black, Marital Status: Divorced Birth Order: 1st Child, Education: College, Grade: Enlisted
*p<0.1, **p<0.05, ***p<0.01

Table 5, which displays the results for the most complete logit model, only includes the statistically significant variables from Table 4 and reports the results in odds ratios for ease of interpretation. The odds ratios represent the ratio of the likelihood of participating in the Artemis Program for each variable, compared to the reference group, which is every non-statistically significant category from Table 4. For instance, when compared to mothers in the excluded MOS categories, EOD/Ammunition Marines are 46.6 times more likely to participate, Logistics Marines are 25.4 times more likely to participate, Ground Supply Marines are 15.9 times more likely to participate, Combat Engineer Marines are approximately 13.1 times more likely to participate, and Communication Marines are 7.4 times more likely to participate in the Artemis Program. The remaining factors, education level of high school and being an officer, remain positive within this model but are not statistically significant. This model indicates that MOS type has a strong effect on participation likelihood.

Table 6 displays the odds ratios for participation in the Artemis Program based on a mother's time to EAS with the reference category being mothers who have between 1–4 years remaining on their contract. The results show that time to EAS may affect participation likelihood; however, none of the EAS categories are statistically significant.

Table 5. Odds Ratios of Stacked Logit Model for Participation Likelihood

Analysis of Significant Participation Indicators

	Dependent Variable
	Participant
MOS: Combat Engineer	13.071***
	(2.049)
MOS: Communications	7.373***
	(1.751)
MOS: EOD/Ammunition	46.642***
	(1.687)
MOS: Ground Supply	15.850***
	(1.573)
MOS: Logistics	25.391***
	(1.547)
Education: High School	1.308
	(1.439)
Grade: Officer	0.523
	(1.940)
Constant	0.003
	(1.681)
Observations	3,603
Note:	Data is from Total Force Data Warehouse
	Results shown in odds ratios
	Reference categories:
	MOS: All MOS Not Shown, Education: College, Grade: Enlisted
	*p<0.1, **p<0.05, ***p<0.01

Table 6. Odds Ratios of Time to EAS and Participation Likelihood

Analysis of Time to End of Active Service

	Dependent Variable
	Participant
Already EAS	0.096
	(2.054)
Indefinite	0.221
	(2.058)
Less than 1 Year	1.103
	(1.282)
More than 4 Years	0.371
	(1.374)
Constant	0.042
	(1.136)
Observations	3,603

Note: Data is from Total Force Data Warehouse
Results shown in odds ratios
Reference category is 1–4 years remaining
*p<0.1, **p<0.05, ***p<0.01

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VI. CONCLUSION AND RECOMMENDATIONS

A. SUMMARY

This study attempted to identify the effects that the Artemis Program has on Marine mothers' fitness scores. The results of the analysis indicate that mothers continue to experience a significant decrease in their combined fitness scores following birth. In terms of who participated in Artemis, the results indicate significant variation across MOS communities in their likelihood to participate, with EOD/Ammunition Marines being most likely, followed by Logistics, Ground Supply, Combat Engineer, and Communications. Mothers in Aviation-related, Artillery, Infantry, COMSTRAT, Cyber, Military Police, and Legal are least likely to participate. Also, Marine mothers with lower levels of education are more likely to participate. This provides insight into which communities would be interested in attending the program should it be implemented at other Marine Corps installations. Additionally, time to a mother's EAS does not indicate any significant effect on the likelihood of participation in the Artemis Program.

The Artemis Program was created to assist mothers throughout their pregnancy and postpartum journeys. It creates a community that provides important resources and support, helping Marine mothers balance their new family roles alongside their responsibilities as servicemembers. Marine mothers continue to face challenges returning to pre-birth fitness outcomes and the Artemis Program represents a step forward in the type of support the Marine Corps offers to improve the overall well-being and care of postpartum Marines.

B. RECOMMENDATIONS

There are mothers located outside of the Camp Pendleton area who have expressed interest in this program or have attempted to replicate the program at their own duty station. While the value of the Artemis Program is difficult to measure due to several administrative factors, I have several recommendations to improve the Artemis Program.

The first recommendation is that accountability must be taken at every Artemis program event to include weekly workouts, guest speakers, health clinics, etc. The rosters should include EDIPI, rank, pregnancy or postpartum status, date of attendance, and type

of event attending. Accurate tracking of participation is key to understanding the utilization of this program and for any future analysis. An example accountability sheet can be found in Appendix B.

Next, for this program to thrive not only at 1st MLG but also at other units, key leaders must be supportive and actively involved in its operation. If key leaders cannot provide the support needed, there should be a designated individual who is responsible for the management and operation of the program. The naturally high turnover rates within the Marine Corps negatively affect the continuity of a program. The Artemis Program should designate a representative to maintain continuity as leaders change out.

Another recommendation to improve the reach of the Artemis Program on Marine mothers is to increase the promotion of this program to mothers at installations where it exists. Participation can increase significantly if more mothers know about the program and have a community of support. There was a significant outreach campaign when the 1st MLG program started in 2021, with several promotion videos, articles, and start-up events on Camp Pendleton. This campaign diminished significantly after the initial launch, which has likely hurt the awareness and participation rates of Artemis in more recent years.

The final recommendation is for any interested unit, command, or installation that wants to create their own Artemis Program. A start-up guide, located on the Women's Health portal on the Navy Medicine website, outlines the steps to create an Artemis Program at any unit. Leaders should be familiar with this guide and use it to establish the program at the unit level if an installation program does not exist.

C. FURTHER RESEARCH

Future studies can replicate this study but include more observations over time as this study was limited by the observation period and sample size since Artemis was recently created in 2021. More data and observation time of mothers that participate in this program will improve the insights into its effectiveness and influence the implementation of this program as a resource across all Marine installations. Additionally, the inclusion of Artemis programs outside of the 1st MLG program will increase the sample size and allow for comparison of program effectiveness at different units across the Marine Corps. It can

also highlight differences between how the programs are run at different installations. Finally, this study solely focused on fitness scores and likelihood of participation. Future studies could include the program's effect on maternal mental health, body composition standards, retention, or promotion rates.

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APPENDIX A. INTENT TO TREAT MODEL

This model employs an ITT methodology to assess the impact of being stationed at Camp Pendleton after the Artemis Program was established during a mother's post-birth period, on the combined fitness score outcome. The ITT approach mitigates potential self-selection bias present in the initial model of this analysis, as assignment to Camp Pendleton is random for individual Marines, whereas in the initial model, mothers self-select into the treatment group. Self-selection bias may occur because Marines who choose to participate in the Artemis Program may inherently differ from those who do not, potentially leading to higher combined fitness scores among participants. This model includes all Marines assigned to Camp Pendleton regardless of their actual participation in the program. The most complete model for the ITT is:

$$Y_{it} = \beta_0 + \beta_1 Pendleton_t + \beta_2 FebLater_t + \beta_3 After_t + \beta_4 Pendleton_t After_t + \beta_5 FebLater_t After_t + \beta_6 P_i + \beta_7 After_t P_i + \gamma_i + \varepsilon_i,$$

where Y_{it} shows the outcomes for combined fitness scores of mothers *i* at time *t*, $Pendleton_t$ is a binary for being stationed at Camp Pendleton, where 1 indicates a Camp Pendleton Monitored Command Code (MCC) and 0 is any other MCC, $FebLater_t$ is a binary for observations that occur after the Artemis Program was created on February 4, 2021, 1 being for after February 4, 2021 and 0 being before February 4, 2021, $After_t$ is a binary indicator for post-birth, where 1 is after birth and 0 is pre-birth, $Pendleton_t After_t$ is a binary for being stationed at Camp Pendleton during the post-birth period, $FebLater_t After_t$ is a binary for being post-birth after February 4, 2021, P_i is a binary for program availability, where 1 is given to mothers at Pendleton after February 4, 2021 and 0 is given to mothers that are not, $After_t P_i$ is a binary indicator for program availability and post-birth, where 1 is for mothers that had the program available to them during the post-birth period and 0 is for those that did not, and ε_{it} is the error term that captures any unobserved factors that may affect combined fitness scores of mothers. Like the first model, γ_i represents individual fixed effects that account for individual characteristics like age, race, MOS, and marital status, and allows me to compare changes within the individual

before and after birth. The coefficient β_1 represents the effect of being stationed at Camp Pendleton on fitness scores regardless of post-birth status and Artemis Program availability. The coefficient β_2 represents the effect of taking a fitness test after February 4, 2021. The coefficient β_3 represents the effect of birth on an individual's combined fitness score. The coefficient β_4 represents the being stationed at Camp Pendleton during the post-birth period on an individual's combined fitness score regardless of duty station location. The coefficient β_5 represents the effect of being in the post-birth period after February 4, 2021, on an individual's combined fitness score. The coefficient β_6 represents the effect of the Artemis Program availability on an individual's combined fitness score. The coefficient β_7 represents the additional impact of Artemis Program availability during the post-birth period on combined fitness scores.

This model, displayed in Table 7, attempts to eliminate any bias that may be present in the first model due to self-selection into the treatment group. Column (1) shows the results of being stationed at Camp Pendleton while the Artemis Program is available and its effect on fitness scores post-birth. Column (2) accounts for individual demographics like age, race, MOS, marital status and grade. Column (3) shows the complete model that accounts for individual fixed effects. This model attempted to control for multiple factors and due to the limited observation time and sample size, the results cannot accurately capture the effects. However, the results do not indicate that mothers at Camp Pendleton are better off post-birth compared to mothers located at other duty stations. The large standard errors of this model indicate that the estimates were noisy and contain collinearity issues. And finally, the results show that the program did not improve combined fitness outcomes for mothers. This model would be improved by a larger sample size and post-intervention observation period.

Table 7. Results of Intent to Treat Model

Intent to Treat Analysis

	Dependent Variable		
	Combined Fitness Score		
	(1)	(2)	(3)
Pendleton	0.035	0.043	0.025
	(0.030)	(0.030)	(0.042)
Feb Later	0.070***	0.078***	-0.035*
	(0.021)	(0.020)	(0.020)
After Birth	-0.166***	-0.165***	-0.021
	(0.047)	(0.045)	(0.036)
Pendleton: After Birth	-0.179	-0.150	-0.056
	(0.136)	(0.132)	(0.106)
Feb Later: After Birth	0.055	-0.019	-0.086**
	(0.053)	(0.051)	(0.042)
Program Available	0.054	0.049	0.005
	(0.065)	(0.063)	(0.062)
Program Available: After Birth	0.327**	0.313**	0.199
	(0.156)	(0.151)	(0.126)
Constant	-0.040***	-0.510***	
	(0.010)	(0.070)	
Observations	19,677	19,590	19,677

Note: Data is from Total Force Data Warehouse
Column 2 accounts for demographic controls
Column 3 accounts for individual fixed effects
*p<0.1, **p<0.05, ***p<0.01

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APPENDIX B. ACCOUNTABILITY SHEET

Date	Name (Last, First)	EDIPI	Rank	Date of Birth	Pregnancy Status (Pregnant, Postpartum)	Type of Attendance (Workout, Class, Discussion Group, etc.)

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